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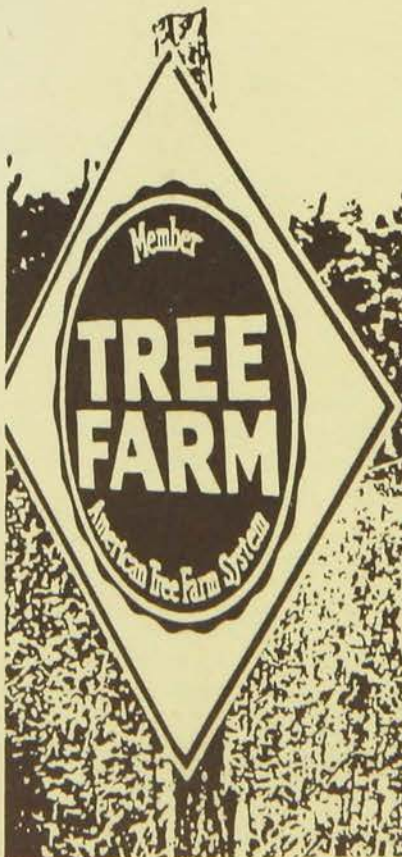
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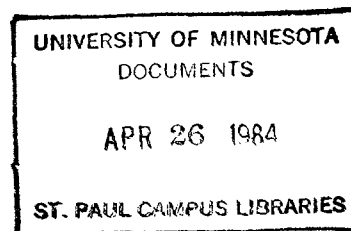
February 18, 1984

Presented by the
Minnesota Department of Natural Resources,
Division of Forestry

and the
University of Minnesota,
College of Forestry
Agricultural Extension Service

With support from the Minnesota Forestry Association, Southeastern Minnesota Forest Resource Center, Forestree Farmers of Minnesota, Inc., Central Minnesota Small Woodlot Owners Association, Minnesota Association of Consulting Foresters, Minnesota Tree Farm System, Society of American Foresters (Minnesota Society), U.S. Forest Service, and the Wisconsin Department of Natural Resources.

Published by
Office of Special Programs
University of Minnesota
405 Coffey Hall
1420 Eckles Avenue
St. Paul, Minnesota 55108
February 18, 1984



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NONGAME WILDLIFE MANAGEMENT
FOR WOODLAND OWNERS AND USERS

Carrol L. Henderson
Nongame Wildlife Supervisor
Minnesota Department of Natural Resources

Few aspects of private forest management have generated as much interest in the last few years as the management of woodlands to enhance wildlife populations that can be viewed as well as hunted.

Recommendations for forest management once dealt with relatively simple concepts because the featured species like ruffed grouse, white-tailed deer, and snowshoe hare were associated with management of aspen to maintain early successional stages of growth.

During the past ten years, however, environmental interests have broadened, and people frequently invest in woodland properties both for wildlife values as well as timber crops. In fact, some people aren't even very interested in the timber value of their property as much as they are the wildlife value.

Woodland hawks that were once shot on sight now send people scrambling for their field guides so they can learn their identity.

The Nongame Wildlife Program in the Department of Natural Resources is keenly aware of the increasing demand that is placed on private forest management consultants to offer constructive suggestions for preservation and enhancement of nongame wildlife. The field of nongame wildlife is still new enough that we do not have many of the answers people are seeking.

However, during the past year our Nongame Wildlife Specialists have been cooperating with the Division of Forestry to collect and prepare as much existing information as is available for enhancement of nongame wildlife in various cover types. This information has been turned over to the Division of Forestry for incorporation into their

Private Forest Management (PFM) guidelines. It should therefore become available later this year.

In the meantime, I am sure you are looking for some interim ideas to incorporate into your woodland management programs.

There are several aspects I would suggest: 1) Mapping your forest for wildlife features so you can incorporate special wildlife and wild plant values into your management program; 2) Nest box and nest platform techniques; and 3) Snag management.

1) Mapping Your Forest for Wildlife and Wild Plant Features

The beginning of any good forest management plan is an inventory of the resources present - both the timber and the wildlife features. Several types of features are important to map. Most are generally of special value to wildlife, including nongame species:

- a) Riparian Edges. These are the forest edges adjacent to lakes, rivers, ponds, and marshes. These are of high value to wildlife for perching, feeding, and nesting. Generally they are best left undisturbed.
- b) Mature stands of mast-producing trees - like white oaks. These are of very high value to wildlife.
- c) Ginseng. Be sure to identify any populations of ginseng present. A well-managed population of wild ginseng could provide a sustained income for a landowner in southeastern Minnesota.
- d) Orchid Bogs. If you are a wildflower enthusiast, you may wish to identify any particularly outstanding orchid concentrations which should be preserved during forest management activities.

- e) Forest Interior. There is an increasing problem with large blocks of forest land being broken up into smaller parcels that are characterized by new openings and access roads. Some songbirds are adversely affected by these practices. For larger forest landowners, there is a value to maintaining some unbroken woodland parcels of 160 acres or more to preserve the richest variety of forest interior songbirds.
- f) Special Nest Sites. Nesting sites used by bald eagles, ospreys, red-tailed hawks, broad-winged hawks, great horned owls, great blue herons and other similar species should be mapped so unnecessary disturbance can be avoided during the nesting season.

Two other considerations are worth mentioning here: nest box techniques and snag management. The availability of nesting sites can be a limiting factor for many woodland birds. You can greatly increase the enjoyment you receive from wildlife on your property by building and placing a variety of nesting structures. Among the forest species which will respond to either nest boxes or nest platforms are: great crested flycatcher , barred owl, raccoon, gray squirrel, fox squirrel, bats, screech-owl, saw whet owl, American kestrel, great horned owl, great gray owl, red-tailed hawk, northern flicker, wood duck, common goldeneye, common merganser, hooded merganser, osprey, great blue heron, double-crested cormorant, and eastern bluebird.

A booklet explaining how to build these structures is now being prepared.

Snag management is also important for wildlife. To explain this

concept, I have a slide-tape program entitled "An Oak Tree Saga" by John Mathisen of the United States Forest Service.

I appreciate the opportunity to have presented these ideas for your consideration. If you have further questions, I encourage you to contact me at Box 7, DNR, Centennial Building, 658 Cedar Street, St. Paul, MN 55155.

SELECTION AND USE OF NATIVE WOODS AROUND THE HOME AND FARM

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University of Minnesota

The timber on your property has value beyond its aesthetic attributes and its potential for commercial sale. In most cases the woodlot is also a potentially valuable source of wood products for your personal use. Per capita consumption of lumber and other wood products is substantial but as a property owner, your use of wood is probably much greater. This is especially true if you now have, or are planning, a residence on the property or if some kind of farming activity is involved. The average house requires over 10,000 board feet of lumber, almost 6000 square feet of plywood and about 2000 square feet of other panel products. Farm building construction may utilize even greater amounts and of course new construction is just the beginning. Substantial volumes of wood are used annually for the upkeep and improvement of existing structures and what about wood use for fencing or, in recent years, the use of wood for fuel. If you're a hobbyist or professional woodworker your woodlot can be an especially valuable resource for high quality lumber required in fine furniture or cabinets. Many other products used around the home and farm are also wood based but of course it's not economically feasible to produce all of them from homegrown timber. It would be unreasonable, for example, to make your own paper or any of the various panel products. On the other hand, most solid wood products, i.e., posts, poles, lumber, etc., not only can be produced from your own timber but in most cases there is the potential for substantial savings. The economics of getting these products from your woodlot is not, however, guaranteed. The timber must be harvested and processed efficiently or it may end up costing more than purchasing the product outright. Furthermore, there must be a good match between the wood's physical, mechanical and chemical properties and the end use requirements. Getting good service from wood depends on making a wise selection, installing it properly and following up with good maintenance. The purpose of this session is to look at some of the factors involved in the selection, processing and use of wood, especially native woods, around the home and farm.

WOOD PROPERTIES AND USE REQUIREMENTS

In order to choose the right wood for the job we must first single out the key use requirements. Then we have to check the properties of the available woods to see which ones meet the requirements. Determining the requirements for various uses may seem simple but quite often the relevant properties or characteristics are overlooked. For example, a builder may believe that a strong wood is needed for siding when in fact strength is a minor consideration. Factors such as paintability, dimensional stability, resistance to nail splitting and easy working qualities are much more important. Strength is an important consideration when choosing lumber for framing purposes but

the final determination is not based on strength alone. Obviously, in the case of floor framing, stiffness has to be considered and framing materials should also be free from pronounced warp, have good nail holding qualities, be relatively easy to nail and not too heavy. In the case of furniture, appearance may be the dominant factor but the wood must also have good finishing qualities, adequate hardness to resist denting, relative freedom from warp and for some parts, moderate strength and good holding power for screws and nails. As you can see from the above examples, seldom does one property alone control the choice of a wood for a given use. Usually it is the degree to which the combination of several properties meet the requirements. Many woods may meet the basic requirements but usually the choice can be narrowed to one or two based on secondary factors and species availability. Common sense can go a long way toward defining the requirement for various uses but other resources are available. USDA Agriculture Information Bulletin No. 311, "Selection and Use of Wood Products for Home and Farm Building" describes the requirements for various construction uses and "Properties, Selection and Suitability of Woods for Woodworking" by Donald G. Coleman provides information relating to furniture and general woodworking uses. Both publications are available from the Forest Products Laboratory, Box 5130, Madison, WI 53705. In addition to describing various use requirements both publications also classify the species according to important properties. These lists of properties and characteristics can be helpful in matching the wood to the job and they can also serve as a checklist for identifying important use requirements. In other words, if you don't know what properties are relevant for a particular use, go through the list and ask yourself: is hardness important?, is strength important?, is decay resistance important?, etc. Once the key requirements have been identified it is relatively easy to check the properties by referencing the published information. For purposes of this session the Forest Products Laboratory publications mentioned earlier have been excerpted in table 1 to give a broad classification of the native species according to characteristics and properties. If a species of interest is not listed it is worth noting that weight per unit volume is the single most useful indicator of wood properties. With this single item of information at least ten important characteristics can be estimated with reasonable accuracy. The properties related to weight/volume are: strength, heat value (as firewood), thermal insulation value, dimensional stability, acoustical insulation value, tendency to retain a paint film, ease of gluing, splitting tendency in nailing, suitability for papermaking and suitability for particleboard manufacturing. The first two, strength and heat value, are best with higher weight/volume and all the rest improve as the weight/volume decreases.

GRADES AND GRADING

When selecting wood for uses where strength is an important consideration, e.g., floor joists, rafters and most other framing applications, it is necessary to look beyond the relative ranking of the various species. Oak, for example, is relatively much stronger than aspen but individual pieces of oak might be much weaker. Even when comparing clear wood it is typical for the stronger pieces of a species to be at least twice as strong as the weakest ones. When the effects of strength reducing defects like

knots, slope of grain, etc. are included the range in strength becomes many times greater. This wide variation in quality and the difficulty of visually judging the actual strength of a piece of lumber is a very real deterrent to greater use of locally sawn native species for structural purposes. Commercially, grading is done by people who have extensive training and years of experience. It is not practical for do-it-yourselfers to develop the same skill but with a basic knowledge of grades and grading it is possible to do a satisfactory job of selecting structural lumber for most applications. Grading should not be taken lightly but the risks are minimal if you recognize your limitations and approach the grading process conservatively.

Dimension lumber, that is, lumber 2 to 4 inches thick and 2 or more inches in width, is graded according to the National Grading Rule. This standard is used primarily for softwoods but the principles of stress grading can be applied to hardwoods as well. (Aspen is one for which this has been done commercially.) Various lumber manufacturing organizations publish grading rules covering certain geographic areas and species. Grade names and grading procedures vary for some lumber items but for dimension lumber they are the same regardless of location. Lake States species are covered by the Northern Hardwood and Pine Manufacturers Association. Their rule book is available for a nominal charge from NHPMA, Suite 501, Northern Building, Green Bay, Wisconsin 54301. A detailed description of the various grades is beyond the scope of this presentation however the following guidelines for selecting stronger pieces from the ordinary run of ungraded lumber may be of some help:^{1/}

1. Select clear lumber or limit the size and location of defects such as knots. Knots reduce strength most when located along the edge in the middle half of the piece.
2. On the wide face of a piece, knots near the edge in the middle half should be less than one-third the width of the lumber. Elsewhere on the piece they should be no more than half the width.
3. On the narrow face of a piece that contains the heart center, knot size in the middle half should be limited to half the thickness.
4. Where a knot appears on both a narrow and wide face of a piece that does not contain the heart center, limit the size of the knot only on the wide face.
5. Reject pieces with 2 large knots within the same six inches of length.
6. Avoid cross grain or sharp kinks of grain if they slope more than 1 inch in 8 inches of length.
7. Exclude pieces that are noticeably undersized.
8. Exclude pieces with any evidence of decay.
9. Limit through splits to 1 1/2 times the width of the piece.

^{1/} Adapted from: Prestemon, D.R. 1977. Selecting Farm Framing Lumber for Strength. Iowa Forestry Extension Notes F-318.

For a more thorough discussion of wood selection for strength in framing see the Sept/Oct 1983 (Vol. 26 No. 5) Minnesota Forest Products Marketing Bulletin or refer to the rule books. If you believe the saying "a picture is worth a thousand words" you might also find a publication titled "Western Wood Species: Vol I. Dimension Lumber" helpful. It shows actual examples covering the range of quality permitted in each dimension grade for several species. The publication is available for a nominal charge from Western Wood Products Association, Yeon Building, Portland, Oregon 97204.

If you are interested in hardwood lumber grades and grading for non-construction uses (e.g., for cut up purposes like furniture, etc.) rules are available from the National Hardwood Lumber Association, P.O. Box 34518, Memphis, Tennessee 38134. Another helpful publication is "Simplified Guidelines to Hardwood Lumber Grading" by Walton Smith. It is available from USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina 28802.

WOOD AND WATER

Getting good service from wood requires some understanding of wood moisture relations and the basics of wood drying. The moisture content of wood is continually changing in response to fluctuating atmospheric conditions. These changes in moisture content cause dimensional changes which, unless controlled, can lead to unsatisfactory service of wood products and structures. If wood is too wet when put into use it will eventually dry to a moisture content approximating the conditions under which it is used. The resulting shrinkage can cause excessive warp, splits and checks, loose joints, popping of nails in drywall, squeaking floors, openings around trim and moldings and many other undesirable conditions. If wood is too dry it will swell excessively and may cause drawers, doors and windows to stick and flooring to heave. For best results wood should be installed at a moisture content close to the midpoint between high and low values it will attain in use.

For interior use this means wood should be dried to a moisture content of 6 to 8 percent. For exterior use, i.e., framing, siding, wood trim, sheathing, etc., it is desirable to have an average moisture content of about 12 percent. Somewhat higher values can be tolerated for exterior use but in this climate the wood will eventually equilibrate at around 12 percent. The commercial standard for dimension lumber requires that the product be dried to a moisture content not exceeding 19 percent to qualify for grade stamping as dry lumber.

There are numerous books and bulletins which provide a more detailed discussion of wood structure and the relationship of wood and water. As a starting point you might write to the U.S. Forest Service, Forest Products Laboratory, Box 5130, Madison, Wisconsin 53705 and ask for their list of publications on drying. Two of the publications you may wish to order are: FPL-0226 "Moisture Content of Wood in Use" and Chapter 1 of the "Dry Kiln Operators Manual." Most publications are free of charge for individual copies. Another good source of information is "Understanding Wood: A Craftsmans Guide to Wood Technology" by R. Bruce Hoadley. The book is published by Taunton Press and it should be available in many libraries and bookstores.

Procedures for attaining the desired moisture content with minimal degrade are essentially simple but not without pitfalls. Unless certain precautions are followed serious loss of quality is likely to occur. Fortunately good information is readily available. Again, the Forest Products Laboratory is a valuable resource. "Seasoning Small Quantities of Lumber " FPL-089 by E.F. Rasmussen is one which you might consider. The book by Hoadley and Fine Woodworking magazine are also good. Another one is "Drying Small Quantities of Hardwood Lumber - Understanding the Effects of Moisture on Wood" by Daniel L. Cassens. It is available from the Cooperative Extension Service, Purdue University, West Lafayette, IN 47907.

WOOD PROTECTION

Many uses of wood around the home and farm involve exposure conditions which are conducive to decay. Where wood will be in contact with the ground, will be wet regularly, or be intermittently exposed to rain or otherwise used where the moisture content will exceed 20 percent, protection from decay is essential for satisfactory service. Wood which remains dry (below 20 percent) will not decay.

The wood of naturally decay resistant species offers some protection but the durability varies a great deal. Wide ranges in service life can be expected and occasionally even the wood of a highly durable species can fail in a short time. Untreated heartwood of highly durable species can give excellent service in areas of low to moderate decay hazard but only a few Minnesota species are rated as durable or very durable. The general classification of the important native species is given in Table 1. Remember that there is little difference in the longevity of sapwood. All untreated sapwood regardless of species should be considered nondurable.

When service conditions are more severe or in any situation involving nondurable species, a proper preservative treatment will usually give better service and probably do so at lower cost. In order for a preservative treatment to be effective it must be treated according to the appropriate standards which specify the preservative, the treating methods and the species limitations. The sapwood of most species can be easily treated but the heartwood is relatively difficult to treat (see rankings in Table 1). Aspen is one native species in which both sapwood and heartwood are difficult to treat. The results are highly variable and it is not recommended for use in severe exposure conditions.

For further information on wood protection and preservative treatments see the following publications:

1. Hoffman, T.R. and L.T. Hendricks. 1982. Selecting Preservative Treated Woods (With Special Emphasis on Landscape Timbers), Extension Folder 649, University of Minnesota, Agricultural Extension Service.
2. Carlson, F. and L.T. Hendricks. 1976. Selecting and Treating Minnesota Woods for Fence Posts. Extension Folder 326. University of Minnesota, Agricultural Extension Service.

3. DeGroot, R.D. and B.R. Johnson. 1979. Preservative Treatment of Wood for Farm Use. A2982. University of Wisconsin, Cooperative Extension Service.

Publications 1 and 2 are available from the University of Minnesota, Agricultural Extension Service, Bulletin Room, 3 Coffey Hall, 1420 Eckles Avenue, St. Paul, Minnesota 55108. The third publication can be obtained from the University of Wisconsin Cooperative Extension Service, Agricultural Bulletin Building, 1535 Observatory Drive, Madison, Wisconsin 53706. The Forest Products Laboratory, Box 5130, Madison, Wisconsin 53705 is also a good source of information.

Table 1. Broad classification of woods according to characteristics and properties (A, among the woods relatively high in the particular respect listed; B, among woods intermediate in that respect; C, among woods relatively low in that respect. Letters do not refer to lumber grades.

Kind of Wood	Weight, dry	Freedom from shrinkage & swelling	Freedom from warping	Ease of working	Paint ^{1/} holding	Nail holding	Decay resistance of heartwood	Proportion of heartwood	Amount of figure	Freedom from odor and taste (dry)	Bending strength	Stiffness	Strength as a post	Toughness	Freedom from knots	Knot size ^{3/}	Ease of treating ^{2/}	Hardness
Ash: Black	B	C	B	C	C	A	C	C	A	A	B	B	C	A	A	B	1	B
White	A	B	B	C	C	A	C	C	A	A	A	A	A	A	A	B	1	A
Aspen	C	B	B	A	A	C	C	B	C	A	C	B	C	C	A	A	2	C
Basswood	C	C	B	A	A	C	C	C	C	A	C	B	C	C	A	B	1	C
Birch	A	C	B	C	B	A	C	C	B	A	A	A	B	A	A	B	1	B
Cedar:																		
Eastern red	B	A	A	B	A	B	A	B	B	C	B	C	B	B	C	A	-	B
Northern white	C	A	A	A	A	C	A	A	C	B	C	C	C	C	B	B	4	C
Cherry	B	B	A	B	B	A	C	B	B	B	A	A	A	B	A	B	-	B
Cottonwood	C	B	C	B	A	C	C	C	C	B	C	B	C	C	A	A	2	C
Elm: Rock	A	B	B	C	C	A	C	B	A	A	A	A	A	A	B	B	3	A
Soft	B	B	C	C	C	A	C	B	A	A	B	B	B	A	B	B	1	B
Fir: Balsam	C	B	B	B	C	C	C	B	C	A	C	C	C	C	C	A	-	C
Hackberry	B	C	B	C	C	A	C	C	A	A	B	C	C	A	A	C	3	B
Hickory	A	C	B	C	C	A	C	B	B	B	A	A	A	A	B	C	-	A
Locust	A	A	B	C	C	A	A	A	A	B	A	A	A	A	B	B	4	A
Maple: Hard	A	C	B	C	B	A	C	C	B	A	A	A	A	A	B	B	2	A
Soft	B	B	B	C	B	A	C	C	B	A	B	B	B	B	A	B	2	B
Oak: Red	A	B	B	C	C	A	C	B	A	B	A	A	B	A	A	C	1	A
White	A	C	B	C	C	A	A	B	A	B	A	A	B	A	A	C	4	A
Pine:																		
Northern white	C	A	A	A	A	C	B	B	C	C	C	C	C	C	C	A	2	C
Spruce: Eastern	C	B	A	B	B	B	C	C	B	A	B	B	B	C	C	A	3	C
Walnut	A	B	A	B	C	A	A	B	B	A	A	A	A	A	A	B	-	B

^{1/} Indicates general paintability and performance characteristics of edge-grained surfaces exposed to the weather.

^{2/} 1 - easily penetrated, 4 - very difficult to penetrate.

^{3/} A = large, B = medium, C = small

THE BASIC ELEMENTS OF MARKETING TIMBER

F. Thomas Milton
Area Extension Agent, Forest Products
University of Minnesota

Dave Martodam
Utilization & Marketing Specialist
Department of Natural Resources

INTRODUCTION

In this session of today's conference, Dave Martodam and I will be discussing the basic elements of timber marketing. There are many topics important to timber marketing that we might have concentrated on. However, we felt that we would like to take an approach that will give attendees a procedure on how to market timber. Our presentation should be most informative to landowners who have little or no experience in timber marketing and it should serve as a good review for those who do. We hope that when you are exploring certain topics or skills on your own that the information we've presented today might serve as a guide on how marketing takes place and how it ties in with forest management.

Marketing is "a matching process, based on goals and capabilities by which a producer provides a product or service at a price and in a manner that meets a consumer's needs." There are four basic elements to marketing: product, price, promotion and placement. It's these four elements as they relate to forest product marketing that we will discuss in more detail. Before we start discussing the four P's, there are several key statements that I would like to make that we feel are most important to remember.

Important Points to Remember

1. Before a stick of timber is sold, a written management plan should be developed. Because marketing is a key component in forest management planning, the landowners marketing goals should be considered and complement the management plan.
2. Marketing is not simply the selling of timber, rather it should be considered the planning process that helps to suggest what to grow and how to manage the product.
3. Selling timber should be a rewarding experience (like the icing on the cake) and can serve as a positive reinforcement to one's satisfaction and involvement in continuing to manage your forest.
4. We want landowners to be aware that there are many sources of information and assistance available to help them plan and manage their forest land. Particularly when it comes time to sell timber, landowners should be aware that they normally are not as well informed as buyers and are at a disadvantage unless professional help is sought.

PRODUCT

The heart of the marketing mix is the product or service. It is what you have or what someone else wants or needs. Understanding your product, in this case your timber, needs to take place long before a pending timber sale. Determining what kinds of trees you have, their volume, age and condition should take place as your management plan is being developed. Thus, what I'm saying is that the "marketing" of a product is tied to the landowner's overall management plan before one decides to sell timber products.

When you do wish to sell some timber, we hope its because the management plan indicates a harvest is necessary to achieve your goals for improving the forest's productivity and because the marketing conditions are favorable. Before a landowner would advertise a pending sale, you would want to have a forester mark the individual trees or areas to be cut and determine their volume and value.

Product Definitions

If you think about it, there is probably no other marketing situation in the world where there are potentially so many products with so many variations (by species, in quality, in size, in pricing). In the U.S, there are roughly 60 native woods that are used commercially. There are at least nine major categories of forest products which indicate the end use of the wood fiber - veneer, saw logs, saw bolts, timbers, posts, poles, piling, pulpwood and fuelwood. In some species there are five grades of veneer logs and five grades of saw logs. In all the categories, there are hundreds of local size specifications, both minimums and maximums. Stumpage prices for your timber can vary significantly from one area to another. In addition, the grades of one product frequently overlap with the grades of another, i.e. some saw bolts could make acceptable veneer logs.

In general veneer logs are more defect free, they are straighter, usually a minimum of 12" diameter and 8'6" in length (for the lower veneer grades) and are scaled individually in board feet.

In general, a saw log should be quite sound and straight, scaled individually in board feet and at least 8' long with a top end diameter of 6" for softwoods and 8" for hardwoods.

In general, a saw bolt is no longer than 8', yet sound enough to make lumber, no less than 6" diameter, and is scaled in cords.

In general, a timber or tie cut (log) is scaled and graded according to whether it would yield a cross tie. A class one tie log must yield a 7x9x8'6" tie.

Pulpwood is sold by the cord or by weight. It is usually 100" in length, small end diameter no less than 3" for softwoods and 4" for hardwoods. Deductions for unsound wood are commonly made.

Posts, poles and piling are usually sold individually, however sometimes by the linear foot. The critical criteria is straightness with soundness very important as well. Posts are usually 5 to 7' in length and 3 to 8" in diameter, small end. Poles might be 12 to 45' in length and 5 to 7" diameter, small end. Piling usually ranges from 15 to 60' in length and 8" minimum diameter on the top.

Product Measurement

The following are a few definitions on product measurement that might clarify some points.

"Cruising" is the term used for the in-woods measurement of tree or stand volumes by individual measurement or by sampling and estimating techniques. "Scaling" is the term used for the measurement of cut products usually on a landing in the woods or at the mill.

A log rule may be defined as a table or formula that estimates the yield of a log in board feet of lumber or cubic feet. Though still widely used and accepted, board feet log rules do have "built-in" errors. Recall that a board foot is 1"x12"x12" (or the equivalent volume), yet on hardwood lumber there is 1/8" to 1/4" more fiber at any thickness than on softwood lumber; i.e. a softwood 2x12-10' long would contain 20 BF even though the actual measurement is 1-1/2x11-1/4-10'. In addition, depending on the log scale used, and the recovery efficiency of the mill, the actual lumber tally may be well over or under the log scale. There are over 95 recognized log rules used in the U.S. and Canada. The accepted log rule in Minnesota is the Scribner Decimal C rule.

Sometimes people are confused over what a "bolt" is. A bolt is a log that is of adequate quality and diameter to be sawn into lumber or staves or possibly shingles. It is not over 8'6" in length and they are measured in cords. Usually it requires 2.5 to 4 cords of bolts to equal 1000 BF of saw logs.

Another problem area is the definition of firewood cords. A standard cord is a unit of volume represented by a pile of wood 4'x4'x8' or 128 ft.³ with the wood in 4' lengths. The amount of solid wood in a cord averages 85 ft.³. Because they will pack together more tightly, a cord cut into 16" firewood, then restacked will occupy an overall space of 110 ft.³ and if cut, split and restacked will occupy 120 ft.³. The solid wood content is unchanged. If you are buying or selling firewood by the rick or stovewood cords advertised as 1/3 of a cord, then the pile size should equal 40 ft.³ (1/3 of 120) for split wood and 37 ft.³ (1/3 of 110) for wood not split.

Product Identification

The product definitions and measurement methods I have just discussed dealt with the differences between various products in the form of cut logs and the way they are scaled. What is probably more important to the landowner is to be able to recognize those various products, species, qualities and value in the standing tree. Or, have a forester help you identify your products. Particularly in hardwoods, at the very least, you should develop your skill at identifying high value tree species like black walnut, red elm, cherry, red and white oak.

Market your timber for its highest recoverable value. Good quality and large timber is becoming more scarce all the time in the U.S. This affects the mills costs for producing lumber or veneer and thus, subsequent products. These costs are passed on to the consumer. For the highest financial return on your investment, don't sell higher quality timber for lower value products if markets for the higher value product exist.

For your own understanding, it would pay to visit with some buyers or mills to find out what their specifications are - sizes, species, grades and prices. Particularly, if you intend to harvest your own timber, be sure to find out what lengths buyers are looking for. Ten foot and longer logs often times receive a premium. Improper bucking is a major factor that can ruin the potential value of a tree.

For your own benefit, and if you are very interested in forest management, I would recommend reading and developing your skills in the following subject areas:

Tree identification - very important

Tree grading - i.e. being able to recognize potential products in the standing tree and their value is very important

Timber cruising and log scaling - very important unless you use the services of a professional forester.

PRICE

Price is the value that is agreed upon by the buyer and seller. Stumpage price refers to the value of the standing timber, in other words the price necessary to purchase the wood fiber "on the stump".

The market price of the stumpage is the price ultimately agreed upon by a willing buyer and seller, reached via a process of competitive bidding or a single offer. The appraised price of the stumpage is the foresters best estimate as to the current value of that timber. It may or may not be the ultimate market price received. State timber is not sold for less than it's appraised value.

The methods and prices used for determining appraised stumpage prices on state timber are also used by most foresters when appraising privately owned timber.

Base Stumpage Prices

Each year in the spring, the DNR's forestry staff reviews and recommends a new base stumpage prices for the state. They are given for each product type, species and region and are intended to reflect a fair market value for that timber in the current year. Base stumpage prices for 1983 (which will be in effect through April 1984) are given in Table 1.

Price Guide Factors

The most important step in appraising a parcel of timber is an on-site evaluation or "cruise". A set of production factors (see tables 2 and 3) are used to adjust base stumpage prices to reflect specific stand conditions and that timber's probable value. These factors have a direct bearing on the profitability of harvesting and delivering the timber to an appropriate market.

Price guide factors have been determined through the analysis of many timber sales. They are not adjusted annually as base stumpage prices are, however, they can be adjusted as various elements of harvesting change.

Example

To understand how price guide factors are applied, let's examine a hypothetical stand of red oak sawtimber in central Minnesota. From Table 1 we see that the base stumpage price for red oak sawtimber in the central region is \$37/MBF. Upon examining the stand, the forester noted field conditions which yielded the following price guide factors (PGF) according to the definitions found in Table 3.

Felling, limbing and bucking conditions average, PGF - .20

Skidding difficulty and distance average, PGF - .18

Hauling distance longer than average, rough roads, PGF - .15

Market outlook only fair, PGF - .04

Road maintenance costs average, PGF - .15

Timber quality slightly below average, PGF - .06

Price guide factors are then added together and the sum is multiplied by the base stumpage price to yield an "appraised" or site specific stumpage price.

$$.20 + .18 + .15 + .04 + .15 + .06 = .78$$

$$.78 \times \$37. = \$28.86/\text{MBF}$$

The forester making the appraisal will determine the stumpage price on each of the species and potential products that stand contains. Thus, if a stand contains veneer trees (at an acceptable minimum volume) they would be priced separately as veneer stumpage and priced accordingly. Whether or not the buyer utilizes these trees as veneer (i.e. their highest recoverable value) is left to the buyers discretion. See Exhibit A for an example timber sale appraisal.

Factors Influencing Selling Price

The various species and products available in your woodlot have been identified. A value has been determined for each species and product combination. This completes the appraisal process. However, the appraised price isn't necessarily the price you will receive. There are other factors which will probably affect the final value you receive for your timber.

Sale Regulations. Sale regulations take many forms. (ex. specified harvesting period, length of harvest time, road and skidway location, disposition of slash and residual timber, special considerations for wildlife and aesthetics, payment requirements, etc.) Regulations directly affect the ease and expense of harvesting which influences how much a logger will be willing to pay for the stumpage.

Sale Method. There are three basic methods of selling stumpage.

1. Single Offer or Over the Counter. The timber is sold to the first person willing to pay the appraised price. It is the easiest method. It is non-competitive and will probably bring the lowest price.
2. Oral Bid. An auction or negotiated bid procedure. Prospective purchasers bid against each other. It requires more time and effort than other procedures, but due to its competitive nature, the oral bid may bring the highest value.
3. Written Sealed Bid. Each prospective purchaser calculates what the timber is worth to him and submits a written sealed bid. It is not as directly competitive as oral bidding and therefore may not yield as high a sale value. It is less trouble to carry out than oral bid procedures.

Payment Method. How the final payment for the stumpage is determined is part of the sale contract and it can have a definite impact on potential value. There are two basic payment methods.

1. Lump Sum. The purchaser pays a lump sum for the right to harvest the timber. The actual amount harvested has no bearing on the amount of payment. It is the easiest method to administer since no scaling of cut products is needed. It may result in better management because the logger has an incentive to remove as much timber as possible so his per unit costs are reduced. It is best suited to clearcut sales of lower value timber. A very accurate appraisal is necessary to ensure that the landowner receives fair value for his timber.
2. Payment Based on Scale of Products Cut. The purchaser agrees to pay a set amount per unit of product cut. (ex. \$4.00/cord, \$45/MBF.) Final value depends on the total number of units harvested. It requires more administrative effort in that a procedure for scaling the cut products has to be established. Ideally, an unbiased third party will do the scaling. This could be a consulting forester. A common procedure is to use a consumer scale. The mill who purchases the products from the logger scales them and payment is based on that scale. The payment by scale system requires a less extensive initial appraisal. It lessens the chances of either party being "gyped". It is best suited to selective cut sales with high value products.

The decision as to what regulations to incorporate and which sale and payment method to use are all based on management plan objectives and the amount, volume and kind of timber involved. A professional forester is best suited to help a landowner decide which sale design to use.

Timber Sale Contract

The best way to ensure that the harvesting operation goes smoothly is to have a written contract with the logger. All sale regulations, details as to type of sale and payment methods are itemized in a good contract. The contract minimizes the chance of either party misunderstanding the other. It provides a legal basis for ensuring that both parties carry out their respective obligations. See Exhibit B for an example of a timber sale contract.

PROMOTION

Once the appraisal is made, regulations determined, and type of sale and payment has been decided upon, the fact that the landowner wants to sell his timber has to be communicated to potential purchasers. The first step is to decide who potential purchasers are. Who they are will depend on the kind and amount of timber, what markets will take the wood and where the markets are.

Independent Logger. The independent logger is the most common purchaser of stumpage. They can be found in all forested areas of the state. Most agency and consulting foresters can provide lists of loggers.

Mills. Sawmills, pulp and paper mills and other primary processing mills often purchase stumpage. They can contract to have it harvested or have company loggers harvest it. Many larger mills employ foresters. These foresters can usually provide a landowner with the full range of forest management services. The kind and amount of timber a landowner has dictates whether a mill will be interested in purchasing it. (ex. a pulp mill will have no interest in hardwood sawlogs.)

Brokers. A broker is a middle man who usually buys harvested products and resells them to a mill. Occasionally they will purchase stumpage. Brokers are often involved if high value products that have a potential for export are produced. The broker serves as the export agent. A broker would be a logical purchaser if the landowner harvests his own timber and then sells the cut products.

Advertising Methods

Once the potential purchasers have been targeted, they have to be informed that the timber is available. The following promotional methods are listed in general order of effectiveness for the typical small woodlot owner.

1. Direct Mail. Probably most cost effective. Mailing lists of potential purchasers can be obtained from local foresters.
2. Newspaper. Has the disadvantage that the intended audience may not see the ad.

3. Minnesota Forest Products Marketing Bulletin. Have to advertise well in advance because it is only published bi-monthly. Good method because it is sent to nearly everyone in the Forest Products Industry in Minnesota. Free.
4. Forest Landowner Association Newsletter. Effective only if landowner is within newsletter mailing area.
5. Organized Tour to Show Sale. Usually a follow up to one of the other methods. A group tour takes less time and effort than showing the sale to each potential purchaser separately.
6. Personal Contact. Usually a follow up effort. Direct it at potential purchasers who are considered best able to do the job.
7. Radio, T.V., Trade Journals. Not commonly used. Very expensive. Could be effective for large amounts and/or high value timber.

Notice of Timber For Sale

The "Notice of Timber for Sale" is the message that the chosen advertising method conveys. It provides the information that allows potential purchasers to evaluate the sale and decide if they are interested in it. A typical notice contains the following information:

1. Name, Address and Phone of the timber owner.
2. Location. Legal description.
3. Size of Tract(s). Acres.
4. Species and Products. ex. 150 cords of jack pine.
5. Price. Total appraised value or per unit value. ex. 150 cords of jack pine @ \$8.25/cord.
6. When Timber Can Be Inspected.
7. Type of Sale. Oral bid, sealed bid, etc.
8. Type of Payment. Lump sum, payment on scale, etc.
9. Date, Time and Place of Sale.
10. Special Requirements. ex. 10% down payment, winter harvest only, slash piled and burned, etc.

Sample Notice of Timber for Sale. Stumpage for sale. John Doe, Rt. 1, Box 63, Lakeville, MN 55740, 612-389-4521, offers for sale one 10 acre tract of elm sawtimber, SW/NE/NE Sec. 10, Twp. 42, Rge. 51. Selective cut of marked trees. Appraised value \$1,549.00, lump sum sale, full payment at time of sale. Oral auction, at sale site, on Saturday, April 12, 1984, 10:00 a.m. Timber can be inspected Saturday, April 5, 1984, at 10:00 a.m. - 12:00 a.m. and before the sale.

PLACEMENT

Placement is the fourth "P" in the marketing sequence. Placement refers to the location of forest products in relation to markets and how the products are gotten to market. For timber products, the question of how the product is delivered to market is the key item. Wood using industries are invariably located in the forested area of the state. However, there can still be a great amount of variability in the transportation systems available to get the wood to market.

The primary transportation system available to move forest products are rail and truck. Rail is very limited in serving the small landowner. Trucking options vary considerably with the amount and quality of road systems between the timber and its potential market.

Placement Affects Price and Promotion.

Price. The further the market is from the timber, the less value the timber will have. Timber may be close to markets but if transportation systems are poor, the stumpage will still have low value due to transportation costs.

Promotion. Advertising in a local newspaper will not be very effective if most or all of the potential purchasers live beyond the circulation range of the paper.

Tools to Identify Potential Placement Problems. The following tools will help the landowner identify potential problems his timber sale might have relative to its location to markets.

1. Lists of local mills. Local foresters can provide lists of mills that will use the timber products a sale will produce. The mill locations can be plotted on a map to visually show distance relationships and identify possible transportation problems.
2. Logger lists. Same as #1.
3. Broker lists. Same as #1.
4. Highway road information. Can be obtained from County and State highway departments. Information on possible road weight restrictions, bridge height and weight restrictions, etc. will help identify transportation problems. Transportation problems such as road restrictions may dictate when timber can be cut and hauled.
5. Trucking rates. High trucking rates will increase transportation costs and result in lower stumpage prices. Mills commonly pay a set amount for a product. If any component of the harvesting or transportation costs gets unusually high, some other component will have to be decreased. Stumpage is one of the few costs that can be controlled and it is the one most likely to be reduced.

All of the above factors of placement directly affect timber price and how the sale will be promoted. By now, it should be apparent that all of the four P's are inter-related and can affect each other.

MARKETING PLAN

A marketing plan that considers the four P's is a necessary part of a forest management plan if timber is going to be harvested. If a professional forester is developing a management plan for you, request that marketing be a part of the total management plan.

SUMMARY

Marketing of forest products is a key element of any forest management plan. A complete marketing plan incorporates the four P's of marketing.

1. Product. What forest products the timber will produce.
2. Price. What are the products worth.
3. Placement. Where are the products in relation to markets and how will they be transported to market.
4. Promotion. What tools will be used to communicate the fact that timber is available for harvest.

With the assistance of a professional forester and the many sources of information available, the small woodlot owner should find marketing his timber a rewarding experience. The timber will be properly harvested in a business like manner. The timber owner will receive maximum value for his timber and his forest land will be managed to meet his objectives.

Table 1

MINNESOTA DNR DIVISION OF FORESTRY BASE STUMPAGE PRICES (effective May 2 1983)

	NW Region 1	NE Region 2	Central Region 3	SW Region 4	SE Region 5	Metro Region 6
SAWLOGS (\$/MBF)						
White & Norway Pine	60.00	60.00	60.00	50.00	50.00	60.00
Jack Pine	37.00	37.00	37.00	—	—	37.00
White Spruce	37.00	37.00	37.00	—	—	37.00
Tamarack	20.00	18.00	18.00	—	—	18.00
Cedar	28.00	28.00	28.00	—	—	32.00
Balsam Fir	16.00	14.00	18.00	—	—	18.00
Aspen	14.00 ¹	12.00 ⁶	16.00	25.00	25.00	25.00
Birch	14.00 ¹	12.00 ⁷	16.00	35.00	35.00	35.00
Balm of Gilead	14.00 ¹	12.00 ⁶	16.00	—	—	—
Basswood	30.00 ²	25.00	32.00	55.00	55.00	55.00
Cottonwood	—	—	25.00	25.00	25.00	25.00
Ash	30.00 ³	25.00 ⁸	32.00	65.00	65.00	65.00
American Elm	30.00 ⁴	25.00 ⁹	32.00	40.00	40.00	40.00
Red Elm	30.00 ⁴	25.00 ⁹	32.00	75.00	75.00	75.00
Oak Species	35.00 ⁵	25.00 ⁹	36.00	70.00	70.00	70.00
Maple Species	20.00	25.00	36.00	65.00	65.00	65.00
Black Walnut	—	—	—	285.00	285.00	285.00
Butternut	—	—	36.00	60.00	60.00	60.00
Black Cherry	—	—	—	60.00	60.00	60.00
Hackberry	—	—	—	40.00	40.00	40.00
Black Willow	—	—	—	25.00	25.00	25.00
Hickory	—	—	—	50.00	50.00	50.00
VENEER (\$/MBF)						
Basswood				125.00	125.00	125.00
Red Oak				225.00	225.00	225.00
White Oak				155.00	155.00	155.00
Black Walnut				145.00	145.00	145.00
Butternut				145.00	145.00	145.00
Black Cherry				155.00	155.00	155.00
American Elm				150.00	150.00	150.00
Red Elm				400.00	400.00	400.00
Hard Maple				200.00	200.00	200.00
Soft Maple				90.00	90.00	90.00
Ash				150.00	150.00	150.00
Cottonwood				50.00	50.00	50.00
	*Use twice the sawlog price	*Use twice the sawlog price	*Use twice the sawlog price	Use S.E. MN grade and price guide		
SAWBOLTS (\$/Cd)¹⁰						
White & Norway Pine	24.00	24.00	24.00	20.00	20.00	24.00
Jack Pine	14.80	14.80	14.80	—	—	14.80
White Spruce	14.80	14.80	14.80	—	—	14.80
Tamarack	8.00	7.20	7.20	—	—	7.20
Cedar	11.20	11.20	11.20	—	—	12.80
Balsam Fir	6.40	5.60	7.20	—	—	7.20
Aspen	5.60 ¹⁴	4.80 ¹⁶	6.40	10.00	10.00	10.00
Birch	5.60 ¹⁴	4.80 ¹⁶	6.40	14.00	14.00	14.00
Balm of Gilead	5.60 ¹⁴	4.80 ¹⁶	6.40	—	—	—
Basswood	12.00 ¹⁵	10.00	12.80	22.00	22.00	22.00
Cottonwood	—	—	10.00	10.00	10.00	10.00
Ash	12.00 ¹⁵	10.00 ¹⁷	12.80	26.00	26.00	26.00
American Elm	12.00 ¹⁵	10.00 ¹⁷	12.80	16.00	16.00	16.00
Red Elm	12.00 ¹⁵	10.00 ¹⁷	—	30.00	30.00	30.00
Oak Species	14.00 ¹⁵	10.00 ¹⁷	14.40	28.00	28.00	28.00
Maple Species	8.00	10.00	14.40	26.00	26.00	26.00
Black Walnut	—	—	—	114.00	114.00	114.00
Butternut	—	—	14.40	24.00	24.00	24.00
Black Cherry	—	—	—	24.00	24.00	24.00
Hackberry	—	—	—	16.00	16.00	16.00
Black Willow	—	—	—	10.00	10.00	10.00
Hickory	—	—	—	20.00	20.00	20.00
PULPWOOD & POSTS (\$/Cd)						
Pine	8.00	8.00	8.00	6.00	6.00	8.00
Spruce	13.00	13.00 ¹²	13.00	6.00	6.00	6.00
Cedar	7.50	7.50	7.50	6.00	6.00	6.00
Balsam Fir	4.00	3.50	4.00	6.00	6.00	6.00
Tamarack	5.00	5.00	5.00	6.00	6.00	6.00
Aspen	2.50 ¹¹	2.25 ¹³	2.50	4.00	4.00	4.00
Birch	2.50 ¹¹	2.25 ¹³	2.50	4.00	4.00	4.00
Balm of Gilead	2.50 ¹¹	2.25 ¹³	2.50	—	—	—
Ash	3.00	2.25	4.50	7.00	7.00	7.00
Elm	3.00	2.25	2.50	7.00	7.00	7.00
Oak & Maple	3.00	2.25	4.50	7.00	7.00	7.00
Other Hardwoods	3.00	2.25	2.50	7.00	7.00	7.00

POLES (\$/Piece) ALL REGIONS

Base price per piece is to be calculated using 125% of your regional price per cord of sawbolts and the conversion factors for Pcs per Cd. from Table 10, page J-2.8 of the Scaling Manual.

PILING (\$/Piece) ALL REGIONS

Base price per piece is to be calculated using 150% of the Regional price per MBF of sawlogs and the conversion factors for Pcs per MBF from Table 10, page J-2.8 of the Scaling Manual.⁹

CABIN LOGS (\$/Piece) ALL REGIONS

When appraising special request sales involving Cabin Logs only, use twice the pole or piling price as dictated by the size and quality of the pieces being requested.

When Cabin Logs are only one of many products being cut on a timber sale, use the pole or piling Base Price directions shown above.

FUELWOOD (\$/Cd) ALL REGIONS

Fuelwood included on regular timber sales shall be priced the same as pulpwood, except that the appraiser may lower the price when selling tops, dead and down material.

Fuelwood sold on the Special Fuelwood Permit shall be priced in accordance with directives received from the Area Supervisors Office.

BOUGHS (\$/Ton) ALL REGIONS

All species \$9.25

CHRISTMAS TREES (\$/Pc.) ALL REGIONS

	2-4'	4-6'	6-8'	8-10'
Stagnant Spruce	.04	.08	.11	.14
Scotch Pine	.54	.85	1.22	2.06
White Pine	.50	.80	1.15	1.94
Norway Pine	.37	.54	.85	1.46
Jack Pine	.24	.30	.37	.43
Spruce-Balsam	.24	.30	.37	.43

FOOTNOTES

- Warroad and Baudette Areas use \$12.00
- Perham and Alexandria Districts use \$35.00
- Perham and Alexandria Districts use \$32.00
- Perham and Alexandria Districts use \$45.00 (Red Elm \$60.00)
- Perham and Alexandria Districts use \$50.00
- Sales in Cook County use \$10.00
- All Yellow Birch \$42.00, Birch in Cook County use \$10.00
- Hill City area use Region 3 prices
- When appraising poles or piling, refer to additional directions beginning on page B-3.6 of the Revised Timber Sales Manual
- Prices listed are for bolts under 12" top D.I.B.; for bolts 12" and over use 1/2 sawlog price
- Warroad and Baudette areas use \$2.00
- Spruce in Cook County use \$1.25
- Sales in Cook County use \$1.25
- Warroad and Baudette areas use 40% of the appropriate sawlog price
- Perham and Alexandria Districts use 40% of the appropriate sawlog price
- Sales in Cook County use \$4.00
- Hill City area use Region 3 price

Table 2 PULPWOOD PRICE GUIDE FACTORS¹

PRODUCTION FACTORS	ITEMS TO CONSIDER	S T A N D A R D									
		Poor		Fair		Average		Good		Excellent	
		Quantity	Factor	Quantity	Factor	Quantity	Factor	Quantity	Factor	Quantity	Factor
Felling Limbing Bucking	Cords/acre	0-4	.04	5-7	.07	7	.12	8-20	.15	20+	.18
	DBH" and sticks/tree	3"		6"		8"		8-10"		10+"	
	other factors ²	2	.04	2.5	.09	3.5	.15	4	.19	4+	.24
	Total		.02		.04		.08		.11		.13
			.10		.20		.35		.45		.55
Skidding	Cords/acre	0-4	.02	5-7	.05	7	.07	8-20	.09	20+	.11
	Slope(X)	25+	.02	15-25	.03	15	.05	10-15	.07	0-9	.09
	# of chains ³	10+	.01	7-10	.02	5-7	.03	3-5	.04	0-2	.05
	Total		.05		.10		.15		.20		.25
Hauling Distance	Secondary ⁴	15+	.03	10-15	.07	5-10	.10	3-5	.14	0-3	.18
	Road Haul (miles)										
	Haul to Mill ⁵	90+	.02	60-90	.03	40-60	.05	20-40	.06	0-20	.07
Total(miles)		.05		.10		.15		.20		.25	
Road Maintenance/Construction	Cost/Cord ⁶	1.00+	.05	1.00	.10	.75	.15	.50-.75	.20	0-.50	.25
Market Outlook	Demand		.00		.05		.10		.15		.20
Quality	Soundness ⁷		.00		.05		.10		.15		.20
Grand Total			.25		.60		1.00		1.35		1.70

- 1 To be used for each species on the Sale.
- 2 Limbs, underbrush, stocking, distribution, rocks, terrain, and residual stand requirements.
- 3 Skidding distance in chains plus other factors noted above.
- 4 Distance to all weather road.
- 5 Include secondary road haul mileage. Destination may be a concentration yard or railroad car landing.
- 6 Rocks, terrain, wet areas, and bridges must be considered.
- 7 Amount of rot and knots, sticks per tree, straightness and clarity of bole should be considered.

Table 3 SAWTIMBER FACTORS AND DEFINITIONS

PRODUCTION FACTORS	POOR ⁶	FAIR	AVERAGE	GOOD	EXCELLENT ⁶
Felling ¹ Limbing Bucking	.08	.15	.20	.25	.32
	Scattered timber less than 1300 BF/A. and ave. 1/2 to 1 1/4 logs per tree, short trees, heavy limbs, heavy underbrush, tree cull 35% or more, rocky terrain.		Moderate cut, 800 to 2400 BF/A. 1 to 1 1/4 logs per tree, clean bole trees, moderate to light underbrush, ava. terrain, tree cull 15-35%.		Heavy cut 1500+ BF/A and 2+logs per tree little limbing, clear bole to top diameter, no underbrush or reproduction. Terrain slightly rolling to level. Tree cull 10% or less.
Skidding ²	.04	.10	.18	.23	.29
	Less than 1300 BF/A. Residual stand problem, steep slopes, hilly and rocky, heavy underbrush, scattered timber, swampy or low areas considered if applicable.		Moderate cut. 800 to 2400 BF/A. Light to moderate underbrush, average terrain, residual stand no problem. Generally highland skidding.		Heavy cut. 1500 BF/A. Residual stand no problem, level to gently rolling, no underbrush.
Hauling ³	.05	.15	.30	.36	.42
	40+ miles to defined mill site. Woods road rough, rocky, winding, not all weather.		20-40 miles to defined mill site. Woods road in average terrain of moderate length.		20 miles or less to defined mill site. Woods road generally all weather, short, dry, few rocks, in slightly rolling to level terrain.
Market ⁴ Outlook	.02	.04	.09	.12	.15
	Wood difficult to dispose of, periodic markets, small lots a problem, poor run of logs.		Market generally available, average run of logs.		Local markets readily available, including small lots, very good run of logs.
Road Maint/ Const.	.03	.05	.08	.10	.13
	Extremely high road costs, \$1.50+ per MBF, rough rocky terrain. Wet areas a noted factor.		Moderate road costs, \$1.00 per MBF, average terrain.		Little or no road costs, less than 50¢ per MBF, gently rolling to level slopes, rocks, wet areas no problem.
Timber ⁵ Quality	.03	.06	.15	.24	.34
	Logs of smaller sizes in average, numerous knots, branch stubs, few clear bole trees, cull factor 35% or more, in log grade terms high percent of #2 or #3 logs.		Logs of medium sizes, average number of good logs with clear boles. Tree cull defect 15-35%, ava. run of #1 logs.		Large percent of logs of large sizes, 20+%, mostly good clear bole trees, few knots, swelling or branch stubs, tree cull defect less than 10%. Above average run of #1 logs in terms of log grade.
Total	.25	.55	1.00	1.30	1.65



- 1 Major factors: M. Bd. Ft./A. & logs per tree: Where overlap occurs make factor choice on secondary conditions.
- 2 Major factors: M. Bd. Ft./A and residual stand: overlap choice on secondary conditions, same as #1.
- 3 To specific mill site purchasing logs if known; otherwise closest mill purchasing the species.
- 4 Market Outlook where two or more log values are involved: choose factor for each species and average.
- 5 Quality - if log grade background and skill is known, base factor choice on these conditions.
- 6 Interpolation is allowed within group factors.

TIMBER APPRAISAL REPORT

Permittee John Doe				County Crow Wing	
SE/NE/SW	Section 15	Township 137	Range 26		

SCALE (Mark One) 4" to Mile 8" to Mile

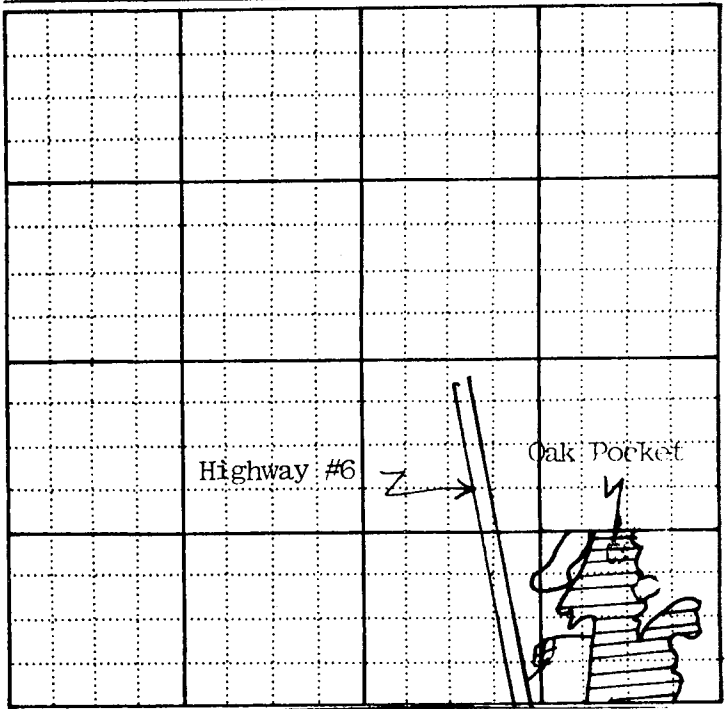
CUTTING REGULATIONS:

 - Leave Area
 - Cut Area. Boundaries marked with blue paint. Fell all stems over 2" except for oaks in marked pocket and any conifers. Dead snags may also be left standing. Oaks in pocket marked with red paint. Pines and spruces are not marked. Utilize to a 4" top minimum.

Owner will designate trails and landings.
 NO SKIDDING through leave area. Trails and roads to be left in passable condition.

Sale Duration: 18 months from sale date
 Slash Disposal Regulations: All slash to be left within 2 feet of ground.
 Price Guide Factors:
 Aspen (.15+.24+.04)+(.09+.09+.04)+(.18+.05)+(.25+.10+.05)=1.28

Price Guide Factors: _____
 Planned Cut No. _____
 Acres Sold by Type (Drain) _____
 Total Acres in Sale Area _____



Species	Products	M Feet	Cords	Pieces	Method of Scale	Unit Price	Value	
Aspen	Pulp & Bolts		380		Consumer Scale	3.70	1406.00	
Hardwood	Fuelwood		67		Sold as App.	1.95	130.65	
							Total Value	1536.65

Remarks: Oak pocket left for wildlife habitat improvement. Fuelwood composition (cords) - birch 32, maple 19, Oak, 11, Elm-Ash 5.

PULP & BOLTS BREAKDOWN			
Species	% Bolts	(Price using P.G.F.)	
		Pulp	Bolts
Aspen	10	3.20	8.20

Forest Development Plans: Allow stand to regenerate naturally to aspen (SI 65)

Appraiser	Date	Landowner	Date
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WOODLAND OWNER
TIMBER SALES CONTRACT

THIS AGREEMENT made and entered into this 28th day of August, 19 81, between John Doe of Anywhere, Minnesota, hereinafter called the Seller, and Mill, of Anyplace, Minnesota, hereinafter called the Purchaser.

WITNESSETH:

SECTION I. The Seller agrees to sell and Purchaser agrees to buy, under the terms and conditions hereinafter stated, all the timber marked or designated by the Seller, estimated to be 240 cords more or less, on certain lands held by the Seller and described as follows: 16 acres in Section (NENE) 8, Township 40, Range 26, County of Mille Lacs, State of Minnesota.

SECTION II. The Purchaser agrees to pay to the Seller the sum of six hundred ninety-six Dollars (\$696.00), more or less, as may be determined by actual scale at the rate of \$2.80/cord for Aspen Pulp & Bolts (To be consumer scaled)
\$3.00/cord for 8 cords of Hardwood fuelwood (Sold as Appraised)

SECTION III. The Purchaser agrees to pay the Seller a mutually agreed upon installment in advance of cutting. The first installment of two hundred thirty-two Dollars (\$ 232.00) shall be paid when the contract is signed, Balance to be paid before any cutting begins.

SECTION IV. The Purchaser further agrees to cut and remove said timber in accordance with the following conditions:

1. All designated or marked timber shall be cut and removed on or before 1 March, 19 83, unless extension of time is requested and granted in writing.
2. Cutting regulations to be followed (see attached appraisal)
3. Sawtimber will be scaled by the Scribner Decimal C log rule, and for sawtimber measured at the small end of the log along the average diameter inside the bark; and for veneer logs measured at the small end of the log along the small diameter inside the bark.
4. Whenever any unmarked or undesignated trees are cut, the Purchaser shall pay for them at a rate not exceeding three (3) times their scale.
5. Immature and unmarked trees shall be protected against unnecessary injury.
6. Stumps shall be cut so as to cause the least waste; stumps of trees up to ANY inches in diameter not higher than twelve (12) inches above the ground.
7. Only designated dead or unmerchantable species may be used for construction purposes in connection with the logging operation.
8. All roads shall be located as to avoid stands of young timber.
9. Care shall be exercised at all times by the Purchaser or his agents against the starting and spread of fire. Any fires caused by the Purchaser or his agents shall be suppressed by the Purchaser at his own expense and the Purchaser agrees to pay for all damage caused by such fire.
10. The Purchaser agrees to repair immediately, at his own expense, damage caused by him or his agents to roads, gates, fences, bridges, or other improvements on the Seller's property.
11. Only merchantable products specified in SECTION II shall be removed by the Purchaser.
12. All trees shall be utilized to a top diameter inside the bark to a minimum of 4 inches, unless defect resulting from decay or branching otherwise limits merchantability.
13. SPECIAL STIPULATIONS: Pruchaser agrees to pay any overrun at the rates specified in Section II within 30 days of sale completion. Purchers agrees to notify land-owner at least three days before cutting is to begin.

SECTION V. It is mutually understood and agreed by and between the parties hereto as follows:

1. All timber included in this agreement shall remain the property of the Seller until paid for in full. Merchantable wood left unhailed at the expiration of this contract, or any extension thereof, shall be paid for the by the Purchaser at the regular rate.
2. The Seller guarantees that he has full right and title to the timber included in this sale.
3. This agreement shall not be assigned in whole or in part by either party hereto without the written consent of the other party.
4. The Seller may stop all operations for violation of any term of this contract by the Purchaser, and for cause may retain all monies deposited to the Seller.
5. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by the parties to this contract; and in case of further disagreement, the final decision shall rest with an arbitration board of three (3) persons, one to be selected by each party to this contract and a third to be selected by the other two members.
6. The Purchaser shall remove all equipment and structures used during the operation within ninety (90) days after completion of this contract. If not removed, the items remaining become the property of the Seller.
7. The Purchaser shall save and hold the Seller (Landowner) harmless from any and all liability arising from the Purchaser's action or use and occupancy of Seller's property.
8. SPECIAL STIPULATIONS: Seller agrees to refund the price of underrun volume at the rates specified in Section II within 30 days of sale completion.

IN WITNESS WHEREOF, The Parties hereto have hereunto set their hands and seals on this _____ day of _____, 19 _____.

(Witness)

(Seller)

(Witness)

(Purchaser)

HOW TO SUCCEED IN TREE PLANTING

Jeff Edmonds
Red Wing District Forester
Minnesota Department of Natural Resources
Lake City, Minnesota

Dr. Scotty Scholten
Extension Forester
University of Minnesota, College of Forestry
St. Paul, Minnesota

WHY DO PEOPLE PLANT TREES?

The reasons for planting trees are not often apparent. After all, trees grow slowly, and the planter will usually not realize any dollar return on his investment. Sawlogs may take 60-80 years to grow, and most people simply can't wait that long.

The real reasons for planting trees are more subtle. One major factor may be pride of accomplishment. People who plant trees take pride in watching their seedlings grow. They have a feeling of doing something worthwhile, of leaving the world in better shape than they found it, of doing something for someone else's benefit.

Many people plant trees to grow forest products, even though they may not benefit themselves. The demand for wood and paper products is increasing, and these people want to leave something for the consumers of the future.

One forest product, however, can easily be planted and harvested in a person's lifetime: firewood. "Energy acres" is a term sometimes applied to these densely planted, fast growing plantations. They quickly regenerate from stump sprouts, and can be clearcut and regrown on a cycle of less than 10 years.

Windbreaks and shelterbelts are another energy-saving type of tree planting.

A good farmstead shelterbelt will . . .

- Reduce the effects of cold, piercing winter winds on humans and animals.
- Moderate the effects of hot, dry, searing summer winds.
- Beautify the home and farmstead, making them attractive places to live, work, and for recreation.
- Help to attract songbirds and gamebirds.
- Reduce the annoyance of noise and dust from adjacent roadways.
- Prevent snow from drifting around buildings, roads, and walks.
- Save tractor fuel and labor--less snow plowing and shoveling.
- Cut down feed costs. Cattle protected against winter winds use feed for weight gain and not merely to keep warm.
- Protect feedlots, gardens, and orchards.
- Aid in establishing lawn and landscape plantings.

Wildlife will benefit from all types of tree planting. Food and shelter can be found in every plantation. Plantings specifically intended for wildlife habitat usually include preferred food plants, such as honeysuckle or ginnala maple.

HOW DO YOU GET STARTED?

Examine the planting site you have in mind. What is growing there now? What are the soils like? Is there a steep slope? What is the aspect of the slope? What are the surrounding land uses? Are they compatible with a tree plantation?

Once you've answered these questions, you must ask a few more: What is the main reason for planting? What purpose would you like to accomplish?

Only when all these preliminary problems are solved can you determine what species to plant. The list of trees that are suited to both the site conditions and the primary purpose of planting should be narrowed down considerably.

You must also decide how to organize the project. Is any site preparation necessary to remove undesirable vegetation? You may have to begin preparing the site almost a year before planting, so plan ahead. Can the site be machine planted, or will you have to hand plant? Are some portions better suited to a different species than the rest of the planting area? Will you plant rows, clumps, blocks of different species, a random mix? What about spacing? Where can you get the necessary advice and equipment?

No single factor assures better survival or faster growth in a new windbreak or plantation than proper preparation of the planting area during the summer before actual spring planting. On open land, fallowing or keeping the land in a cultivated crop the year before planting assures a loose, clean pulverized soil. The soil then holds moisture well and is relatively free of competing weeds. Fallowing a full summer before planting is best.

A recently harvested woodlot may need underplanting to restock desirable species. Completing a clearcut to eliminate overhead competition, or clearcutting small patches for planting, will usually be sufficient to begin. However, it is often necessary to control brush competition in a few years. Several effective herbicides are available, depending on tree species planted and species to be removed.

Sites with "weed trees", unproductive low value species, can easily be prepared for planting by using a frill-applied herbicide. Tordon RTU, Banvel CST, Roundup, or 2,4-D mixes are all effective herbicides for this use. A small amount, squirted in axe chops, will kill the target trees, which can be left standing dead for wildlife, or cut later for firewood. This is a good way to eliminate boxelder, which normally resprouts heavily when cut.

Grasses and some weeds compete heavily with seedlings for moisture. Do not plant trees on sod ground or in an alfalfa field without first plowing well and working the soil for one or two years before setting out trees. This process is especially necessary on fine-textured soils with insufficient moisture during the growing season.

Plow just deeply enough to turn the sod; then disk thoroughly to cut it into small pieces. During the summer, plow deeper. Follow with a disk and spring-tooth harrow to keep down grass and weeds. Finally, let the area lie rough over the winter to catch snow and hold moisture for spring.

A thick sod layer or rank growth of competing vegetation is rarely a problem on light, sandy soils typical of east-central Minnesota. If you prepare sandy soils in the same manner as sod-covered ground, you can expect serious wind erosion and difficulties in planting. For favorable planting conditions, plow soils in the

fall and plant the following spring without working the ground further. Plowed furrows or hand-scalped spots will also work well, especially when combined with pre-emergent herbicides. Herbicides can be band sprayed along the rows, or spread by hand in a granular form.

Planting stock for shelterbelts, reforestation, and wildlife purposes is available from nurseries operated by the Minnesota Department of Natural Resources (DNR). This state agency provides forest planting stock in lots of 500 or more seedlings and transplants for general forestry purposes, including shelterbelts and field windbreaks. They are not sorted by size or condition, so a few scrawny ones will probably have to be culled out when planting. Generally, though, they are in good condition and you can expect good survival. State seedlings are sold at cost, and are shipped in round bundles.

Private nurseries also sell seedlings, often for more than twice the State nursery price. There is often a wider selection of trees and shrubs and they are usually sorted at the nursery. You can choose the size and grade best suited for your purpose.

Since it takes several years for the roots of bareroot conifer planting stock to become established and for significant height growth to begin, you may wish to consider planting container-grown conifers. Some conifer potted stock is available (SCS and private nurseries) in 6- to 8-inch pots. When planting container stock, the roots are not disturbed; therefore, survival is substantially increased. Greater height growth can also be expected the first year following planting.

Occasionally, a local entrepreneur may be selling home-grown seedlings. You should be wary: although inexpensive, the quality is usually inconsistent, and they could introduce disease problems to your plantation. Purchase trees from reliable sources--as close to your home as possible because stock is better acclimated, more suited to your soil, can be delivered quicker early in the spring, and costs less to ship than trees from a distance.

HOW SHOULD YOUR PLANTATION BE DESIGNED?

If you want to plant a shelterbelt, it should . . .

- Not be closer than 100 feet from the house, barn, and feedlot. Trees any closer can cause snow to pile up around buildings and drives and obstruct air circulation during hot summer months.
- Extend south and east 50 to 100 feet past the last main building to avoid snowdrifts which form around the ends of a tree belt.
- Have at least three rows of conifers--6 to 8 rows if hardwoods are included. Never crowd rows--it is better to have fewer rows with proper spacing.
- Contain one or two rows of shrubs or small trees to the south and east of the farmstead if there is a need to control wind and snow blowing from these directions.

Never surround your farmstead with trees on all four sides, as a "dead air pocket" is created in the center. This "dead air pocket" tends to suck the snow blowing over the trees down into the farmyard. Trees on all four sides can also make hot summer days unbearable by slowing down air movement.

If you are planting for timber or other purposes, you have more design flexibility. Rows are simplest to plant and maintain, but, when hand planting, other patterns

could be used. Random arrangements of different species can be planted, as long as all species are suited to the site.

When planting a shelterbelt one of the most important considerations is spacing of trees between rows and within rows. Trees require adequate soil moisture and sunlight to produce healthy crowns. When trees are crowded they compete for available soil moisture and their lower branches die from lack of light. Competition for soil moisture and dead branches result in considerable reduction in tree growth and effectiveness as a shelterbelt.

Close spacing: 1) provides protection earlier, 2) shortens the period required for cultivation, and 3) allows planting more rows on a limited area. However, these advantages are more than offset by the fact that wide spacing: 1) eliminates the necessity for thinning, 2) enables trees to retain branches much longer, and 3) most important, allows use of farm equipment for cultivation.

To maintain healthy vigorous trees for the life of the shelterbelt, they should be at least 20 feet from adjacent trees. Rows spaced at 20 feet also provide snow catches which will reduce snow damage.

If a shrub row is used, ideally it should be planted at least 60 feet (to accommodate farming equipment) out in the field. This serves as a snow catch and this area, because of added spring moisture from melted snow, will increase crop yields.

If a shrub row is to be planted adjacent to the first tree row on the outside, it should be 20 feet from the tree row, and plants should be spaced at least 8 feet apart to allow snow to filter into the belt. This reduces large snowdrifts that could cause damage.

Forest plantations are just as specific in spacing requirements. Deciduous trees, those with leaves, tend to have wider crowns than conifers, and require more room. However, the wide spacings of shelterbelts are not desirable, because, for timber production, it is beneficial for trees to lose lower branches. High quality logs are clear, with few branch stubs. The somewhat reduced rate of growth is offset by straight, clear-stemmed trees. A series of properly timed thinnings can achieve a balance of maximum growth rate as well as self-pruning of lower limbs.

Most hardwood trees will do well planted ten to 12 feet apart. This spacing allows plenty of room for healthy crowns to develop, but not so much that they become "limby". Conifers can be planted somewhat closer, about eight feet apart. Both types of trees will need thinnings as they grow.

CARING FOR YOUR TREES

The care your seedlings receive before and during planting can determine the success of your project. Keep them cool and moist; a root cellar is ideal for storage, but any unheated, shady, ventilated place will do. Keep them out of the sun at your planting site, and, while planting, do not allow the roots to dry out. Use mud, wet moss or sawdust to keep the roots damp.

If seedlings must be kept for more than a week or two before planting, they should be "heeled in". Dig a long shallow trench, open the tree bundle, spread out the seedlings along the trench and fill it in to cover the roots. Heeled in trees will keep for months, although it is best to plant them as soon as possible,

preferably before they break dormancy in early spring.

Machine planting can be done on any fairly level, smooth site. Old fields and pastures are ideal, and even clearcut forest areas can be machine planted if stumps and limbs do not interfere. You can expect to plant about 4,000 trees per day with a machine. A farm or caterpillar tractor is necessary to pull the planter, which generally consists of a cutting colter, a hollow plow shoe, and packer wheels to close the slot. When planting, be sure to set the trees at the proper depth to avoid "J-roots", bent or bunched up roots. It's a good idea to have an extra person walking along behind the machine to make sure the seedlings are properly placed, standing straight, and that the soil is well packed.

Hand planting is done on small areas, or sites that are too steep, rough, or rocky for a machine. A shovel can be used, or the more heavy-duty planting bar. Again, make sure the trees are planted at the proper depth, and the roots aren't bunched together. Keep leaves and grass out of the hole, and be sure it is packed at the bottom, as well as the top. About 700 seedlings can be hand planted in a day.

Once your trees are in the ground, your worries are not over. Young seedlings are easily overgrown by grass and weeds, and can be killed from lack of moisture or sunlight. Mechanical release (discing, tilling, hoeing) or herbicides should be used to eliminate heavy competition, especially from sod. Chemical herbicides provide an effective measure for controlling weeds and grasses and can relieve the landowner of time-consuming mechanical cultivation.

Caution: Always read the container labels for full directions on how to use the chemical product.

Simazine is a pre-emergent weed killer that controls most grasses and broad-leaved weeds. Apply it in late fall or early spring before weeds emerge. It is safe to use around most tree and shrub species, but avoid using it around honeysuckle, poplar, cottonwood and willow.

Where you intend to cultivate between tree rows, economical weed control can be obtained by spraying simazine in a 4-foot band over the tree row. If you treat narrower bands, tall weeds will fall across the treated strip and cover the small trees. It can also be applied as a granule, sprinkled in 4-foot circles around each seedling.

Amizine is a combination of a post-emergent herbicide and simazine. This combination is particularly effective in cleaning up shelterbelts or plantations that are over-grown with weeds and grasses.

Apply amizine on growing weeds in the early part of the growing season or before weeds have matured and gone to seed. DO NOT spray amizine on any tree foliage. Use a directed spray to prevent contact with the leaves and needles of your young trees.

The usual method of applying amizine is to make band applications between tree rows. You can apply it with a boom sprayer with nozzles 4- to 6-inches above ground designed to cover a 4-foot swath up to the base of trees. Use a low pressure cone-shaped coarse spray directed away from tree foliage. After three or four years, the trees should be able to outgrow the competition and spraying can be stopped.

For additional information on chemical weed control, see Chemical Weed Control in Shelterbelts and Forest Plantations, Forestry Fact Sheet 13. It is available at your County Extension Office or the Extension Forestry Office, 102 Green Hall, University of Minnesota, St. Paul, MN 55108.

Animals can also cause problems. Grazing must be eliminated. Before planting, build or repair fences as necessary to keep livestock away from the trees. Cattle, sheep, and horses will browse on the foliage and break lower branches. Horses will chew on the bark and often strip it off. The tree will die if the bark is stripped off completely around the stem. Hogs will "root" the soil, causing damage to young feeder roots. Chickens pick off new growth and needles and scoop out holes at the base of trees. When trees are taller, chickens roost in them, plastering stems and branches with droppings that can kill the trees.

The high nitrogen content of livestock droppings, especially from sheep and poultry, can be harmful to trees--conifers are particularly susceptible to damage from high nitrogen concentrations. All forms of livestock cause soil compaction by trampling. The heavier the soil the more serious the compaction. Compacted soil reduces the amount of rain water infiltrating the soil. Reduced soil water reduces tree growth and serious compaction may even kill the trees. Mice, rabbits, and deer can also kill or deform seedlings, by eating the bark and twigs. Remove tall grass and brush piles from the plantation to reduce rodent habitat. Deer can be harder to control. Try to avoid planting in areas heavily used by deer, as they often continue to use the same areas after the trees are planted. Sometimes the best alternative is to use cultural means to encourage the trees to grow as fast as possible, so that they are out of the deer's reach in a short time.

Moisture stress can be avoided by removing competing vegetation, mulching or watering. It normally is not a serious problem, except on extremely sandy soils.

Fire can be devastating in a conifer plantation. Plowed firebreaks should circle the perimeter of the plantation, and also cut through the interior to provide access. It will be necessary to disc the break several times a year, or use herbicides, to prevent its growing back to grasses. Special care should be taken to maintain a good firebreak along roads, since many fires begin at roadside.

Finally, take time to walk through your plantation. Appreciate the progress, note the changes, and be aware of any unusual circumstances. Most diseases or other problems can be controlled easily if detected early enough. If you're not sure what the problem is, or you need advice on your planting, there are several sources of assistance. The county extension agent, often located at the county seat, is available for agricultural assistance, including windbreaks, and general tree questions. The Department of Natural Resources forester can answer more specific questions on trees, from what to plant to how to harvest. He can write up a management plan, and provide detailed on-the-ground information. The SCS (Soil Conservation Service), and the ASCS (Agricultural Stabilization and Conservation Service) are ag oriented federal agencies. The SCS can be helpful in planning windbreaks or erosion control plantings. The ASCS administers federal cost-sharing programs, which will pay a portion of your costs of site preparation, the planting, or other forestry projects.

ALTERNATIVE FOREST CROPS--LET'S TRY MAPLE SYRUP

Carl E. Vogt
Extension Educator
Department of Forest Resources
University of Minnesota

Making maple syrup is a tradition and pastime for hundreds of forest landowners in the northern United States and Canada. Up until the early 1900s, maple syrup and maple sugar were the major confections used in North America. Americans made small amounts of maple syrup long before that. Early colonists, farmers, and pioneers learned syrup making from the Indians and then developed more elaborate collection and boiling techniques. The basic syrup making process has not changed in more than 380 years.

Figure 1 shows the geographic distribution of hard maple trees and the range of commercial production of maple syrup.

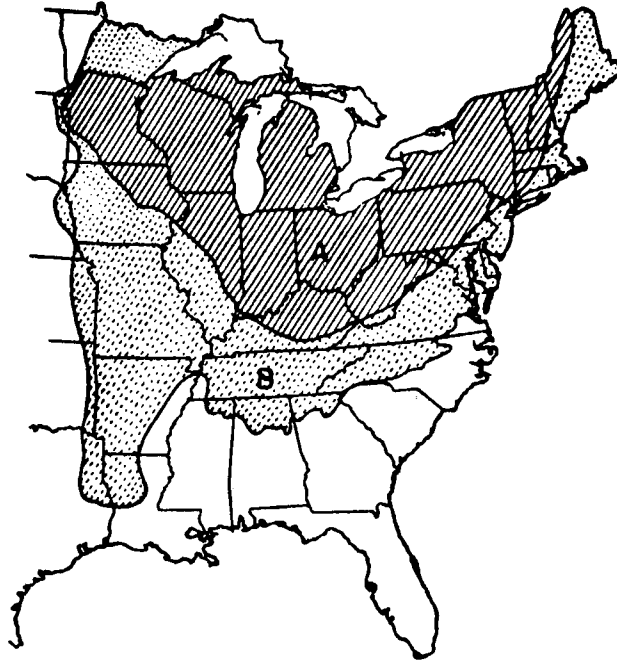
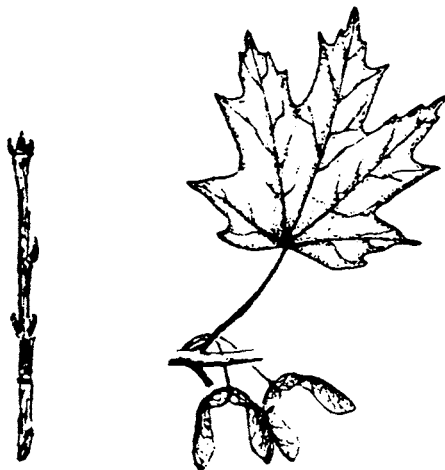


FIGURE 1. A and B, range of hard maple trees. A, range of commercial production of maple syrup.

Thirteen species of maple are native to the United States, and four of these species are used for maple syrup production in Minnesota. In order of preference, they are:

- Sugar maple (Acer saccharum)
- Red maple (Acer rubrum)
- Silver maple (Acer saccharinum)
- Box elder (Acer negundo)

Below are sketches of identifying characteristics of the four species of maple used for maple syrup production in Minnesota.



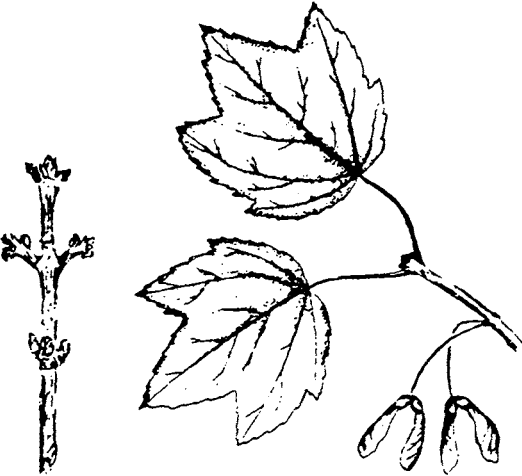
Sugar maple
(hard maple)

Acer saccharum



Silver maple
(soft maple)

Acer saccharinum



Red maple

Acer rubrum



Box elder

Acer negundo

Sugar content in maple trees varies from as little as 1 percent to as high as 10 percent. The sugar maple and red maple are generally preferred for sap production because they have the highest sugar content. Sugar maples in Minnesota have an average sugar content of 2 to 4 percent. Some trees near Mille Lacs Lake have a consistent sugar content of more than 12 percent.

If you have a stand of maple trees, a few basic pieces of equipment, below freezing nighttime temperatures, and above freezing daytime temperatures, you are ready to collect sap and make maple syrup.

EQUIPMENT NEEDS

Maple syrup can be produced with a minimum of equipment, but a few standard items increase the efficiency of the sap collection and the quality of the syrup:

- * a drill with a 7/16 or 1/2 inch bit
- * a metal spout for each taphole
- * a container (bucket or plastic bag) or tubing line to collect the sap from each taphole
- * metal trash cans with plastic liners to store sap
- * a large pan for boiling down the sap (the size will depend on how much sap you have)
- * a large-scale thermometer calibrated at least 15 degrees above the boiling point of water
- * wool, orlon, or other type filters for filtering hot, finished syrup
- * facilities and containers for storing the finished product

TAPPING THE TREE

To obtain the earliest runs of sap, trees should be tapped by mid-February in southern and central Minnesota. Tapping should be completed by the first week of March in the northern part of Minnesota. Only tap trees with a trunk diameter of at least 8 to 10 inches. A good rule for determining the number of tapholes that can safely be made in a single tree is shown below:

<u>Tree Diameter (inches)</u>	<u>No. of Tapholes Per Tree</u>
Less than 10	0
10-14	1
15-19	2
20-24	3
25 or more	4

Trees may be marked with a painted numeral, a series of paint dots, or different colors to indicate the number of taps per tree so it will not be necessary to remeasure each succeeding season.

Making fewer taps than permissible reduces the potential sap harvest without any benefit to the tree. Over-tapping may result in damage to the tree. For best sap production, a tree should have a short trunk topped with abundant foliage. Good management of a maple stand consists largely of cutting practices which favor the development and retention of such trees.

To tap a tree, select a spot on the trunk about 2 to 4 feet above the ground in an area which appears to contain sound wood. At this point, drill a hole approximately three inches deep into the wood, slanting it slightly upward to facilitate the downward flow of sap. Then lightly tap a collection spout. If you are using open buckets to collect sap, make sure to cover them so that rainwater and debris do not get in.

SAP COLLECTING EQUIPMENT

The different types of containers used to collect sap at the taphole are: (1) metal or plastic buckets, (2) plastic bags, and (3) plastic tubing.

Galvanized metal buckets of 15-quart capacity are the oldest and probably still the most common containers. Buckets made of lead-coated metal, lead-soldered buckets, or buckets painted with lead paint should not be used because the lead may dissolve in the sap. The syrup would then contain toxic lead residues.

Many syrup producers prefer plastic sap bags because they require minimum storage space and are easily transported in the woods. Moreover, the plastic is transparent to the ultraviolet rays in sunlight, which are lethal to micro-organisms and so tend to keep the sap sterile. Finally, the plastic bags are disposable, thus eliminating the task of cleaning collection equipment.

Plastic tubing provides an economical, labor-saving method of sap collection. Because it is a closed system, tubing minimizes microbial infections and keeps the sap clean and free of foreign matter. Vacuum tubing collection systems can increase sap production by as much as 100 percent.

The development of plastic tubing for sap collection has probably done more than any other factor to revolutionize the maple industry. Tubing has many advantages. It:

1. lowers labor costs and spreads them more uniformly over the period;
2. minimizes access and terrain problems;
3. produces greater sap yields than buckets and bags;
4. reduces initial costs per taphole;
5. improves sap quality; and
6. opens up the possibility of using artificial vacuums to produce even greater sap yields per tap.

COLLECTING THE SAP

Normally, a single taphole produces from a quart to a gallon of sap per flow-period (which ranges from a few hours to a day or more). Its seasonal accumulation is usually between 10 and 15 gallons.

To produce high-quality syrup, sap should be collected and boiled down as soon as possible. Where this is not possible, collections should be made as required, not exceeding every two or three days during prolonged flow periods. During periods of rather low temperature and under favorable storage conditions, collected sap may be kept for four or five days before boiling without reducing syrup quality. If sap is allowed to become warm before boiling, a darker syrup of poor quality may result.

SAP REQUIRED TO PRODUCE ONE GALLON OF SYRUP

The amount of water that has to be evaporated to reduce sap to syrup varies with the sweetness (percent of sugar) of the sap.

To determine the number of gallons of a particular sap required to produce one gallon of standard-density syrup, follow the "rule of 86". Standard-density syrup contains 86.3 percent of solids on a weight-volume basis. In maple syrup, the percentage of solids in sap and the sugar percent (degrees Brix) are essentially the same. Therefore, dividing 86.3 by the Brix value of the sap will equal the number of gallons of sap required to produce one gallon of syrup. The number 86.3 is usually rounded to 86. Thus, when the Brix value of sap is 2 degrees, the number of gallons of sap you will need to make one gallon of syrup is 86 divided by 2, or 43 gallons. The higher the sugar concentration,

the less sap is required to produce one gallon of syrup.

BOILING THE SAP (MAKING SYRUP)

The process of making maple syrup is essentially one of concentrating the sap (sugar solution) to a predetermined level by boiling it. The heat applied in the process develops the syrup's characteristic color and flavor.

Large commercial operations use a continuous feed evaporation process to make syrup. The evaporation pan is set up so that sap may be added and drawn off continuously. Small operations usually use a "batch approach". The evaporation pan is filled with sap, and more sap is added as necessary to replace that lost by evaporation. When a suitable amount of concentrated sap is present, the pan is "finished-off", to produce the correct density syrup.

To begin the continuous feed evaporation process, fill the evaporating container with sap. A large, shallow Teflon-coated pan is ideal. Begin heating the sap to the boiling point, taking care not to burn or scorch it. As the level of sap in the pan is lowered through evaporation, add more sap. Continue the process until most of the sap in the pan is highly concentrated, and the boiling point of the liquid begins to rise above the boiling point of water.

Finished syrup boils at seven degrees above the boiling point of water. As the temperature of the boiling sap approaches this point, boiling should be carefully controlled to prevent burning and overheating. Throughout this process, it may be necessary to occasionally skim the surface of the boiling liquid to remove surface foam and other materials.

Finishing maple syrup is an exacting task. The syrup must be drawn from the evaporator or finishing pan at just the right instant; otherwise its percent of sugar will be either too high or too low. To conform to federal and state requirements, syrup must have a density (percent of sugar) of no less than 66 percent Brix at 68 degrees Fahrenheit.

It is easiest to heat water to boiling at the time and place syrup is being made. Insert the bulb of a liquid stem thermometer or the stem of a dial thermometer and record the temperature of boiling water for the barometric pressure at the time and place. To find the boiling temperature of standard-density syrup, add 7.1 degrees to the temperature of boiling water.

Check the temperature of boiling water frequently (at least daily), especially if weather changes should occur. Failure to do this may result in syrup that is too thick or too thin. If

syrup is too thick, you will end up with fewer gallons, which will crystallize in storage. If syrup is too thin, the syrup will be watery and will tend to spoil easily.

PACKAGING MAPLE SYRUP

Once the desired boiling point has been reached, the syrup is ready for filtering and packaging. Pour the syrup while it is still hot through a paper pre-filter and then a suitable wool or orlon filter. Filtering removes suspended particles such as sugar sand and improves the appearance of the syrup. After filtering, package the syrup at a temperature above 180 degrees Fahrenheit (preferably about 185 degrees to 190 degrees Fahrenheit) so that the heat sterilizes the container. Place filled and capped containers on their sides so that the hot syrup sterilizes the cap. After cooling, store containers in a cool, dry place.

OTHER MAPLE PRODUCTS

Maple syrup may be converted into other products such as maple sugar, maple candy and maple fudge. Basically, these are produced by concentrating finished syrup to a greater density and stirring it during boiling.

KEEPING PURE MAPLE SYRUP

Keep bottles or cans of maple syrup in the refrigerator. If you purchase a very large can of maple syrup, it is a good idea to heat the syrup to the scalding point and recan it in smaller containers, adding just a little water to compensate for the slight evaporation.

Should the syrup start to ferment or should mold appear on the top of the can, do not be alarmed. Heat the syrup to the boiling point immediately and skim. This will usually restore the syrup to good flavor. The flavor of syrup that has been kept for a long time can often be restored by heating.

ADDITIONAL SOURCES OF INFORMATION

Minnesota Maple Syrup Producers Association
%Minnesota Maple News
P.O. Box 124
Osseo, MN 55369

North American Maple Syrup Council
Route #2
Bainbridge, New York 13733

Minnesota Department of Agriculture
ATT: Marketing Specialist
90 West Plato Blvd.
St. Paul, MN 55107

Extension Forestry Office
College of Forestry
University of Minnesota
1530 North Cleveland Ave.
St. Paul, MN 55108

REFERENCES

Maple Syrup Bulletins are available from the Cooperative Extension Service in your state.

USFS. Maple Syrup Producers Manual. Agriculture Handbook No. 134, Washington, D.C. 20402.

Thompson, Bruce. 1978. Syrup Trees. Fountain Hills, Arizona 85268.

USFS. 1982. Collecting Maple Sap with Plastic Tubing. NA-FR-23.

Mann, Rink. Backyard Sugarin' II. The Countryman Press, Taftsville, Vermont 05073.

WEED AND BRUSH CONTROL: MECHANICAL

C. Barry Morse

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Control of weed, grass and brush competition is necessary to successfully establish and manage new forest plantings. The control of competing vegetation prior to planting is referred to as Site Preparation. Continued vegetation control several years after planting is called Plantation Release.

SITE PREPARATION

It is important that seedlings be given a good start in the forest planting, since they cannot be cared for like a garden or trees in your back yard which are easily accessible.

This is accomplished with a site preparation activity which reduces the competition for sunlight, moisture and nutrients as much as possible. The method of site preparation will be determined by the site conditions, species of trees to be planted, availability of equipment and estimated costs to accomplish the task.

Fields With Light Sandy Soils

A minimal amount of mechanical site preparation will be required to control vegetation on light soils since sod mats are generally absent. However, the soil moisture and growth potential of the site can be improved if disked during the mid to late summer prior to planting. If disking the entire site presents an erosion problem, then disk strips 6'-8' wide and plant on the center of the strips.

Furrowing with a 1 or 2 bottom plow can also be done. The plow depth should be adjusted to just peel away the sod roots to minimize the amount of top soil removed. The furrows form the rows that the trees will be planted in.

Fields With Heavy Soils & Heavy Sod

The control of heavy sod prior to planting is critical to early plantation survival. Mechanically removing the sod by plowing and disking the site, the fall prior to planting is recommended. The disked area can then settle during the winter months which will produce a suitable planting site with good soil moisture. Avoid working on these heavier soils during wet weather. Soil compaction can severely limit root development and tree growth.

Cut Over Areas & Brushy Sites

These sites are generally the most difficult and most expensive to treat mechanically. Trees planted in these sites must not only compete with other root systems for moisture and nutrients, they also must compete with other above ground stems for light.

The following mechanical methods to control brushy vegetation should be considered. Note however, that a combination of mechanical and chemical methods will generally be needed to sufficiently manage or control unwanted vegetation on these sites.

1. Shearing & Piling - Medium to larger dozers with special shearing or raking blades are used to shear and pile brush, scattered trees, and logging slash. Extreme care should be taken to minimize the amount of top soil pushed into the slash and brush piles. Minimum soil disturbance and compaction will occur when this type of work is done during the frozen soil winter months.
2. Scarification - A variety of specialized scarification implements are used to create acceptable planting sites. As with the shearing and raking methods, large cats or timber skidders are used to pull the equipment. Shark finned barrels, patch scarifiers, heavy duty disks, and disk trenchers are just some of the types of equipment used in Minnesota to prepare large sites (10 acres +) for forest tree planting.

On smaller sites hand cutting of brush, hand scalping of grass and sod, or chain saw felling of trees can be done. However, it takes an extreme amount of human energy and sprout regrowth of cut stems is prolific in many species of hardwood trees and brush that you may be trying to control. The use of selective herbicides before or after the mechanical activities is usually necessary.

MECHANICAL RELEASE OF ESTABLISHED PLANTINGS

Control of unwanted vegetation may be necessary for several years after your trees are planted. The intensity and method of control are dependent upon the individual planting site characteristics, such as soil type, type and density of vegetation to control, and the growth rates of the trees you have planted.

Releasing From Weed & Grass Competition

Plantation release from grass and sod development may be necessary 2-3 years after planting even though good site preparation work was done prior to planting. Mechanical control of grass and sod can be accomplished by hand weeding, or cultivation with various types of motorized equipment. With either method, one must be very careful not to disturb the root systems of the young trees or damage the above ground stems.

Releasing From Tree And Brush Competition

Trees planted on cutover or brushy sites generally suffer from competing and over topping vegetation. Dense growths of Raspberry, Hazel brush, Alder brush, willow and various species of tree sprouts such as Aspen, oak, and birch, can be very difficult to control through mechanical methods.

Dense over topping vegetation often makes it very difficult to even locate young seedlings. Hand cutting of brush around individual seedlings will provide temporary (1 growing season or less) release. Cut stems of most woody plants will re-sprout vigorously resulting in an increased number of unwanted stems of vegetation which can effectively smother a young plantation. It will therefore be necessary to cut unwanted brush and tree sprouts repeatedly until the planted seedlings are able to grow above the surrounding vegetation.

Motorized brush choppers and mowers can be used to cut competing vegetation between rows of trees if rocks and stumps are not present, and if the rows of planted trees are visible. Repeated mowings will be necessary to control re-sprouting stems.

SUMMARY

Control of competing vegetation in forest plantings is necessary to assure good survival and maximum growth of planted seedlings. Mechanically removing vegetation during the site preparation activity improves the ease of planting and increases the initial survival of planted seedlings.

Multiple release activities by mechanical means will improve long term seedling survival and promote seedling growth. Mechanical methods usually require specialized heavy equipment or many man hours of hand labor effort.

WEED AND BRUSH CONTROL: HERBICIDE USE

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Minnesota Department of Natural Resources

A herbicide is one of several tools which can be used by a forest landowner to help manage competition. You, as landowner and manager, must ultimately make a decision which tool should be used. Consider the following when deciding which is the best tool:

1. COMPETITION IS PRESENT ON THE SITE: This may seem obvious, but make sure you do have a competition problem. Just because there are noncrop species of trees and shrubs on your site does not mean a problem exists. Your plantation does not have to look like a bare ground agricultural field. Try to compare height growth between crop trees growing out in the open and crop trees growing among the noncrop trees or brush. If there is a difference of 50% or more, treatment will be needed. Also, put in a series of circular milacre plots throughout the area you want to treat. With plantations, use the crop trees as plot centers. If 50% or more of the plots have thick grass sod, or all of the plots average at least two overtopping woody stems and at least 50% of the plots have at least one overtopping woody stem, competition is probably severe enough to make treatment necessary.
2. COMPETITION HAS DEVELOPED: Most herbicides, except for the preemergent grass herbicides, work best when there is leaf surface to absorb the herbicide. Even in the case of soilactive herbicides such as picloram (Tordon) and hexazinone (Velpar), leaf uptake is also important. For best results, be sure that the target vegetation is above ground, has fully expanded leaves, is actively growing, and is not under stress.
3. SPECIES CONVERSION IS THE OBJECTIVE: When planting conifers on sites formerly occupied by hardwoods, herbicide use will nearly always be required. The tremendous sprouting capability of most hardwood root systems will quickly re-establish the hardwoods and choke out the conifers. Herbicides used especially during site preparation will help to kill out the root systems and give the newly planted conifers a chance to establish and grow.
4. LARGE AREAS ARE TO BE TREATED: Often, herbicides are the most cost effective treatment, especially when areas are large enough to be aerially treated. Consider using herbicides by aerial application on sites 20 acres or larger in size. On large areas with spotty competition problems, consider treating only those areas with competition rather than aerially spraying the entire site.
5. AREA TO BE TREATED IS REMOTE OR INACCESSIBLE: Since herbicides kill both tops and roots, one application is usually sufficient. Remote or inaccessible areas, then, would have to be treated only once and could be done with a helicopter reducing both expense and effort.

6. FUNDING IS LIMITED: Herbicide costs typically range between \$30 and \$60/acre; costs for competition reduction with heavy equipment range between \$60 and \$120/acre; burning costs range between \$40 and \$140/acre; and costs for utilizing hand labor range between \$150 and \$200/acre. Heavy equipment, burning and hand labor rarely disturb the root systems, and resprouting, retreating, and spending of more funds are the results of not using herbicides.

7. AREA IS CLOSE TO HOMES, WATER OR NEIGHBORING PROPERTY: There are no herbicides registered for forestry applications that can be applied into water. Most neighbors do not want herbicides to drift or run onto their homes and properties. If your treatment area is close to any of these features, either use noherbicide-treatment buffer strips or choose an alternate means of treatment.

8. NEIGHBOR ATTITUDES AND/OR LOCAL POLITICAL CLIMATE IS ANTIHERBICIDE: Herbicide use is a very controversial issue. If your use of herbicides may lead to legal litigation or hostile neighbor action, consider alternate means of treatment.

9. A HERBICIDE CAN BE FOUND WHICH IS LEGAL TO USE AND WILL ACCOMPLISH YOUR OBJECTIVES: Be sure you read the label of the specific herbicide you wish to use. Not all herbicides can be used on all sites. For example, there are many formulations of 2,4D but there are only a few that can be used on forestry sites in the Lake States. The label will tell you what kind of site on which to legally use the herbicide, the legal rates to use, the target vegetation, the crop trees on which the herbicide can be safely applied, the time of the year to apply the herbicide, and precautions to be aware of. Read and be familiar with the label before making the final decision to use a herbicide.

To help guide you in your planning and decisionmaking, the following is a guide for herbicide selection for forestry uses in Minnesota as of January, 1984. Because pesticide registrations and regulations vary from state to state and they are constantly changing, consult state forestry personnel, consulting foresters and/or extension agents before making your final decision.

SITE PREPARATION

<u>CHEMICAL</u>	<u>BRAND NAME</u>	<u>TARGET SPECIES</u>	<u>RATES</u>	<u>COST</u>	<u>APPLICATION</u>
Hexazinone	Velpar L	See Release	1-2 gal.	\$37/gal.	See Release
	Velpar Gridballs	See Release	7½-20 lbs.	\$ 3/lb.	See Release
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Glyphosate	Roundup	See Release	3-4 qts.	\$70/gal.	See Release
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2,4-D	Esterone 99C	See Release	3-4 qts.	\$15/gal.	See Release
	Weedone LV4	Hazel	3 qts plus 3 qts fuel oil	\$15/gal.	Broadcast both ground and aerial
<hr/>					
2,4-D 2,4-DP	Weedone 170	Alder, ash, aspen, birch blackberry, fir, honeysuckle, oaks, pines, poplar, red elm, and maple, spruce and willow.	1 gal.	\$22/gal.	Broadcast both ground and aerial, basal bark, cut surface, frill.
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Picloram 2,4-D	Tordon RTU	See Release	See Release	See Release	See Release
	Tordon 101-R	See Release	See Release	See Release	See Release
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	Tordon 101	Alder, aspen, birch, black- berry, bracken fern, cedar, cherry, elm, balsam fir, hickory, honeysuckle, locust maple, oak, pine, spruce, sumac, wild rose, willow and annual and perennial broad- leaved weeds.	1-4 gal.	\$27/gal.	Broadcast both ground and aerial
<hr/>					
Triclopyr	Garlon 4	Alder, ash, aspen, beech, birch, blackberry, cherry, chokecherry, cottonwood, hawthorn, dogwood, elder- berry, elm, hazel, hickory, hornbean, locusts, maples, oaks, pine, poplar, sumac, willow, winged elm, and annual and perennial broad- leaved weeds.	1½-4 qts.	\$70/gal.	Broadcast both ground and air, and basal bark

SITE PREP

<u>CHEMICAL</u>	<u>BRAND NAME</u>	<u>TARGET SPECIES</u>	<u>RATES</u>	<u>COST</u>	<u>APPLICATION</u>
Fosamine	Krenite	Birch, blackberry, black locust, bracken fern, pin cherry, quaking aspen, red alder, red oak, sumac, white oak, big leaf maple, black cherry, chokecherry, elm, hawthorn, hickory, red maple, willow, white ash, cottonwood, white pine, multiflora rose, slippery elm, wild grape, and wild plum.	1½-3 gal.	\$47/gal.	Broadcast both air and ground.
Dalapon	Dowpon M	Annual and perennial grasses and cattails	4-15 lbs.	\$1.25/lb.	Broadcast both air and ground
Amitrole Simazine	Amizine	Annual and perennial broad leaves & grasses	7 lbs.		Broadcast from ground To be used <u>only</u> when planting black walnut (24-C label)
Simazine	Princep 80W	See Release	See Release	See Release	See Release
	Caliber 90	"	"	"	"
	Princep 4L	"	"	"	"
	Princep 4G	"	"	"	"
Dicamba	Banvel	Alder, white ash, aspen, basswood, birch, dogwood, hickory, maple, oak and pine.	-	\$17/gal.	Injection only
Dicamba & 2,4-D	Banvel 520 Banvel 720 Banvel CST	See Banvel	1-9 gal.	\$20/gal.	Broadcast both ground and air; basal bark and injection.
Trimec	Acme Brush Killer 800	Ash, aspen, brambles, oak, willows, birch, blackcherry, dogwood, elm, gooseberry, maple, pine, spruce, sumac, wild plum, plus broadleaved herbaceous weeds.	12 gal.	\$35/gal.	Broadcast both ground and air; basal bark and injection. (Can be mixed with Garlon 4 at Trimac & 1 pt. Garlon 4)

RELEASE

<u>CHEMICAL</u>	<u>BRAND NAME</u>	<u>CROP TREES</u>	<u>TARGET</u>	<u>RATES/ACRE</u>	<u>COST</u>	<u>APPLICATION</u>
Hexazinone	Velpar L	Red Pine White Spruce	Aspen, blackcherry, oak, plum, red maple, ash, brambles, box elder, bracken fern, asters, golden rod, perennial grasses.	1-2 gal.	\$37/gal.	Broadcast both aerial and ground. Spot treatment, Stem treatment. (Label Sup.)
	Velpar Grid- balls	Red Pine White Spruce	Aspen, birch, blackcherry, oaks, wild plum, winged elm	7½-15 lbs.	\$ 3/lb.	Grid pattern from ground or air. (24-C label)
Glyphosate	Roundup	<u>Pinus</u> spp. <u>Picea</u> spp. Other silvi- cultural species*	Alder, berries, elderberry, honeysuckle, maple, oak, poison ivy & oak, willow, perennial grasses, annual grasses, annual and perennial broad leaved weeds	1½-2 qts.	\$70/gal.	Broadcast both ground and air; tree injection. *Use as a post directed spray.
2,4-D	Esterone 99C	Jack, red pine, white, black spruces	Alder, aspen, birch, hazel, and willow	1½-3 qts.	\$15/gal.	Broadcast both ground and air; tree injection. (Vertac)
2,4-D 2,4-DP	Weedone 170	Red, jack, Scots white pines; black and white spruces; balsam fir.	Alder, aspen, birch, cherry hazel, oak and willow.	2-4 qts	\$22/gal.	Broadcast both ground and air; tree injection. (24-C label)
Picloram 2,4-D	Tordon RTU Tordon 101R	----	Alder, aspen, birch, cherry, dogwood, elm, fir, green ash, hawthorn, hickory, hornbean, maples, oaks.	1ml/2-3 in. of stem dia.	\$22/gal.	Injection or cut surface treatment only.
Amitrole/ Simazine	Amizine	Balsam fir, Nor- way spruce, red pine, Scots pine, silver maple, white ash and white spruce. Black walnut (24C label)	Annual and perennial broad leaved weeds and grasses.	7 lbs.	---	Directed ground sprays away from crop trees. Use only on trees established at least one year.
Simazine	Princep 80W Caliber 90 Princep 4L Princep 4G	B. walnut; R. oak; W & N spruce; R, W & Scots pines, & W cedar	Grasses and annual broadleaved weeds	2.55 lbs; 80W; 2.24.4 lbs; 90; 24 qts; 4L 50100 lbs: 4G	\$3.50/lb. \$1.00/lb.	Apply before or after seedling transplanting.

RELEASE

<u>CHEMICAL</u>	<u>BRAND NAME</u>	<u>CROP TREES</u>	<u>TARGET</u>	<u>RATES/ACRE</u>	<u>COST</u>	<u>APPLICATION</u>
Simazine/ Atrazine	Princep 80W Caliber 90 Princep 4L Aatrex 80W Aatrex Nine0 Aatrex 4L or 4LC	Red oak, white oak, white ash, black locust	Grasses and annual broadleaved weeds	<u>Simazine</u> 2.5 lbs, 2.2 lbs or 2 qts. <u>Atrazine</u> 2.5 lbs, 2.2 lbs or 2 qts.	\$3.50/lb \$2.35/lb	Apply before or after seedling transplanting
Dicamba	Banvel		See Site Prep		\$17/gal.	Injection only.

SHIITAKE: THE JAPANESE FOREST MUSHROOM

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For individuals having access to small diameter hardwood trees, especially oaks, it is possible to produce a valuable edible mushroom. Shiitake (she-e-ta-kay), an important crop in Japan, can be successfully cultivated in the United States.

Shiitake is the major edible mushroom in Asia. In 1978, the Japanese Shiitake industry employed 188,000 people and generated \$1.1 billion in retail sales; dried Shiitake was Japan's major agricultural export. Successful commercial cultivation began in the 1940's in Japan with the development of new inoculation techniques. Small diameter hardwood logs, especially oaks, are the preferred material on which to cultivate this mushroom. Trees are usually felled in winter. In early spring logs are cut and inoculated with pieces of wood overgrown with the Shiitake fungus. After an inoculation period of 1-2 years, mushrooms are produced for three to five years, usually during the spring and autumn. When properly cultivated, one hundred pounds of logs will yield as much as 9-35 pounds of fresh mushrooms. Because fresh mushrooms are 90 percent moisture, dry weight yields are 10 percent of the fresh weight.

Markets exist within the United States for the sale of Shiitake. With increased availability of Shiitake, further market expansion should be possible. Although suitable hardwood species are available in many areas of the United States and the climate often acceptable, current U.S. Shiitake production is limited, primarily because of the lack of accessible information on Shiitake and its cultivation.

Potential markets for Shiitake include local Oriental food stores and restaurants which now purchase dried Shiitake from Japan. When a grower can consistently produce and deliver quality mushrooms in sufficient quantity, inquiries can be made into the possibility of supplying mushrooms through grocery markets, distributors, or to food packaging companies for use in their products.

WHAT YOU NEED TO KNOW ABOUT TAXES

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A clear understanding of income and property tax procedures may benefit you financially and as a result encourage better forest management. This article briefly describes how to handle common transactions, including purchase of woodland, timber sales, operating expenses, capital expenses, timber stand improvement, tree planting, cost-share payments, timber damage and property taxes. More detailed instructions are available in "A Guide to Federal Income Tax for Timber Owners", listed at the end of this article. Consult the Internal Revenue Service or your tax advisor if you have special problems.

How you handle some transactions will depend upon how you use forest property. Property held for personal use includes the house and land that serve as your residence and forest property used for a second home or for recreation. Property used to produce income, such as a farm woodlot, but which is not an integral part of a trade or business is investment property. Property is held for use in a trade or business, if it is an integral part of an activity entered into for the purpose of making a profit. This article focuses on how to handle transactions when the land is owned for personal use or investment.

COSTS OF FOREST OWNERSHIP AND OPERATION

For income tax purposes your expenditures as a forest owner are classified as (a) additions to capital, such as acquisition of land and timber, (b) deductions from gross income, such as operating expenses, or (c) deductions from timber sale proceeds, such as timber sale expenses.

Capital Expenditures

Money you spend to acquire real estate or equipment, or to make improvements that increase their value, is classified as a capital expenditure. Examples include purchases of land, timber, buildings, equipment having a useful life of more than one year; acquisitions of rights-of-way extending more than one year; expenditures for construction of bridges, roads, firebreaks; and tree planting. You cannot deduct capital expenditures from gross income in the year they are incurred. Instead, such expenditures are recorded in a capital account and become the original cost basis which is generally deducted from future earnings. The original cost basis may change as capital improvements are made to the asset or as allowances for depletion or depreciation are

claimed. In most cases you will want to establish capital accounts for each class of asset (land, timber, roads, fences, buildings, etc.) in order to claim depreciation deductions. It is to your advantage to determine the original cost basis of the various assets by allocating the total basis according to the separate fair market value of each (Example 1).

Example 1. You bought a 100 acre tract of timber land in 1975. The contract price was \$41,000, but you also paid \$800 for a boundary survey, \$200 for a title search, and \$1,600 for timber inventory. Therefore, your total acquisition cost was \$43,600. The timber inventory showed that the tract contained 1,000 cords of merchantable pine pulpwood on 90 acres valued at \$18.00 per cord, and 10 acres of premerchantable young growth valued at \$25.00 per acre. Now you can figure your original cost basis for the land, merchantable timber and young growth by determining the proportion of the total fair market value represented by each and multiplying this ratio by the total acquisition cost. For example, by dividing the fair market value of the merchantable timber by the total fair market value, $\$18,000/\$38,250 = .4706$, and multiplying by the total acquisition cost, $0.4706 \times \$43,600$, gives an original cost basis of \$20,519 for the merchantable timber. The original cost basis for all assets is given below.

ASSET	FAIR MARKET VALUE	PROPORTION OF TOTAL FAIR MARKET VALUE	ORIGINAL COST BASIS
Land	\$20,000	0.5229	\$22,798
Young growth	250	0.0065	283
Merchantable timber	18,000	0.4706	20,519
TOTAL	\$38,250	1.000	\$43,600

You must allocate the basis according to the relative values of the assets at the time the property is acquired. If you acquired forest land several years ago, it still may be possible to determine the fair market value of the timber when the property was purchased. Contact a forester to obtain a timber inventory.

Land Account: Assets that you place in the land account include the land itself, nondepreciable improvements (e.g., clearing, grading, and ditching of permanent roads; land leveling; and impoundments), and depreciable land improvements (e.g., bridges, culverts, graveling roads, fences, and nonpermanent structures and improvements).

Timber (Depletion) Account: You should place items included in the timber (depletion) account into one of three sub-accounts (1) timber, (2) young growth (trees of premerchantable size), or (3) plantations or deferred reforestation (trees that are planted or seeded). Each of these sub-accounts includes entries reflecting

the volume of timber or the number of acres of young growth or plantation as well as the dollar basis for each. The plantation sub-account should report costs incurred in connection with establishment of the timber stand (e.g., site preparation, cost of seedlings, tools, depreciation charges for equipment used in planting and hired labor.) You should transfer amounts from the plantation accounts to the timber sub-account as the trees become merchantable.

Equipment Account: This account usually consists of a set of sub-accounts for each item or class of items of equipment, including power saws, tractors, trucks, and tree planting machines. Increase the basis of equipment by any amount spent for major repairs or reconstruction that significantly increased the value or prolonged the life of the equipment. You can recover through depreciation allowances any expenses for equipment purchases, major repairs and improvements to the equipment.

Operating Expenses

You may deduct expenses incurred for managing, conserving, or maintaining property providing the expenses are ordinary, necessary, and directly related to the income potential of the property. Operating expenses may be deducted whether or not the property is producing income currently. Operating expenses include what you spend for tools of short life (usually one year or less) or small cost (e.g., axes, hand saws, sledges and wedges), costs of operating and maintaining equipment, hired labor, travel expenses if your trip is primarily related to the income potential of the property, property taxes, interest payments, insurance premiums, and maintenance of roads and fire lines.

Receipts From Timber

When you report proceeds from the sale of timber, you must determine the amount as well as the kind of gain or loss. You determine the amount of gain or loss by reducing the total proceeds by the cost basis of the asset that is sold and by any expenses directly related to the transaction. Once you have established the original basis of the timber, adjustments may be needed (Example 2), especially at the time timber is sold, to reflect additional timber acquired, timber disposed of since the last adjustment, capital improvements, losses claimed and carrying charges that you capitalized.

Example 2. In 1979 you purchased a 50 acre tract of timber land next to your original tract (Example 1). The total purchase cost was \$22,500 of which \$10,589 was allocated to the timber (700 cords) and the balance of \$11,911 to the land. The cost basis and volume of this timber were added to the existing timber account for the 100 acre tract. In the same year you had all your timber recruised in

anticipation of making a sale. The cruise indicated that the total volume of merchantable timber on the 150 acres was 2,110 cords. You usually expensed your carrying charges for the property, however, in 1979 you capitalized carrying charges of \$1,017. The adjusted timber account as of the end of 1979 was:

TRANSACTIONS	QUANTITY (cords)	COST BASIS
Estimated quantity (at end of 1977)	1,210	\$20,802
Addition for growth (2 years)	200	---
Timber acquired during year	700	10,589
Addition to capital during year	---	1,017
<u>Net Quantity and Value</u>	<u>2,110</u>	<u>\$32,408</u>

When you sell timber, you have an opportunity to recover your cost basis. That is, you can deduct the original purchasing cost of your timber from your timber sale receipts and therefore reduce the amount of your taxable income (Example 3).

Example 3. In 1980 you sold 1,000 cords of the timber available on your 150 acre tract. The contract price was \$22,000 payable in cash on the effective date of the contract. A consulting forester cruised, marked and sold the trees charging \$2,200 for these services. You determine your allowable basis for the timber sold by multiplying the depletion unit by the number of units sold. You estimate that growth has added 210 cords to your inventory over the past year. Your depletion unit is calculated by dividing the cost basis (\$32,408) by the adjusted volume (2,320 cords). The depletion unit is \$13.97 per cord. The allowable cost basis that can be deducted (\$13,970) is determined by multiplying the depletion unit (\$13.97) by the number of units sold (1,000 cords).

TRANSACTIONS	QUANTITY (cords)	COST BASIS
Estimated quantity (at end of 1979)	2,110	\$32,408
Addition for growth (one year)	210	---
Total at end of year before depletion	2,320	32,408
Depletion unit	---	13.97
Quantity of timber sold	1,000	---
Allowable as basis of sale	---	13,970
<u>Net quantity and value</u>	<u>1,320</u>	<u>\$18,438</u>

Capital Gains From Timber Transactions

Your standing timber for income tax purposes is either a capital asset or a noncapital (ordinary) asset. Ordinary gains (income) are fully taxable and ordinary losses are fully deductible. If you sell timber that you have owned for less than one year, the income is treated as an ordinary gain. You can deduct from that gain the cost you incurred in conducting the sale (e.g., advertising, timber cruising, marking, scaling, fees of consulting foresters, and lawyers).

If you sell timber that has been held more than one year, then only 40 percent of your gain, referred to as net long-term capital gain, is subject to tax. The 40 percent subject to tax is added to your other income and taxed at the rate for ordinary income. Timber is a capital asset if it is not used in your trade or business or held primarily for sale to customers. Therefore, timber is a capital asset if you are holding it primarily for personal use or as an investment. If timber is a capital asset to you, then it is permissible to sell standing timber for a lump sum and claim the capital gains deduction. If your timber does not qualify as a capital asset because you use it in the course of your business, then you must treat sales of standing timber for lump sum as ordinary income.

Timber cut under a contract that requires payment only at a specified rate for each unit of timber actually cut, rather than a lump sum amount of money, is a disposal with an economic interest retained. Such a transaction is reported as a capital gain regardless of whether the timber is held primarily for sale, even if you are a dealer or speculator in timber.

When standing timber is cut by the owner and the logs or other

timber products are sold, the proceeds represent (1) the gain from holding the standing timber, and (2) the value added to the standing timber by converting it into products. The value of the standing timber can be treated as a capital gain, providing you held the timber for more than one year. A profit realized from converting the standing timber to products is treated as ordinary income, and the proceeds from the sale of the converted products are not capital gains (Example 4).

Example 4. You cut 60,000 board feet of timber during 1983 from a tract purchased in 1965. The fair market value of the standing timber that you cut was \$30.00 per thousand board feet, or \$1,800 as of January 1, 1983. Your basis in the timber cut was \$355.80. Also in 1983 you sold, at the roadside next to the tract, the sawlogs produced. You received \$3,300 for the logs. Your logging and skidding costs totaled \$1,080. Since you had owned for more than one year the timber cut, you can report part of your earnings as a long term capital gain. You determine the gain or loss on the cutting of the timber separately from the gain or loss from the sawlogs as follows:

Gain From Cutting

Fair market value as of 1-1-83 of timber cut during 1983-----	\$1,800.00
Less: Cost or other allowable basis -----	355.80
Capital gain-----	\$1,444.20

Gain From Sale of Sawlogs at Roadside

Proceeds from sale of sawlogs-----	\$3,300.00
Less: Fair market value as of 1-1-83 of timber cut and sold during 1983 (depletion allowance)-----	\$1,800.00
Logging costs-----	1,080.00
Cost of logs sold-----	2,880.00
Ordinary Income-----	\$ 420.00

You had a \$1,444.20 gain to report for which only 40 percent will be subject to tax. You also have ordinary income of \$3,330 and ordinary expenses of \$2,800 to report.

TIMBER STAND IMPROVEMENT

Noncommercial thinnings and timber stand improvement work, if done after the stand is established, can be deducted as ordinary operating expenses. Such expenditures may be capitalized to the timber account as carrying charges if you do it consistently from

year to year. If you received cost-share payments through the Forestry Incentives Program or Agricultural Conservation Program, take note. You may not exclude payments received for practices for which the cost is deductible, such as Timber Stand Improvement. Instead, report the payments as income and deduct the full cost of the practice.

TREE PLANTING

Costs incurred for the establishment of timber stands by planting or seeding should be capitalized. Qualified expenditures are the direct costs you incur in connection with stand establishment, such as site preparation, seed or seedlings, labor, and tools including depreciation of equipment used in planting or seeding. Qualified reforestation expenditures made after December 31, 1979 can be amortized over a 7-year (84-month) period. To qualify for amortization, the property forested must be located in the United States, and the site must be used in the commercial production of timber products and be greater than one acre in size. The portion, if any, of the reforestation expenditure for which you have been reimbursed under any governmental cost-sharing programs such as the Forestry Incentives Program does not qualify for amortization, unless the amount received was included in your gross income for tax purposes. Agricultural program payments for tree planting may be excluded from gross income. Payments excluded may be subject to recapture as ordinary income when you realize capital gains from the sale of the property improved by the payments. Excluded payments would be recaptured in full if the property were disposed of within 10 years. The proportion subject to recapture declines 10 percent per year for each year the property is held beyond 10 years. After 20 years, therefore, no portion is subject to recapture. The maximum dollar amount that qualifies for amortization is \$10,000 per year (\$5,000 in the case of a separate tax return by a married individual). How you apply amortization is demonstrated in Example 5.

Example 5. You own a 50-acre tract of cutover timber land that needed to be planted. You contracted for site preparation and tree planting in the spring of 1983. The cost was \$150 per acre which you paid in full in May 1983. You elect to amortize the full amount (\$7,500). The monthly amortizable amount is \$89.29 determined by dividing \$7,500 by 84. On your 1983 tax return you deduct \$535.74 determined by multiplying \$89.20 by 6 months. You used 6 months because the 84 month amortization period begins on the first day of the second half of the taxable year in which the expenditure is made. This is July 1 since you are a calendar year taxpayer. Assuming you make no other reforestation expenditures you would deduct \$1,071.48 (\$89.29 x by 12) in each of the years, 1984-1989, the balance of \$535.38 would be deducted in 1990. You would file an attachment to your form 1040 in which you described the expenditures and when you made them.

Since the trees planted have a life of more than 7 years, you can also claim on your 1983 tax return the full 10 percent investment credit (\$750 in this example)

Casualties, Thefts, and Condemnations

If part or all of your timber is destroyed, stolen, or condemned for public use, you may be entitled to deduct the loss on your income tax return. To be deductible, losses must occur from sudden, unexpected, identifiable events during the taxable year. Such events may include fire, windstorm, hail, theft or condemnation of property for public use. Disease or insect infestations gradually leading to death of trees or loss of growth are usually not deductible.

If timber held for use in your business or for the production of income as an investment is destroyed, your deductible loss is the allowable basis in the timber destroyed, less any insurance or other compensation, such as earnings from salvage. Figure the basis of timber destroyed as you would for a sale (Example 2). You may wish to employ a consulting forester to cruise the timber.

MINNESOTA PROPERTY TAXES

Forest land in Minnesota is usually classified for property tax purposes in one of four categories listed below:

<u>CLASSIFICATION</u>	<u>TAX RATE</u>
3e Timberland	19%
Agricultural--nonhomestead	19%
Seasonal/Recreational	21%
Vacant Land	40%

Most woodland owners would prefer to have their land classified 3e Timberland because of its low tax rate. Minnesota Statutes describe Class 3e as "Real estate, rural in character, and used exclusively for the purpose of growing trees for timber, lumber and wood products." In addition to these requirements, some counties further require that land exceed a minimum acreage (e.g., 20 acres), that no residence or buildings be located on the parcel, that a timber management plan be followed, or that physical evidence of forest management be shown (ie., tree planting, firebreak maintenance, pest control).

In addition to these classifications, there are 10 counties that permit forest land to be taxed under the Tree Growth Tax Law. Under this law, lands growing commercial forest types are taxed each year in the amount of 30 percent of the value of the estimated average annual growth. Temporarily, nonproductive forest land is taxed at 5 cents per acre per year, providing the owner complies with his agreement for reforestation within the

time specified within the agreement. Permanently nonproductive lands are also taxed at 5 cents per acre per year. It is the county's option to approve or disapprove a landowner's application to be taxed under the Tree Growth Tax Law.

SUGGESTED REFERENCE

A guide to federal income tax for timber owners (Agricultural Handbook No. 596). Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

WILDLIFE MANAGEMENT

James R. Kitts
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Minnesota Agricultural Extension Service
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It is vital from the outset that the landowner keep in mind the fact that wildlife means all animals that are not domesticated. Wild creatures respond in ways that are considerably different from their domestic counterparts. To a large degree, this is why wild animals are fascinating. These behavioral features, however, may lead to frustrations for landowners who are unwilling to accept the differences.

WILDLIFE MANAGEMENT PRINCIPLES

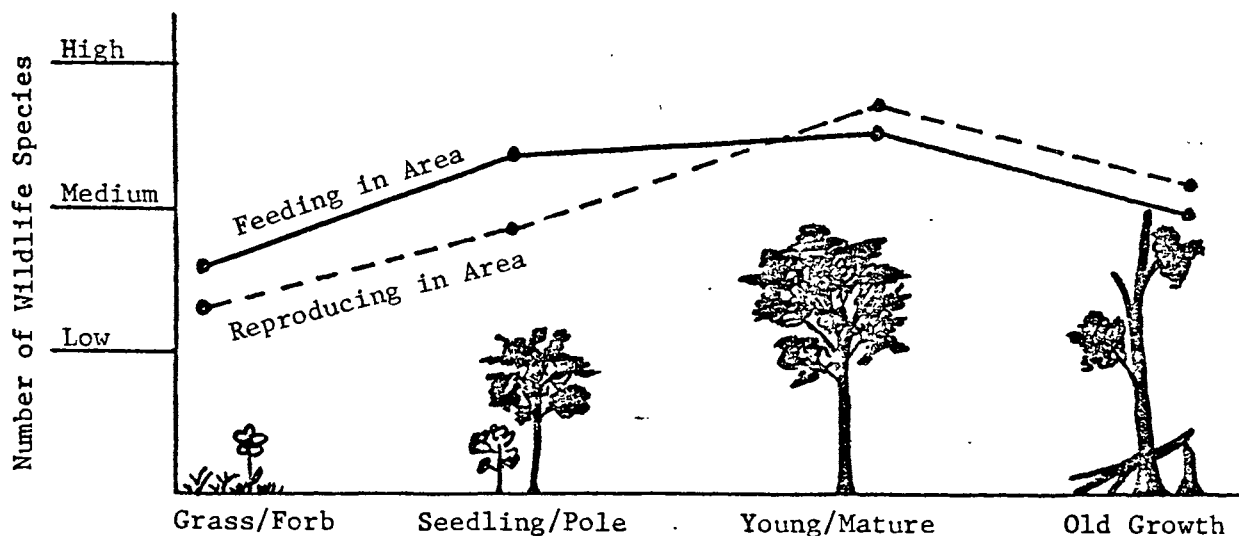
That "nature abhors a vacuum" is an idea useful in modern wildlife management. Empty habitat will be filled. Habitat is the combination of foods, water, covertypes, and minimum space requirements unique to each species of wild animal. No two species have identical requirements. Therefore, a landowner wishing to attract certain species need only provide the required habitat elements. If the desired wildlife species occur in that geographic area, they will occupy the newly provided habitat. But, don't expect dramatic, "over night" results.

How many animals can occupy the new habitat? Generally, the higher the quality and larger the area, the greater will be the number of animals supported. "Carrying capacity" is the proper term used to describe the maximum number of individuals which can occupy an area indefinitely without degrading the habitat. Nature is not a static state; it is dynamic. Carrying capacity of any area fluctuates from season to season, year to year. Habitat and the animal populations using it are joined in reciprocal relationships--habitat influencing the animal populations and the populations influencing habitat.

All animals have a dependency on plants. This dependence is closely related to species and age of the plants. Plants age and die naturally, often to be replaced by plants of different species. These processes of maturation and succession determine the length of time an area will remain as suitable habitat for any particular species of wildlife. Landowners interested in providing habitat for specific species of wildlife must be prepared to engage in controlling the age and successional stage of plants on their properties.

The figure below is generalized to show the major successional changes likely to occur in mixed forest types of the Upper Midwest. Also, notice that the greatest number of wildlife species (mammals and birds) occurs during mature stages of forest growth. Old growth stands are more valuable as reproduction areas to a wider variety of wildlife species than open or very young age classes of mixed forests.

Forest Succession & Wildlife



WHAT ARE YOUR OBJECTIVES?

Goal setting should receive your highest attention. Exactly what do you wish to accomplish? Be reasonable with your expectations. Let the size, location, and natural features of your property be your guides.

The first step in goal setting should be your resource inventory. Use aerial photos, topographic maps or sketch your own map--it needn't be complicated. Your inventory should include soil type(s), aspect, drainage patterns, major vegetation types, and wildlife species. Design your project to scale on graph paper--check Ag. Extension Publications, Yard and Garden, 700 and 701. When you are satisfied with the design, go to work in the field.

Attached is a sample woodlot Work Plan and Resource Inventory. Something similar to this should be prepared for your property before any work is begun.

Wildlife Management Work Plan

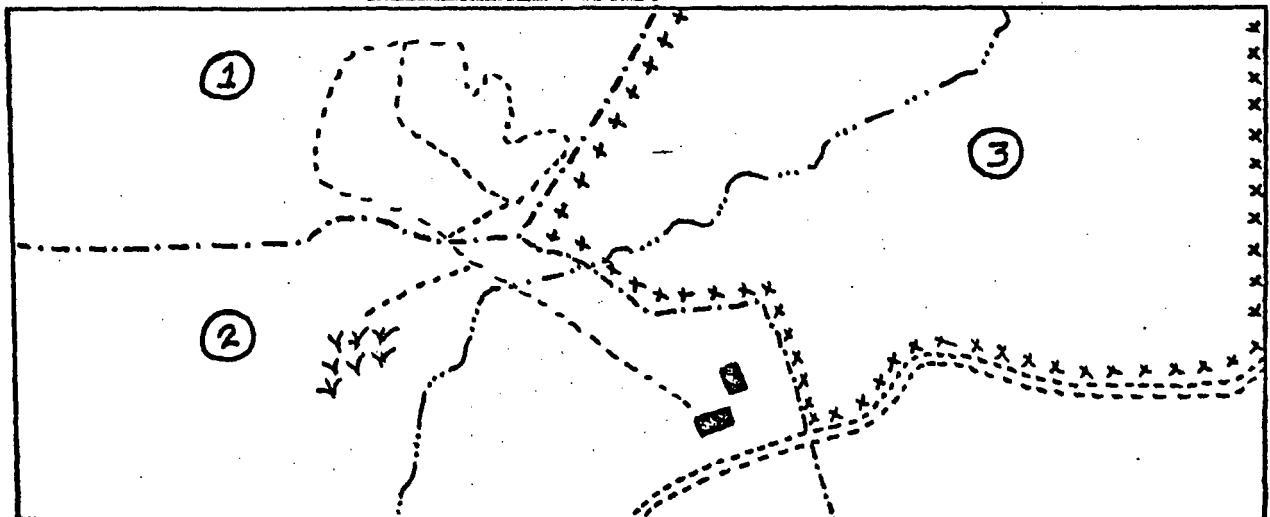
For Mr. & Mrs., MN. Landowner

Date Prepared: Dec 4, 1982

OBJECTIVES: cavity nesting wildlife,
ruffed grouse, waterfowl, white-tail deer

<u>Work Area</u>	<u>Project Description</u>	<u>References</u>
1	Commercial cutting-save marked snags all aspen	Kitts Gullion
2	Clear some brush, dam creek for pond 2 acre surface-max. dept 4' at dam. Reseed banks, etc. to prairie grasses	SCS Tech. Assist.
3	Thin conifer to get firewood and 2-4 acre openings. Plant white clover & birds-foot treefoil in openings and along trails.	Hassinger, et al. Gullion

RESOURCE INVENTORY



<u>Work Area</u>	<u>Vegetation Types</u>	<u>Est. Acres</u>	<u>Legend</u>
1.	Mixed hardwoods- mature commercial log save snags.	10	Boundary Gravel Road Trail
2.	Pasture with marsh and shrubs-farm pond, reseed prairie grasses, et.	20	Vegetation Types Work Area
3.	Second growth hardwood old X-mas tree planting. Thin conifers to give 2-4 acre openings-plant white clover & Birds-foot treefoil	30	Creek Building Marsh

WHO WILL HELP?

Several public agencies are able to supply various forms of assistance to private landowners.

The Minnesota Agricultural Extension Service is able to assist landowners during the planning stage of wildlife projects. County Agents may be able to assist with soil analysis, suggestions for various plantings--windbreaks, shelter belts, etc. Wildlife habitat development questions should be addressed to Extension Wildlife Specialist but forwarded through your County Extension Office.

Minnesota Department of Natural Resources is a land management agency and has personnel who can provide the technical information concerning plants and animals as well as any legal information.

Personnel from the Soil Conservation Service can assist landowners with some technical information on soils and plants. They may also be able to direct landowners to sources of cost-sharing funds for certain types of land management practices.

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SILVICULTURE OF DECIDUOUS FOREST TYPES

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INTRODUCTION

High quality hardwood stands are found growing on a variety of sites in Minnesota and Wisconsin. These stands range from simple aggregates of cottonwood or elm to complex mixed associations consisting of oak, maple, and basswood. Stand composition reflects the varying shade tolerances and growth rates of the species that compose them. They may also show the influence of burning, flooding, and other disturbances. Successful regeneration and management of desirable species requires an understanding of the ecological needs of those species.

SILVICULTURAL METHODS

Oak-hickory

Oak-hickory sites range from dry, infertile ridgetops to moist, highly productive coulees. Species composition varies greatly with geographic location and site quality. Although one oak species occasionally dominates, stands usually contain a mixture of oaks along with other species. Northern red and white oak are often found on fertile soils with ample moisture. Hickories are a consistent, but minor, component throughout the type. In our region, sugar maple, American basswood, and white ash often become established under oak-hickory stands and tend to dominate the site when old stands decline or are harvested.

Three silvicultural methods can be considered for regenerating oak-hickory forests: (1) clearcutting, (2) shelterwood, and (3) group selection. In applying these methods, consideration must be given to the number, size, and distribution of advance reproduction (seedlings and sprouts) before removing the overstory.

The clearcut is the simplest and least expensive of the three methods to apply. However, it should only be used where adequate reproduction of oaks or other desirable species are present. A minimum of 430 well distributed oak seedlings or sprouts per acre at least 4 ft. tall is considered adequate reproduction. A guide evaluating the adequacy of

oak advanced reproduction is available (Sander et al., 1976). Oak and hickory stump sprouts that will develop after clearcutting can be used to compensate for deficiencies in advance reproduction. Advantages of a well-planned clearcut in the oak-hickory type are ample sunlight that favors rapid growth of reproduction, low-cost logging, and excellent habitat for some wildlife species. The major disadvantages are poor appearance of clearcut areas for 2 to 3 years and the related lack of control over the species composition of the new stand.

If oak and hickory reproduction is not adequate under mature stands, the shelterwood system is most likely to encourage abundant numbers of young oaks. The first cut in the shelterwood method should reduce the overstory enough to establish seedlings. A heavy cut will permit a vigorous understory of light-demanding species to develop, and an inadequate cut will favor shade tolerant species at the expense of the oaks and hickories. Because crops of acorns and hickory nuts are irregular in occurrence and are consumed by wildlife, 5 or more years may be required for seedlings to become established. While oak reproduction is reaching adequate size, one or two additional cuts may be needed to prevent the overstory from restricting growth. Control of undesirable understory plants is usually required. When enough vigorous young trees have developed, all remaining overstory trees should be removed in one cut. The major advantages of the shelterwood method are better appearance than clearcutting and extended period of acorn and nut production for the benefit of wildlife. The major disadvantage is a delay in harvest in stands that are at or near maturity.

If adequate advance reproduction is present, an oak-hickory stand can be regenerated by the group selection method. Under this method, size of opening varies widely, and the opening created by harvesting a large group may be identical to a small clearcut area. The primary difference then is that the groups are considered to be parts of a larger stand rather than individual stands. Oaks will grow best near the center of openings where they are not suppressed by the surrounding stand. If openings are kept small and scattered, group selection simulates aesthetic qualities of an unbroken forest. This method is well suited to small woodlots where occasional cuts are desired, but where regularity of yield is not important. The method produces excellent wildlife habitat. Regulating the cutting and maintaining the uneven-aged character of the stand using this method may be difficult.

Thinning of well-stocked oak-hickory stands speeds growth of the remaining trees. Yield of high-value products is increased and time to final harvest is shortened when proper thinnings are applied. Thinnings should begin at age 15-20 and continue at 10-year intervals until age 60 or 70. Each time a stand is thinned, enough uniformly spaced trees must remain to fully utilize the site. The trees with good form, vigor and well-developed crowns should be favored.

Elm, ash, cottonwood

These rapid growing hardwoods are normally found growing on moist, fertile sites, usually along river and stream bottoms throughout southern Minnesota and Wisconsin. Species composition varies from simple aggregates of cottonwood and willow to extremely complex mixed stands of several species, including silver maple, red maple, American elm, green ash, and white ash. Changes in composition occur with sites and location along stream bottoms. American elm and green ash are leading dominants of lowland forests.

Because cottonwood is intolerant of shade, advance reproduction is seldom present at harvest. Thus, clearcutting followed by intensive site preparation and seeding or planting is the only consistent successful regeneration method. The seed-tree method of leaving up to 10 high-quality trees per acre as a source of seed for a new stand has sometimes proven effective. However, under most circumstances these trees are unnecessary because seed is supplied from surrounding stands and because roots and stumps from the old stand will often sprout. If clearcutting is used, it is important that competing vegetation be eliminated to permit desirable regeneration to develop. The disadvantages of the clearcut method include poor wildlife habitat, an unattractive appearance, and relatively little control over species present in the new stand (unless site is planted).

From the seedling stage, natural cottonwood stands grow rapidly and natural thinning begins almost immediately. At each step of development, the better trees are above their neighbors. On a good site, crop trees should average about 5 to 6 feet of height growth and 0.6 to 0.8 inches of diameter growth may continue at nearly the same rate. Cottonwood will continue growing well for at least 75 years, but most stands are harvested by age 50.

Two silvicultural methods can be considered for regenerating stands of American elm, green ash, and white ash: (1) clearcutting and (2) group selection. Presence of elm or ash advance reproduction is variable to scarce, thus intensive site preparation followed by seeding or planting, and competition control are key requirements for regenerating these species. Ash seedlings are somewhat tolerant to competition and will survive up to 10 years before being released from overhead vegetation.

Elm and ash usually develop in mixed stands with several other relatively intolerant tree species. Historically, thinning of elm and ash have started when trees reach sawtimber size, about 14 inches diameter breast height. Larger trees with the best crowns should be favored. For good diameter growth, elm and ash require a minimum crown to total height ratio of 40 percent. Advantages of frequent, light thinnings as compared to infrequent, heavy thinnings are fuller site utilization and less chance of undesirable branching on the boles of crop trees. Proper thinning will

allow for utilization of trees that would otherwise die and will distribute nearly the same growth among fewer, selected crop trees.

Black walnut

Black walnut typically grows as scattered individual trees or in small groups in mixture with a variety of other hardwoods. Pure stands of walnut are rare, small, and occur as groves at the edge of hardwood forests. In southern Minnesota and Wisconsin, black walnut frequently appears with white ash, basswood, beech, sugar maple, red oak, and hickories. This species is extremely sensitive to soil conditions. It grows best on deep, well-drained, nearly neutral soils which are moist and fertile. Seedlings of this species do not grow well or survive very long, on wet bottomlands, on sandy dry ridges and slopes, or on soils underlain by shallow bedrock or gravel which limit deep rooting.

Relatively few black walnut seedlings occur under natural stands because this species is extremely intolerant of shade. In mixed forest stands, walnut must be in a dominant or codominant position to maintain itself. Clearcutting or the creation of large openings by the group selection method is recommended as the best site preparation if advance reproduction is present. Since the natural regeneration of black walnut is a slow and uncertain process, many woodland owners prefer to plant black walnut seedlings after removing residual trees in a regeneration cutting. Before actual planting, spacing, site preparation, plant material and planting method must all be considered. Following planting, control of competing vegetation is necessary if black walnut seedlings are to survive and grow to a dominant position in a mature stand. Intensive culture of walnut is most easily achieved in pure stands, but these are rarely encountered in nature. Thus, plantation culture or intercropping of black walnut is a recommended management alternative (Schlesinger and Funk, 1977).

Once black walnut trees are 10 feet tall, pruning and thinning to improve the quality of the bole becomes important. Pruning of lateral branches helps produce knot-free wood. Periodic thinning provides the opportunity for selecting superior crop trees. Crown competition factor is a useful tool for deciding when and how to thin black walnut. The pamphlet "Quick Reference for Thinning Black Walnut," which is available from the USDA Forest Service, is a useful guide.

Aspen-birch

The forest community is in a continual state of change referred to as plant succession. The first species to establish themselves on a site are known as pioneer species. As time progresses the composition of the forest community will gradually shift from pioneer species to a stable climax community that are capable of self perpetuation. Aspen and birch

are pioneer species that will usually be succeeded by other tree species if the site is of sufficient quality. To manage these species, the normal course of plant succession must be interrupted.

Aspen is a shade intolerant species requiring full sunlight, is a prolific seed producer and sprouts readily. Generally, aspen reaches economic maturity in 40-50 years. Aspen sprouts from its root system (sucker) and is most commonly regenerated by the clearcutting method.

White birch is another intolerant species and slightly longer-lived than aspen. Birch will stump sprout but will not root sucker as aspen does. The best silvicultural system to regenerate pure stands of birch is a shelterwood system. This system would leave enough trees after initial harvest to provide 40 to 60% shade. The logging operation should provide some mixing of organic and mineral soil to provide an adequate seed bed. Birch is a light seeded species and requires mineral soil for germination and establishment. After the birch seedlings are established, the remaining mature trees may be removed.

Basswood-maple

Basswood is a moderately tolerant species and longer-lived than white birch. It prefers slightly heavier soils than aspen or birch. Basswood usually occurs midway in the successional path to a climax northern hardwood forest. Basswood may be regenerated from seed with a shelterwood system, but the most reliable regeneration of basswood is from stump sprouts after clearcutting.

Sugar maple is a very shade tolerant, long-lived species and is a major component of a climax northern hardwood forest. Sugar maple prefers heavier, well-drained soils, and is considered economically mature when it reaches a stem diameter of 20 to 24 inches. Sugar maple is a cool germinating seed and regenerates well in the understory of an existing stand. This characteristic enables it to be managed on an all-aged or even-aged silvicultural system. Even-aged management would require a shelterwood system somewhat similar to birch and basswood. All-aged management permits selective removal of mature trees and thinning of some immature stems on a ten to fifteen year interval. Regeneration will continually re-establish itself in the understory.

SOURCES OF ASSISTANCE

There are three primary sources from which private landowners in Minnesota and Wisconsin can obtain technical assistance for implementing proper silvicultural treatments. These sources include the Department of Natural Resources (DNR), private consulting foresters, and industrial foresters. Lists identifying consulting and industrial foresters which provide silvicultural assistance are available from the DNR.

The Wisconsin DNR has a service forestry program that can provide up to three days annually of forest management assistance for the private landowner. There is generally one service forester per county with offices located at the county courthouse. Within the Minnesota DNR, private forest management specialists provide silvicultural assistance to woodland owners. These specialists are placed at strategic locations throughout the state and can be contacted through your local DNR forestry office.

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- Schlesinger, R. C. and D. T. Funk, 1977. Managers guide for black walnut. USDA For. Serv. Gen. Tech. Rept. NC-38, 22 p.

PROCEEDINGS OF WOODLAND OWNERS AND USERS CONFERENCE

Detailed information on individual species are given on the following insert sheets. Most notable highlights of individual species are capsuled here to give a brief overview of each species.

JACK PINE

- A valuable timber species
- Grows rapidly
- Good choice for dry sandy or gravelly area
- Readily available from state nurseries
- Tends to suffer deer browsing damage in areas of deer concentration
- Needs full sunlight

WHITE SPRUCE

- A valuable timber species
- Does well on heavy clay and/or moist soils
- Can tolerate shade better than jack and red pine
- Should be planted at wider spacing than most other conifers
- Grows quickly after a long establishment period
- Does not suffer as much deer browsing damage
- Planting stock sometimes in short supply at state nurseries (order early)

BALSAM FIR

- Has limited commercial value
- Can tolerate shade well, but will grow slowly
- Is an important Christmas Tree species
- Subject to wind throw

BLACK SPRUCE

- Is a commercially valuable species
- Thought of as a lowland species, but will do well on moist loamy upland sites. It should be planted more on these types of sites.
- Stock is not always available.

NORWAY PINE

- Valuable timber
- Grows rapidly
- Few insect or disease problems
- Grows well on drier, sandy soils
- Seedlings readily available
- Needs full sunlight
- Limited value for wildlife

WHITE PINE

- Valuable timber
- Wide **range** of soils - best on sandy loams
- Seedlings available
- Has insect and disease problems
- Tolerates shade well
- Recommended for underplanting in certain aspen-birch stands

TAMARACK

- Only native conifer which loses its needles annually
- Can tolerate very wide range of soil moisture
- Cannot tolerate shade
- Seedlings not available
- Best reproduced by shelterwood cuts
- Wood is durable, has high strength to weight ratio
- Seeds eaten by wildlife

Submitted by:

Brian Haugen
Thomas Kroll
DNR - Division of Forestry

JACK PINE



Description

Jack pine is a medium-sized, short-lived tree. It grows further north than any other American pine and reaches some of its best development in northeastern Minnesota. Depending upon the site, jack pine matures between 40-70 years and begins to deteriorate between 50-90 years. Size at maturity can range from 40-80 feet in height and from 6-14 inches in diameter. It is considered a pioneer species and is very intolerant to shade. Due to its wide range, the species shows a great deal of genetic variation.

Jack pine is often found in pure even-aged stands, or mixed with aspen, white and red pine. It can maintain itself on very sandy or gravelly soils where other species scarcely survive; but it grows best in well-drained loamy soils.

Management

Regeneration

Reproduction of jack pine often occurs naturally in areas where logging or fire has occurred. This is due to the abundant release of seed from the serotinous cone which may remain sealed for 10-15 years, especially in northern Minnesota. Where the seed source is adequate, the stand of saplings may be so thick as to require weeding in the first ten years. Sometimes germination is less successful and interplanting is required to bring the stand to a desired stocking. Recommended stocking is 600-1000 trees/acre in order to maintain good form. Other methods of reforestation are planting and direct seeding. Preparation of the site to insure adequate light is necessary. On better sites, jack pine may be considered a temporary type that may be replaced by a more suitable species at the end of rotation.

Culture

Jack pine on better sites (site index 60), can be thinned to about 90 square feet of basal area at age 30-70 in order to maintain good diameter growth. Average annual growth ranges from .3 cords/acre/year on poor sites to .7 cords/acre/year on better sites.



Harvest

Clearcutting is the recommended method of harvesting mature trees where the next stand will be established by planting, direct seeding, or scattering serotinous cones. Rotation ages range from 40 years on poor sites (site index 40) to 70 years on better sites (site index 70).

Principle Enemies

Jack pine is very susceptible to fire at any age. Deer browsing and girdling by rodents can be a problem. Many insects also attack jack pine. Of special note are the jack pine budworm and bark beetles. Several varieties of stem rust also affect jack pine. Over-mature stands are often affected by heartrot fungi. Maintaining the stand in a healthy and vigorous condition is the best method of preventing or reducing damage.

Uses

Jack pine is used for pulp and sawtimber and is often managed for these uses. Larger sawbolts and poles can be produced on the better sites. Thinnings can produce pulp and post materials.

Wildlife Considerations

Jack pine provides good winter cover for wildlife, especially for deer in areas where traditional deer wintering areas are absent or no longer adequate.

Identifications and Uses

Jack Pine (*Pinus banksiana*) needles are stout, flat, 1-1½ inches long, dark green deciduous in their second and third years, and in 2-leaved bundles. The cone is usually erect, 1½-2 inches long, and generally curved in toward the branch. Cones are green or purplish when full-grown, turning light yellowish-brown as they ripen. They may remain on the tree for years. Cone scales are armed with small prickles that are often deciduous. The tree is frequently 70 feet tall with a straight trunk about 2 feet in diameter. The branches are long and spreading, forming an open crown that often has a ragged appearance. The wood is soft, light, and not strong. It is used mainly for pulpwood, rough construction, boxes, crates, shipping containers and prefabricated buildings. Ornamental.



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A. Forest Service

WHITE SPRUCE



Description

White spruce is a large tree native to the northeastern part of Minnesota; and where it is found to be predominant in the stand, there are only 79,000 acres of this forest type.

It reaches heights of 100 feet, and diameters over 20 inches on good sites. It is quite tolerant of shade, grows slowly in the understory, and responds well to release.

White spruce is generally found in mixed stands of balsam fir, aspen and paper birch. The best white spruce are found on heavy clay soils.

Management

Regeneration

White spruce will regenerate itself naturally if a seed source is present. However, this is not recommended, because good seed years are infrequent - generally one out of four years. Planting is the recommended method of regeneration. Stocking should be at least 600-1000 seedlings per acre for good form development.

Culture

After the first five years or so, the white spruce seedlings grow rapidly, rivaling the fastest growth among conifers. Once established, the stand should be thinned from 15-20 years, reducing the basal area to 90-100 feet²/acre. Several intermediate cuts may be made periodically until the rotation age is reached.

Harvest

White spruce can either be clearcut and managed as an even-aged stand, or can be cut selectively as an



uneven-aged stand. Selective cutting should be done by removing larger trees from the overstory, while maintaining a good stocking of young trees. While white spruce reaches maturity between 80-120 years, balsam fir and aspen reach their maturity some 20 years sooner. This may necessitate earlier harvesting. Large spruce left after a partial cutting are very susceptible to heavy loss by windthrow.

Principal Enemies

The yellow-headed spruce sawfly, spruce budworm, and wind are the major problems of white spruce.

The yellow-headed spruce sawfly, a defoliator, affects open grown ornamental and field grown plantation trees up to 15 feet in size. Normally, individual trees are attacked, making control a minor problem except on wet, organic sites which contain open grown trees.

Due to the heavy crown and shallow rooting, heavy winds can blow it down unless it is well stocked within the stand.

Uses

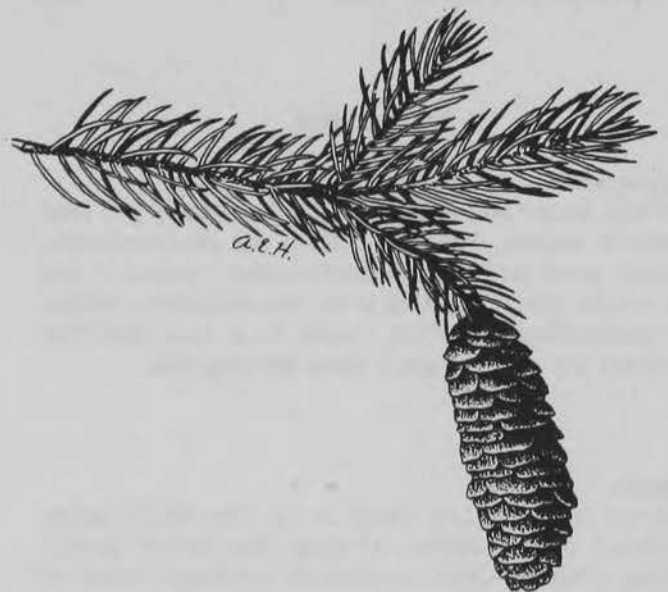
White spruce is managed for pulpwood and sawtimber. Because of the long fibers in the wood, it makes excellent paper.

As sawtimber, it makes good dimension lumber for construction.



Identification and Uses

WHITE SPRUCE (*Picea glauca*) leaves are crowded on the upper side of the branches by the twisting upward of the needles on the lower side. Needles are $\frac{3}{4}$ -1 inch long, and bluntly pointed. Cones are usually about 2 inches long, becoming pale brown and lustrous when mature. Cone scales are flexible and smooth-margined. Cones fall soon after they ripen in autumn, rarely persisting through the winter. The tree grows 60-75 feet tall with trunk diameter of 2 feet. Foliage of white spruce has a somewhat disagreeable odor when crushed. The wood is used for pulpwood, interior trim, and interior parts of furniture.



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Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A. Forest Service

BALSAM FIR



Description

Balsam fir is a medium-sized, short-lived tree. It reaches maturity between 60-65 years, then starts to deteriorate. It will reach 40-60 feet tall and have a diameter of 12-18 inches.

Balsam fir is one of the most shade tolerant trees in Minnesota. It generally grows in combination with white and black spruce, white cedar, aspen and paper birch. It will grow very rapidly when the overstory of less shade tolerant hardwoods is removed.

It grows best on loamy soils, but will also grow on gravelly soils and peat (at a much slower rate).

Management

Regeneration

Balsam fir will regenerate well naturally, even though good seed years occur only every 2-3 years. On the best sites, if good regeneration is not achieved, it may be planted from 600-1,000 per acre.

Culture

Balsam fir will thin itself naturally in dense stands of pure fir, although a pre-commercial thinning may be necessary if growth is too slow due to crowding. Growth is rapid on good sites with adequate sunlight.

Harvest

Due to its high shade tolerance, balsam fir can either be clearcut and managed as an even-aged stand, or be cut selectively as an uneven-aged stand.

Selective cutting should be done by cutting the larger overstory tree, as they are very susceptible to windthrow. A good stocking of smaller understory trees should be maintained. It should be cut at maturity due to rapid deterioration by butt-rot and windthrow.

When clearcut, the slash should be broken down or removed, as balsam fir does not regenerate well through heavy slash.



Principal Enemies

Fire, wind and the spruce budworm are the principal foes of balsam fir. Being shallow rooted and having a thin bark and very flammable needles, balsam is easily killed by fire.

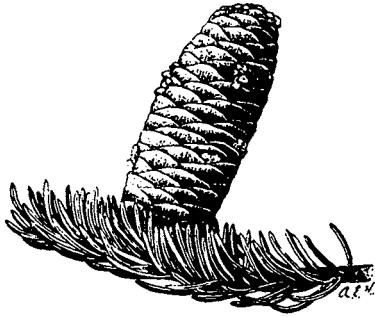
Wind can blow over the shallow rooted balsam, particularly if large individual trees occur in the stand.

Flooding, particularly from beaver dams will kill balsam quite rapidly.

Spruce budworm periodically defoliates balsam, since this is the preferred food of the insect. Repeated defoliation can do great damage which has been the case in northern Minnesota through the 1970's. Large acres of commercial size balsam fir have been wiped out by the budworm.

Identification and Uses

BALSAM FIR (*Abies balsamea*) is a small-to-medium-sized tree that grows in cold, moist climates. The dark green **needles** are $\frac{1}{2}$ to 1 inch long, flattened, mostly 2-ranked (one row on each side of the branch), and marked on the undersides by 2 silvery-white bands. The cylindrical **cones** are erect, dark rich purple in color, 2-4 inches long, with scales longer than broad. **Bark** on old trees is thick, rich brown, and separated into scaly plates. **Bark** on young trees often has resin blisters. Balsam fir has a symmetrical, slender, pyramidal crown that is quite dense. The tree grows up to 60 feet in height, with trunk diameter of 2 feet. The wood is light, weak, soft, and coarse-grained. Not much used for lumber, the balsam fir is utilized in the paper industry for pulp. It is planted as an ornamental, and prized for Christmas trees.



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A. Forest Service

RED OR NORWAY PINE



Description

A century ago, red pines made up about one-third of the 22 million acres of pine forest in Minnesota, Wisconsin and Michigan. Today it covers only a little more than one million acres - mostly planted since 1930.

Red pine is one of the most versatile of forest trees. It has high aesthetic value as well as being heavily used as a pulpwood and lumber tree. Because it is so versatile and usable, red pine is a highly recommended planting species.

Red pine requires direct sunlight and is quite intolerant to shade. Trees growing in medium to heavy shade usually wither and die in a matter of months or years.

Management

Red pine usually does best on coarse, well-drained sandy or sandy loam type soil. Red pine planted on sandy and relatively unfertile soil will do well with a minimum of attention simply because there is very little vegetation competition. Good drainage is essential. Red pine planted in low areas seem to suffer from high mortality for a variety of reasons. Even a little dip in an otherwise flat parcel of land will tend to cause problems. Red pine does poorly on undrained or heavy clay loam soils.

Spacing

Recommended initial spacing is 600-800 trees per acre. This will result in merchantable trees at the first thinning. The worst and most common mistake made in tree planting is to plant trees too close together. Be sure to give the trees needed growing space.

Planting

To achieve best survival, plant red pine seedlings as early in the spring as possible. Good soil moisture is essential at the time of planting to avoid high mortality. Containerized seedlings, however, may be planted throughout the summer with good survival.



Site Preparation

The control of competing vegetation in young red pine plantations is essential for good survival. Site preparation will vary, depending on the site. Your forester can tell you what kind, if any, is needed. Site preparation is discussed in more detail in the "Tree Planting" insert.

Brush Control

Release from competing vegetation may be needed within five years of planting. The method of release should be either chemical or hand release. This is discussed in the "Timber Stand Improvement" insert.

Risk Of Loss From Damaging Agents

Although red pine is not the "problem free" tree it was once thought to be, it still rates high in its ability to deal with its natural enemies. Like all trees, fire, insects and disease can affect the health and yield of red pine plantations. The best advice to be given here is to pay attention to the condition of your trees. If insects or disease become evident, be sure to contact your local forester immediately for further advice.

Yield

Red pine on better sites yield from 1.5 to 2.0 cords per acre per year of annual growth, and yield between 30-50 cords per acre at age 80.

Intermediate thinnings beginning at about age 25 will help to maintain good diameter growth in your plantation. Your forester can recommend the specific intervals of the thinnings.

Harvest

The final harvest of red pine usually occurs at a rotation age between 80-120, depending upon the site. Clearcutting, seed tree or shelterwood, are some of the harvesting methods used. Clearcutting is used most often because the seed tree and shelterwood methods depend upon natural seeding for reproduction which is not as dependable as hand planting.

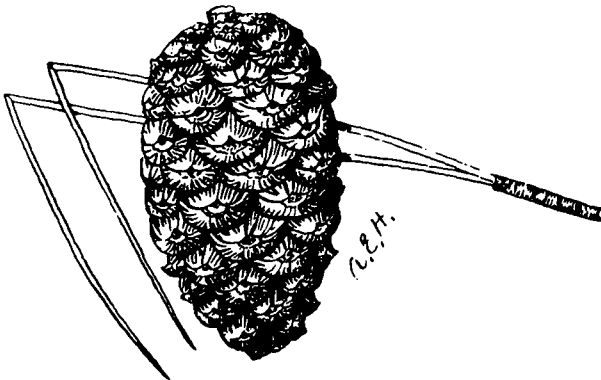
Wildlife Considerations

Red pine stands are considered poor habitat for wildlife. If enough sunlight is allowed to reach the ground, however, small trees, shrubs, and other plants will offer diversity to the stand, increasing wildlife numbers and species. For approximately the first 30 years, red pine stands will offer winter cover for deer, but past 30 years the lowest live branches are too high above the ground to offer any thermal regulation. At the same time, the shading caused by a closed canopy will greatly reduce the understory layer of plant material, offering very little to wildlife.

Identification and Uses

RED or NORWAY PINE (*Pinus resinosa*) is a medium-sized to large tree of northeastern United States and adjacent Canada. Bark reddish brown, with broad, flat, scaly plates. Needles 2 in cluster, slender, 5-6 inches (13-15 cm) long, dark green. Cones 2 inches (5 cm) long, light brown, without prickles.

Principal uses: General building construction, planing-mill products, and general millwork. Pulpwood. Ornamental and shade tree. (State tree of Minnesota).



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A Forest Service

EASTERN WHITE PINE



Description

Eastern white pine is the largest pine found in Minnesota. It was, and continues to be, highly prized for its valuable lumber. The large stands of tall white pine served to lure the timber barons to our state at the turn of the century. The tree is commonly 80-120 feet in height and has a diameter between 2-3 feet at maturity. While it is not unusual to have undisturbed trees live 200 years or more, rotation age is commonly 90 to 125 years. It will grow on a wide range of soils, but grows best on moderately moist, sandy loam soils. The most rapid growth rate occurs in the southeastern areas of the state, where 2-3 feet of height is not uncommon on good sites. Eastern white pine is an aggressive tree, and will readily invade openings such as old fields. Moderate shade tolerance allows the tree to become established in existing stands of pine or other species, provided the shading is not complete.

Management

Regeneration

A good white pine seed crop is produced every 3-5 years with the seed capable of travelling 200-700 feet or more, depending on wind currents. Soil scarification will help to prepare a moist mineral seedbed for natural regeneration. Hand planting approximately 600-800 trees per acre provides uniform stocking and spacing, and produces a high percentage of survival. In the northern two-thirds of the state, planting should be done under a light forest canopy to reduce damage by the white pine weevil and white pine blister rust. Eastern white pine can tolerate as much as 70 percent shading and maintain adequate seedling growth.

Culture

If trees have become established under a forest canopy, they should be released when the pine are approximately 20 feet in height. Examinations of the stand at this time will determine whether the first



thinning should be accomplished simultaneously with the harvest of the overstory. The basal area should be reduced to 100-140 square feet per acre, and periodic thinnings of 10-15 square feet per acre should be practiced. Treatment in open grown plantations would be similar. Early pruning may be used to help prevent losses due to blister rust.

Harvest

Preparation for the final harvest should begin 15-20 years prior to the actual cutting. Reducing the basal area to 50-60 square feet per acre will open the stand sufficiently to reproduce white pine from seed. After the regeneration has reached approximately 20 feet in height, the older trees are harvested to release the juvenile stand to full sunlight.

Principal Enemies

Insect and disease are two serious enemies of white pine. The white pine weevil attacks the terminal leader of young pine, which cause serious deformities in the main stem. This insect can be discouraged by avoiding planting in full sunlight.

White pine blister rust is a fungus which attacks white pine. Although capable of infecting any age tree, it is found most common in younger stands. Ribes plants (such as gooseberry), serve as the alternative host for the fungus: therefore, locations where ribes are prevalent should be avoided if possible. The state is broken into three zones, demonstrating the relative probability of a white pine becoming infected with blister rust. The highest hazard is the northeast one-third of the state; medium hazard in the northwest and central; and lowest hazard south of the Twin Cities. Selecting sites with favorable air movement will also lessen the incidence of the disease.

Insects and disease often enter into less vigorous, older, and fire damaged trees, These can be reduced by practicing proper management.

Uses

The tree produces a premium quality lumber for use in the construction and manufacturing industry.

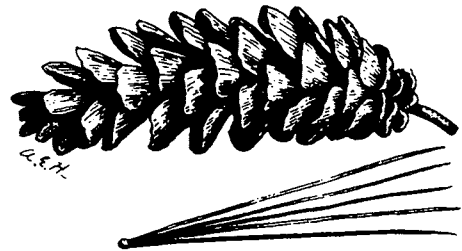
Wildlife Considerations

Although wildlife receive virtually no food benefit from white pine, younger dense stands may be used for shelter during inclement weather. Deer and rabbits browse heavily on white pine seedlings, and this may become a problem in certain plantations.

Identification and Uses

EASTERN WHITE PINE (*Pinus strobus*) L. (white pine, northern white pine, northern pine, soft pine, Weymouth pine). Large tree (largest northeastern conifer) of northeastern United States, adjacent Canada, and Appalachian Mountain region; variety in mountains of Mexico and Guatemala. **Bark** gray or purplish, deeply fissured into broad ridges. **Needles** 5 in cluster, slender 2½-5 inches (6-13 cm) long, blue green. **Cones** long-stalked, long and narrow, 4-8 inches (10-20 cm) long, yellow brown, with thin, rounded scales.

Principal uses: Construction, millwork, interior paneling, and trim. Pulpwood. Shade tree and ornamental. (State tree of Maine and Michigan. "Pine cone and tassel" is State flower of Maine.)



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

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TAMARACK



Description

Tamarack is the only native conifer in Minnesota that sheds its needles every year. The tree grows on a variety of sites, but is found most often in swamps. It may live to be 200 years old, but loses its vigor after 100 years of age. Size at maturity varies from 40-80 feet in height and 6-24 inches in diameter, depending on the site.

Tamarack is usually found on moist organic soils, but can tolerate a wide range of soil moisture. It is fast growing on better sites, but stagnates in wetter areas where the movement of soil nutrients is restricted. It is the fastest growing conifer in the eastern United States for its first 20 years. Short periods of flooding have little effect on growth, but prolonged flooding will kill tamarack. It is usually found in pure, even-aged stands, but may be mixed with black spruce and white cedar.

Management

Regeneration

Due to its extreme intolerance to shade, tamarack does not often reproduce itself without disturbance, and is frequently succeeded in nature by the more tolerant spruce. Natural regeneration following harvesting is best in a good seed year (3 to 6 year intervals), and on completely cleared sites. A moist mineral soil or sphagnum moss is best seedbed. Brush will severely inhibit regeneration. The seeding range is limited to twice the tree height, so strip or rim cutting is often recommended where there is a good seedbed. For best growth, tamarack seedlings need abundant light and a constant water level.

Culture

Growth can vary from nearly nothing in stagnant water-covered stands up to 0.7 cords/acre/year on well-stocked stands, (95 square feet basal area). Thinnings on upland sites can be made when markets exist and the stand should be reduced to 70-90 square feet basal area per acre. Thinnings are not recommended in organic soils because the trees are shallow-rooted and subject to windthrow.



Harvest

Rotation age at final harvest will range from 70 years on the best sites to 120 years on the poor sites. Clearcutting in a good seed year is recommended. However, the alternative to clearcutting may be to leave 10-15 well distributed seed trees per acre. These scattered trees will then supply the seed needed for reforestation of the cutover area.

Principal Enemies

Principal enemies of tamarack include the larch sawfly, whose larvae periodically defoliate large areas for several years, causing growth loss and severe mortality. The eastern larch beetle sometimes attacks and kills trees weakened by sawflies, drought, wounding or flooding. Strong winds can uproot trees. A large change in the water table will also cause mortality.

Uses

Tamarack is a very durable wood in wet ground, and is often used for posts, mine timbers and poles. Pulp and sawn products are also main uses. The wood has a very high strength-to-weight ratio and holds nails well.

Wildlife Considerations

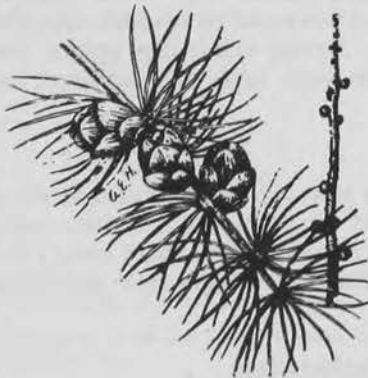
Tamarack is not heavily used by wildlife, although spruce grouse feed on the buds and needles and red

crossbills eat the seeds. Also, the Great Gray Owl is commonly associated with tamarack swamps.



Identification and Uses

Tamarack (*Larix laricina*) has one of the widest ranges of all American conifers. Its **needles** are deciduous, $\frac{3}{4}$ -1 $\frac{1}{4}$ inches long, soft, flat, and roughly triangular in cross-section. They turn yellow and drop in September or October. Leaves are borne singly or alternate, but often form brushy clusters at the tips of short spur shoots. **Cones** are roughly rounded-oval, $\frac{1}{2}$ - $\frac{3}{4}$ inch long, with about 20 scales that are longer than broad. The **tree** is 40-80 feet tall with trunk diameter of about 2 feet. It is most commonly found on moist organic soils such as those in swamps and muskegs. Tamarack often has a narrow pyramidal shape in forest stands, but develops a broad picturesque head in open areas. **Bark** is thin, bright reddish-brown to gray, and scaly. The **wood** is hard, heavy, durable and strong, but difficult to work with tools. It is used for posts, poles, ties, and as construction lumber.



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A Forest Service

BLACK SPRUCE



Description

Black spruce is a medium-sized tree, reaching heights of 90 feet on the best sites, with diameters of 8-16 inches. It is found mainly on organic soils, but also is found growing on mineral soils in the northeastern part of the state. Black spruce grows in pure, even-aged stands on peat soils as well as in mixed types along with cedar, balsam fir, and tamarack. On rocky mineral soils of the Laurentian Shield, it can also be found in combinations with jack pine.

Management

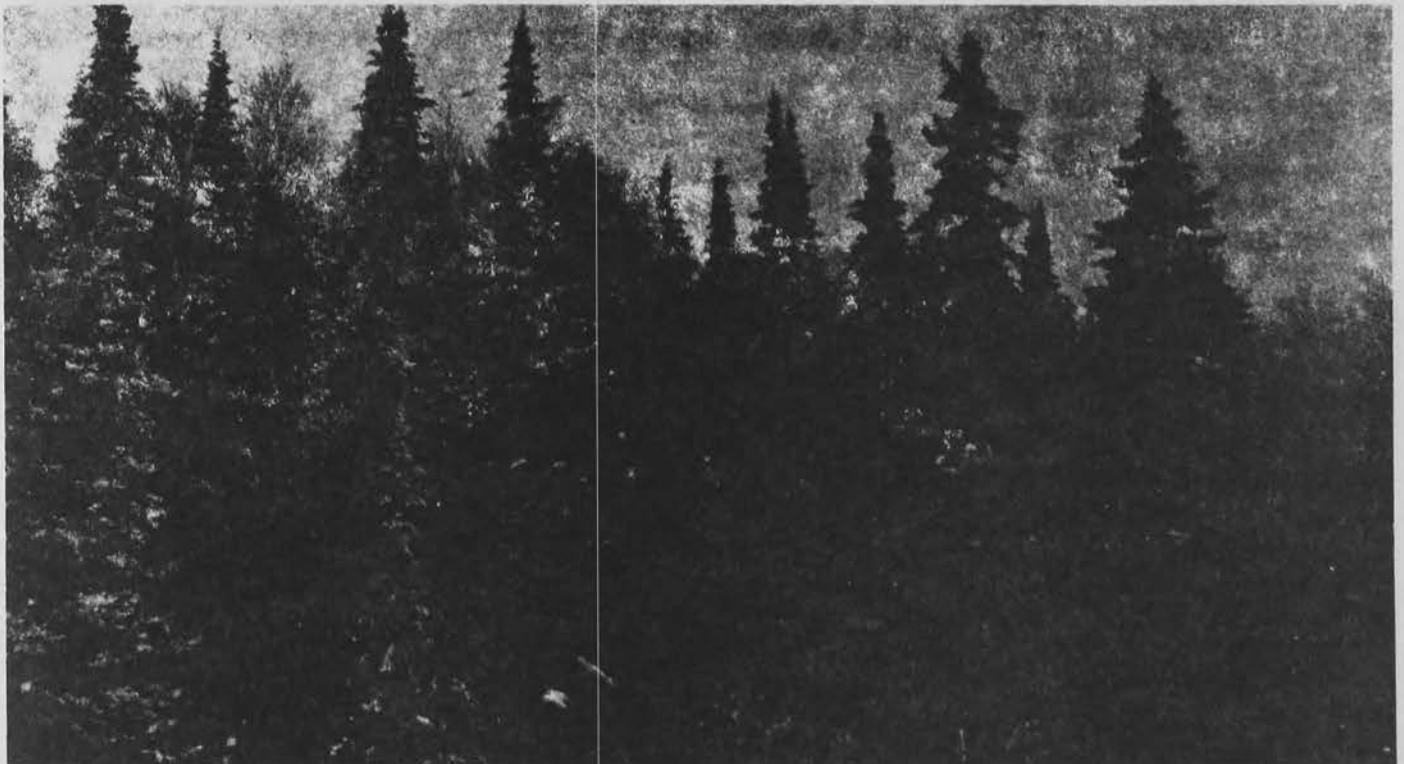
Regeneration

The original black spruce are even-aged, due to their origin by fire. Today, we maintain even-aged stands through clearcutting, followed by either natural regeneration or direct seeding. A good seedbed is essential to regenerate sites to full stocking.

Black spruce cones are persistent on the trees for several years, releasing seed gradually as the cones are heated by the sun. With a good seed source, preferably west of the stand within 2-3 tree lengths, good stocking should result if a sphagnum moss seed bed is present. Trees will seed from other directions also, but due to the prevailing westerly winds, this cannot be counted on.

Culture

Black spruce thins itself naturally, and additional thinning is generally not necessary. Black spruce is a slow growing tree with great variation between sites. Growth can vary from stagnancy on poor sites, ranging up to a cord per acre per year on the best sites, although this maximum growth is not common.



Harvest

Clearcutting is the recommended harvest method for black spruce. This may be either by strip cutting or mechanized harvest, such as full tree skidding. Rotation ages range from 60 years on the upland sites to 90-140 on bog sites. In harvesting, all trees above five feet should be cut or knocked down to prevent problems with the dwarf mistletoe disease.

Principal Enemies

Black spruce has few serious enemies, although wind, impeded water flow, beaver, and dwarf mistletoe can do damage at times.

Timber edges exposed to the prevailing winds are subject to windthrow and stem breakage, particularly if the trees have butt-rot. With proper management, this shouldn't be a major problem.

Dwarf mistletoe, also known as witch's broom, is a slow spreading parasitic plant that can eventually kill trees. Clearcutting the affected trees as well as any apparently healthy trees within at least 60 feet of the affected area is recommended. Whenever possible, the slash should be burned.

Uses

Black spruce is generally managed for pulpwood. Because of its long fibers, it is made into the finest paper.

Traditionally, low site index black spruce (below 23) has been utilized for Christmas trees, but due to the extensive Christmas tree plantations, this is no longer a major use of the tree. To a minor extent, it is sawn into construction studs.

BLACK SPRUCE (*Picea mariana*) has blue-green needles that are rigid but blunt-tipped. Needles are $\frac{1}{4}$ to $\frac{3}{4}$ -inch long, 4-sided but somewhat rounder in cross-section than the red spruce or white spruce. The cones are oval, pointed, $\frac{1}{2}$ -1 inch long, and persistent on the tree for sometimes as long as 20-30 years. Cone scales have rough margins. The tree is commonly 30-40 feet tall with a trunk diameter of 1-2 feet. Black spruce is one of the most abundant conifers of northern North America. It prefers wetland sites such as bogs, muck-filled seepages, and edges of streams and swamps. The wood is light, soft, and not strong. It is used extensively for pulpwood.



Line drawings for this series are by Mrs. Hoyle (1931) courtesy of the U.S. Forest Service.

Species Identification Information for this series is from "Important Trees of Eastern Forests," U.S.D.A. Forest Service

WOODLAND PEST MANAGEMENT

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Introduction

Any woodland, regardless of what product it is being managed for, will at some time be influenced by insect and/or disease pests. Therefore, it is important that a woodland owner/user be familiar with the more important forest insects and diseases of their area. There is no need for you to become forest pest specialists, but you should be able to recognize the type of damage occurring, the relative severity of the problem, and know who to consult for help in diagnosing the problem and developing a management strategy.

Regardless of whether your product is sawtimber, pulpwood, a recreational experience, or Christmas trees, the likelihood is very good that insects or diseases will affect your woodlot in some way during the life, or "rotation" of, the stand. Pest impact could vary from a single light defoliation resulting in some growth loss to several seasons of heavy defoliation that ultimately destroy the stand. What can this mean in dollars and cents? A young red pine plantation, for example, could cost about \$300.00 per acre to establish when you include site preparation costs, seedlings, and planting costs. At that rate, the loss of a ten acre plantation would cost \$3,000.00 plus the value of whatever growth had occurred before the trees were killed. A forty acre plantation loss could cost you between \$10,000 and \$12,000.00. However, not all insects are pests, and not all pest infestations are necessarily serious, so it is to your advantage to be able to recognize the major pests of this area and to be able to roughly estimate the relative seriousness of an infestation.

The following are factors you should be aware of as a woodland owner/user:

1. Sources of assistance
2. Prevention of pest problems
3. Detection and assessment of problems
4. Pest suppression
5. Recognition of common pest problems

Sources of Assistance

Knowing where to go for help is important because most of you are not resource managers and lack the knowledge necessary to deal with many of the forest pest problems. However, as you gain experience you may feel more confident to deal with some of the situations and seek help only occasionally.

Assistance is available from several sources such as:

1. County Extension Agents
2. State Department of Natural Resources
Forest Pest Specialists
Area or District Foresters
3. Colleges and Universities
4. Federal Agencies (Forest Pest Management)
5. Private Consultants

Prevention

Preventing pest situations from developing should be an important part of your management strategy. A relatively pest free plantation will produce greater volumes, higher quality materials, and at lower costs than a plantation where considerable pest damage has occurred.

Careful planning may help you avoid creating a situation that may stimulate or accelerate development of a serious pest problem. Points to consider are:

1. Select the tree species best suited to your site.
2. Prepare the site properly to reduce competition.
3. Use healthy planting stock and plant it properly.
4. Where possible, select species that are resistant to commonly abundant pests.

In plantations or naturally occurring stands that are already established, there are many measures that can be applied to prevent pest populations from building up. Techniques such as pruning of lower branches to reduce blister rust infection, removal of bark beetle or wood borer brood trees, thinning to preserve species diversification, or the removal of bushy crowned or "wolf" topped jack pines to prevent jack pine budworm are but a few examples.

Detection and Assessment

Another important consideration in forest pest management is early detection. The earlier a pest is detected, the greater the chances are of minimizing the impact and of successfully controlling the problem if it becomes necessary. Damage to the trees will be less and any control costs should be lower.

The key to early detection is surveillance. It is essential that the woodlands or plantations be regularly inspected. Examinations should be timed, as much as possible, to coincide with the occurrence of the damaging stages of common forest pests in your area. During these visits you should attempt to look at all the different age classes and species of trees you may have. Try to get a good idea of what's happening in the whole stand by making a "loop" walk through the stand rather than just checking the edges. You might find it helpful to make notes on your findings so you can compare activity with previous years. Your notes will also be helpful in the event that you need help from a professional resource manager.

Early detection also allows you more time to assess the severity of the situation. Not all infestations will be damaging and those that are may not be damaging enough to warrant direct control measures. To determine a course of action for a pest situation, an assessment must be done.

Assessing the severity of an infestation may require the assistance of a specialist. However, before seeking help you should attempt to answer the following questions:

1. How widespread is the pest on my property and on surrounding lands?
2. What is the history of this pest?
3. Has it caused recent damage?
4. What are the chances of continued buildup or collapse?
5. Will the damage affect my intended product? How seriously?
6. Will the value of the product protected be greater than the costs if I control?

You might need help to answer some of these questions, but if you at least work your way through the list, you will probably be able to answer most of the questions and also will be better able to communicate with whomever you seek assistance.

Suppression

Suppression or control of a pest can be approached in a variety of ways. Each method of control has its advantages and disadvantages. Considerations include:

1. Pest being controlled
2. Cost of materials and application
3. Timing of application
4. Application equipment requirements and availability
5. Your management goals
6. Efficacy of treatment
7. Environmental considerations
 - sensitive areas in or near your woods
 - water
 - apiculture
8. Pesticide selection and restrictions
 - labeling
 - restricted use pesticides

A pest management program may utilize several different types of control--an integrated approach. Integrated Pest Management (IPM) relies on the combining of many management techniques to prevent or reduce losses, maximize production, minimize costs, and to do these things in a manner that has the least impact on the environment.

Control methods, commonly a part of an IPM program, can be grouped into five categories:

1. Legal controls - quarantines or embargoes on the movement of infected plants or other materials capable of spreading an infection or infestation.

2. Genetic controls - the use of pest resistant species or varieties to reduce losses.
3. Cultural controls - preventative in nature, they include the removal of alternate hosts, the removal of infected trees, site preparation to reduce competition from other plants, or slash treatment to reduce the threat of bark beetle buildup.
4. Biological controls - the use of microbial organisms such as bacteria or viruses to control pest populations. These controls are usually more insect host specific so fewer non-target insects would be affected.
5. Chemical controls - normally are used only as a last resort. In outbreak situations they can effectively protect foliage for a season as part of an IPM program, but are not normally going to control the pest over the long run.

After attempting control it is really important that you follow up with a post-control evaluation. You need to know if the method and materials used achieved your management goals. Was the insect or disease adequately controlled? Are there things you would want to do differently? Were your initial cost estimates accurate? Answering these types of questions soon after the control was applied will help you to evaluate the effectiveness of the control project and to consider the utility of such a treatment in future management practices.

Pest Recognition

It is essential that a forest pest be correctly identified. Different pests will affect the forest resource differently and at various levels of severity. Some pests may be capable of rapid population buildup while other pests may develop more gradually providing the owner more time to consider management options. Since different pests require different controls or preventative management strategies, a proper diagnosis is important.

Identification of forest pests may involve more than just looking for an insect chewing on your trees. Other indicators of possible pest problems include partially eaten leaves or needles, leaf spots and/or discoloration, discoloration or fading of the tree crown, boring holes in the stem, accumulations of boring dust or shavings around the base of trees, discoloration or death of isolated branches, wilting of foliage, the development of abnormal growths or "galls", the presence of conks on tree stems, the loss of vigor, or just a generally unhealthy look to the stand.

Although identification of a particular pest can sometimes be difficult and perplexing, with the help of reference materials such as How-To's, Pest Alerts, and other insect and disease guides, you should be able to diagnose many of the more common forest pest problems. If you feel unsure about a particular diagnosis, however, seek the help of a pest specialist.

The following table summarizes the more common insect problems occurring in the Lake States:

Table 1. A summary of the important insect pests of major tree species in the Lake States with diagnostic comments.

TREE SPECIES	PEST	DAMAGE	WHEN TO LOOK	COMMENTS
Aspen	aspen blotch miner	leaf mining and some growth loss	June - July	Causes unsightly blotches on leaves - normally not a serious problem
	large aspen tortrix	defoliation, growth loss, die back, and tree mortality	mid May	Populations usually collapse in 2-3 years-normally not treated-trees will refoliate in June
	forest tent caterpillar	defoliation, growth loss, dieback, some tree mortality in severe cases	mid-late May	Populations are cyclic - usually subside after 3-4 years of defoliation
	poplar borers and gall makers	structural damage to branch, dieback and provide disease entry routes	anytime*	* 2-3 year life cycle so insects are generally always present. Well shaded stands reduce attack - not serious
Balsam-fir	balsam gall midge	causes galls in base of needle - can be a serious pest in Christmas tree planting	late May, early June	Difficult to control because of timing - apply a pesticide with systemic properties in early-mid June
	spruce budworm	defoliation, growth loss, top kill, and tree mortality	May - June	Mixed hardwood/conifer stands and stands with hardwood overstory are more resistant to attack
Basswood	basswood thrips	defoliation - abnormal leaf development and growth loss	mid May	The adults overwinter in the grass - move to the trees as soon as the leaves start expanding
Birch	birch leafminer	defoliation, growth loss, dieback - stress leads to attack from bronze birch borer	May - September	Ornamentals may be protected with insecticides - watering and fertilization also helpful several generations per year
	birch skeletonizer	defoliation, growth loss, stress leads to attack by the bronze borer	late June	Populations may stay up for 2-3 years

Table 1. Continued

TREE SPECIES	PEST	DAMAGE	WHEN TO LOOK	COMMENTS
Northern hardwoods - Mixed	orange humped mapleworm	late season defoliation may cause some growth loss and stress	July	
	pale tussock moth	"	late July, early August	Not a serious pest in itself but part of a late summer defoliating complex - not normally treated
	redhumped oakworm	"	mid-late July	Can cause isolated areas of severe defoliation
	variable oakleaf caterpillar	"	mid-late July	Can cause widespread severe defoliation-since defoliation is late in season it is not as serious as it might be
	walkingstick	"	June to August	Several years of severe defoliation can result in branch dieback and even tree mortality
Maples	maple trumpet skeletonizer	leaf skeletonizing-leaves are folded and sometimes crumpled up	July, August	Not a serious pest but a common one - no need for control
Pines	jack pine budworm	defoliation, growth loss, top kill, and mortality	May, June	Outbreaks last 2-4 years-can cause losses of reproduction, sapling and pole sized and mature trees
	pine tussock moth	defoliation, growth loss, top kill and mortality	May, June	Jack pine is the preferred host - entire trees can be stripped-in outbreaks extensive mortality can occur
	redpine needle midge	needle galls, drooping, and discoloration from larval feeding in fascicle	June, July	Damage sometimes highly visible-not a serious pest in a forest situation
	European pine sawfly	defoliation, growth loss red and Scots most hit in the Lake States	Mid May	Trees are rarely killed because new foliage is not eaten-can be a serious Christmas tree pest - a virus is registered for control

Table 1. Continued

TREE SPECIES	PEST	DAMAGE	WHEN TO LOOK	COMMENTS
Pines (continued)	redheaded pine sawfly	jack and red pine are preferred hosts- defoliation, dieback, and tree mortality	early-mid July	Damage is most severe in young plantations - shaded areas are preferred - avoid hardwood over- story
	red pine sawfly	defoliation dieback and tree mortality red and jack pine are favored hosts	late May	Overmature trees are quite sus- ceptible to damage - only old foliage eaten - several years of of defoliation leads to tree mortality
	pine spittlebug	stress, twig, branch, and tree mortality - jack and Scots pine favored	early mid-June	Can be a serious pest in Christ- mas tree plantings - forceful application of a contact insecticide works
	Saratoga spittlebug	stress, branch dieback, form loss, and mortality of red and jack pine	early-mid June	Control by removing the alternate hosts necessary for developmen- sweetfern, brambles, willows, and herbs
	northern pine weevil	feeding puncture wounds on stems and branches can cause dieback and tree mortality - Red and Scots pine	May	Damage most severe where there is an abundance of stumps or small dying trees to reproduce in
	introduced pine sawfly	defoliation, dieback, and occasionally tree mortality - white pine favored	early July	Heavy populations can strip a tree completely - 2+ generations a year with some overlap
	pine root collar weevil	mining of the cambial area at the root collar and the bases of larger roots - tree mortality can result- Scots pine favored	May to August	Sanitation and lower branch pruning may help - the adult weevils are intolerant to sunlight
	white pine weevil	two to three years of leader growth is killed by an attack - White pine, Norway spruce, and jack pine are attacked	August	Planting white pine on good medium soils and under a hardwood overstory helps reduce impact

Table 1. Continued

TREE SPECIES	PEST	DAMAGE	WHEN TO LOOK	COMMENTS
Pines (continued)	red pine shoot moth	shoot mortality, loss of form, height growth loss - most pines-red favored	May or June	Scots and red pine Christmas Tree plantings can be seriously damaged
	pitch nodule maker	feeding damage of larvae may cause girdling of shoot - weakened or crooked trunks on smaller trees (less than 5 feet)	any time	Two year life cycle - look for round (3/4" - 1 1/2") pitch masses - not a serious pest
	pine tortoise scale	stress, branch, and tree death - Scots and jack pines favored	June and July	Sapling size trees are usually the most damaged - two years of heavy feeding may cause tree mortality
	white grubs	partial or complete destruction of seedling root systems	April, May	Areas with heavy sod cover are highest risk
	bark beetles - IPS engravers	Mining in the cambial area girdles the tree - top kill and tree mortality	May to September	Normally not a problem in healthy vigorous stands - slash disposal helps reduce risk
Spruces	Spruce Budworm	defoliation, dieback, topkill, and tree mortality	mid May, June	At least 3 years of heavy defoliation before tree mortality starts to occur - avoid two storied spruce stands
	Yellow-headed spruce sawfly	defoliation, dieback, and tree mortality	May and June	Young open grown plantations are most susceptible - 3 or 4 years of defoliation may cause tree death
Walnut	walnut caterpillar	defoliation, dieback, or tree mortality	June	Walnuts and hickories are preferred - 2 or more years of heavy defoliation may cause tree mortality

WOODLAND DISEASE MANAGEMENT

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INTRODUCTION

In Minnesota, it is estimated that annual losses due to insects and disease are greater than one-half of the net annual growth of the growing stock on commercial forest land. While diseases are often not as spectacular as insect infestations, they cause the majority of the volume losses. A management program emphasizing prevention and early detection of disease problems can help avoid such losses. There are no practical or economic cures that can be used once a forest tree is diseased. Therefore, we have to rely on management techniques to prevent disease buildup, to minimize disease impact, and to restrict disease spread in forest situations.

This presentation is focused on four forest types commonly encountered in Minnesota and Wisconsin. Important diseases for each type will be presented with emphasis on recognition, relative severity, and practical management techniques. The aim of this presentation is to give woodland landowners a few concrete examples of management techniques since the basic approach to pest management has been presented in the previous paper.

ASPEN

The two major diseases of aspen are caused by fungi; Hypoxylon canker is caused by Hypoxylon mammatum and white trunk rot is caused by Phellinus tremulae. Either or both of the diseases can be found in most aspen stands in Minnesota and Wisconsin.

Hypoxylon canker

Hypoxylon canker is the most serious killing disease of aspen. The disease starts when fungal spores infect wounds in the bark, such as, those produced by insects on small branches.

Recognition. Any size tree can become infected. Cankering is commonly associated with dead branches. At first, yellowish-orange areas appear on the bark. After a couple of years, the outer bark layers become papery and peel off to reveal a dark, carbonaceous appearing material where new spores are produced. At the edge of the canker, white fan-like growths of the fungus can be found.

Severity. Hypoxylon canker kills trees thereby reducing stand density. Decay fungi and insects can also enter through the cankers, which weakens the stem and subjects them to wind breakage.

Management. Hypoxylon canker cannot be prevented, however, proper management can minimize its impact. The amount of Hypoxylon canker infection is related to species, clonal differences and stand characteristics. Of the native poplars, quaking aspen is most susceptible, bigtooth is moderately susceptible and balsam poplar is rarely infected. Within each species, clonal susceptibility varies. Infection and canker formation are favored by open stands, poor stocking

and along stand edges. Infection can be prevented by maintaining dense stands with closed canopies.

Aspen stands should be checked periodically for Hypoxylon canker. If 15-25% of the trees are cankered, harvest the stand by age 40 in a manner which will encourage dense aspen reproduction. If more than 25% of the trees are cankered, harvest as soon as possible and convert to another species. If the stand is lightly infected, it may be safe to manage it on a rotation longer than 40 years.

White trunk rot

White trunk rot causes the most volume loss in aspen. It becomes more common as the stand ages.

Recognition. Conks, the fruiting body of Phellinus tremulae, are the most obvious indicators of infection and decay. The conks are hoof-shaped with a dark, rough upper surface and a tan to white lower surface. Conks are often found on the trunk at the bases of the dead branches. White trunk rot is a white, spongy decay of the aspen wood. Black zone lines surround the decayed wood.

Severity. A single conk on a 16 foot aspen log means the log is probably not useable for lumber. Trees may be infected and have decay in them for a number of years before conks are produced. To estimate the amount of rot in your aspen stand, determine the percentage of trees with conks on them and double that percentage. Almost twice as many aspen trees have decay as have conks.

Management. Protect your trees from fires and other stem wounds. Wounds often become infected with decay organisms, such as Phellinus tremulae. Maintain dense stands with closed canopies. Harvest your stand before decay becomes severe, generally by age 40.

NORTHERN HARDWOODS

This type includes sugar maple, basswood, yellow birch, paper birch, oaks, elms, ashes, etc. The net annual growth of hardwood sawtimber is greater than removals, yet the demand for high quality hardwoods exceeds the supply. The difference is due to losses to decay. In general, decay fungi cause about 80% of all volume losses due to disease in hardwoods.

Decay

Fungi are the major cause of decay in trees. Decays can be grouped by where they occur on trees, such as, root rot, butt rot and trunk rot. Spores are spread by wind and rain. Most fungal spores must enter the tree through wounds or branch stubs to become established and to cause damage.

Recognition. External indicators of decay are: rotten branches, cracks, seams, fire scars, logging scars, butt bulges, burls, conks and cankers. Although cankers are caused by fungi that primarily kill the tree cambium, they are wounds through which decay fungi can enter.

Management. Trees have no wound healing process. Trees compartmentalize the injured wood and may generate new tissues over the injured areas, but they can never replace or repair the injured tissues. It is not possible to eliminate decay from stands, however, decay can be reduced by preventing wounds, thinning sprout stands properly and using timber stand improvement techniques.

Prevent wounds by:

1. Protecting stands from fire
2. Reducing logging wounds by better design of skid trails, reducing felling damage and harvesting damaged residual trees.
3. Maintain stocking levels to encourage self-pruning of small branches and rapid wound closure.
4. Proper pruning. Pruning can be the best thing you can do for your trees, or the worst, depending on how you do it. It's best to prune most trees when they're young and during the dormant season. In live branch pruning, only branches that will leave wounds two inches or less in width should be pruned. Find the bark ridge and cut downward and slightly outward. Do not injure or remove the branch collar. Do not paint the wound except for cosmetic purposes, and if you do, use a very thin coat of some commercial material (not house paint).

Many high value hardwood species are vigorous sprouters. Stands developing after harvest are likely to contain many stems of sprout origin. Sprouts are generally more susceptible to decay than are seedlings. Decay can be reduced in sprout origin stands by:

1. Favoring seedlings, seedling sprouts or sprouts from small, decay-free stumps.
 2. Removing excess stems in sprout clumps when stands are young, generally less than 20 years old.
 3. Favoring sprouts of low origin on the stump over those of high origin.
- In established stands, proper thinnings and improvement cuts can reduce the number of decayed trees. Sound management practices include:

1. Prevent wounds, as discussed above.
2. Remove cull, conky, scarred, or root-diseased trees. Such trees are of low value and are taking up valuable growing space and resources. They also serve as sources of insects and diseases for surrounding healthy trees.
3. Avoid thinning in the spring when bark is easily knocked off the tree.

RED PINE

A number of different fungi cause blights and cankers on red pine; three of them will be discussed briefly. They are Sirococcus shoot blight caused by Sirococcus strobilinus, Diplodia tip blight caused by Sphaeropsis ellisii and Scleroderris canker caused by Gremmeniella lagerbergii.

Recognition. In the forest situation, it is often difficult to differentiate the three diseases. In general, the symptoms are needle discoloration and death or needle droop or premature needle drop and shoot mortality. Branch and stem cankers caused by Diplodia are resinous and dark colored below the bark. Scleroderris cankers causes a greenish discoloration beneath the bark of dead branches.

Severity. Any one of these diseases, under the proper conditions, can destroy a red pine plantation. Damage is cumulative and heavily infected trees can die, especially seedlings and saplings. Damage can be more severe if the tree is under stress from drought, J-rooting or being planted offsite.

Management. Proper management techniques are:

1. Remove all overstory red and jack pine from a site scheduled for red pine planting as they are potential disease carriers.
2. New plantings should not be established adjacent to older pine plantations with existing disease outbreaks without treatment of those problems.
3. Do not plant red pine in frost pockets or off sites. Avoid J-rooting of seedlings.
4. Do not replant old Scleroderris infection sites to red pine.
5. To reduce the amount of infection on a site, infected branches can be pruned and burned along with infected or dead trees. Do not prune when the trees are candling or while wet.
6. Do not plant infected nursery stock.

WHITE PINE

White pine blister rust

White pine blister rust, caused by Cronartium ribicola, was introduced into the USA about 1900. Rust diseases are unique in that two hosts are required for completion of their life cycle. In this case, gooseberry and currant are the alternate hosts. Only spores produced on gooseberry or currant can infect pine needles. The fungus kills branches and trees by girdling them.

The Lake States have been broken up into four hazard zones. Zone 1, southern MN and WI, has the lowest hazard of rust infection and Zone 4, northern MN and WI, has the highest hazard.

Recognition. By the end of the first year, needle infections have spread to the branch or main stem where the bark becomes brown, bordered by yellow. By end of the second year, the branch becomes swollen and spindle shaped. In subsequent years, cankers enlarge and take on a sunken appearance. Abundant resin flow from the canker is an obvious symptom.

Severity. This is the most serious disease on white pine and has severely limited its planting. White pine can be grown in the southern parts of MN and WI with no significant mortality from blister rust. However, open field plantings in the northern part of the States generally will not produce productive plantations and should be avoided.

Management. In Zones 3 and 4 (Northern MN & WI) establishment should only be attempted in an understory situation where it is possible to control the overstory through gradual removals. Prune the lower branches off the white pine to 50% of live crown at age 5-7 and continuing every two years until there are no live branches within at least 9' of the ground level. Consider planting resistant stock when it becomes available. In central and southern MN & WI (Zones 1 & 2), open field planting is acceptable. Prune as described above. Managed areas should not be located in areas where cold air collects at night or in or on the edges of small forest openings.

CONCLUSION

A woodlot owner must become familiar with the many diseases that commonly affect his trees and develop management strategies to avoid pest buildup and economic loss.

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WISCONSIN'S FOREST TAX LAWS
CAN BENEFIT THE FOREST OWNER

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Property taxes play an important role in the success or failure of any forest management enterprise as an investment. Wisconsin's two forest tax laws are intended to encourage the production of timber in support of the forest industry. They accomplish this by providing an opportunity to the landowner to commit his forest lands to long term forestry practices with the guarantee that his property taxes will remain at a level consistent with the land's ability to produce timber products.

Ownership of Wisconsin's 14.5 million acres of forest are approximately as follows:

Small private - 8.5 million acres
Industrial - 1.4 million acres
Public - 4.4 million acres

The importance of these forest lands can be measured in part by looking at contributions made by forest industries to the economic welfare of the state:

1. First in the nation in proper production
2. 1400 companies providing 75,000 jobs with a payroll of \$1.4 million.
3. The leading industry in 24 of 72 counties
4. 200 million cubic feet of wood used annually with a value of about \$350 million

Difficulties of the forest owner may encounter with rising property taxes can be illustrated by comparing 10 year trends in Wisconsin:

	<u>Forest Lands</u>	<u>All Lands</u>
Assessed Value	up 9.2 times	up 4.5 times
Property Tax	up 5.2 times	up 2.1 times
Forest products value	up 2 times during same period	

The unfortunate result of these comparative changes is that a significant acreage of forest land is being taxed beyond its ability to profitably produce forest products. It is in effect being taxed on the basis of other uses and values regardless of its present or intended use. If, under such circumstances, an owner is concerned with his forest land as an investment he may well be forced to consider alternatives such as sale of the land, subdivision for residential development, recreational use or development or even conversion to agricultural production. Landowner response to these alternatives is all too evident in many areas of Wisconsin, a fact which could portend serious erosion of a strong forest land base to support forest industries.

From the state's perspective one alternative is simply to suffer the loss of the forest land base as it may occur. Other more positive alternatives might include major changes in property assessment and taxing methods, formal zoning tied directly to land use, or special forestry tax incentives. Of these only the tax incentives approach has proved workable.

Wisconsin employs two forest tax laws which in concept require sound forest management and provide for a reasonable long term annual tax rate in combination with a yield tax at the time of harvest.

The Forest Crop Law (FCL) was initiated in 1927 in response to widespread forest exploitation, the devastating effects of continuing forest fires, and wholesale tax delinquency resulting from ill advised conversion of forest land agricultural use. Today there are over 1.4 million acres entered under the Forest Crop Law and the first of many expected 50 yr contract renewals are occurring. Approximately 50,000 acres are added each year.

The Woodland Tax Law (WTL) was implemented in 1954 primarily to offer a forestry tax incentive to forest owners with acreage to small for eligibility under the Forest Crop Law. 425,000 acres are presently entered under the Woodland Tax Law with annual increases of about 50,000 acres.

The Woodland Tax Law and the Forest Crop Law in Brief

	Woodland Tax Law	Forest Crop Law
Size of tract	10 acres or more, but not including a full quarter-quarter section or government lot.	At least a full quarter-quarter section, government lot or fractional lot.
Contract	15 years.	25 or 50 years.
Annual tax	20¢/acre if entered before 1977. If entered in 1977 or after, \$1.49/acre (will be adjusted in 1992).	10¢/acre if entered before 1972. If entered in 1972 or after, \$.74/acre (will be adjusted in 1992)
Severance tax	None.	10% of stumpage value. Landowner must file notice of intent to cut and report after cut.
Public use	None required.	Open for public hunting and fishing.
Forest Management	Follow approved management plan.	Follow approved management plan.

The Woodland Tax Law and the Forest Crop Law in Brief

	<u>Woodland Tax Law</u>	<u>Forest Crop Law</u>
Application Deadline	April 30, applications filed by April 30 are processed prior to November 20 of the same year. If approved tax benefits begin January 1 of the following year.	
Contract Renewal	Upon completion, contracts may be renewed by mutual consent of the landowner and the DNR.	
Sale of Contract Lands	The contract may remain in force if the land is sold, however, if the land is partitioned it must be withdrawn.	The contract may remain in force if the land is sold. If part of a full quarter-quarter section government lot or fractional lot is sold the land must be withdrawn.
Withdrawal Penalty	None if entered prior to 1977. If entered after 1977, 1% of value of average acre of woods in county x no. of acres in tract x no. of years under the law.	Difference between actual "acreage share" plus severance payment and what would have been paid under general property tax plus 12% simple interest (5% if entered before 1978).

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