BMPs FOR PLANTATIONS

Plantations are planted woodlands. The most common plantation found on Ontario farmland consists of a single conifer species, all the same age and planted in rows. Plantations were established this way to assure tree survival and to attain crown closure in the shortest possible time. Close-spaced trees – just like polewood hardwood stands – require thinning to reduce mortality, maximize growth and produce marketable products.

Tree plantations can be very rewarding if they're properly maintained. This chapter explains the principles and practices of:

- ▶ thinning – why, when and how
- ▶ pruning
- ▶ general care.

The reasoning was that plantations could stabilize the soil, stop the spread of drifting sands, and rehabilitate fragile lands with forest cover. Once established, these plantations would generate forest products and remain as forest land.

Many older plantations date back to before the Great Depression. At that time, government programs were established to encourage tree planting on "wastelands" – abandoned farm-lands with "blow" sands and severe washouts.

In the latter half of the 20th century, more diverse plantations were established to retire fragile and marginal lands or simply to serve as an alternative land use to agriculture.

Today, there is a trend towards diversity or specialization in recently established plantations. Some newer plantations consist of a wide mixture of conifers and hardwoods, trees and shrubs to attract wildlife; others have been planted to generate specialty products such as veneer hardwoods, nuts, maple syrup and forest farming products.

Fragile lands are croplands that are prone to severe water erosion, wind erosion, compaction and flooding. They may still be productive but have a high risk of degradation.

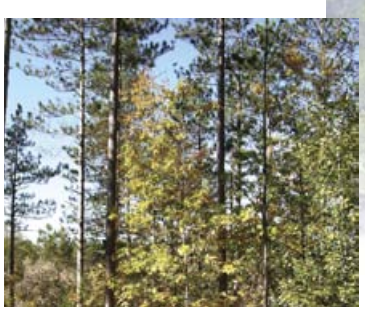
Marginal lands are crop or pasture lands that, due to their soil and landform features, are only marginally productive as farmland. Such lands are often too stony, dense, dry, wet, shallow or steep for profitable farming with conventional crops.

TYPES OF PLANTATIONS

Most established plantations found in Ontario are made up of one of the following:

- conifers – single or multiple species
- hardwoods – single or multiple species
- mixedwoods – a mixture of conifers and hardwoods and in some cases, shrubs
- specialty plantations – fibre, biomass, maple sugar, Christmas trees, and orchards.

Conifer plantations are the most common type found in Ontario. Most are single species (e.g. Red Pine, White Spruce), but some consist of two or more species. Conifer plantations were often established to retire fragile or *marginal lands*. When managed, these stands produce poles, sawlogs, posts and pulpwood. Many are converted to more naturalized mixedwood stands.



Hardwood plantations are not that common in Ontario. In many cases, single or multiple species of valuable hardwoods were established on small acreages in field corners, adjacent to farm woodlots, near farmsteads or on floodplains. They require intensive levels of management to outperform weed competition and to generate products such as timber and maple syrup.

Mixedwood plantations are often found in areas near watercourses or on poorly drained lands. They consist of one or more species of conifers (e.g., White Pine, Norway Spruce) and one or more species of hardwoods (e.g., White Ash). The intent of these plantings was to provide cover with a hardwood seed source, control the rate of snowmelt, or to protect sensitive groundwater areas. These plantations are richer in diversity, than single-species plantations.

Specialty plantations of fast-growing hardwoods provide short-rotation pulp or biomass energy products. As with hardwood plantations, careful attention is needed to ensure establishment and optimal growth. In these plantations, trees are managed as coppices following harvest.

RAW WOOD PRODUCTS AND THEIR ORIGINS

PRODUCT	PLANTATION TYPES	TYPICAL SPECIES
POLES	Conifer – Pure, Mixed	Red Pine, White Pine
SAWLOGS	Conifer, Mixed, Hardwood	Red Pine, White Pine, White Spruce, Norway Spruce, European Larch, Red Oak, White Ash, Black Walnut, Black Cherry, Sugar Maple, Silver Maple
VENEER	Hardwood, Mixed	Oak, Walnut, Ash, Maple, White Pine
FENCING MATERIAL	Conifer, Mixed	White Cedar, European Larch, White Spruce, Norway Spruce
FUELWOOD	Mixed, Hardwood	Oak, Ash, Maple, Larch
FIBRE (PULP)	Specialty	Hybrid Poplar, Silver Maple, Red Maple
MAPLE SYRUP	Specialty, Hardwood	Sugar Maple, other Maples
FIBRE (BIOMASS)	Specialty	Red Maple, Silver Maple, Hybrid Poplar, Willow

PRINCIPLES OF PLANTATION MANAGEMENT

Some plantations are actually abandoned Christmas or nursery tree plantations. These can be challenging to manage for forest products.

Managed plantations can provide these significant benefits:

- a good source of revenue
- wood and energy products for on-farm use
- cover and protection from wind and water erosion
- a productive, alternative land use for marginal cropland
- protection for lands associated with sensitive water sources
- a way to expand or connect existing forests and other natural areas
- a "sink" for carbon dioxide – to reduce atmospheric levels of greenhouse gases
- landscape diversity
- encouragement of succession from field to natural forest.

Consider hiring a forestry consultant for advice. A consultant can help to:

- **avoid costly mistakes**
- **represent your interests**
- **explain the methods of management**
- **maximize your returns and other benefits.**

Some trees are planted "off-site". The dying Red Pine trees in this plantation are over 25 years old and are now showing complete intolerance to high lime soils. High lime conditions can be found on sites with a history of severe soil loss.

There are several ways to manage a plantation. Management options for plantations are determined by:

- your objectives – what are your short- and long-term goals
- species planted – the function and benefits of tree species differ
- site conditions (soil type and moisture) – better productivity means more choices
- tree density – dense plantations are ready for thinning
- age of the plantation – it's easier to start them young
- condition of the plantation – healthy stands means more options.

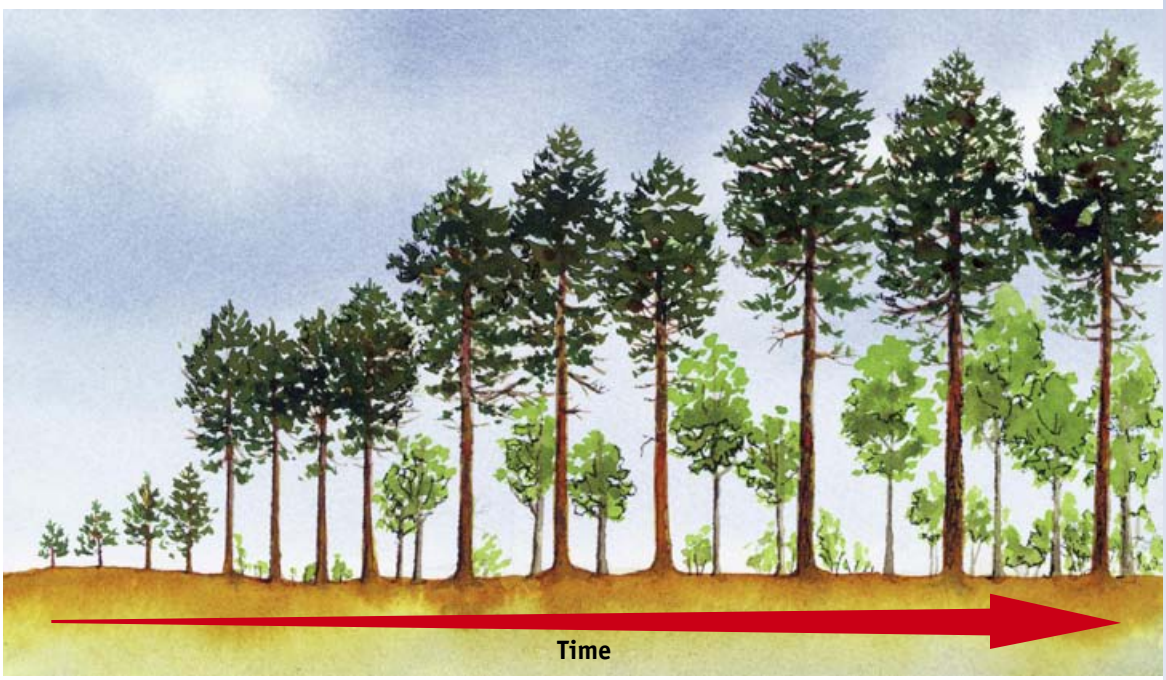
Plantations, like natural woodlands, change over time. Often planted at densities that may be as high as 2,400 seedlings per hectare (1,000/ac), they grow at a rate that is influenced by the site and species. By the time your plantation is ready for its final harvest, the density will be much lower, often in the 200–400 trees per hectare (80–150/ac) range.

A plantation can be thought of as a crop where the management objective is to grow the best trees to maturity ("crop trees") – trees that give the highest yield and return on investment – while serving as a nurse crop for natural regeneration. By conducting a number of well-timed thinnings where the poorest trees are removed and better quality trees are left, you'll be able to maximize the potential benefits. Failing to manage your plantation may result in greatly diminished economic and environmental returns.

Unthinned plantations produce trees that are structurally weak and small-crowned. These trees are prone to ice and wind damage.

LIFE CYCLE OF A CONIFER PLANTATION

Knowing how a plantation develops is essential to understanding how to manage it. Let's start with the life cycle of a conifer plantation.



Plantations can be managed in a number of ways. In this example, Red Pine has been established on a dry sandy site to stabilize the site and grow high value sawlogs and polewood. After 80 years, the Red Pine will be harvested as poles, leaving a new forest of hardwoods on the site.

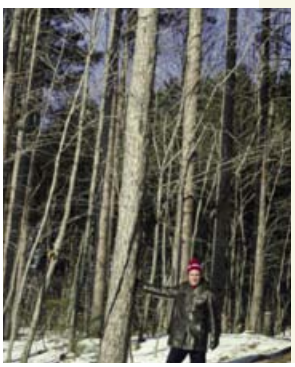
GROWTH STAGES OF CONIFERS

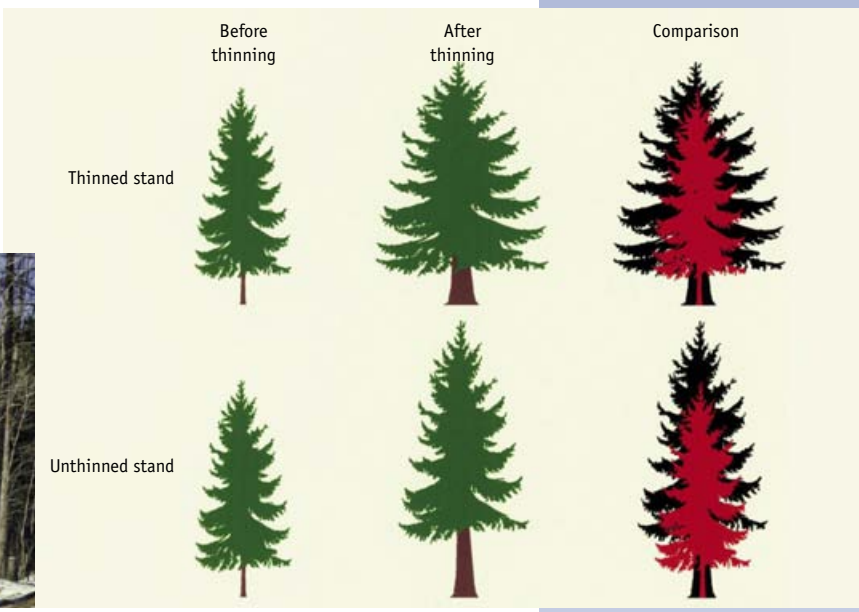
STAGE	ESTABLISHMENT (0–3 years)	RAPID GROWTH (3–30 years)	ACTIVE MANAGEMENT (15–60 years)	SPECIES CONVERSION (>60 years)
TYPE OF GROWTH	• Exploitation by roots • Shoot growth	• Root differentiation • Fast height growth • Small crowns • Minimal diameter growth	• Lateral extension of roots • Slower height growth • Larger crowns • Maximum diameter growth	• Root diameter growth • Slower height growth • Fully developed crowns • Steady diameter growth
STAND DYNAMICS	• Competition with weeds and natural vegetation	• Inter-tree competition • Suppression of slow-growing trees • Mortality of suppressed trees	• Removal by thinning • Crown classes form • Volume increases • Spaces filled by residual-dominants + understory regeneration	• Crop tree removal by harvest • Volume growth steady • Spaces filled by intermediates and natural regeneration
MANAGEMENT IMPLICATIONS	• *Site preparation* • Weed control • Refill may be needed	• Stand protection • Prune crop trees • Thinning to create access	• Successive thinnings • Crop tree pruning • Pest management	• Crop tree harvest • BMPs to avoid damage to site and to young trees

WHAT HAPPENS WHEN YOU THIN A PLANTATION

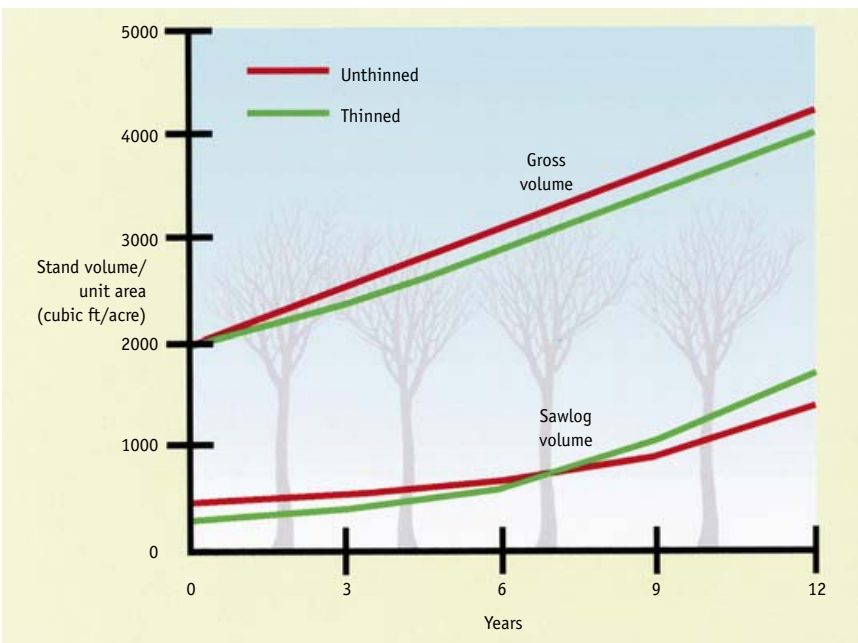
- ► an increase in tree growth – not visible until one or two years following thinning
- ► roots and crown need time to develop before diameter grows
- ► crown diameters and lengths are greater in thinned vs. unthinned plantations
- ► residual trees will be more vigorous, increase sugar production and increase uptake of water and nutrients
- ► lower mortality rate in thinned stands, especially selectively thinned stands
- ► average tree diameter is greater in thinned stands
- ► dominant height growth is similar between thinned and unthinned – height growth is primarily a reflection of site quality
- ► stand volume of thinned stands can be less than unthinned: however, the merchantable volume is substantially greater

- thinning response is greatest in selectively thinned stands as opposed to stands subjected to row thinning only
- timing is everything: stands thinned early (15–25 years old, depending on site quality) have more dramatic responses to thinning
- stands receiving first thinnings late in their cycle do not perform as well: some tree crowns from dense stands can't generate sufficient new growth to increase diameter





Trees in unthinned plantations develop short and narrow crowns, resulting in slow diameter growth. Trees in thinned stands develop greater diameter growth and have less taper.



After thinning, the proportion of merchantable volume continues to increase with time, even though the total volume may be reduced. In unthinned stands, the gross volume continues to increase, but the proportion of merchantable volume decreases dramatically with time.

PLANTATION MANAGEMENT SYSTEMS

The management of a plantation is reasonably straightforward: trees are planted and maintained, they grow, and when they get too dense they are thinned. Thinning is a silvicultural treatment that reallocates stand growth throughout an evenly spaced population of crop trees.

Thinning can:

- ► increase net value of a stand
- ► provide cash flows from thinning sales
- ► improve stand health
- ► diversify stand composition and habitat.

The trick is to time your thinning and plan the intensity of removal so that the trees grow at their optimum rate and the plantation remains as healthy as possible.

A thinning method is a specific strategy to select plantation trees for removal.

A **selective method** is where individual trees are removed according to specifications of size, quality, crop tree spacing or species. In most cases, trees with lower growth potential – smaller, diseased and overtopped trees – are the ones that are removed.

A **systematic method** removes a fixed proportion of a given stand, such as removal of complete rows or corridors to improve access for harvest equipment.

Integrated approaches are usually the best, where operational challenges are taken into consideration and maximum growth of crop trees is promoted.

It's also important to consider the combined effects of intensity (proportion removed) and timing (stand age at thinning) on silvicultural objectives. Thinning at the optimal intensity will prolong thinning response (volume growth); whereas thinning at the best time will maintain growth rates and prevent stagnation.

Well-timed plantation thinnings will improve the overall vigour, growth potential and value of your plantation.

There are two main approaches to selective thinning.

Thinning from below – removing shorter and small-diameter trees

- ► at low intensities, overtopped trees are removed
- ► at subsequent thinnings, only the dominant trees are left
- ► most suitable to single-species stands with uniform site and growth characteristics

Thinning from above

- ► intent is to remove co-dominant and dominant trees with poor crowns and low potential for growth
- ► more suitable in stands with variable stand and site quality

This is an even-aged Pine plantation at 20–25 years of age in the pre-thinned condition.

PRE-THINNED

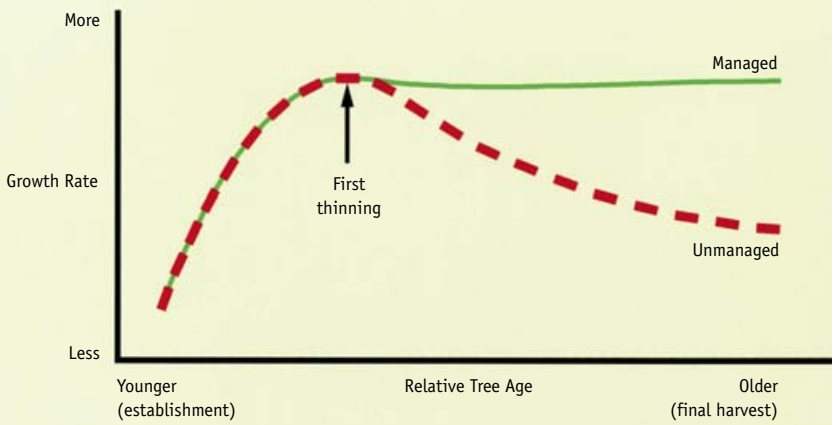
After thinning to create access, the strategy in this thinning regime is to selectively thin smaller and defective trees to provide space for crop trees.

THINNING FROM BELOW

In this thinning regime, larger trees – both merchantable and defective – are removed to provide space for smaller growing trees.

THINNING FROM ABOVE

EFFECTS OF THINNING ON GROWTH RATE



When a plantation is first established, it grows quickly due to an abundance of light and space. Over time, the crowns begin to touch and the growth rate slows and eventually begins to plateau. It's at this point that the first thinning should be done. After this, regular well-timed thinnings keep growth at its highest rate. In unmanaged plantations, crowding continues to cause the growth rate to drop off.

The larger-diameter and healthier trees in managed plantations will generate more revenue.

Fewer trees in unmanaged stands reach their potential growth and value because they are overstocked.

The average time between thinnings varies considerably and depends on five main factors.

1. **Site quality** – trees grow faster on better sites.
2. **Tree density** – plantations with a higher density (more trees/acre) will need less time between thinnings.
3. **Species planted** – some species grow faster than others.
4. **Environmental variables** – drought, insect attack and disease can stress trees, which slows growth.
5. **Intensity of the previous thinning** – the more trees that are removed, the longer it is between recommended thinnings.

Sawlogs can be grown on a range of sites and require thinnings to maintain rapid diameter growth.

Generally, first thinnings are most often required 15–30 years after planting. Subsequent thinnings will be required about every 8–12 years afterwards.

Management decisions are based on site conditions, tree growth characteristics (silvics), and tree status (size, density and condition). These are addressed in some detail in the next section of this book.

Also, remember to factor the following into your decision-making.

Market conditions and opportunity – sometimes it may be possible to hold off harvesting until poor market conditions improve. There is usually a window of 2–5 years when a stand should be thinned before growth slows down.

✔ Research current market trends and opportunities for several years before you plan to harvest.

✔ Know how your stand is doing and estimate when thinning might be recommended. Don't wait too long to take an inventory of your plantation.

Final product objective – the desired final product will influence your decisions of when and how much to thin. For example, if you wish to grow utility poles, the trick is to choose productive sites and conduct frequent low-intensity thinnings from below. This promotes the growth of cylindrical-shaped trees with modest crowns and small lateral branches (i.e., smaller knots), resulting in higher quality utility poles.

Ideal conditions for pole production include good sites, fast height growth and frequent light thinnings to prevent knots.

✔ Research market requirements for your desired final product.

✔ Determine if your current management plan will eventually achieve the desired end result. Adjust plan if necessary and if possible.

Some plantations can be thinned with machinery like this mechanized harvester. The long boom on the front of this harvester allows it to reach out to selected trees in amongst the rows.

GENERAL BMPs FOR THINNING CONIFER PLANTATIONS

Plantations are usually managed through a series of thinnings.

First thinning

- removes an entire row and some of the trees in the remaining rows
- provides access for machinery
- promotes growth of the remaining trees
- is most beneficial when the plantation is 10–30 years old

Subsequent thinnings

- usually occur every 8–10 years
- involves individual trees being selected based on their size and form – usually the poorest and smallest trees are chosen first
- promotes natural regeneration of hardwoods and occasionally softwoods such as Eastern Cedar and White Pine, as trees seed into the plantation
- frees up space for the remaining trees and for other trees species to seed in (i.e., conversion to natural stand)
- reduces the plantation's density gradually, although some trees may be left in the stand for diversity

Plantations are thinned to increase the amount of space and other resources available to the remaining trees. Taking out an entire row during the first thinning opens the stand up for future access.

Here are three examples of management options for a plantation of Red Pine. Note how each option is based on landowner objectives and site potential, which help guide the actions taken.

Option 1: Manage for sawlogs and square timber logs for log homes

▶ best for drier sites – where height growth potential is modest at best

✔ Keep the trees growing at their fastest possible rate

- ▶ this is done by controlling the density through thinning
- ▶ most plantations will need three or more thinnings over their lifetime – this is especially true for log-home logs and utility poles where height and diameter directly influence the potential value of each tree harvested.

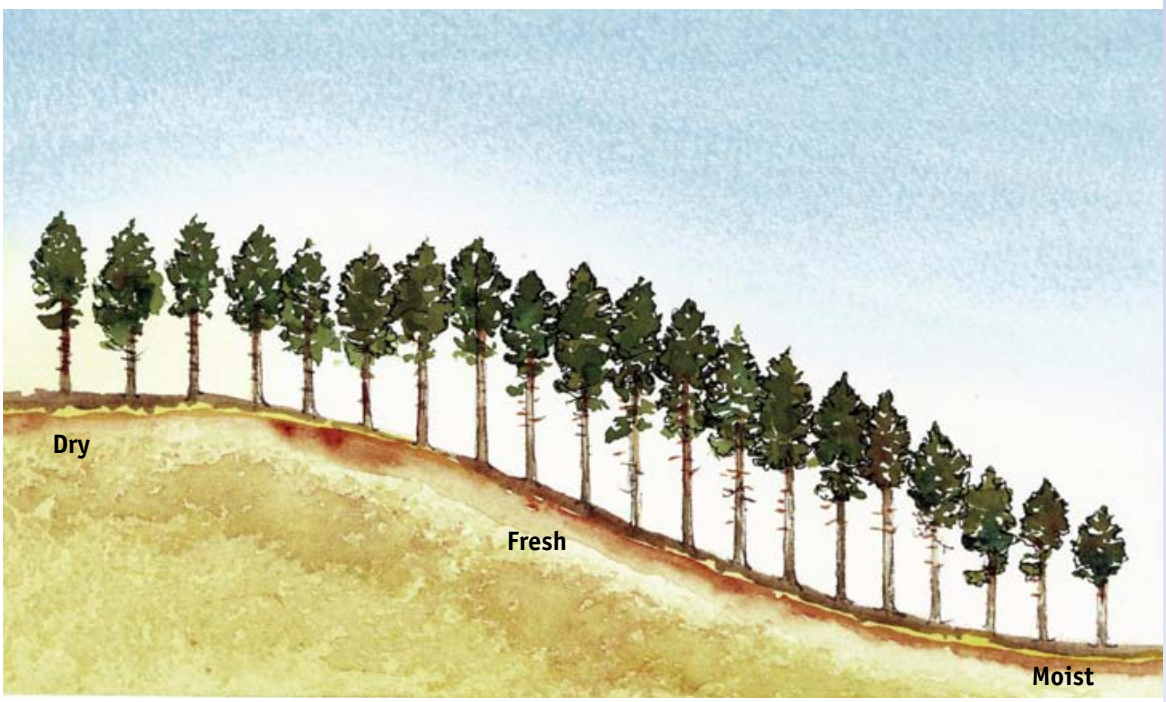
✔ Grow large trees with large crowns

- ▶ thin from below
- ▶ favour crop trees with high potential for crown development
- ▶ prune crop trees for added value.

✔ Capitalize on market opportunities

- ▶ the price paid on harvested products varies from year to year
- ▶ consider delaying harvesting if market price is low.

✔ Use timely and well-planned harvests as a tool to help achieve these BMPs.



Site conditions can influence growth potential and management practices. In this plantation, Red Pine trees were planted from the top to the bottom of this sandy hill. Due to available moisture, the trees grew best in the mid-slope position and were thinned lightly to develop poles.

Option 2: Manage for utility poles and round logs for homes

▶ most suited for well-drained fresh sites where height growth is rapid

✔ Keep the trees' height growth at its fastest possible rate:

- ▶ this is done by controlling the density through careful thinning
- ▶ select crop trees and remove any inferior trees that interfere with height growth
- ▶ thin to keep diameter growth at a modest rate – so that trees will have more compacted growth rings to enhance structural strength.

✔ Grow large trees with medium-sized crowns:

- ▶ thin from below in several thinnings to keep spacing tighter than for sawlogs
- ▶ favour crop trees with small lateral branches and healthy crown development
- ▶ prune crop trees for added value to reduce knots.

✔ Capitalize on market opportunities:

- ▶ the price paid for harvested products varies from year to year
- ▶ consider delaying harvesting if market price is low.

Height growth was slower at the top of the slope and in the lower slope area. The Pine on these sites were thinned more heavily to produce sawlogs and to encourage the regeneration of local, native species. The Pine growing in the midslope position were thinned lightly to discourage rapid crown devlopment, large-diameter lateral branches in the crown, and knots.

Option 3: Promote hardwood forest regeneration within the stand adjacent to an existing hardwood forest

✔ Thin as soon as the plantation needs to be thinned.

✔ Remove the maximum recommended number of trees.

✔ Protect hardwood regeneration (if desired) during thinning.

✔ Under-plant hardwoods, White Pine or White Cedar in areas that are not regenerating naturally and where site conditions are suitable.

INDICATORS FOR THINNING

Choosing the right method

There are two methods of managing plantations:

1. Basal Area Reduction
2. Density Management Diagrams.

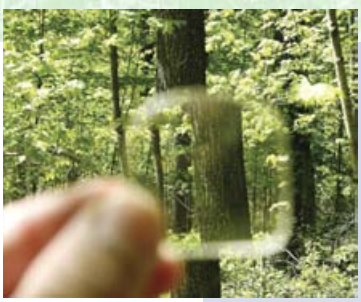
Basal Area Reduction (BAR)

This involves using a prism to measure the initial basal area of the plantation, and:

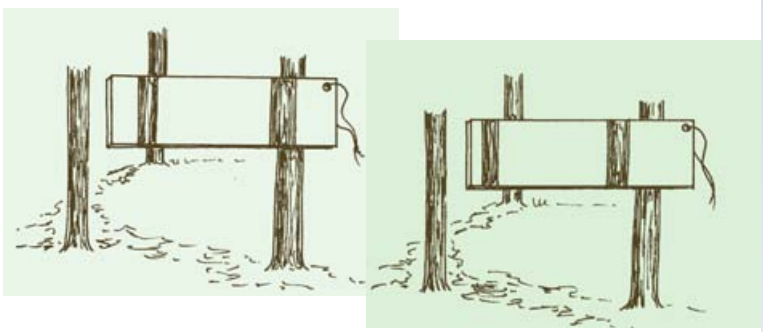
- ▸ thinning to reduce the overall basal area (BA) of the stand
- ▸ achieving a desired BA based on the initial BA determination
- ▸ reducing the overall BA by a set percentage.

A prism may be used to determine basal area. A tree is counted "in" if the stem seen through the prism overlaps the stem seen through the naked eye. A stem is counted out if it doesn't overlap the stem as seen through the naked eye. The basal area of the stand is the total of all the "in" trees counted in a circular plot multiplied by the BA factor of the prism (usually 2).

Example: 14 trees counted in. BA = 14 x 2 = 28 m^2/ha (120 ft^2/ac).



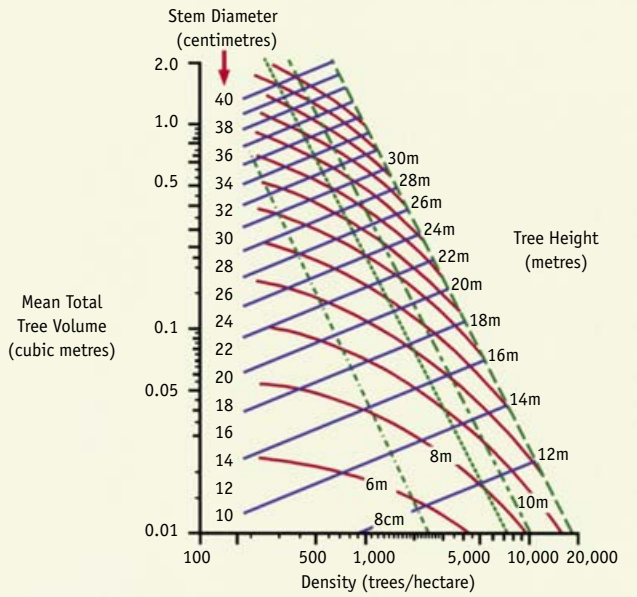
Proper use of a prism is important when estimating basal area for a stand.



The trees in the fixed prism plot on the left are both "in," meaning they are counted and will be included in the BA estimate for the stand. On the right, the trees are too far away from the plot centre and show an offset image, meaning that they are "out." They will not be included in the estimate of basal area.

Although the DMD may at first appear complicated, its usage can be simplified to easily provide a measure of stocking. Where your stand "fits" on the graph will immediately tell you if it needs thinning and if so, how many trees need to be thinned.

DMDs can also be used to predict future thinning needs.



Density Management Diagram (DMD)

- ► DMD diagrams vary according to species and whether stands are natural or planted
- ► from your inventory, you'll only need to calculate average diameter and number of trees per hectare to use the DMD
- ► where your woodland "plots" on the graph determines whether it needs thinning – the amount of thinning is determined by comparing what you have to what's recommended on the graph

THINNING METHODS		
	BASAL AREA REDUCTION	**DENSITY MANAGEMENT DIAGRAM**
ADVANTAGES	• More traditional method • Quick to estimate approximate harvest level	• Can be used for crop planning ○ determining when next harvest is recommended ○ determining next harvest levels • Easier to use in the field • Harvest level is easier to understand and implement • Species-specific – one DMD per species
DISADVANTAGES	• Requires stand inventory • Requires experience using a prism • Marking trees also requires a prism • Optimum BA is variable as stand changes	• Requires stand inventory – not available for all species • Newer method not as well-recognized • Requires use of a complicated graph • Requires more data collection

If your plantation is less than 1 hectare (2 ac), it may not be advisable to use a DMD or BAR to manage your plantation. Use the following guidelines for your management activities in smaller plantations.

✔ Never remove more than one-third of the stand at any one time – one tree in three.
✔ Harvest the poorer quality trees with the smallest crowns.
✔ Schedule harvests apart by a minimum of eight years.
✔ Monitor the growth of the remaining trees each year after the harvest.

BMPs FOR THINNING AND PRUNING YOUR PLANTATION

ASSESSING HOW MUCH TO THIN

The first step in managing your plantation is to determine density: is yours overstocked, understocked or appropriately stocked? If it's overstocked, thinning is recommended. If it's understocked or appropriately stocked, thinning is not needed at this time.

Unfortunately, the determination of stocking is not simply a matter of counting the number of trees per acre. Stocking is a comparison of what you have, to the desired level. One thousand Red Pine per acre means nothing unless you have an idea of the trees' diameter. If the 1000 trees/ac (or 2500 trees/ha) have an average diameter of:

- 10 cm (4 in.) – the plantation is understocked
- 12.5 cm (5 in.) – the plantation is appropriately stocked
- 15 cm (6 in.) – the plantation is overstocked.

If market conditions are poor, you might want to consider delaying thinning operations until prices improve. However, long delays are not recommended because they can negatively impact tree growth, quality and potential.

FOUR STEPS TO DETERMINING HOW MANY TREES TO THIN

1. GATHER THE APPROPRIATE INFORMATION	• management history
	• past harvesting records
	• age of plantation
	• is there a market for plantation products?
	• check with local saw mills and pulp mills
	• contact forestry agencies for advice:
	  ○ Ontario Woodlot Association
	  ○ Ontario Ministry of Natural Resources
	  ○ private consultants
	• area of plantation
	• opportunity to coordinate harvest with neighbours

2. CONDUCT AN INVENTORY OF THE PLANTATION	• see pages 49–50 • collect the forest information necessary for the management system you have chosen
3. DETERMINE WHICH MANAGEMENT SYSTEM YOU ARE GOING TO USE	• Basal Area Reduction (BAR) – requires a prism and an understanding of basal area • Density Management Diagrams (DMD) – requires average diameter and tree density (trees/ha)
4. COMPARE YOUR RESULTS TO WHAT IS RECOMMENDED	• site of harvest is determined by comparing your *stand density* to recommended or ideal levels • thinning recommendations are provided in either stems/ha (DMD) or basal area (BAR) • recommended stocking levels are difficult to determine and beyond the scope of this manual; seek additional information before proceeding

White Pine plantation.

Special applications – according to plantation type

White Pine

- Start first thinnings when average diameter is 13 centimetres (5 in.), between 20 and 30 years of age.
- Be systematic with first thinning to provide access.
- Thin selectively and from below during subsequent thinnings, especially if there is weevil damage (30–50% of stems/row) and poor uniformity. The proportion removed should be lowered if weevil is present: this will provide more shade for residual trees and deter weevil infestation.
- Understand that first thinning may be pre-commercial or break-even, but will enhance the quality and value of the residual stand.
- Prune 125–150 White Pine crop trees per acre that are destined to remain until final harvest.

Mixedwoods

- Remember that the greater the number of species, the greater the variation in growth patterns.
- Make your first-access thinning in a row with poor performance and poor value (e.g., slow-growing Spruce or Cedar) if timber production is the long-term goal and species are similar within row.
- Manage similar to natural mixedwood stands during successive thinnings for timber – with emphasis on crop tree release – based on performance, condition, potential, value and density.

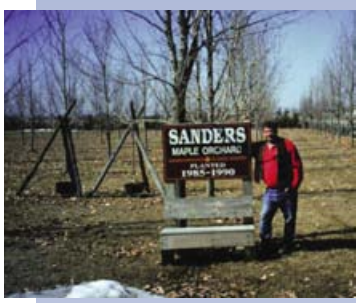
Sugar Maple plantation.

Hardwoods

- You must first select and prune crop trees.
- For stands with several species, choose which species should be favoured.
- Explore forest farming options.
- As the trees mature to crown closure, treat the stand like an even-aged natural polewood stand. Release crop trees by removing suppressed, defective and forked trees. Use thinning materials for fuelwood. Leave smaller material in piles for wildlife.
- Manage coppice regeneration for the more valuable trees.
- Prune veneer quality stems between thinnings, while maintaining proper crown ratios (40–60%).

Where harvestable volumes of conifer are low, it may be economically advantageous to coordinate the harvest with neighbours.

Maple plantations



Maple plantation.

- Until crown closure, control perennial grass and weeds that compete for light, space, moisture and nutrients with the young Maple trees until crown closure.
- Refill large gaps with large transplanted stock.
- Select crop trees that have large healthy crowns and no major defects.
- Prune to make the orchard trees structurally strong and at less risk of damage from wind and other damaging agents.
- Aim for approximately 250 crop trees of 15–25 cm DBH per hectare (100 crop trees of 6–10 in. DBH/ac) with a spacing of one tree every 6–7.6 metres (20–25 ft).

Energy plantations

- Design Hybrid Poplar or other fast-growing hardwood plantations with production objectives in mind.
- Be advised that Willow plantings are based on extremely high densities of 110,000 trees per hectare (43,560 trees/ ac) and 1-year rotations. Some Willow plantings are arranged in double-row mechanical plantings of 15,300 trees per hectare (6,200 trees/ac) with the expectation of mechanical harvest on 3- to 4-year coppice cycles.
- Focus on weed control and creating improved site conditions through fertilization and irrigation.
- Harvest during the dormant (winter) season. Winter harvesting ensures that the ground is hard and trafficable, and does not interfere with normal farm harvesting operations in the summer and autumn.
- Stockpile winter-harvested material (which is immediately chipped) for use throughout the year.

Ideal harvest equipment for energy plantations would be:

- continuous-travel feller/chipper, combined primary/secondary chip transport, and separation of clean chips from residues
- continuous-travel feller/loader, combined primary/ secondary transport of whole trees, delimbing/ debarking, and chipping.

Hybrid Poplar plantation for energy.

Both systems could be used to produce either pulp chips or, by eliminating the separation step (and chipping in the second tree system), whole-tree chips or trees for energy.

Some industrial growers are diversifying their management of Poplar to grow sawlogs for plywood based on 10–20 year rotations – using cull materials for chipped biomass for energy.

Tree marking is a way of ensuring that the right trees are cut and can help prevent possible harvesting errors such as over- or under-harvesting.

MARKING YOUR PLANTATION

Once you know how many trees need to be thinned, the next step is choosing which trees to take and which ones to leave for future thinning.

✔ **Choose the poorest quality trees first.** Leave the best quality trees for last.

✔ **Mark unacceptable growing stock (UGS) trees that:**

- ► have poor form
- ► have smaller crowns
- ► are damaged or diseased
- ► are smaller than average in diameter
- ► are immediately adjacent to an obvious crop tree.

Crop tree left until cycle of cutting.

Poor quality tree removed during thinning.

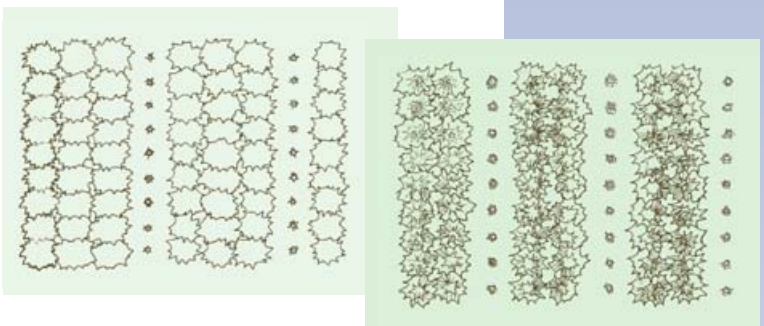
✔ **Leave acceptable growing stock (AGS) or crop trees, which are:**

- ► straight
- ► defect- and disease-free
- ► well-spaced from other crop trees
- ► sometimes marked with a different colour (usually blue) of paint.

✔ **Remove entire rows of trees and some of the poorest quality trees in the remaining rows during first thinnings:**

- ▸ allows for easier access to the stand
- ▸ usually one row in four (25%) or one row in three (33%)
- ▸ individual trees will be selected for removal during subsequent thinnings.

Removing one out of every 3–4 rows leaves room for crop trees to grow and allows for future equipment access into the stand. In most cases, some poor quality trees are selected and removed from the remaining rows.



Don't forget to:

✔ **Hire a certified tree marker who is experienced in marking plantations:**

- ▸ the Ministry of Natural Resources offers a training program for tree markers as well as an introductory course for landowners
- ▸ certified tree markers have passed a competency exam.

✔ **Operate safely:**

- ▸ never work alone
- ▸ rest when tired
- ▸ take a chainsaw safety course
- ▸ let other people know where you are working.

✔ **Hire a reputable logger to harvest your trees:**

- ▸ sign a contract listing obligations, payment schedules (in advance) and expectations
- ▸ check references and visit previously harvested sites.

✔ **Deal with the slash:**

- ▸ cut it down as low as possible (less than 1 metre or 40 in.) to facilitate decay and lessen the fire hazard
- ▸ if you're harvesting your own trees, work from the back of the plantation out to provide a clean unencumbered path for tree removal.

Harvesting generates a considerable amount of slash.

Cleaning it up provides a clean path for travel.

BMPs FOR MAINTAINING YOUR PLANTATION BETWEEN THINNINGS

Sawflys can be a serious pest in young conifer plantations. Regular monitoring can identify a future problem early and may help you reduce the potential impact of an outbreak.

Most plantations will require some form of maintenance between thinnings. Maintenance activities are a way of helping protect your investment from loss, or from events that may lower the value of living trees.

Monitoring – impacts from stressors like insect attack and Beaver-related flooding can often be lessened through early detection.

✔ Check your plantation for problems on a regular basis.

✔ Keep a record of your observations – this can be helpful in future years.

✔ Address any problems as necessary.

Cleaning – a clean plantation clear of debris looks better and is at less risk of insect infestation and fire.

✔ Cut fallen trees and slash down as close to the ground as possible (90 cm or 36 in. or less) to speed up the decomposition process and reduce the fire hazard.

✔ Cut any trees that pose a threat to safety.

Pruning – pruning the lower limbs from the trees in your plantation can provide significant benefits including:

► increased log grade and value of future harvests – applies primarily to White Pine and Red Pine grown for poles

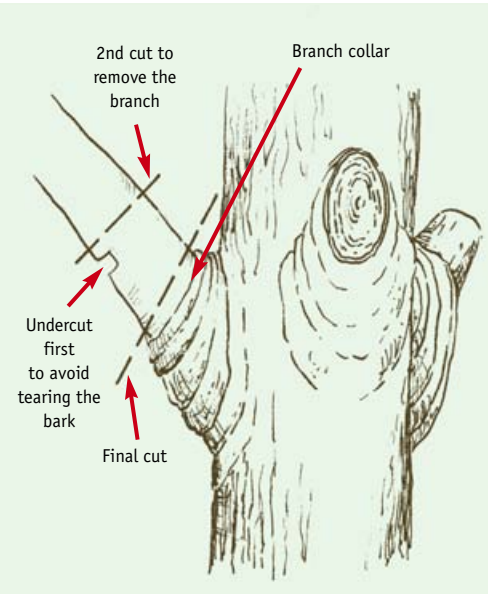
► reduced fire risk

► lowered incidence of White Pine Blister Rust infection – pruning opens the stand up, reducing the high humidity that encourages the disease.

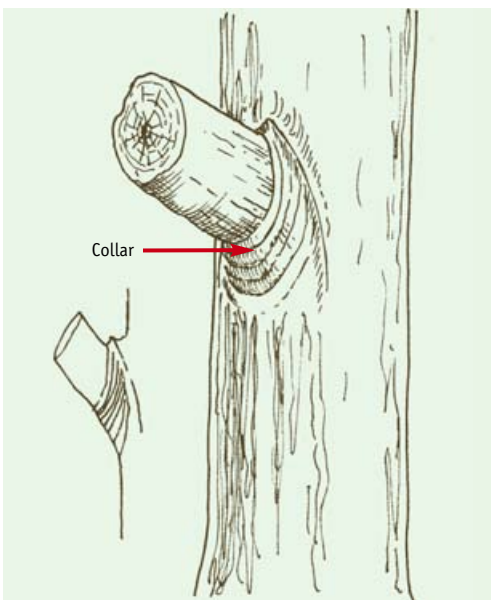
✔ Remove lower branches to create safer conditions for working in the plantation.

Before you start, carefully evaluate the cost versus the benefit of pruning. In some cases, pruning may only provide an economic benefit to the log buyer or the person retailing the finished product. There is no economic reason to prune Spruce at this time.

Pruning poles can help you reach higher branches.



Pruning should be done carefully to ensure that you don't damage the main stem. Damage creates entryways for insects and diseases.

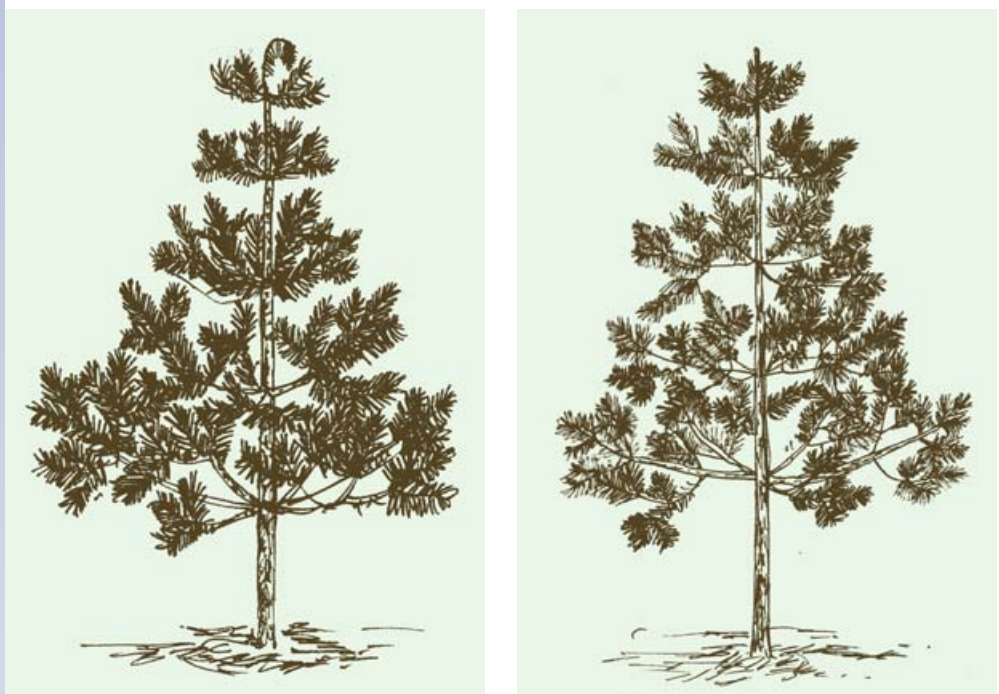


Improperly pruned branches will cause defects that will reduce your merchantable volume at harvest.

Poor pruning habits lead to improper recovery. Poorly recovered stems can act as pathways for insects and disease.

BMPs for pruning plantations

✔ Prune near the collar (but not the collar itself); don't leave branch stubs.
✔ Leave at least two-thirds of the live crown intact.
✔ Prune up to a height of 5 metres (17 ft).
✔ Prune only crop trees and those along pathways and travel corridors.
✔ Prune as soon as possible after thinning to capitalize on the increase rate of growth
  ► ideally, stem diameters will be between 15 and 20 cm (6–8 in.)
✔ Prune when the tree is not actively growing – fall, winter.



White Pine Weevil is a serious pest of young White Pine trees, especially in understocked plantations. Larvae tunnel down the leader and create a characteristic "hook" at the top of the tree. Corrective pruning of the dead leader and all but one of the side laterals can help improve the future quality of the impacted tree. White Pine planted with a cover crop usually suffers less Weevil damage. Closer spacing in White Pine may help to deter Weevil.

White Pine Blister Rust is spread though spores that enter a healthy tree through the needles. Infected branches eventually die and can often be seen for some distance. These branches can be pruned off before the fungus travels to the main stem.

BMPs FOR HARVESTING YOUR PLANTATION

Harvesting and selling standing timber can be a lot of work that many landowners are not prepared to do themselves. A landowner in eastern Ontario sought independent advice on what to do with his 25-year-old Red Pine plantation that had never been thinned. The company he contacted was a reputable one with many years of experience managing Pine stands. They sent out a forester who reviewed the landowner's plan with him.

The company had three economic criteria to be met before they would send out their tree-harvesting machinery.

1. **Good access to the stand. This was no problem as this stand was just off the main road.**
2. **Sufficient volume per hectare. They wanted a minimum BA of 40 m^2/ha (175 ft^2/ac) with an average diameter of between 16 and 25 cm (6–10 in.). This was no problem: the stand was at 43 m^2/ha (190 ft^2/ac) with an average diameter of 18 cm (7.2 in.).**
3. **Sufficient stand size (which is somewhat related to the quality of the product). In this case, the landowner only had 4.5 hectares (11 ac) of plantation so the company would not move their equipment the 100 km due to high operating costs.**

The landowner still ended up having the company harvest his trees because he was able to recruit two of his neighbours into thinning their plantations as well. The company did a very good job and the stands are better for it. The landowners were satisfied and they will contact the company again in 8to 10 years when the plantation needs to be thinned again.

Specialized machinery may be required to thin dense plantations.

SALE OF STANDING TIMBER CONTRACT

This contract entered into this _____ day of _____ 2007,

between _____
Of (Seller Address) _____
Hereinafter called the Seller,

and Purchaser _____
Of (Purchaser Address) _____
Hereinafter called the Purchaser.

DESCRIPTION OF SALE AREA

Lot(s): _____ Concession(s): _____
Township: _____ Area: hectare / acre _____
County or Regional Municipality:_____

Now therefore this contract witnesseth:
The Purchaser agrees to pay to the Seller the following amounts for all sawlog quality trees designated for harvest, under the conditions set forth in this contract:

Species	Timber: Price m^3/ fbm	Fuelwood/Pulp: Price m^3/ fbm

and, pay to the Seller the following amounts for all pulpwood / firewood trees designated for harvest, under the conditions set forth in this contract as specified above.

The Purchaser agrees to pay to the Seller ($ ____), by certified cheque or money order, as down payment upon the signing of this agreement, and the balance of the purchase price, $____ , shall be paid to the Seller, by certified cheque or money order, within ____ calendar days of the signing of this agreement or prior to the commencement of logging operations, whichever comes first.

(1) All marked trees, designated trees, or trees for sale, harvest, or felling, referred to in this contract have been marked.

(2) All trees of sawlog quality, which are designated for cutting, have been marked with yellow dot(s) at or about eye level and below stump height.

(3) All trees of fuelwood quality, which are designated for cutting, have been marked with yellow slash(es) at or about eye level and below stump height.

Signed in duplicate this _____ day of _____ 2007

(Witness for the Purchaser) _____ (Purchaser) _____
(Address/ Phone Number) _____ (Address/Phone Number) _____
(Witness for the Seller) _____ (Seller) _____
(Address/ Phone Number) _____ (Address/Phone Number) _____

A timber sale agreement would show how to best market your timber as well as offer legal protection from unscrupulous loggers. The very fact of having a contract tends to discourage these types of loggers from bidding on a timber sale.