

EXTENSION NOTES



MANAGING RED PINE PLANTATIONS

Red pine planting in Ontario dates back to the 1920s. These early reforestation efforts were largely the initiative of the provincial government. Most of the forest cover was removed in the previous century by settlers clearing the land for agriculture. However, large areas of sandy soils throughout southern Ontario could not sustain agricultural practices and this marginal farmland was soon abandoned. To prevent soil erosion, tree planting programs were initiated, and the most suitable species for planting in sandy soils was red pine.

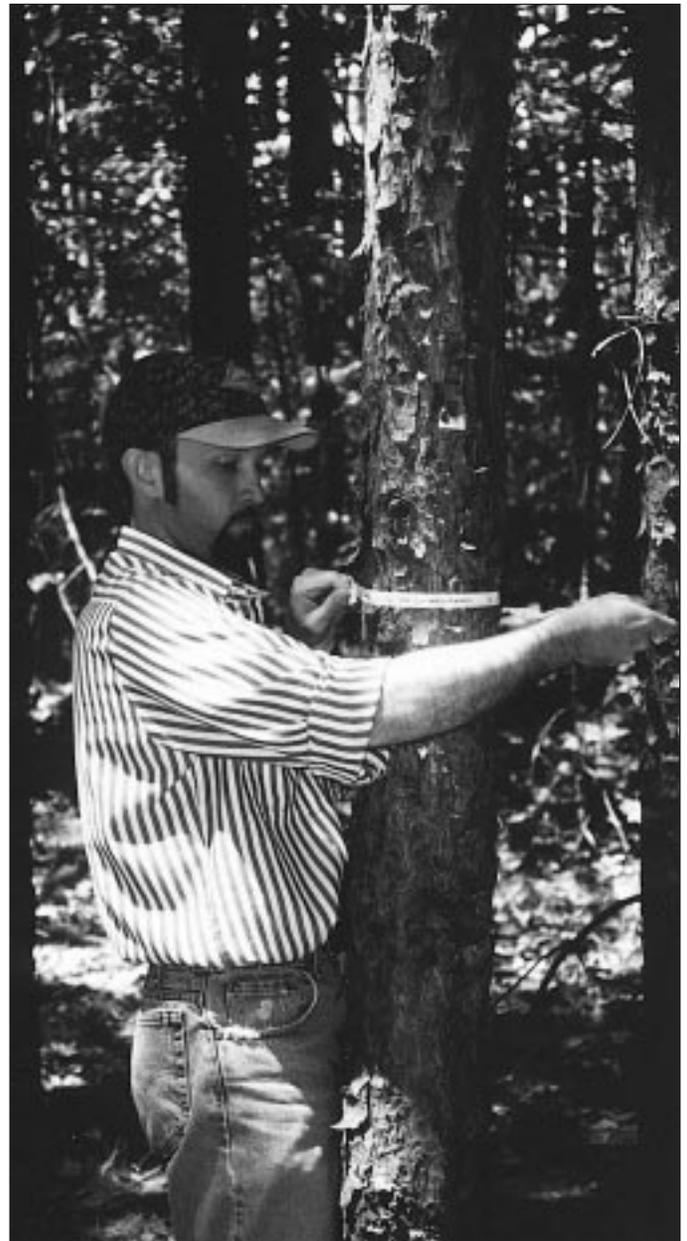
Some of the best examples of red pine plantation management can be found in various Agreement Forests across southern Ontario. The LaRose Forest near Ottawa, the Durham and York Regional Forests near Toronto, and the Hendrie Forest near Barrie were some of the first major red pine plantings.

In the 1960s, the reforestation emphasis shifted from public land to private land with the implementation of the *Woodlands Improvement Act* (WIA) program. As a result, there are now healthy red pine plantations on both public and private land, ready for harvesting and other management activities. Many of these plantations are now mature and provide the right conditions to restore a more natural forest, as well as critical wildlife habitat. This Extension Note provides details on how to best manage your planned or existing red pine plantation for forest products and environmental benefits.

ESTABLISHING A PLANTATION

Establishing a successful red pine plantation requires planning. Site selection, planting stock choice, and timing and method of planting all need to be considered. (See the Extension Note *Planning for Tree Planting*.)

To begin with, you should ensure that the site and soil are appropriate for this species. Red pine prefers dry locations and grows best on sandy, coarse loam soil which is well-



Red pine planted in the 1920s are now mature forests.



drained. It is not suitable for moist soils or sites that are seasonally flooded.

The type and origin of the stock to be planted is also an important consideration. Check with your supplier to determine where the seed came from that was used to grow your stock. The seedlings should be grown from seed that was harvested from mature trees in your geographic area to ensure maximum growth performance. The size of the seedling to be planted should match the amount of competition from grasses and weeds that you expect on your planting site. The more competition expected, the larger the planting stock should be. On average sites in Ontario, two or three-year old nursery grown seedlings are commonly used. The most successful plantations have always removed any competition from the site prior to planting during the site preparation stage.

Red pine stock should be planted early in the spring before it exhibits any kind of growth such as bud elongation or white root tips. Ideal planting conditions usually occur within a few weeks after the snow has melted. Summer or fall planting of red pine is not recommended.

Spacing is very important because the distance between trees will determine future thinning and management options. Trees which are planted too close will require thinning at a young age before they can be used for forest products, and may prevent any equipment from accessing the stand to conduct weeding or thinning operations. Trees which are planted too far apart will develop heavy, persistent limbs along the entire length of the tree, which will limit its usefulness for forest products. Current research suggests that the optimum planting space between rows is 2.4 to 2.7 metres and seedlings should be planted between 1.8 to 2.4 metres apart within the rows.

Planting methods can range from simple hand planting using a spade, to mechanized planting using a tree planter machine that scalps the sod and furrows the soil, allowing a seedling to be placed by an operator. Often, herbicides can be applied at the same time. The choice of planting method depends on the site and the number of trees to be planted. Small, stony sites are best planted by hand. When planting by hand, dig a hole that is large enough to accommodate all of the roots of the seedling. Gently replace the soil, and tramp lightly with your foot. Vigorous tramping may compact the soil too much and the roots may be damaged. Red pine is sensitive to shallow planting, so plant seedlings at the same depth as they were grown in the nursery.

Once the seedlings have been planted, it is important to allow them to grow in full sunlight. Competing shrubs, grasses or weeds should be cut back or sprayed with an approved herbicide. Alternative methods such as mulching can be used as well. This tending should be done soon after planting or before the competition becomes too severe. Subsequent tending may be needed over the next three to five years as required or until the seedlings are well established and free to grow.

FIRST THINNING DEPENDS ON INITIAL SPACING

Initial Spacing	Number of trees per hectare	First thinning required when average diameter reaches:
2.4 m x 1.8 m (8 ft x 6 ft)	2300 per hectare	14 centimetres
2.4 m x 2.1 m (8 ft x 7 ft)	1984 per hectare	16 centimetres
2.4 m x 2.4 m (8 ft x 8 ft)	1736 per hectare	17 centimetres
2.4 m x 2.7 m (8 ft x 9 ft)	1543 per hectare	18 centimetres

THINNING

One of the most important factors affecting the quality and quantity of sawlogs and other forest products from red pine plantations is control of the stand density.

Thinnings (the removal of some trees to give remaining ones room to grow) need to be conducted about every ten years beginning when the trees are 25 to 30 years old. Depending on the original spacing, approximately 30 per cent of the stems should be removed in the first thinning. Row thinning is the most practical method for the initial thinning, as this provides access room for the harvesting equipment. In addition to the rows which are removed at first thinning, poor quality or unhealthy trees in the remaining rows should also be removed, especially if they are interfering with the growth of the better trees in the stand. In Ontario, the most common practice is to remove every fourth row of trees for access purposes, and to remove one tree out of every five to seven trees in the remaining rows, concentrating on removing trees from the centre row. Another common thinning pattern is to remove every third row, with some additional crop tree release in the remaining rows to bring the plantation to the appropriate spacing. Most thinning is done in the winter months when the ground is frozen and the bark on the remaining trees is less susceptible to logging damage. Red pine cut during the summer months may develop a “blue stain” which will reduce the value of the lumber. Check with your



The first thinning usually involves the complete removal of every fourth row of trees.

local forester or consultant on the most appropriate method for your plantation.

The second thinning should remove trees which are growing slowly, are unhealthy, or which are interfering with the growth of the best trees in the stand. By the third and subsequent thinning, all trees should be of good quality and will be well spaced. The choice of trees to be thinned will usually depend on the market demand for specific products or other long-term considerations, such as biodiversity or environmental concerns.

The amount of thinning undertaken will have a direct impact on the growth and yield of a plantation and should be determined by the type of product that you want to produce. Simply put, young trees with adequate spacing develop more foliage and thicker branches than crowded trees. This increased foliage results in quicker stem development as more wood is produced annually (this can be seen as wider annual growth rings if you look at a cross section of a cut stem). The goal of thinning is to ensure that there are live branches between one-quarter to one-half of the total height of the trees that remain. This will ensure that the growth and health of the trees is maintained. Trees with short, narrow crowns due to crowded growing conditions will respond slowly to thinning and may not recover the lost growth potential. In contrast, trees that are widely spaced may have broad crowns that cover more than one-half of the trees height. These branches will cause large knots in the logs, which will reduce their value as sawlogs or utility poles.

Plantations with no thinning can still return a profit to the landowner, but their use will likely be limited to low-value pulpwood. Unthinned stands will begin to



The second thinning should remove trees which are interfering with the growth of the best trees in the stand.

deteriorate at the 45 to 50 year mark, as trees become spindly with very short, live crowns. As these stands become older, they are susceptible to blow-down or breakage by wind, ice and snow. Any effort to thin

plantations for the first time at this stage would result in marginal growth returns and may actually increase the risk of wind damage. Consideration should be given at this stage towards stand conversion to other forest types or uses.

SAMPLE RED PINE CROP PLAN

Year	Activity Description	(Cost) or Revenue
-1	Site preparation	(\$225 / ha)
0	Plant 2,300 trees per hectare @ 2.2 x 2.2 m spacing (anticipate 100/ha mortality)	(\$650 / ha)
3	Hand tending (apply herbicide)	(\$75 / ha)
6	Hand tending (apply herbicide)	(\$75 / ha)
32	Row thin 1 in 4, plus selection — remove 873 stems/ha (average 15 cms DBH yields 87 m ³ /ha)	\$325 / ha
42	Selection thin — remove 527 stems/ha (average 20 cm DBH yields 51 m ³ /ha)	\$502 / ha
55	Selection thin — remove 300 stems/ha (average 26 cm DBH yields 90 m ³ /ha)	\$1080 / ha
75	Final harvest — remove 500 stems/ha (average 35 cm DBH yields 550 m ³ /ha)	\$6600 / ha

Note: crop plans will vary depending on the site quality, intensity of management, market values for forest products, etc. This crop plan assumes Site Index of 22 m and row thinning at year 32. Market values assumed were \$5/m³ for boltwood, and \$15/m³ for sawlogs.

PRUNING CROP TREES

Pruning is the removal of live or dead branches from standing trees to produce knot-free sawlogs. The selection and pruning of crop trees can add significant value to plantations that are established on more productive sites and where active management practices such as regular thinnings are being carried out. Before crop trees can be identified and selected, your thinning regime or pattern should be determined, to avoid the possibility of removing crop trees in subsequent thinning. A crop tree should be a dominant or co-dominant tree, exhibiting a well-developed leader and a full, round, finely branched crown, and a straight, injury free stem.

between 10 and 15 centimetres. The trees may be 15 to 20 years old at this time. Pruning can be conducted in conjunction with the thinning operations. At first thinning, prune the tree to a height of about three metres. But do not remove branches over more than one-half of the total tree height. At the time of second thinning, more branches can be removed on your selected crop trees to bring the total branch-free height to 5.1 metres. If you plan to grow utility poles, you should prune to a height of 7.4 metres. Pruning can be done at any time of the year, and if properly done, will not harm the tree. Careless pruning can cause injury and reduce the health of the tree.

Between 250 and 350 crop trees per hectare should be pruned when the average diameter of the plantation is

RED PINE MARKETS

In some regions of southern Ontario, markets for the small diameter material that is removed during the first thinnings has been poor in the past decade. However, new products and processing technologies are now available which have improved the market situation. Much of the smaller material is now being sold to sawmills which produce landscaping material by squaring off the tree, and treating the wood with preservatives. Landowners should investigate the local market thoroughly before making any decisions about establishing or thinning red



Larger dimension products like utility poles have always found a ready market.

pine plantations. It is always wise to contact local contractors or forestry consultants who may know about special, local product requirements.

Larger dimension red pine, such as sawlogs, utility poles, or logs for log home construction, have always found a ready market in the past. Factors such as log quality, accessibility of the plantation, the volume of wood to be harvested, and even time of year all have a bearing on both the price and salability of your products.

INSECTS AND DISEASES

As with any crop, insects and disease can damage your plantation. Growing trees of the same species in close proximity can often provide conditions that are conducive to increased insect infestation or the spread of disease. With more than 500 species of insects in Ontario that are capable of damaging pine, as well as numerous pine diseases, preventive measures are worthwhile. In general:

- conduct regular inspections of your stand to become familiar with its normal conditions. This will help in the early detection of any problems that will affect tree health or growth.
- determine the cause of any problems. You may require professional help to identify the insect or disease causing the problem.
- evaluate the potential for injury or tree damage before deciding on the most appropriate control methods.

Some common pests of red pine plantations include:

REDHEADED PINE SAWFLY (*Neodiprion lecontei*)

This caterpillar-like insect is probably the most serious pest of red pine plantations. The larvae have a distinctive colouration of reddish-orange heads and yellow bodies bearing six rows of black spots along the back and sides. The larvae feed in dense colonies. They may consume the entire foliage of the both the current and previous year's growth of needles. A single complete defoliation usually kills the tree.

EASTERN PINE SHOOT BORER (*Eucosma gloriola*)

Adult moths of this insect emerge from their cocoons in late April, and lay eggs on the new shoots, needles or buds. The larva then enters the pith of the new growth and mines downward through the leader. This feeding causes the terminal leader to fade, then turn red, and break off. These attacks cause reduced vertical growth and distorted main stems.

FOMES ROOT ROT (*Heterobasidion annosum*)

Fomes root rot can be a serious problem in pine plantations. This fungus produces fruiting bodies at the base of living trees or infected stumps from previous

RED PINE PRODUCTS

pulpwood	< 2.54 m in length	< 10 cm top end diameter
boltwood	> 2.54 m in length	Between 10 and 20 cms top end diameter
sawlogs	> 2.54 m in length	> 20 cm top end diameter
utility poles	> 10 m in length	> 20 cm top end diameter
log home	> 7 m in length	20 cm top end diameter

thinning operations. These fruiting bodies produce spores, which can infect healthy trees. This causes the roots to rot, which can swiftly kill both seedlings and mature trees. The dead trees are usually found in roughly circular patches within the plantation. To avoid infection, plantation managers may treat freshly cut stumps with fungicides. In addition, you should avoid any unnecessary damage to residual trees during thinning operations.

SCLERRODERRIS CANKER (*Gremmeniella abietina*)

There are two known strains of this fungus in Ontario. The North American strain will infect young trees but rarely kills trees over two metres tall. The European strain had been reported to kill larger trees. The first indication of infection is a reddish-orange discoloration at the base of needles in May or June. The needles also bend down. In summer, the needles and branch tips turn yellow to brown. The fungus then grows back to the main stem, where it eventually forms a canker that can kill the portion of the tree above that point. Because the fungus usually infects lower branches, pruning is an effective control measure.



Look for redheaded sawfly in June.

ENVIRONMENTAL CONSIDERATIONS

Many people view red pine plantations as sterile forests that provide little to no environmental benefits. Research has shown this to be untrue. As plantations mature, they begin to transform old field sites into forest conditions. The increase in organic material in the soil from the shed needles helps to prevent erosion from wind and water. As the stand is thinned, the increase in sunlight reaching the forest floor provides ideal conditions for native hardwood and conifer species to germinate and grow. The diversity of plants and animals will also increase. In order to maximize the value of red pine plantations for song bird habitat, it is recommended that:

- management operations do not occur from April to July to avoid the nesting season
- that some red pine be allowed to grow to a very old age in all plantations to act as supercanopy trees
- that new plantations be established near existing hardwood forests to increase the amount of interior forest conditions
- that patches of hardwoods be promoted within the plantation, either through planting or natural regeneration, and
- that snags and cavity trees be promoted and maintained throughout the life of the stand

CONCLUSION

Red pine is a significant resource in Ontario and the supply of mature trees is increasing annually. However, good forest management, including proper thinning, must be carried out if the full potential of this resource is to be reached.

Existing plantations on private lands are in need of immediate attention. Many of the older stands (30 years

old) have never been thinned. The trees are reaching an age where their ability to respond with increased growth and diameter to management efforts is reduced. In addition, many of the newer plantations on private lands which are less than 20 years of age will require thinning in the next decade if they are to reach their maximum potential.

FOR FURTHER READING

- Davis, C.N., 1997. *Field Guide to Tree Diseases in Ontario*. Natural Resources Canada. ISBN 0-662-23576-2
- Ministry of Natural Resources. 1989. *Common Pests of Trees in Ontario*. ISBN 0-7743-9439-0
- Ministry of Natural Resources. 1986. *Managing Red Pine Plantations*. ISBN 0-7729-0910-9
- Smith, DJ and M. Woods. 1997. *Red and White Pine Density Management Diagrams for Ontario*. SCSS Technical Report #48. Ministry of Natural Resources. ISBN 0-7778-5108-0

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