1972

Aspen Minnesota's No. 1 Tree

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ASPEN

Minnesota's No. 1 Tree

For thousands of years after the last glaciers disappeared from northern Minnesota, the forces of nature worked to develop a magnificent forest of predominantly white and red pine. Stands of big pines covered more than 5 million acres.

Until the 1800's, the only human occupants of Minnesota's pine forests were a few thousand Indians and a few traders and missionaries. Then farmers in large numbers moved into southern Minnesota, Iowa, Missouri, Nebraska, Kansas and other prairie states. Timber was needed to build the big barns, homes and cities of these states. Loggers from Michigan and Wisconsin moved into the pineries of Minnesota to meet the big demand for timber farther south.

Logging in the pine forests of northern Minnesota reached a peak during the 1890's. By the 1920's the big pines were gone except for comparatively small or inaccessible stands.

As big logging declined, many operations moved to the big timber in the western states, but many loggers opened farms in northeastern Minnesota. During the early 1900's most people believed that agriculture had a bright future in the area, and emphasis was put on land clearing rather than upon reforestation.

Severe drops in agricultural prices during the 1920's and 1930's plus development of large-scale farming in other areas based on mechanization, fertilizers and insecticides, has resulted in a sharp decline in farming in northeastern Minnesota during the last three decades. This has stimulated interest in use of the lands of northeastern Minnesota for timber production.

As logging and sawmilling declined with the depletion of virgin pine stands, some timber operators and industrialists turned to paper making to use the spruce stands which occupied much of the lowlands of northeastern Minnesota. Early in the 20th century, paper mills were built at Cloquet, Grand Rapids, International Falls, Little Falls, Sartell and Brainerd. During the 1920's plants were built at International Falls and Cloquet to make fiber boards out of the smaller and less desirable woods which interspersed the pine and spruce stands. During the last 20 years most of the paper mills in northern Minnesota have expanded, and fiber board mills have been

This picture illustrates the best method of harvesting to assure a good stand of aspen. All of the trees were cut so that nothing remains to shade the aspen suckers which will soon appear. If any trees were left, their shade would kill or slow down the growth of aspen suckers.

established at Bemidji, Virginia, Floodwood and Duluth. The first wafer board plant in the United States is going into production at Grand Rapids late in 1972.

Forest industries established in northeastern Minnesota now produce paper, fiber boards, lumber and other forest products valued at about $400,000,000 a year. Approximately 30,000 people are employed in the woods and by the forest industries of northern Minnesota.

However, forest industries of northern Minnesota are facing serious problems. One is severe competition from other regions such as the south, west and east, and from other states in this region such as Wisconsin and Michigan. Minnesota mills are generally small compared to some of their competitors, and they are faced with making very large investments to improve capacity and efficiency. They are also making big investments to reduce water and air pollution. While most Minnesota forest industries will be able to continue on a sound basis, there is some doubt about the outlook for several plants.

Squeezed between competition from other areas and rising costs, Minnesota forest industries are looking with even greater interest at aspen. The species is now in large supply, it grows rapidly

and is relatively easy to harvest and process. However, it has some disadvantages compared to other species, and research has been going on to overcome these deficiencies and find new methods of using aspen.

For as far ahead as foresters can project, aspen will be the primary species upon which expansion of the forest industries of Minnesota must depend. Other desirable species such as pine and spruce are in short supply and grow slowly.

Millions of visitors vacation in northern Minnesota each year. While evergreens and hardwoods such as birch, elm, basswood, oak and maple are found around most lakes, the dominant forest species visitors see in the central parts of northern Minnesota is aspen. Early spring leaves are bright green, which darken as the summer progresses and turn golden yellow in the fall.

Vigorous aspen forests also are the best providers of food and cover for deer, grouse and most other forest animals.

Well-managed aspen forests contribute better to water supplies than evergreens. Rapid regeneration and strong root systems help to prevent erosion. Following fires, aspen will come in rapidly to prevent the takeover of burned areas by brush.

This is the same area shown on the preceding page one year after clear-cutting. Within a few weeks after cutting, aspen suckers sprout up from the old roots. After a few months of growth, old slashings are covered and the general appearance of the site is attractively green.

Minnesota is fortunate that nature provided a desirable tree like aspen to take over after man had logged, cleared and repeatedly burned the pine forests. But unless men utilize their intellects and resources, aspen forests could deteriorate and be succeeded by less desirable species.

Sound public policies are essential to good forests. While foresters may lead the way, average citizens who are not technically trained must adopt constructive attitudes and enact wise laws. If northeastern Minnesota is to prosper and be attractive to visitors, citizens of the state generally must understand the basic principles of forestry. The balance of the booklet describes some of the characteristics, possibilities and problems of aspen.

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Minnesota aspen are members of the *Populus* genus which includes cottonwoods, poplars and aspens. Three members of this group are found in quantity in northeastern Minnesota.

Balsam poplar *(Populus balsamifera)* is a rapidly growing tree usually found in low wet areas such as river flats, sandbars, the borders of lakes and swamps. Its lower trunk is generally rough and dark colored, with a yellowish cast to the smoother bark above. The

Five years after cutting, a good aspen stand looks like this. The trees are about 15 feet tall. Natural thinning has reduced them to about 5,000 stems per acre from at least double that number of original suckers.

A 16-year-old aspen stand will be about 35 feet tall. Density will be reduced by natural thinning to about 2,000 stems per acre. The trees are entering their period of maximum growth and attractiveness.

buds are large and resinous, and it gives off a distinctive smell from which its common name of Balm-of-Gilead originates. Leaves are narrower than those of aspen. While a close relative often confused with aspen, it is not so desirable for commercial use and not so pleasing in appearance. Quantities of balsam poplar are comparatively small in northeastern Minnesota.

Quaking aspen *(Populus tremuloides)* is the principal member of the poplar family in Minnesota. When Minnesotans speak of aspen, trembling aspen, poplar, trembling poplar and popple, they are generally referring to quaking aspen. Leaves are heart shaped, but come to a short point, usually with 15 or more short teeth along the side of each half. Buds are brown and nonresinous. The smooth bark is generally white, gray or light green. Roots are pale brown.

Bigtooth aspen *(Populus grandidentata)* is the other aspen common in Minnesota, and is often referred to as the largetooth aspen or poplar. It is frequently found in mixed stands with quaking aspen and balsam poplar. It is quite similar in general appearance to quaking aspen. However, its leaves have larger indentations, with generally 10 or less teeth along the side of each half. Buds are grayish in color. The smooth bark is greenish yellow. Roots are dark reddish

This 42-year-old aspen stand is nearing its peak of productivity. On a good site, the trees will be about 75 feet tall. Insects, disease and natural selection will have reduced the stand to about 500 trees per acre. By this age, the stand yields good pulpwood.

brown. Bigtooth aspen are generally shorter lived and in very much smaller supply than quaking aspen in northern Minnesota. Management practices for both species are the same in most respects.

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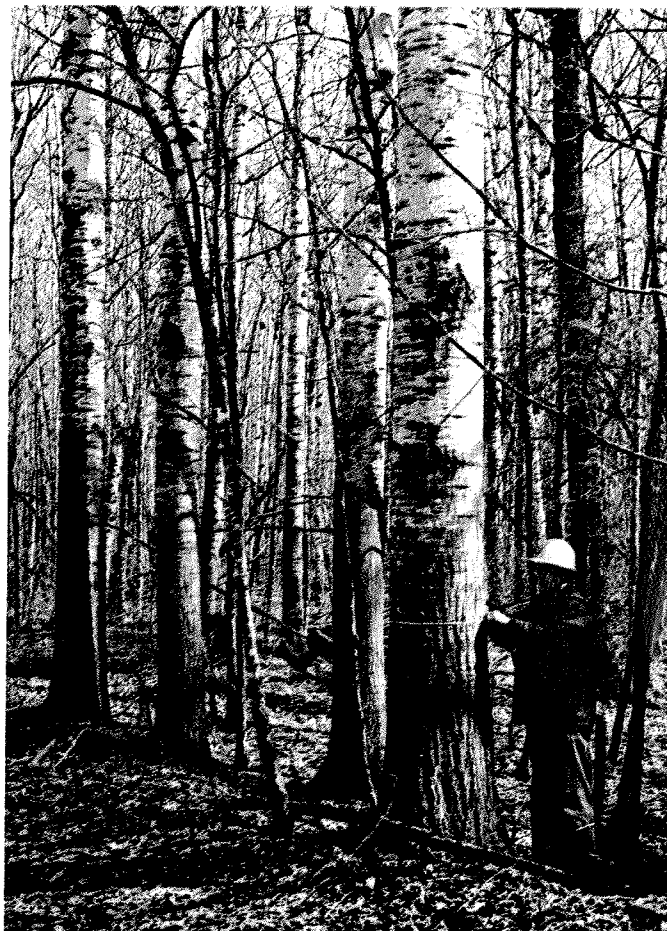
Quaking aspen is the most widely distributed tree species in North America. The range of aspen extends across Canada from the Atlantic to the Pacific as far north as the tree line, and in the northern and eastern states from Pennsylvania westward to the prairies of Iowa and the Dakotas. Aspen is also found in parts of the Rocky Mountains, including Colorado and small parts of New Mexico, Arizona and California. Canada has about five times as much aspen as the United States, but cuts only half as much because of inaccessibility and lower demand there.

The broad distribution of aspen is indicative of the ability of aspen to grow under wide variations in climates that are generally cool and to adapt to a variety of soil conditions. Its range is also based on its very rapid growth rate, compared to other tree species found in cool climates.

The unusual reproductive vigor of aspen also plays a key role in establishing large stands of aspen over big geographical areas. Reproduction may come from seeds which are produced in tremendous quantities. But once established in an area, most aspen reproduction comes from suckers which grow from the roots of trees which have been cut or otherwise killed.

Flower buds are developed near the ends of aspen twigs during the summer growing season. In late winter they swell and break into flowers in April or early May. Male and female flowers are normally on separate trees. Pollination is accomplished by wind, and the fruit ripen in from four to six weeks after flowering. The fruit is a one-celled capsule containing many small brown seeds, each of which is surrounded by tufts of long, white silky hairs. There are from 2½ to 3 million seeds per pound. Trees begin to have good seed after about 20 years and reach their peak seed production at between 50 and 70 years. As many as 5 million seeds have been counted from one aspen tree, but heavy seed crops usually come only once every four or five years.



On a good aspen site, a 60-year-old stand will look something like this. Heights will reach about 90 feet. Some of the trees will make good lumber or veneer bolts. The number of trees will usually be down to about 300.

The light seeds may be carried by winds for many miles. They germinate in a day or two after reaching a moist place. The seedlings are easily damaged by excessive heat, drought, fungi and other causes. If they survive, seedlings may grow to heights of 12 inches or more during the first year and develop an 8 to 10 inch taproot. During succeeding years wide-spreading lateral roots are developed which may extend to more than 80 feet from a mature tree. Despite large seed production, observers feel that establishment of an aspen stand by seeding is uncommon under natural conditions.

Aspen root suckers are produced from buds on the shallow lateral roots, usually from those within 3 or 4 inches of the soil surface. A few suckers will arise almost every year in uncut stands. However, strong light and heat must reach the forest floor to produce abundant and vigorous sucker reproduction. These conditions are generally produced by logging or light burning of aspen stands. Suckers are initially sustained by the root system of the parent tree, but they soon form their own root systems. Strong suckers under favorable conditions commonly grow 4 to 6 feet the first year. On a well-stocked aspen stand which has been clearcut, 10,000 to 60,000 aspen suckers per acre may develop.

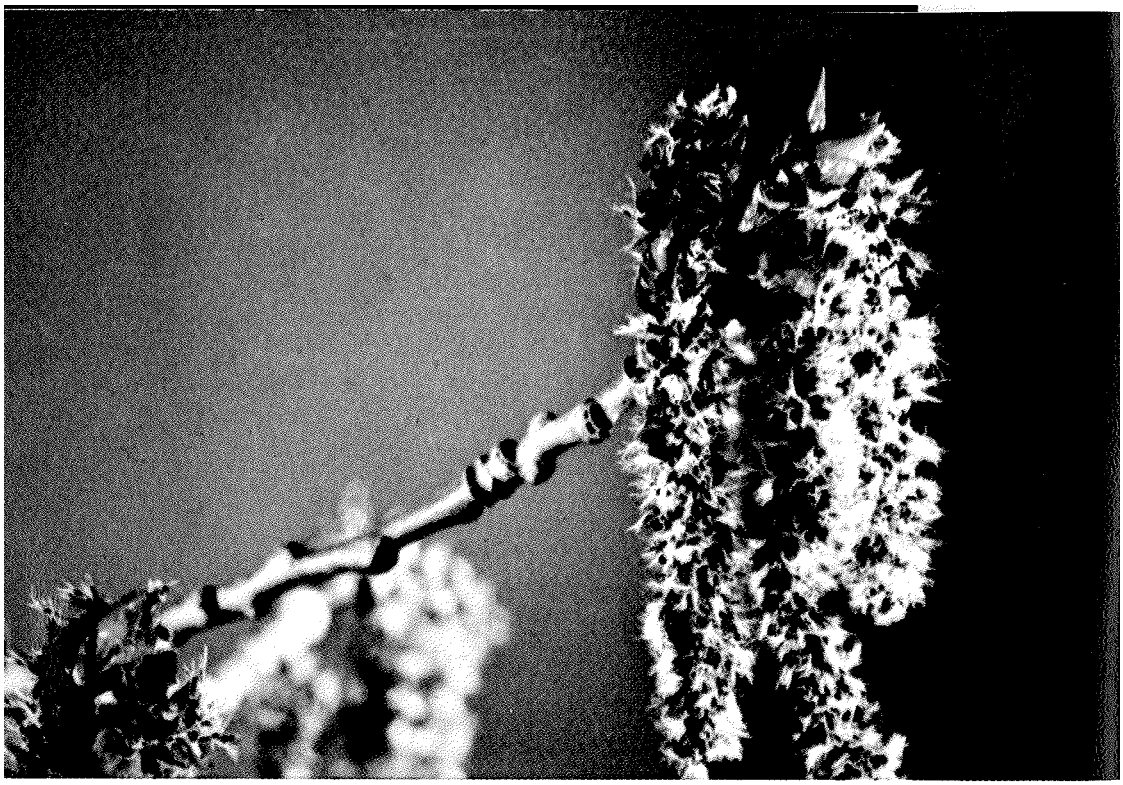
When an aspen stand becomes over-mature, wind, insects and disease begin to take a heavy toll. A whole stand will degenerate in a few years to look like the one below. Over-mature aspen is not worth logging, and investments must be made in clearing or burning to get good regeneration.

Balsam-fir frequently grows as an understory to aspen. If the aspen is not logged or the balsam-fir is not removed at the time the aspen is harvested, it will shade and thus restrict aspen suckering and the area will be lost as an aspen forest.

One of the key elements in aspen growth is sunlight. Aspen is highly intolerant to shade. If some trees are left when a stand is cut, the shade from these trees will inhibit the growth of aspen suckers. It is thus essential to cut or otherwise kill all trees on a site, if good aspen reproduction is desired.

Intolerance to shade produces natural thinning in young aspen stands. Some suckers will grow more rapidly than others and soon their shade will kill the slower growing suckers. Such competition will generally reduce the number of aspen stems to about 7,500 per acre after one year. At age 10, the trees will be about 25 feet tall and number 3,000 stems per acre. By age 20, further natural thinning will reduce the number of stems to about 1,700 per acre, and the trees will be about 40 feet tall. When aspen stands reach maturity at about 40 to 60 years, there will normally be from 500 to 1,000 stems per acre and they reach heights of more than 90 feet on favorable sites.

Unless cut, burned or otherwise removed at maturity, aspen stands deteriorate rapidly. Insects and disease take a heavy toll of old aspen. When a few die the top canopy is broken, and wind and ice break down the stand further. Foresters agree that an aspen stand may be in good shape up to a mature age (which depends upon site quality, climate and other factors), but that in a few years thereafter the stand will "breakup" and be reduced to worthless condition in



Aspen buds flower in April or early May, and pollination is accomplished by wind. The fruit is a one-celled capsule containing many small brown seeds, each of which is surrounded by tufts of long, white silky hair. A tree may produce millions of seeds a year, but few grow.

5 or 10 years. As the aspens die they are replaced by trees more tolerant to shade and to brush species usually present as an understory. The weak aspen suckers cannot compete with this vegetation and most of them die. Aspen stands left to go their own ways will generally not reproduce good new stands.

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Aspen wood has many good characteristics such as uniform texture, medium weight and light color. Lumber made from aspen is used extensively for crating and pallet material. It machines, glues and wears well in furniture and cabinetwork, where it will accept many finishes and colors. Aspen lumber can be used in construction of many kinds, and is being used for making studs. However, it is best if sawed into smaller sized pieces, compared to pines, firs and denser hardwoods. New techniques for sawing, drying and treating aspen have expanded its uses considerably in recent years.

Plywood and lumber core stock can also be made from aspen veneer. Development of equipment to cut veneer from small diameter bolts is increasing the demand for larger sized aspen. Aspen veneer is used extensively for making matches.

One of the largest uses for aspen is in fiber boards of many types. At International Falls and Cloquet, aspen fibers are used together with other wood and mineral fibers to produce insulating boards, siding and other relatively soft boards. At Duluth, much aspen is used in production of more dense and harder boards. At Grand Rapids a new plant is being built to utilize specially cut aspen "wafers" bound together with resin under heat and pressure to produce a very strong and durable board for general construction uses.

At present the largest use of aspen is in papermaking. The aspen is first debarked either in the woods or at the paper mills. Then various pulping processes are used to break down the wood into separate fibers by mechanical, chemical or combination methods. After refining and bleaching wood fibers, several kinds of fibers are mixed in exact proportions with other ingredients in a watery solution which is converted into a web of paper on a paper machine. Various finishes and coatings may then be applied to the surface of the paper. Papers using aspen pulp are of many different types ranging from rough papers and tissues to publication papers, fine printing papers and paperboards.

Most aspen start as suckers which sprout from the shallow roots of trees which have been cut or burned. The growth of suckers is very rapid compared to growth from seeds as indicated by the picture. The seedling at the left and the suckers on the right are one year old.

Aspen fibers are shorter than those of spruce and other softwoods, so they do not provide as much strength. But they are whiter, lighter, more opaque, and more easily pulped. The yield of fiber from pulpwood is lower for aspen than for most other species especially if pulped by chemical processes. However, the yield of fiber from aspen wood if pulped by mechanical, or partially mechanical processes, is excellent. At present, most papers made in the Lake States of Minnesota, Michigan and Wisconsin contain substantial amounts of aspen but use some fibers from other trees to give added strength. Intensive study is being given to developing new methods of producing stronger pulp from aspen, which is in good supply compared to most other species in the Lake States.

The amounts and proportions of aspen used in paper mills varies greatly. An indication of what has happened is found at the Blandin Paper Company mill at Grand Rapids. Consumption of aspen here was 2,500 cords per year in 1945. Ten years later it reached more than 6,000 cords. By 1965 aspen consumption was 18,000 cords. Since 1969 consumption has been more than 30,000 cords of aspen pulpwood per year. Without the development of new processes to allow greater usage of aspen, it is doubtful if Blandin would have been able to obtain the spruce and other traditional pulpwoods that would have been needed to sustain expansion of the mill. Research is continuing on new methods of pulping which may permit aspen

Controlled burning can be used to remove an over-mature stand of aspen or a stand which contains too much hardwood, balsam or brush to permit aspen to regenerate. However, there are not many days in a year when burning conditions are ideal.

Five years after a controlled burn, the aspen has suckered prolifically and grown to a height of 12 feet. Most of the old trees have fallen down, and the new stand looks attractive. On some remote areas controlled burning may be the only practical way of generating good aspen stands.

to replace more spruce and other pulps in the future. Greater and more efficient use of aspen will be helpful in keeping Blandin paper competitive with that from mills in other states and regions.

Aspen is now providing about 50% of the pulpwood used by the mills of the Lake States. It is estimated that by the year 2000 at least twice as much aspen pulpwood will be utilized if it is available and if expected progress is made in the technologies for its use.

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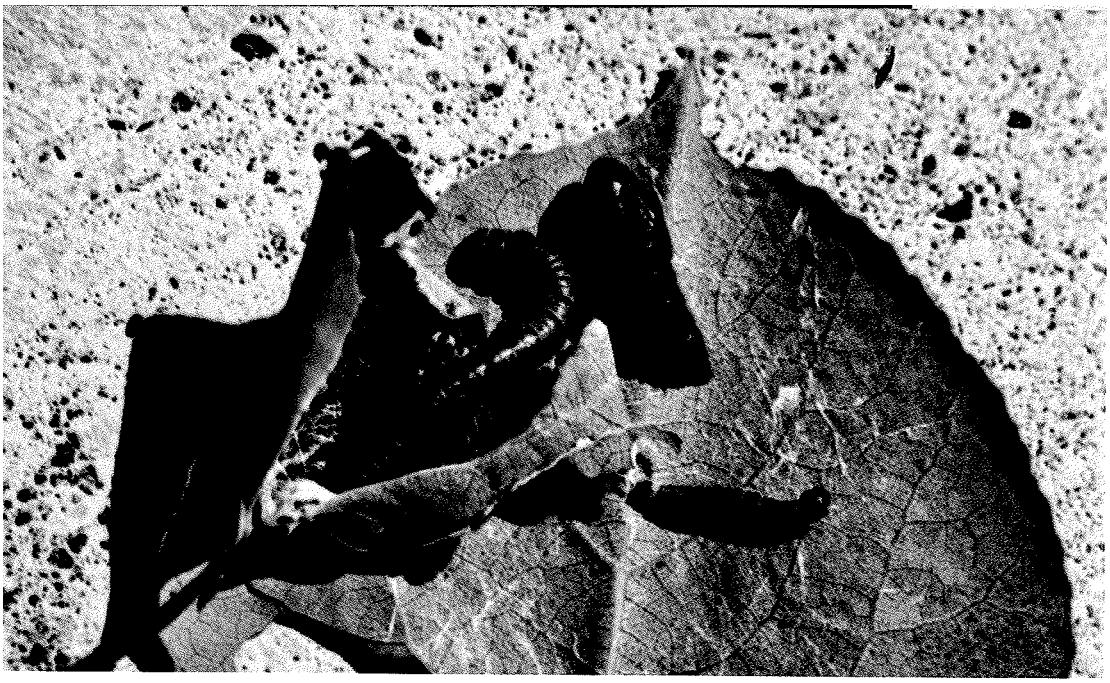
For several decades foresters and public leaders have been concerned about the underutilization of aspen in northeastern Minnesota. However, expansion in use of aspen by paper mills, fiber board mills and lumber mills now appears to be bringing a catch-up in capacity.

The new Blandin board mill at Grand Rapids is projecting use of between 70 and 90 thousand cords of aspen per year based on one production line. The plant is designed for two production lines if acceptance of the board is up to projections, and this would require another 70 to 90 thousand cords of aspen. The apparent surplus of aspen within reasonable distance of Grand Rapids has been estimated at about 300,000 cords per year. If Blandin's use of aspen for paper and board increase as expected, these mills will use about



Aspen are attacked by a wide variety of insects, generally when they are in the larval stage. Caterpillars like the one feeding on a quaking aspen leaf can defoliate thousands of square miles of aspen in the spring. While trees are not killed, their growth is slowed.

200,000 cords per year of the surplus. And there are other paper companies, sawmills and industries nearby who might well expand to consume the balance of the readily available aspen.

While enough aspen is available to meet the projected needs of the mills in the Lake States for the next few years, foresters are now wondering whether there will be enough to meet the long-term needs. The outlook for northeastern Minnesota is for an adequate supply to meet projected needs to the end of the century. However, an economist for the North Central Forest Experiment Station said at the Aspen Symposium, ". . . forest industries drawing their aspen from Michigan and Wisconsin must plan to procure their wood elsewhere within these states, substitute other species of wood for aspen, or cut less than the projected amount during the next 15 to 25 years. Further, firms planning replacement of their capital equipment would be wise where possible to install equipment and processes that can substitute other wood species for aspen at minimum cost. . . ."

Because of growing demand for aspen, intensive studies are being made on what can be done to increase future supplies.

The most obvious answer is to log mature stands of aspen as soon as possible and in such a way that they will reproduce better stands than presently exist. As indicated before, if all trees are logged

off an area containing aspen, the aspen will sucker prolifically and grow rapidly. However, if only a relatively small number of trees are left, these will shade and kill much of the young aspen. Aspen stands which are logged now will be ready for cutting again within 50 years, and can be used sooner if needed.

Another possibility is to convert open land, brush land and stands of less desirable species to aspen. Low-grade stands of unmerchantable maple, birch, elm, and balsam fir generally contain enough aspen so that the aspen will sprout and spread if the other trees are all removed by cutting or burning.

About 25% of Minnesota's aspen forests are poorly stocked and these stands would come back more thickly if cut or burned.

Possibilities of seeding and planting aspen are being experimented with. While there is some direct seeding of areas under favorable natural conditions, most seed studies are directed toward nursery production of particularly desirable strains of aspen which can then be transplanted on sites favorable to aspen growth. Such planted stands may be much more productive than natural aspen stands, especially where there are not enough aspens to reproduce a full stand.

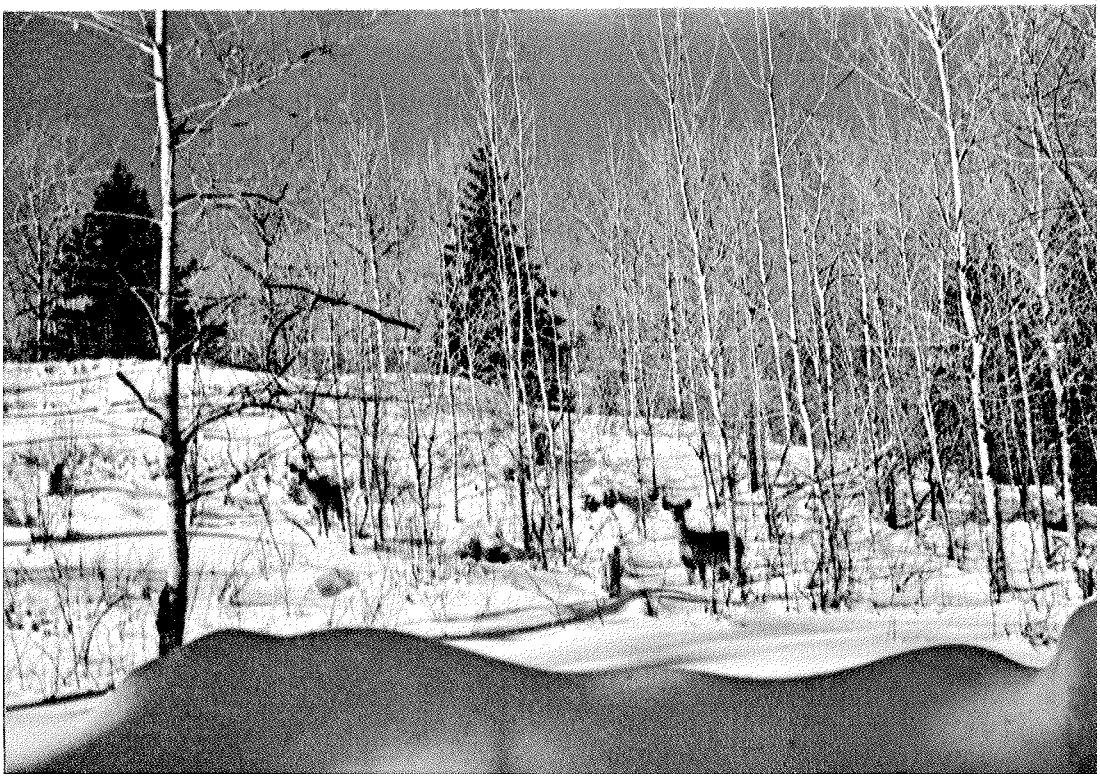
Hypoxylin cankers are the most common and serious disease of aspen. Starting as a tan or yellowish area in the bark at a branch stub or stem abnormality, it kills and blackens an area of bark. It may eventually girdle or weaken an aspen tree so that it dies or breaks off.

Insects and disease are common among aspen. However, on good aspen sites where there is a young, thick stand, they usually do not seriously reduce total growth on the site. However, if an aspen stand is permitted to become overmature, disease and insect damage contribute to a rapid breakup of a previously good stand.

Experiments have been conducted in thinning aspen stands. It has been demonstrated that removal of competing species of trees at age 10 will result in a very substantial increase in aspen growth. If an aspen stand is carefully thinned at about 10 to 30 years, more large aspen trees suitable for sawlogs or veneer will result in a shorter time. Thinning at too early or too late an age, however, will not produce much gain, and may actually hurt the productivity of a stand. The economic justification for thinning is in doubt at this time.

Little experimentation has been done with the use of fertilizers. Aspen tends to build up soil rather than to deplete it. While fertilizers might correct specific deficiencies in some sites, it would probably be more economical to devote the same money or effort to improving stands on good aspen sites.

While aspen browse is not the favorite food of deer in Minnesota, the plants and brush associated with young aspen stands are essential for maintaining good deer populations. If more aspen is cut so that more young aspen stands result, deer will increase.



During the last few years, the Minnesota Division of Game has contracted for clearing substantial acreages of aspen land to convert them to desirable deer habitat. Shearing with a bulldozer was one of the methods used. Areas selected were impractical to log commercially.

One of the best ways to expand aspen production is to concentrate efforts on the best aspen sites. If good aspen sites are kept in or converted to fully stocked pure aspen stands, they will produce much more timber. Because production varies tremendously from site to site, the site qualities should be thoroughly checked when areas are selected for cutting and other management efforts.

Considerable attention is being given to shortening the rotation on aspen sites. Interest in this is particularly strong in Wisconsin and Michigan which face potential aspen shortages during the next few decades. The Institute of Paper Chemistry at Appleton, Wisconsin, has conducted studies and reports, "There is considerable evidence to show that by completely utilizing young aspen sucker stands (age 15 to 20 years), the harvested volume per acre per year will be approximately double the volume obtained by a conventional harvest at age 40. The increased production appears to be due to rapid juvenile growth, complete tree utilization, utilization of virtually all the trees on an area, and the salvaging of volume growth that normally would be lost to disease and insects." Fertilization and irrigation might be worthwhile on some short-rotation sites.

More complete utilization of trees will be a source of increased aspen fiber. Normally aspen bark is either removed by peeling at

Ruffed grouse are one of Minnesota's favorite game birds. They are dependent upon aspen for food and cover throughout the year, and require aspen of all ages within reasonable distances. More cutting of mature aspen would improve the outlook for these birds.

the wood assembly sites or by debarking at the mills, and is largely disposed of by landfill or burning. Increasing amounts of aspen are chipped before they are pulped. Methods are being developed for removing the bark from the chips either before or after pulping the chips. If economic ways can be found to do this, less wood will be wasted by debarking, and it might be possible to chip tops and branches of trees and thus utilize material now left in the woods or at the landings. Research is also being devoted to finding economic uses for aspen bark.

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Harvesting of aspen is receiving very close attention. Because logging is costly, mills are seeking more efficient methods. Landowners and mills are also concerned that harvesting methods will be used that will encourage good reproduction of the aspen stands. Sportsmen and game managers are anxious that logging be conducted to improve deer and grouse habitat. Vacationers and conservationists are concerned that stands be cut so that they will look attractive as soon as possible, that erosion be minimized, and that water and air quality be maintained.

Harvesting is the key operation in the management of aspen. How well it is done affects not only the regeneration and growth of the new forest but also the habitat for wildlife and other forest

values. Recent developments in aspen harvesting equipment and techniques will make it easier to have better aspen forests in the future.

Thirty years ago most logging in northern Minnesota was done in about the same way it was fifty years earlier. Trees were felled and trimmed by lumberjacks using cross-cut saws, bow saws and axes. Horses were used to skid the logs out of the woods to landings alongside roads. Many of the men working in the woods were still transients living in logging camps in winter and going elsewhere during the summer.

Following harvest of the big stands of pine and spruce, production of pulpwood from smaller stands became the dominant method. This was aided by the introduction in the 1940's of bulldozers to make roads more economically, and better trucks to haul pulpwood from remote sites direct to mills. Logging became a year-around operation in which a few men worked together near their homes or in small portable camps.

During the 1950's, new lightweight chain saws tremendously increased the efficiency of loggers. The early 1960's saw wide use of skidders, hydraulic loaders and other power equipment in the woods.

Male flower buds of aspen are rich in protein and fats, and they are the principal food of ruffed grouse during the late fall, winter and early spring. These buds are clustered on rigid stems that facilitate rapid feeding. Grouse generally feed on aspen buds for about 15 minutes at sundown.

Revolutionary changes in logging equipment have come into use since 1965. A variety of large mobile equipment holds and cuts or shears off trees. Some equipment limbs the trees and cuts them into shortwood length (usually 100") for moving to landings. Other equipment quickly limbs trees in the woods, while a variety of bunching and skidding equipment has been developed for hauling tree length stems and full trees which have not been trimmed to landing areas. Other equipment has been designed to process full trees at the landings into tree length logs, shortwood or chips.

While short-length logging will continue to be used in smaller operations and on some sites, interest is centering on handling aspen full length. With the right equipment in the woods, at the landings and at the mills, both logging and transportation are more economical. This is particularly true where mills chip wood, and can save the fiber lost in sawing to shorter lengths.

Some researchers believe that full tree logging will find wide application in aspen harvesting. The method takes branches and tops to the landings where the tree is processed. Full tree logging and hauling destroys most of the non-merchantable trees and brush. By removing the slashings (tops and limbs) from the site, aspen will sprout better. If practical methods can be found for mills to use chips with bark on, the limbs and tops can be chipped at the landings and sent to the mills instead of presenting a disposal problem.

Study is being given to planning harvest operations so they are not only economical but also result in best possible reproduction of new stands, improved habitat for wildlife and better appearance. State, federal and county units of government own about two-thirds of the aspen land in Minnesota. Their terms of sale now generally include provisions for removal of non-merchantable trees and other management practices. Other landowners are equally concerned to see that good forestry practices are followed. Forest industries with tremendous investments are concerned not only with reasonable costs for wood today but also with assured supplies for many decades in the future. Some forest landowners prefer to spend relatively small amounts in improving aspen regeneration than to invest much greater amounts in establishing plantations of spruce or pine that will take much longer to reach maturity. However, sites that are particularly suited to other species may yield a better return over the life of the forest. Aspen stands may be greatly expanded, but will not remove the need for sound development of forests of other species.

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Experiments were done in this area to determine the effect of clearcutting aspen on water supply and water quality. The results indicate aspen clearcutting has beneficial effects on both the quantity of water runoff and its timing, and creates no erosion or water pollution problems.

While timber operators, forest industries, timber landowners and foresters are those primarily interested in aspen stands, sportsmen and conservationists are also demonstrating increased interests in forestry. The Minnesota chapter of the Wildlife Society sponsored a symposium in November 1971 at the University of Minnesota in St. Paul to consider the future of whitetailed deer. Nearly 400 professionals and citizens attended. John Mooty, Jr., a big-game biologist for the Minnesota Department of Natural Resources, summarized the relationship of deer to aspen forests succinctly:

> *Commandment No. 1:* "Popple" or aspen forests are the best deer-producing areas. Aspen itself is not a highly preferred or perfect deer food, but the shrubs and small flowering plants that grow in aspen stands are foods that deer prefer.
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> *Commandment No. 2:* Aspen forests under 25 years of age are the best producers of deer food and deer.
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> *Commandment No. 3:* Young aspen forests equal good deer production. Old aspen forests equal poor deer production. By good

Harvesting is the key to aspen management. In recent years new equipment has been developed to mechanize the felling, trimming, bucking and bunching of trees. Such equipment makes it possible to log aspen more economically for regeneration.

deer production I mean an abundant adult population producing healthy, numerous fawns.

What is the difference between good and poor deer production in young and old aspen forests? On the average we could expect 25-35 deer per square mile in aspen forests under 25 years of age. Populations in older forests would vary with the age of the stand. A good estimate of the average would probably be 10-15 deer per square mile. . . .

As far as acreage is concerned we are in good shape with roughly 5.5 million acres of aspen forests in the state. . . . Our main concern is the age of these forest stands. . . . The per cent of aspen forests under 25 years of age are estimated as follows: 1942, 76%; 1952, 65%; 1962, 36%; 1972, 21%; 1982, 14%.

It's no wonder that Minnesota had good deer populations in the 40's with 76 per cent of the stands under 25 years old. In 1952 we dropped to 65 per cent. However, things were still pretty good and deer numbers remained high.

By 1972, the estimate is for 21% of the aspen stands to be under 25 years. Thus in the last 20 years, we lost the bulk of our best deer habitat. Recently, our winters have been more severe than normal. Five out of the last six winters have been very tough on deer and their numbers have declined dramatically.

Recognizing the plight of deer in recent years, sportsmen and conservationists joined behind a program to "Save Minnesota Deer" and persuaded the 1969 Minnesota Legislature to appropriate $600,000 to improve deer habitat during that biennium. A program of cutting and controlled burning of mature aspen stands to stimulate growth of deer browse was initiated. While smaller appropriations were made by the 1971 legislature, about 20,000 acres were cleared in 1972 under the program administered by state game managers in cooperation with public and private foresters. This compares with about 65,000 acres per year of aspen improved as wildlife habitat by current commercial logging operations.

While emphasizing that special deer habitat programs are urgently needed, Milt Stenlund, the regional game manager for northeastern Minnesota, told the deer symposium, "At present, logging is our best answer and sales of commercial timber are, therefore, first priority. If the commercial harvest could be doubled and well distributed, the problem of maintaining a young forest would be largely solved. . . . Implementing programs to achieve the desired results will require close cooperation among all agencies having jurisdiction over the land, since the Division of Game and Fish

Large rubber-tired skidders make it possible to rapidly pull up to 10 aspen trees at a time from the woods to a landing for further processing, storage and loading. Skidding tree-length logs helps to break down undesirable trees that would otherwise compete with sprouting aspen.

Some use has been made of full-tree systems where the limbs and tops are left on the trees when they are skidded. At the landings, processing machines cut off the limbs and tops. In some cases, the logs are also debarked and chipped in a continuous process.

actually has control of little land in the northern deer range. Cooperation among land management agencies and increased wood production could maintain Minnesota's deer herd in good numbers and good physical condition for many years to come."

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Commonly referred to as "partridge", the ruffed grouse is one of the principal game birds of Minnesota. It is a favorite of tens of thousands of hunters who enjoy the brightly-colored woods of northeastern Minnesota in the fall of the year.

Ruffed grouse, like deer, are uniquely dependent upon aspen for their food and their cover. Long and intensive study of ruffed grouse at the Cloquet Forest Research Center has indicated that aspen buds are the number one winter food, male aspen buds and catkins the number one spring food, and aspen buds and leaves the second most important fall food. Even during the summer, aspen leaves constituted more than 50% of the identifiable material eaten by grouse examined, outranking five-fold the second most common food.

Very young aspen stands provide excellent cover for broods following their early summer hatch. By the time aspen has reached 10 years, the aspen saplings are 25 to 35 feet tall and provide high quality cover for wintering and breeding grouse. After aspen stands reach age 25, their stumps are large enough and the stand is open enough to provide good cover for the nests which female partridges build on the ground. Also at about age 25, the aspen trees begin to have good crops of the nourishing male aspen buds. In aspen stands winter snow accumulates quickly to depths where grouse can burrow under it for cover during cold weather.

Gordon Gullion, a research associate of the University of Minnesota department of entomology, fisheries and wildlife, has spent more than 15 years studying ruffed grouse at the Cloquet center. He has concluded a very close correlation exists between ruffed grouse populations and the availability of aspen stands of various ages. He is emphatic in recommending that aspen stands be clearcut at maturity to provide high-density sucker regeneration. He feels that if approximately one-fourth of an area could be cut every 10 years, ideal food and cover would be provided for ruffed grouse.

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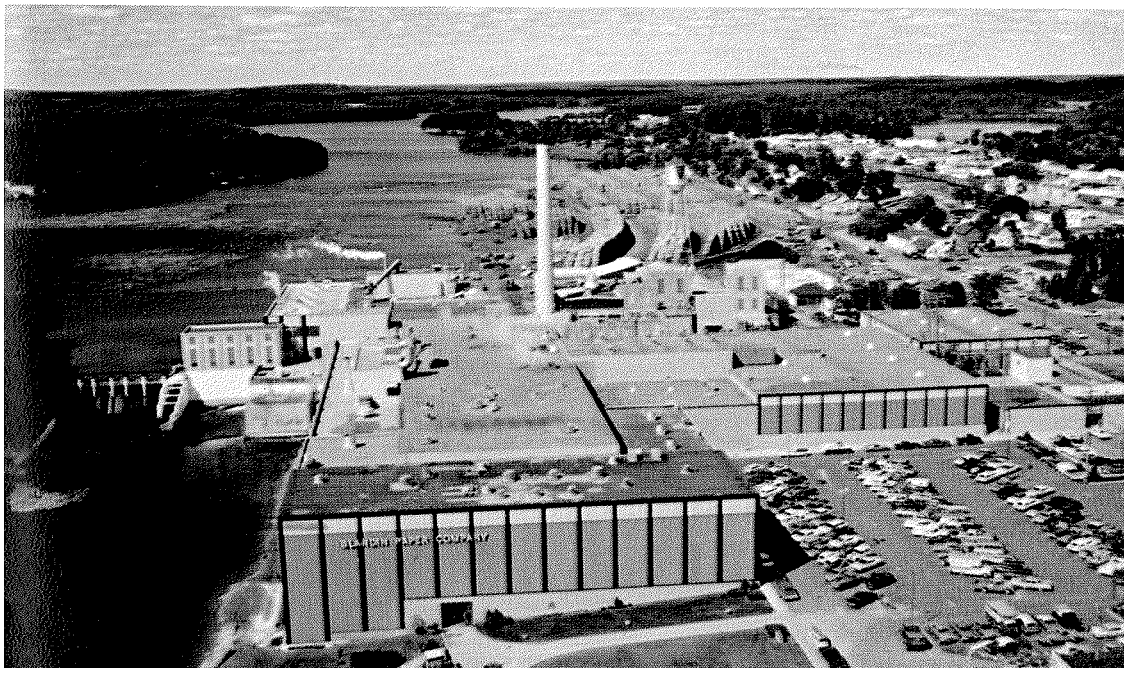
The future of paper mills such as the Blandin Paper Co. mill at Grand Rapids is dependent in large measure upon continued economic supplies of aspen. The Blandin mill employs more than 800 people in making publication papers, and several hundred more are employed in supplying pulpwood, now largely aspen.



Little study has been given to the relationships of aspen to wildlife other than deer and partridge. However, game managers know that aspen is a popular food and building material for beaver. Bear find much of their food in areas which have been recently burned or cut and in which aspen sprouts and grows. Even the moose, which are thought of as inhabitants of pine forests, depend upon young aspen stands for much of their browse.

Many songbirds are found in aspen stands, especially along their edges and near openings. Fox, coyotes and wolves pursue their quarry that live in aspen forests. Snowshoe hare are partial to young aspen sprouts for food.

Most wildlife in northern Minnesota will be benefitted if the aspen forests of the area can be maintained in good productive condition. The best way to do so is by following good logging practices on increasing areas of the maturing stands.

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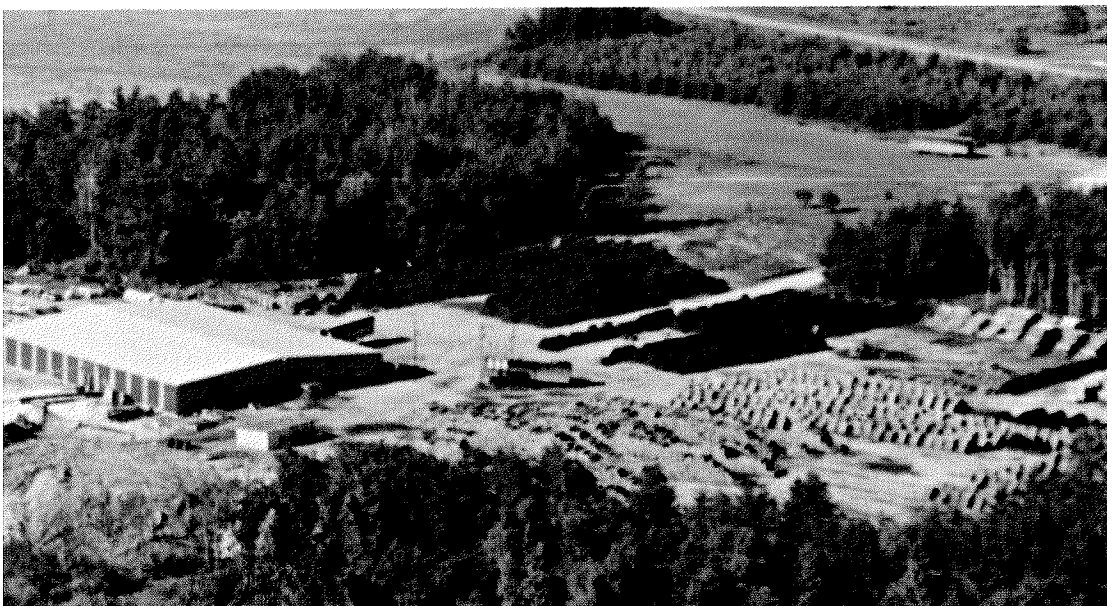
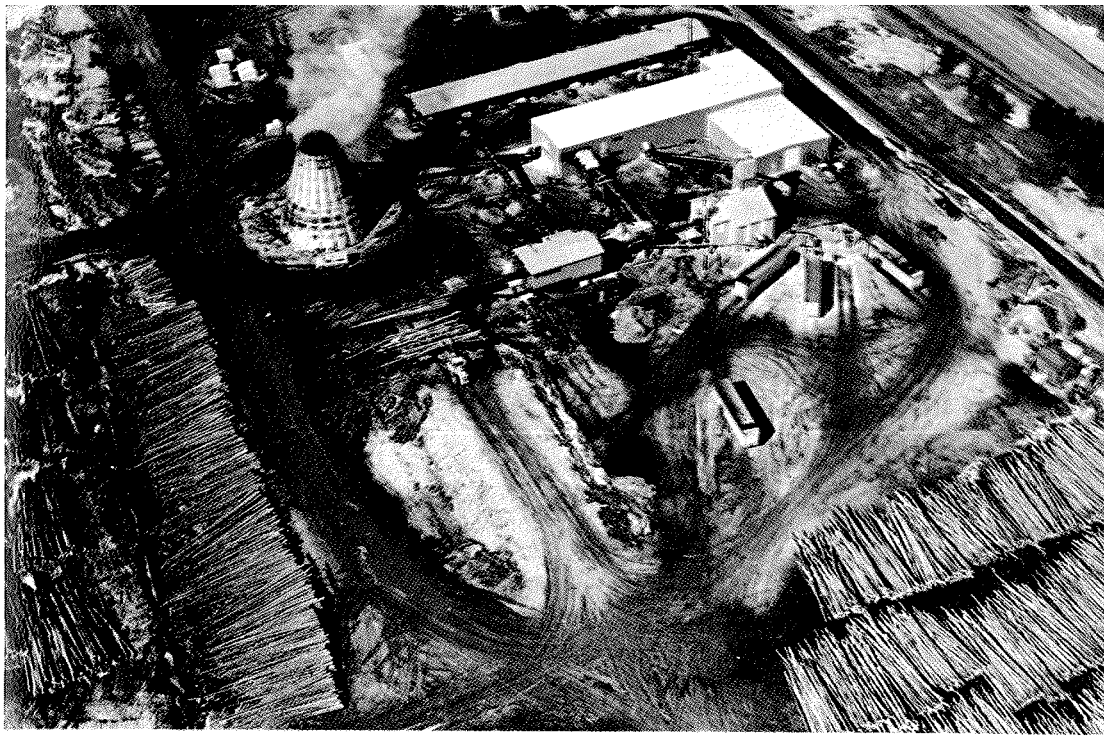
Because aspen will not tolerate shade, it is essential to clearcut mature aspen stands to get good reproduction. In other parts of the country clearcutting of other species has resulted in some erosion of soil and deterioration of surface water quality. The North Central Experiment Station of the U. S. Forest Service has conducted an experiment north of Grand Rapids to ascertain the effect of clearcutting aspen on water yield and quality.

Many sawmills and wood specialty plants are located in northern Minnesota. Cole Forest Products of Grand Rapids uses aspen to produce snow fencing. It is the largest producer in the country, and much of its output goes to farms of the midwest where it is used to make corn cribs.





The Rajala Timber Company operates a large, modern saw-and-chip mill west of Deer River. The larger-diameter portions of tree length aspen logs are sawed into lumber. The smaller portions are debarked and chipped. Chips are now trucked to the Boise-Cascade mills at International Falls.

E. S. Verry, associate forest hydrologist for the experiment, reports that the first year after clearcutting the increase in water yield was 42% for the clearcut area, and the water yield increased throughout the summer and fall. Clearcutting part of the watershed spread out and reduced the peak flows from spring snowmelt. The gain in water supply was accomplished by decreased transpiration and reduction of canopy interception losses which would have been experienced if the stand had not been cut. Water quality was carefully monitored and samples supported the conclusion that for all constituents there was no difference between concentrations on the clearcut and control watersheds. Erosion was not increased because of the rapid growth of a new aspen sucker stand.

The implication of this study is that the water supply in the lakes and streams of northern Minnesota could be increased significantly if the amount of clearcutting of aspen were doubled, as might be expected during the next few decades. In an area such as the Mississippi headwaters, the annual water yield might be increased by several per cent. This could be particularly important during dry years.

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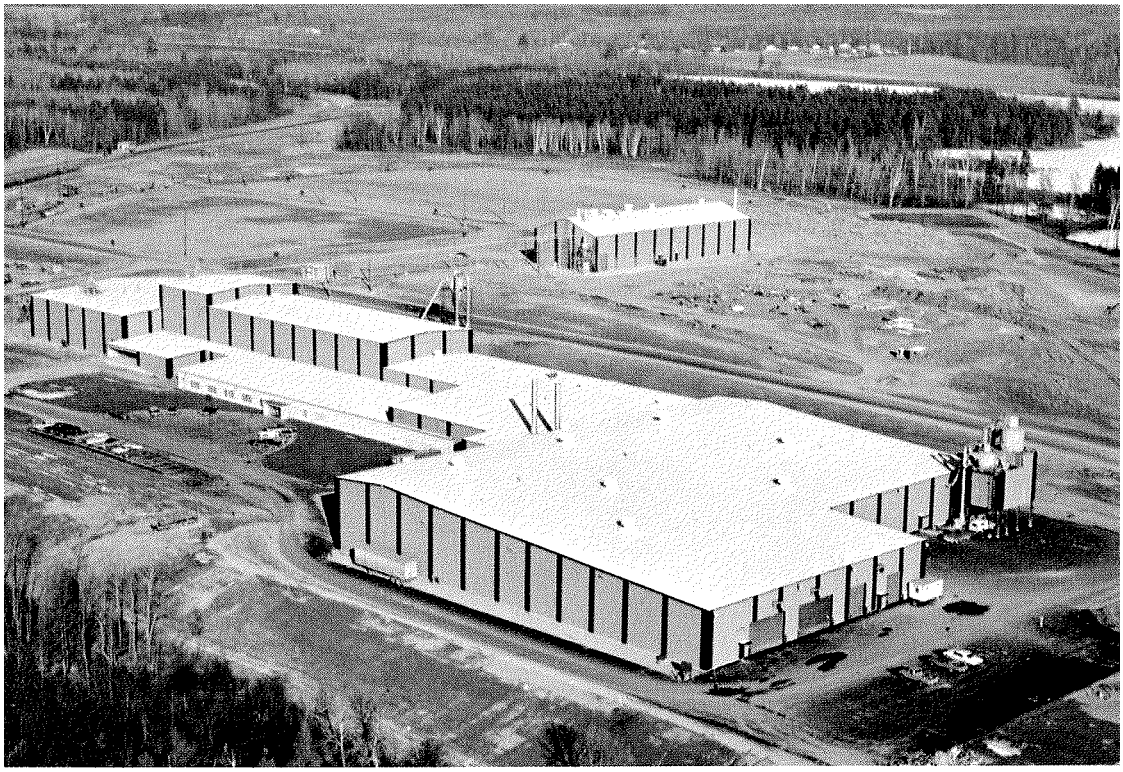

The new Blandin Wood Products Co. plant west of Grand Rapids will begin to produce "wafer" board from aspen late in 1972. The plant will employ about 125 people and use more than 70,000 cords of aspen per year. The board can be used for interior and exterior construction.

Many of the virtues and possibilities of aspen have been described in this booklet. We are optimistic about the good things that intelligent management and utilization of aspen can do for northern Minnesota. But it is appropriate to point out that the forests of Minnesota cover more than 15 million acres of land. Large investments of money over long periods of time will be required to increase the utilization of our timber resources and to substantially improve the quality of our forests.

To achieve the potential benefits of aspen the costs of development will have to be shared by the industries that use the timber, by private and public landowners whose property will increase in value, by those who enjoy the hunting and recreational benefits of vigorous, healthy forests, and by the general public who will benefit from a sounder economy.

Forestry is an enterprise which requires vision, understanding and a high degree of cooperation among many people. Northern Minnesota is blessed with climate and land which will grow magnificent forests — if men will have the wisdom to help them grow.

ACKNOWLEDGEMENTS

In August 1972 approximately 400 foresters and others interested in aspen met at the University of Minnesota, Duluth, for two days of intensive discussion. More than 25 experts discussed papers they had prepared on various phases of aspen growth and use. Much of the material used in this booklet was presented at the aspen symposium. However, space permits use of only a small portion of the information presented at the meeting, and those who wish more details may obtain the symposium proceedings from the North Central Forest Experiment Station of the U. S. Forest Service in St. Paul. Other sponsors of the symposium were the College of Forestry of the University of Minnesota and the Minnesota Forest Industries Information Committee.

The general characteristics of aspen are described in *Silvics of Forest Trees of the United States* (Agriculture Handbook No. 271) published by the U.S. Forest Service in 1965.

Information on the supply and cut of aspen and other species in 1936, 1953 and 1962 are contained in *A Third Look at Minnesota's Timber* (U. S. Forest Service Resource Bulletin NC-1) published by the North Central Forest Experiment Station of the U. S. Forest Service in 1966.

Future supplies of aspen in Minnesota, Wisconsin and Michigan are discussed in *Projecting the Aspen Resource in the Lake States* (U.S.D.A. – Forest Service – Reasearch Paper NC-81) published by the North Central Experiment Station in 1972.

The importance of aspen management to deer populations is contained in *Proceedings of a Symposium on the White-tailed Deer in Minnesota.* The November 1971 symposium was sponsored by the Minnesota Chapter of The Wildlife Society, and the proceedings were published by the Section of Game of the Minnesota Department of Natural Resources.

Current information on harvesting may be found in the *Proceedings of the Conference on Biological and Economic Considerations in Mechanized Timber Harvesting.* The conference was held in October 1971, and was sponsored by the College of Forestry of the University of Minnesota.

The writer is indebted to many public and industry foresters, wildlife specialists and others with knowledge about the growth and use of aspen who have given generously of their time in discussions over many years. Special thanks to Zigmond A. Zasada, who devoted nearly 30 years to forest research in northern Minnesota prior to important assignments in Washington and St. Paul. Since retirement from the U. S. Forest Service several years ago, he has been a research associate at the Cloquet Forestry Center of the University of Minnesota, where he is conducting studies on timber harvesting in northern Minnesota. Mr. Zasada has encouraged interest in wider use of aspen since the 1930's.

G. A. R.