BMPs FOR WOODLOTS

WOODLOT PRODUCTS AND ECOLOGICAL VALUES

Woodlots can be managed for multiple values such as timber, fuelwood, specialty forest products, recreation and wildlife. Although some of these values may seem conflicting, in most cases it is possible to realize more than one benefit from your forest. See the photos on this page for some examples of the multiple benefits a well-managed woodlot can yield.

Recreational use along woodlot access roads and trails.

Forestry farming products.

A diversity of plants and animals.

Timber sales.

Fuelwood from a sugar bush.

Cedar pickets from swamp forests that retain wetland values.

Remember too that these areas have a very important ecological function. Ontario was once covered in woodlands, wetlands and other natural areas. Today, a rural community with a good proportion of natural areas (i.e., 20% forest cover) and farmland is more resilient to water and wind erosion and less prone to flooding or droughts. Additional functions from which we benefit are listed in the following chart.

BENEFITS OF WOODLOTS TO THE LANDOWNER	
DIRECT BENEFIT	**MARKETABLE PRODUCTS**
WOOD PRODUCTS FEED PROCESSING	• Timber from woodlots and plantations • Veneer logs from timber harvests • Fuelwood from woodlots • Pulp from woodlots and plantation thinnings • Modified feedstuffs to improve palatability and availability of nutrients
NON-WOOD PRODUCTS	• Maple syrup and other maple products • Cedar boughs for ornamental purposes • Ground Hemlock for medicinal purposes • Mushrooms for culinary markets • Forest herbs for alternative medicine
ON-FARM WOOD PRODUCTS	• Fuelwood to offset energy costs • Fencing materials • Building materials for framing, siding, pens, wagons, tools, home furniture-making
INDIRECT BENEFIT	**THE DETAILS**
INSURANCE	• Use timber sales from woodlots and plantations as insurance against low farm commodity prices
PROPERTY VALUE	• Include timber when determining the value of your property for real estate or for equity purposes • Remember that woodlands are an asset – beyond timber value – if you're considering the non-farm real estate market
LABOUR USE	• Use on-farm labour during off-seasons or when conditions are unsuitable for fieldwork to produce maple syrup, fuelwood, fencing and building materials
LAND USE	• Create or maintain woodlots and plantations for wise land use – especially for marginal and fragile lands on your property

Fuelwood is often a secondary product from timber harvest operations. It can also be a major source of revenue from degraded stands.

Maple products are derived from tolerant hardwood stands dominated by Sugar Maple.

Timber products include veneer and *sawlogs*.

BENEFITS OF WOODLOTS TO THE COMMUNITY	
INDIRECT BENEFIT	**THE DETAILS**
SOIL	• Tree canopies and understory vegetation intercept rainfall and protect soil from storm events • Forest soils are higher in organic matter and have erosion-resistant soil structure • Tree roots anchor soil and keep it in its place
WATERSHED	• Woodland soils hold onto more water than cropland • Riparian woodlands can reduce the impact of flooding
GROUNDWATER	• Woodlands protect sensitive groundwater areas such as recharge and discharge zones • Woodlands help keep surface water tables at normal depths
CLIMATE CHANGE	• Woodlots and plantations trap or "sequester" carbon dioxide from the atmosphere and produce oxygen, thereby reducing the impact of climate change • Riparian and wetland woodlands take up nitrate-nitrogen moving from shallow aquifers, reducing the risk of generating nitrous oxide (a greenhouse gas)
WILDLIFE HABITAT	• Wildlife require food, water, cover and space – many woodlands provide all four requirements for some species • Woodlands are particularly important for fauna that are woodland-dependent
FISH HABITAT	• Riparian woodlands protect aquatic habitats from land-based disturbances • These woodlands also provide base-flow for habitat and shade to keep stream temperatures low
HUNTING AND FISHING	• Farm woodlands, especially those with diverse well-connected components, make ideal spots for hunting and fishing ○ some landowners have found it advantageous to lease their natural areas to responsible game and rod clubs
OTHER RECREATIONAL ACTIVITIES	• Woodlands make ideal recreational environments for hiking, nature-appreciation, snowmobiling and other trail uses
AESTHETIC	• Rural tourism benefits from aesthetically desirable landscapes: a mix of field, forest and streams is considered prime rural scenery for most tourists

"Riparian" forests help protect water quality and habitat.

Autumn leaves in full colour are beautiful to behold, and can be an important tourism draw.

Many landowners manage their stands for wildlife, such as this Saw-whet Owl, as well as for other benefits.

MANAGEMENT PRINCIPLES AND SILVICULTURAL SYSTEMS

MANAGEMENT PRINCIPLES

A common management goal is to develop a healthy and productive woodland from which marketable products can be derived, while conserving other woodland values.

Here are 10 principles to consider.

1. **Trees are a crop – they mature and quality declines over a long period.**
2. **Trees will regenerate themselves – it's more difficult if site conditions and past management are unfavourable.**
3. **Each tree species has special needs – light, space, nutrients, water, seedbed requirements.**
4. **Each tree has value – some are more commercially valuable than others.**
5. **Spacing should be controlled: tight when young, freedom as they mature – space increases diameter growth, and volume growth is exponential to diameter growth.**
6. **Thinning young stands increases space for growth of crop trees.**
7. **Removing poor producers and poor quality trees gives more space to trees with potential.**
8. **Woodlands need protection.**
9. **Woodlands are ecosystems – respect all values and uses.**
10. **Woodlands should be managed according to a suitable silvicultural system for the local area.**

SILVICULTURAL SYSTEMS

A silvicultural system is a planned program or system of management treatments scheduled throughout the life of the stand. Harvesting, thinning, pruning and planting activities can all be considered silvicultural treatments that may be used to influence the development of a forest stand over time.

The appropriate system for your forest depends on two main factors:

your management objectives for the stand

► what do you want to get out of the stand now, as well as in the short and long term?

the appropriate silvicultural and ecological choices for the existing forest

► the options you have for management are determined by the type of:

▷ forest currently growing in the overstory – different types of forests require different methods of management

▷ regeneration coming up in the understory – trees in the understory will eventually grow and become the future overstory

► every stand will have a number of alternatives for its future management direction

▷ your choice of treatments should in part be based on the capability of the site – is it a good site for the type of forest growing on it, or in the understory?

It is relatively easy to predict the short- and mid-term changes to a stand that will result from management actions.

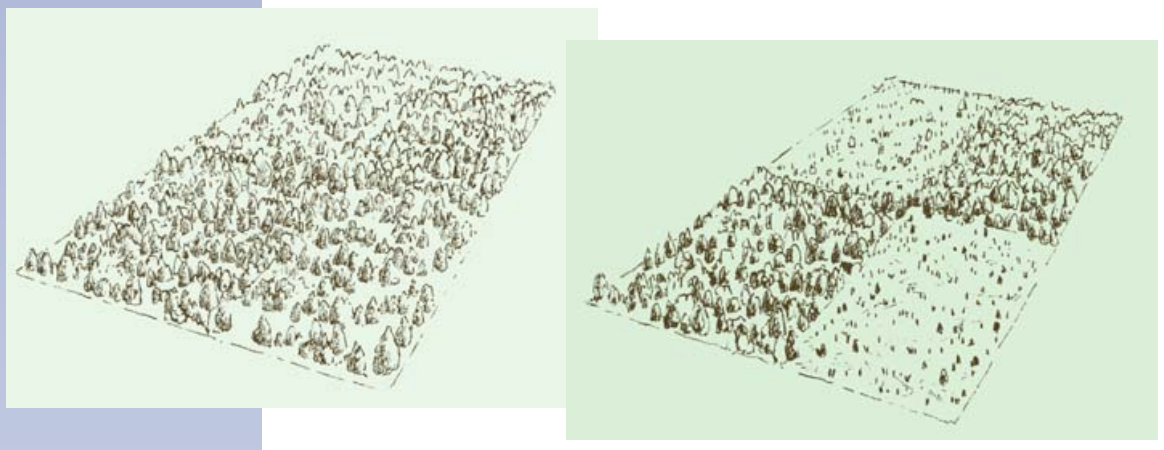
It is important to find a balance between these two factors. Many of your management objectives will coincide with the silvicultural and ecological potential for the stand, but others may not.

Management systems best suited to your woodlot should be discussed with a forestry professional. The following chart introduces three types of management systems that may apply to your woodlot.

Selection is an *uneven-aged* silvicultural system, best suited for shade-tolerant hardwood woodlots. It involves the harvest of relatively few trees to promote the growth of higher value trees and regeneration of seedlings.

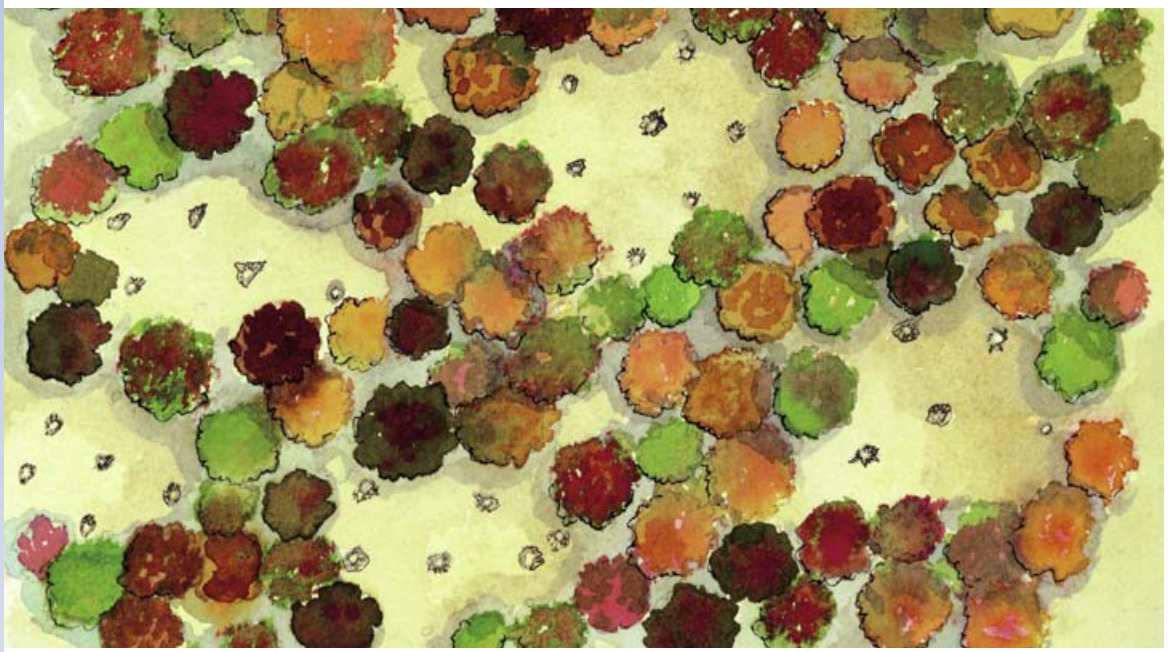
MANAGEMENT SYSTEM	DESCRIPTION	USAGE	FOREST TYPE
SELECTION (individual tree, group)	• harvesting of individual trees or small groups of trees • most of the trees and a variety of *age classes* (uneven-aged) left to grow and regenerate naturally	• promoting high-value hardwoods • managing sugar bush • enhancing environmental values	• shade-tolerant species – Sugar Maple, Beech • shade-tolerant conifers – Hemlock
SHELTERWOOD	• gradual removal of the entire stand in a series of two or more partial cuts • natural regeneration encouraged in the shelter and shade of the remaining trees	• growing high-value hardwoods and conifers • renewing degraded stands	• mid-tolerant hardwoods – Red Oak, White Ash, Hickory, Yellow Birch, Basswood, Red Maple • White Pine
CLEARCUT, STRIP CUT, PATCH CUT	• removal of the entire overstory in one cut • regenerate poor quality stands – plant with seedlings or leave to regenerate naturally • most clearcuts are modified clearcut for a specific purpose (e.g., patch cut in Cedar)	• regenerating shade-intolerant species – Poplar, Birch • regenerating species that can reproduce vegetatively	• early successional, shade-intolerant species – Poplar Birch, Cedar

In the shelterwood system, the overstory is removed in a series of three or four harvests. The regeneration of mid-tolerant trees such as Red and White Pine as well as Oak, Ash and Hickory is encouraged with this system.

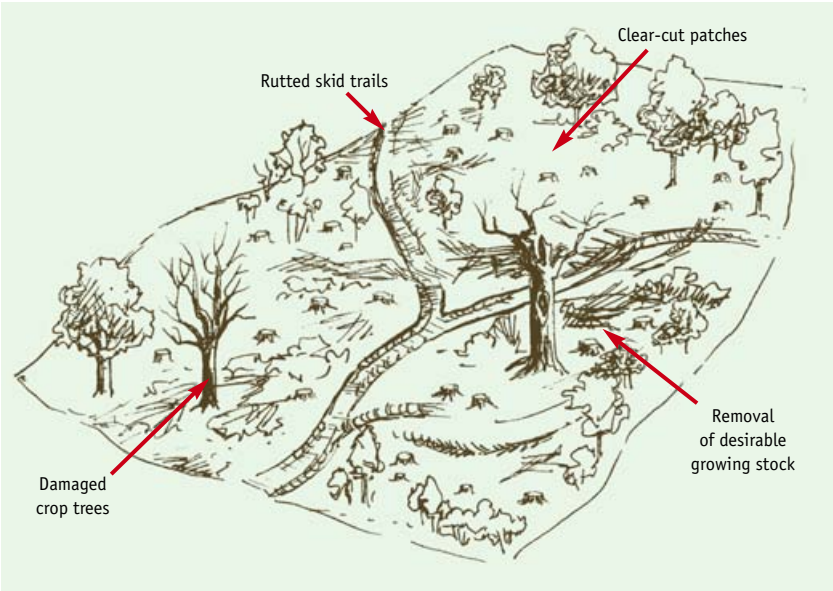


The patch-cut system is a form of clearcut that has been successfully applied in renewing Poplar stands.

Some forest managers and landowners create small openings within a stand. These openings are usually as wide as the stand is tall and help promote species diversity within the stand. Group selection within stands of shade-tolerant hardwoods promotes the establishment of mid-tolerant hardwoods like Oak, Basswood and Yellow Birch.



Poor logging practices can damage the site and residual growing stock.



Poor management practices can ruin a woodlot. This illustration shows a woodlot where all the best trees were removed from the stand, leaving the poor quality ones to grow as the future forest. This woodlot will not yield any more timber – at least for the next 50 years or so!

WOODLOT STRUCTURAL FEATURES

If the goal of woodlot management is to obtain a full stand of valuable trees in a shorter period of time, then the ideal woodlot would have a diverse range of tree ages and sizes with proper spacing between crop trees to maximize growth.

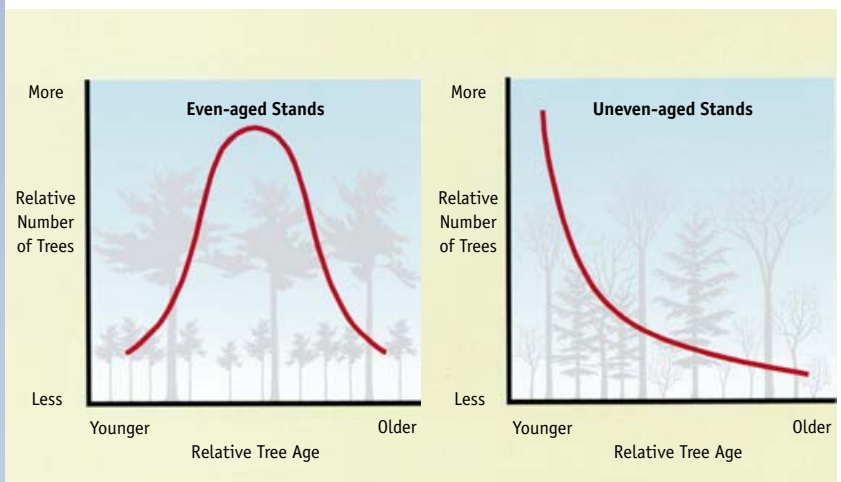
In truth, there are few woodlots that approximate this condition. Many are overmature with no regeneration or too tightly spaced to allow for crop tree growth. Woodlot planning and suitable forest management BMPs are essential to shaping the stand to this ideal.

There are two key conditions considered during the inventory stage – beyond forest cover type and past history – that directly affect the suitability of a silvicultural system and the BMPs to make the system work:

- ▶ stand age and size class distribution
- ▶ density.

The 1998 ice storm in eastern Ontario caused widespread damage to forests throughout the affected area. Although it is impossible to account for this type of disaster in a management plan, woodlots that were well-managed before the ice storm tended to fare better than those that weren't.

STAND AGE AND SIZE CLASS DISTRIBUTION



In even-aged stands, most of the trees in the woodlot are in the same age range. Uneven-aged stands have trees from all age classes:

- **most of the trees are younger (seedling and sapling)**
- **a moderate number are the polewood-size class, and**
- **a few are mature and over-mature trees.**

Even-aged? Uneven-aged? What do these two terms really mean?

Most of the trees in even-aged stands tend to be about the same age. If you were to plot them on a graph, it would look something like the one shown on the left above: a bell-shaped curve that peaks around the average age of the stand. Uneven-aged stands, on the other hand, tend to have a completely different distribution when plotted on the same graph. In this type of stand, there are more younger trees than there are older ones. In this stand, only a few of the younger trees will live to maturity.

Which is better?

For the tolerant hardwood working group, uneven-aged management is usually recommended, although there are circumstances where even-aged management would be appropriate.

Uneven-aged stands tend to:

▶ provide a constant and more regular supply of forest products
▶ provide a more stable supply of habitat features.

Even-aged stands change considerably throughout the life of the stand (young to mature) and don't usually yield timber products until the stand has matured. This can mean a span of 50 years or more between harvests. Even-aged management is more suited to mid-tolerant and intolerant species.

Can even-aged tolerant hardwood stands be converted to an uneven-aged structure?

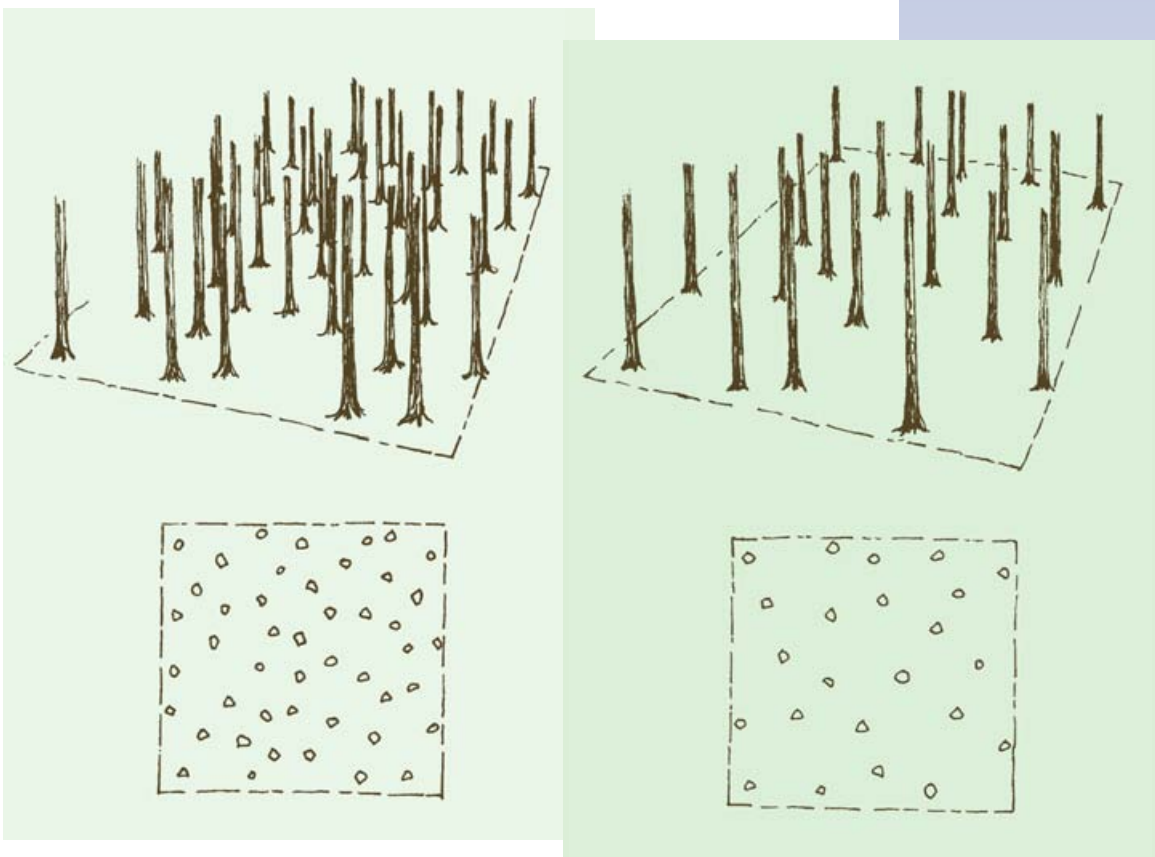
The answer to this question is yes, but it may take many years. If your stand is even-aged, using the selection system to promote regeneration will work. However, this will often result in a woodlot made up of two ages (old and young) because a second commercial harvest will not generally be warranted for many years.

One way of converting an even-aged forest to an uneven-aged one is to reduce harvest intensity, but increase the frequency of harvests. Instead of one harvest every 15 to 30 years (depending on site), break the harvest up and take fewer trees but cut every 5 to 10 years. Landowners completing the work themselves often prefer this approach.

There are other methods of achieving this goal and it is recommended that you discuss your circumstances with a forester before harvesting.

STAND DENSITY (EXPRESSED AS BASAL AREA)

Basal area is used as a guide to estimate the density of a woodlot and to plan woodlot harvests. In this sketch, the stand on the left is overstocked, at BA > 32 m^2/ha (140 ft^2/ac). The illustration on the right shows the same stand after thinning to a residual basal area of 20 m^2/ha (88 ft^2/ac) – which is often preferred for best-diameter growth.



The cross-sectional area of trees can be determined with the following formula: 3.14 x ($^1/_2$ diameter x $^1/_2$ diameter).

For example, with a diameter of 20 cm at 1.3 metres:
3.14 x ($^1/_2$ 20 cm x $^1/_2$ 20 cm)
= 3.14 (10 cm x 10 cm)
= 3.14 (100 cm^2)
= 314 cm^2

BA is the sum of the cross-sectional areas on a unit area basis (per hectare or per acre).

What is a "basal area"?

The concept of basal area (BA) is a very important one in agroforestry. Basal area can be determined by measuring the individual diameters of the trees in the stand and using this information to calculate the total cross-sectional area of the trees 1.3 metres (4.5 ft) aboveground.

The measurement is taken at 1.3 metres aboveground because it is high enough to avoid stump flare near the ground, a convenient height for measurement, and an accepted industry standard.

The total cross-sectional area of all trees is then calculated and expressed on a unit area basis (BA per hectare or BA per acre).

A prism can also 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 stand's BA is the total of all the "in" trees counted in a circular plot, multiplied by the BA factor of the prism (usually 2). For an example of some illustrations, please see pg. 115.

How is the basal area concept put to use?

Because basal area is a measure based on a unit of land, we can compare individual basal areas to each other or to a known standard to see how our forest compares.

For example: If the basal area of a Maple forest was estimated to be 32 m^2 per hectare (140 ft^2/ac), it would help to form a general idea of what the forest is like even if you have never been there to see it. Forest science tells us that a basal area of around 20 m^2 per hectare (88 ft^2/ac) is ideal for optimum growth. Because this stand is at 32 m^2/ha, you would probably be right if you guessed that it was fairly dense and perhaps there were too many trees.

What is missing here is any reference to tree size. Basal area is a good indication of stocking. A BA of 32 m^2/ha is overstocked regardless of tree diameter, but is it made up of many small trees all crowded together, or is it a few very large trees scattered about as if in a park setting? Or is it a mix of the two? Basal area is only one part of the picture. You need to know the size class distribution of the trees as well.

Bear in mind that BA is used along with other considerations such as the physical condition of the trees, their physiological age, and their crown position.

GENERAL BMPs FOR WOODLOTS

BMPs FOR WOODLOT PROTECTION

Maintaining a healthy woodlot is essential to achieve your long-term objectives. Taking the following steps can go a long way to reducing some predictable threats to woodlot health.

Fire

Forest fires in southern Ontario woodlots are rare. Conifer plantations on dry sites are at the greatest risk, e.g., Red Pine on coarse sandy sites.

- ✔ Maintain a ploughed/disked buffer around plantations to keep grass fires from spreading. Width: 4.8 m (16 ft) or 2 cultivation widths.
- ✔ Maintain fences and limit access by unwanted users.
- ✔ Keep fire-fighting equipment on site and in your vehicle.

Maintained firebreaks can lower the risk of grass fires spreading to woodlots and plantations.

Insect and disease damage

- ✔ Monitor forest health on a regular basis. Scout three or four times annually to check for degradation/unauthorized use, forest pests or disease, and the presence of invasive species. Spot problems early while they can be controlled. Seek help from provincial forestry or agroforestry specialists or forestry consultants when a problem is suspected.
- ✔ Learn to identify some of the more common insect pests like Gypsy Moth, Forest Tent Caterpillar, and Pine Sawfly.
- ✔ Learn to identify established invasive pests like Asian Longhorn Beetle and Emerald Ash Borer. Report any suspected sightings to the Canadian Food Inspection Agency (check the blue pages of your phone book for contact information).
- ✔ Learn about some of the more common disease problems facing southern Ontario's woodlots. Dutch Elm Disease, Chestnut Blight and Butternut Canker have already severely impacted Ontario's forests. Disease such as Beech Bark Disease and Oak Wilt are spreading throughout North America.

Problems from improper harvesting practices

- ✔ Do not over-harvest, high-grade cut or diameter-limit cut your woodlot.
- ✔ Poor harvesting practices that damage residual quality trees can dramatically reduce the future potential of your woodlot to produce high-value forest products. Minimize cutting, felling and skidding damage to remaining trees.

Poor harvesting practices can damage a tree, lowering its value as a future crop tree.

It is possible to introduce new tree species to your woodlot. Shumard Oak is listed as a vulnerable species in Ontario and like other Carolinian species can be found growing with a number of different species. If you live in an area where Shumard Oak can grow, you may be able to establish it in your woodlot.

Invasive plant species

✔ Pressure-wash forestry equipment before it's moved from one bush to another to help limit the spread of weed seeds and vegetative material.

✔ Don't dispose of waste plant materials in your woodlot. Prunings, cuttings and seeds may reintroduce the problem.

✔ Maintain natural vegetation along woodlot edges. Dense vegetation along edges reduces the number of weed seeds that can blow into your woodlot.

✔ Don't plant non-native groundcovers (e.g., Periwinkle) in your woodlot.

Nuisance wildlife

Beavers

✔ Monitor wetlands and streams regularly for Beaver activity.

✔ Consider installing a beaver baffler system to help control pond size.

✔ If needed, contact a local trapper (names available from Ontario Ministry of Natural Resources) to help manage Beaver populations.

A beaver baffler similar to the one shown above can help regulate water levels in Beaver-flooded ponds. Because the outlet pipe is set below water level, Beavers have difficulty stopping the flow of water.

Porcupines

✔ Monitor your woodlot regularly for signs of Porcupine activity. Porcupine are most easily seen in leaf-off conditions, when they may be observed feeding on young bark.

✔ If needed, control Porcupine numbers.

BMPs FOR TIMBER PRODUCTION

Generally, forest management for timber production is a manipulation of forest composition and density to maximize growth, quality and return. In a selection system, managing for timber production is a matter of promoting diameter growth by removing low-value, unproductive trees from the stand so that the remaining trees have space to grow faster.

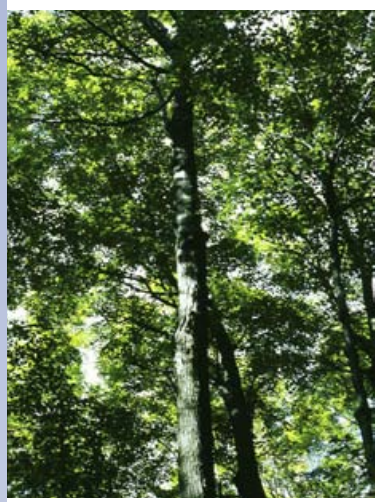
The value of similar quality trees varies considerably across Ontario. The tree on the left was veneer quality at harvest, with a stumpage value of $1,800. On the right, the defected, stunted tree from an unmanaged woodlot was worth $30. Not only was Tree A younger, but it was larger and as a result more valuable, yielding one or two veneer logs, one 3-m (10-ft) sawlog and some fuelwood from the treetop. Tree B hadn't even reached the small sawlog-size class after 75 years. It yielded only firewood.

Tree A.

Tree B.

Follow these best management practices to keep your woodlot healthy before, during and after timber harvest.

BEST MANAGEMENT PRACTICES FOR TIMBER PRODUCTION	CONSIDERATIONS
SELECT CROP TREES WITH CLEAR, STRAIGHT BOLES AND HEALTHY CROWNS	• Crop trees are trees left for future use. • Choose trees with large, well-formed crowns, few defects, and few or no forks in the first half of the trunk.
KEEP LIVESTOCK OUT OF YOUR WOODLOT	• Livestock compact soil around tree roots and also damage exposed roots. Grazing livestock will reduce the quality of stems and their growth rate. • Refer to Environmental Farm Plan Worksheet #23 for more advice on winter access.
HARVEST ON FROZEN GROUND, OR IN AUG.–SEPT. WHEN CONDITIONS ARE DRY	• Logging on wet or moist ground can cause extensive rutting and soil compaction. • Logging from April to July when the bark is loose causes excessive damage to tree stems.
LIMIT FELLING AND SKIDDING DAMAGE	• This means careful layout of logging roads and skid trails, and use of skidding logs in lengths and numbers that will minimize damage to remaining stems.
USE TREE MARKING AND A FOREST MANAGEMENT PRESCRIPTION	• Tree marking ensures that stand quality is retained for future harvests. Forest inventory and a *management prescription* are the guidelines for tree marking, and help ensure that enough trees are left in the stand to maintain optimum growth. Use forestry consultants.
UNDERSTAND WHAT YOU HAVE IN YOUR WOODLOT	• Shop around for markets and prices. Some sawmills distinguish between Grade 1 (high), 2 and 3 (low) sawlogs and pay appropriately. Other buyers do not, and some #2 and #3 logs end up being sold for lower-grade sawlogs or fuelwood and in some areas, pulp. • A forestry consultant can help you determine what you have and help you market it most effectively. Have several loggers provide you with a bid. Get at least three bids and have a consultant monitor the harvest operation on your behalf.
MAINTAIN A DIVERSITY OF TREE SPECIES IN YOUR WOODLOT	• Sugar Maple, Red Oak and White Pine have been and probably always will be valuable species. • Low-value species today may be quite valuable 50–100 years from now when those saplings become sawlogs. • A good forest manager will also retain critical habitat features such as cavity trees and mast trees, regardless of their timber value. • Refer to EFP Worksheet #23 for further advice on habitat planning for your woodlot.



Crop trees should have straight, defect-free trunks. Over time, good forest management practices will remove many of the poorer quality trees from a woodlot. This serves to increase both the proportion of high-quality trees in the woodlot as well as the future return per hectare coming from it.

When planning harvest operations, ensure loggers and consultants work within clearly marked property boundaries.

Take extra precautions when harvesting. Site damage caused by poor logging practices can dramatically reduce any future returns from your woodlot.

An Ontario landowner knew that he had a good quality woodlot at the back of his farm. He just did not know how valuable it was! Over the years he had had several loggers asking him if they could "selectively" log his woodlot. One went so far as to offer him $10,000 for the timber after only a quick walkthrough!

The landowner had heard logging horror stories from some of his neighbours so he decided to do things right. He hired a forestry consultant to help him with his management plan. The consultant inventoried the woodlot and worked with the landowner to decide what should be done based on what he had. After deciding to go ahead with a harvest, the landowner hired the same consultant to mark and tally the woodlot accordingly. The marked trees were then sold to one of three loggers who bid on the harvest.

The logger paid the landowner about $14,000 for the standing timber. The total cost to the landowner for the consultant was $1200. The logger harvested 45,000 *board feet* (bf) of sawlogs, 5,000 bf of veneer and 100 cords of fuelwood.

Although the landowner only made $2,800 more than the first logger had offered, he was happy with the return. He recognized that the woodlot would generate income in future, periodic harvests, and that his woodlot was well-managed. Who knows what would have happened if he had done it differently?

A CASE FOR SUSTAINABLE MANAGEMENT OF A FARM WOODLOT

George and Sandy Barrie farm 250 acres in N. Dumfries Township in Waterloo Region, and produce cash crops, cattle, sawlogs/fuelwood, and maple syrup. They have realized the potential of their forests without compromising the capital because they use sustainable management practices.

PROPERTY – GENERAL

- 187 acres in corn–soybean–wheat
- 48 acres in hardwood woodlot
- 12 acres of fragile soil, reforested
- 24 acres for maple syrup (22 taps/ac); Sugar Maples on pipeline to take advantage of hilly terrain; formerly held paid school tours to demonstrate how syrup is made
- 2.5-ac wetland

SOIL AND SITE FEATURES

- Dumfries loam, somewhat gravelly with some flat terrain with sandy loam to loam soils
- rolling terrain with large central drumlin and some flat terrain

PROPERTY – WOODLOT

- 3 woodlot (W) sites
- forest – 30 acres
  - Sugar Maple 90%; Cherry 5%; minor components of White Ash, Red Oak, Beech and White Pine
- plantation – 12 acres, 3 acres established under Woodlands Improvement Agreement (WIA) with MNR
  - 12,000 Red Pine, 1,000 Black Walnut (1970)
  - area retired under National Soil Conservation Program; planted in 1992: 1300 Black Walnut and 1300 Black Locust
- forest – 17 acres
  - Sugar Maple 84%, Red Maple 10%, minor components of Cherry, Beech, White Pine, Ash, Basswood

LAND USE AND MANAGEMENT HISTORY

- 1968 reforestation under MNR WIA Agreement
- hired professional forestry services to mark trees for harvest
- used logger for large tree-harvest operations
- cut and skid their own fuelwood trees
- produced maple syrup since 1987
- participated in National Soil Conservation Program in 1992
- key opportunities:
  - Red Pine served as nurse crop to 12-ac Black Walnut plantation
  - planned and implemented BMPs
  - use wood products on farm

PRODUCTS

- 22 taps produce 0.8 litre/tap and earn $5 profit/litre, average $88 profit/acre
- 150–200 face cords/year are sold; firewood sales average $26/ac/yr over a 10-yr period – most fuelwood comes from tops of saw logs
- over 10 years, as a result of stand improvement, the yield of maple saw logs rose from 125 bf/tree to 220 bf/tree
- timber harvest yielded timber for barn renovations, and treetops were used for firewood

KEY REFERENCES

- ▶ Terry Schwan, District Forester, MNR Guelph; Steve Bowers, Stewardship Coordinator, Huron County; and Cher Brethour, George Morris Centre, Guelph
- ▶ factsheets, BMP books, EFP Program
- ▶ forest consultant

LANDOWNER TESTIMONIALS

- ▶ "Unlike livestock that must go to market when it's ready no matter the price, trees can be left to grow another year or two if prices aren't favourable."
- ▶ "It's taken a long time to get the woodlot to the point where it's producing at an optimum level."
- ▶ "Trees are a crop. You have to have a long-term outlook, but I'm kind of amazed at the income we're getting from the woodlot. I never suspected there was that much in it."
- ▶ "There are low-input costs for the woodlot, unlike the cash crops. Trees reseed themselves and don't need to be cultivated, fertilized or sprayed with pesticides."
- ▶ "Woodlot product prices tend to remain more stable than for field crops. You know Brazil isn't going to flood the market for firewood. We basically set our price."

WOODLOT AND CROPLAND ECONOMIC ANALYSIS

- ▶ the Barries' operation was one of 8 studies comparing woodlot and crop rotation scenarios
- ▶ total revenues and costs/acre were calculated for each harvest year using using the outcome from forest operations and generic crop enterprise budgets
  - ▶ present value revenue and costs/acre were determined for each crop rotation or forest product at various interest rates – present value costs were subtracted from the revenue to determine the **Net Present Value** per acre (NPV)
  - ▶ crop rotation
    - ▷ 1/3 corn, 1/3 soybean and 1/3 wheat annually and utilizing OMAFRA crop enterprise budgets reflective of industry average costs and returns (variable and fixed)
  - ▶ 1977–2003, $/acre: Woodlot NPV: $6,292. Agriculture NPV: $2,927 = $3,365 more revenue for the wooded portion of the farm than cropland for the 26-year period

For more information about this and related case studies, see www.huronstewardship.on.ca

*RESULTS, WOODLOT & CROPLAND ECONOMIC ANALYSIS COMPARISON, 1997–2003**

- ▶ results showed **$3,365** more revenue for the wooded portion of the farm than cropland for the 26-year period
  - ▷ Woodlot NPV ($/acre) = $6,292
  - ▷ Agriculture NPV ($/acre) = $2,927
- ▶ timber sales – $3,225/acre
- ▶ fuelwood sales – $599/ac
- ▶ maple syrup sales – $2,468/ac

* *Note:* All dollars expressed in 2003 dollars, a 5% compound interest rate and on a per-acre basis.

"Working in the woodlot is not time-critical. Unlike field crops where there is a narrow window for planting or harvest, you can operate in your woodlot from early November to March, whenever you have time."

– George Barrie

"Hire a consultant to help decide which trees should be cut and to get competitive bids. Competitive bids gave us a price range – in one year, the bid range was from $24,600 to $38,570."

– Sandy Barrie

BMPs FOR FUELWOOD PRODUCTION

The income in-kind value of fuelwood cut and burned on farms in Ontario is greater than any other crop harvested and consumed at home. In addition, sales of fuelwood have increased as consumer demand continues to place greater demands on farm woodlands to supply it.

Many timber harvesting operations produce a significant volume of fuelwood as a secondary benefit. Fuelwood harvesting in most woodlots can have a positive impact on woodlot management if carefully planned and properly executed.

Harvesting the low value, low quality trees for sale as fuelwood can:

- ▶ improve growing conditions for the remaining valuable crop trees
- ▶ improve growing conditions for regeneration
- ▶ increase the diversity of tree species in the woodlot
- ▶ improve the health and vigour of the woodlot
- ▶ enhance forest sustainability
- ▶ produce better quality, more valuable timber in the future
- ▶ open a market for low quality wood that may be impossible to sell as sawlogs.

HEATING VALUE OF NATIVE SPECIES OF WOOD

HEAT VALUES	TREE SPECIES	BRITISH THERMAL HEAT UNITS (BTUs)
HIGH HEAT VALUES (26,200,000–32,000,000 btu per air-dried cord)	Rock Elm	32.0
	Ironwood	31.2
	Shagbark Hickory, White Oak	30.6
	Bitternut Hickory, Bur Oak	29.2
	Sugar Maple	29.0
	Beech	27.8
	Red Oak	27.3
	Yellow Birch	26.2
MEDIUM HEAT VALUES (21,700,000–25,000,000 btu per air-dried cord)	White Ash	25.0
	White Elm	24.5
	Red Maple, Tamarack	24.0
	Black Cherry	23.5
	White Birch	23.4
	Red Elm, Green Ash	22.1
	Silver Maple	21.7
LOW HEAT VALUES (15,500,000–19,300,000 btu per air-dried cord)	Largetooth Aspen	18.2
	Hemlock	17.9
	Trembling Aspen	17.7
	Butternut	17.4
	White Pine	17.1
	Basswood	17.0
	White Cedar	16.3
	White Spruce	16.2
	Balsam Fir	15.5

Ironwood offers high heat value.

White Ash has medium heat value.

Basswood has low heat value.

As a general rule, the following trees should be removed from a hardwood woodlot for fuelwood.

Diseased, dead and dying trees – leave an appropriate number of snags and cavity trees.

Trees with weak forks.

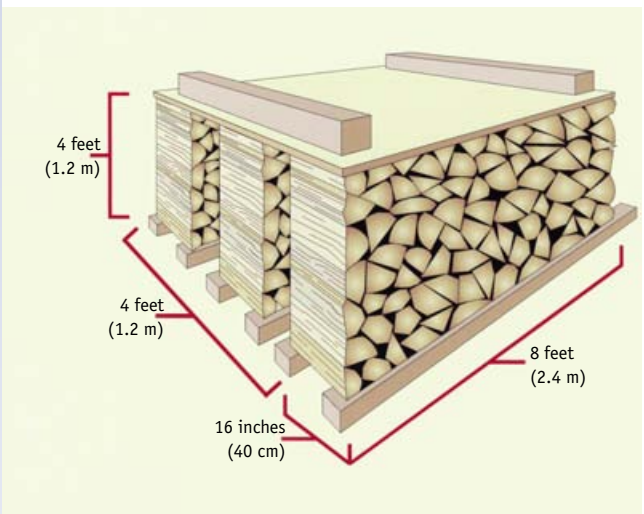
Weed trees such as Ironwood – leave some for edge protection, wildlife such as grouse, and diversity.

Wolf trees (large-crowned, short-boled trees) – consider leaving the occasional wolf tree for wildlife habitat.

Trees that have been overtopped by others with seriously stunted growth.

Crooked or leaning trees.

Firewood should be sold by the standard cord (4 x 4 x 8 ft or 1.2 x 1.2 x 2.4 m) or fraction thereof (such as half cord or quarter cord). Sale of firewood by other units of measurement is illegal.



Wood cut and split during the fall and winter and piled in the open in the spring should be well-seasoned for burning the following winter. Some species such as Hickory and Oak benefit from additional seasoning. Fuelwood should be covered to protect it from the rain while drying.

BMPs FOR SUGAR BUSH MANAGEMENT

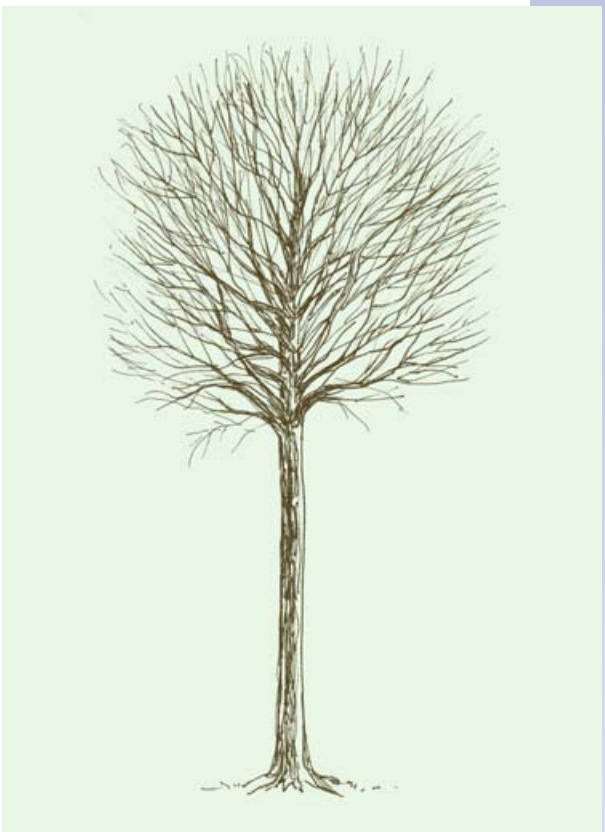
There are two key activities in sugar bush management that contribute to the overall productivity, health, sustainability and profitability of the operation:

- ▶ thinning to develop and improve the sugar bush for maple sap production
- ▶ tapping to maintain tree health and improve sap production.

What makes a tree a "crop tree" depends on the landowner's objective(s).

IDEAL MAPLE SYRUP TREE

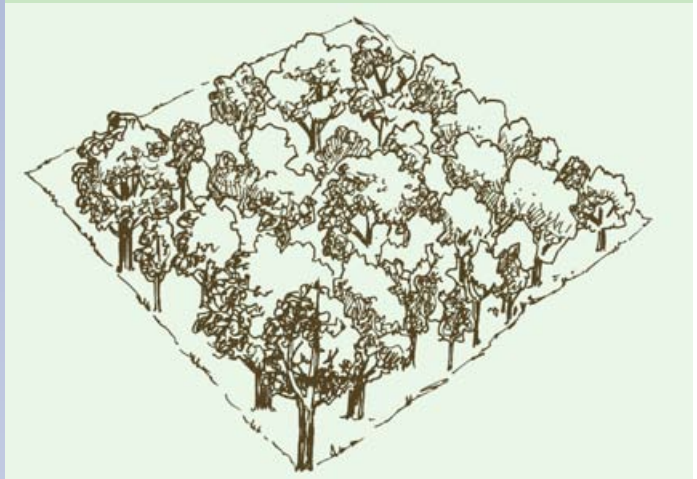
- **Sugar or Black Maple**
- **Larger healthy crown**
- **Trunk shape not as important**
- **Sweeter sap compared to non-crop tree**



IDEAL TIMBER TREE

- **Smaller crown**
- **Long straight trunk with little taper**
- **Trunk free of all defects**
- **Multiple species – not just Maple**

YOUNG SUGAR BUSH

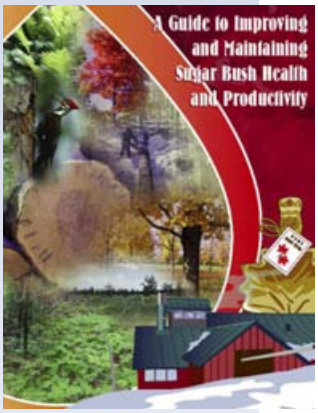


YOUNG SUGAR BUSH AFTER THINNING

TO DEVELOP THE YOUNG SUGAR BUSH IN PREPARATION FOR TAPPING

- **choose approximately 250 crop trees of 15–25 cm DBH per hectare (100 crop trees of 6-10 in. DBH per acre)**
- **try to select one every 6–7.6 m (20–25 ft)**
- **remove neighbouring trees around each crop tree**
- **create openings around the crop trees of 1.8–3.0 m (6–10 ft)**
- **depending on the growth response after thinning, thin every 5 to 10 years.**

For much more information on sugar bush management, see *A Guide to Improving and Maintaining Sugar Bush Health and Productivity,* produced by the Ontario Ministry of Agriculture, Food and Rural Affairs and partners.



Crop tree selection in the tapped sugar bush

✔ Select trees that are currently good producers.

✔ Select young, vigorously growing Maple trees that will add to the productivity of the sugar bush as soon as they reach tappable size.

✔ Select healthy trees with large crowns.

✔ Retain edge trees – do not thin trees heavily around the borders of the stand as they form an effective windbreak and help stop the movement of invasive and weed seeds into the stand. Their presence also reduces the negative impact of drying winds in the interior of the woodlot.

Trees to remove in improvement harvests

► over-mature, or diseased and defective Maples that are no longer producing well
► low producers – trees producing sap with a sugar content less than 1° Brix
► trees of other species, particularly those that are crowding Maple crop trees
► trees that are a safety hazard

Note: Some maple syrup producers prefer to retain some non-producing species for various reasons (e.g., timber or fuelwood), and this is an option each producer must evaluate when planning an improvement harvest. Retaining other species contributes to diversity but their presence in the overstory of a producing sugar bush may reduce the overall potential of the stand to produce sap.

Managing the tapped sugar bush

The management of a tapped sugar bush involves a continuous program of thinning so that a high sustained yield of sweet sap is obtained.

- ✔ Select individual trees as crop trees. Remove unwanted competing trees individually.
- ✔ Review management options, according to woodlot size. You'll have more options for larger stands; fewer for smaller stands or stands that are overmature and declining.
- ✔ Avoid heavy thinning (reducing BA below 20 m^2/ha [87 ft^2/ac] or removing more than one-third of the original BA).
- ✔ Schedule thinnings at intervals of 10–15 years; this may coincide with a tubing system upgrade.
- ✔ Set a target: a well-managed sugar bush should have a target of 170–220 tap holes per hectare (70–90 tap holes per acre).
- ✔ Thin before trees reach their maximum height to reap maximum benefits from thinning.

In healthy trees, a tap hole will cover over in two to three years. In slow-growing unhealthy trees, it could take many more years.

Tapping Maple trees to maintain tree health and improve sap production

Improper tapping can seriously damage trees, reduce longevity, and decrease sap yields. It should take two to three years for healthy fast-growing trees to cover over 11-mm ($^7/_{16}$-in.) diameter tap holes resulting from use of the traditional spout.

If trees are healthy and showing relatively fast growth, follow the "normal" tapping guideline (see below). If trees are unhealthy, damaged or slow-growing, producers should follow the Conservative Tapping Guideline.

The number of tap holes drilled in a tree each year depends on the diameter of the tree, the state of its health, and operator preferences. Some producers follow conservative guidelines for tapping regardless of tree health.

Tap the trees when the temperature is near or above freezing to reduce cambial damage.

NORMAL TAPPING GUIDELINE FOR HEALTHY TREES

TREE DIAMETER INCHES	(cm)	TAP HOLES PER TREE INCHES
less than 10	(>25)	0
10–14	(26–35)	1
15–19	(36–50)	2
20–24	(51–60)	3
larger than 25	(>60)	3

CONSERVATIVE TAPPING GUIDELINE FOR UNHEALTHY, STRESSED TREES

TREE DIAMETER INCHES	(cm)	TAP HOLES PER TREE INCHES
less than 12	(<30)	0
12–18	(31–45)	1
Greater than 18	(>45)	2

Inoculating shiitake mushrooms.

Inoculated oak bolts in forest.

Forest herb production (wild ginseng).

Harvest-ready shiitake mushrooms.

BMPs FOR SPECIALTY PRODUCTS

Forest farming and gathering

Forest farming practices can be used by woodland owners to grow specialty non-timber forest products, to supplement family income and to encourage biodiversity. Similarly, specialty forest products can be gathered from woodland trees (Cedar boughs, White Pine tips) and plants – irrespective of their value as wood.

In forest farming, high-value specialty crops are grown under the protection (shade and micro-climate) of a forest canopy that has been managed to provide preferred shade levels.

Crops like ginseng, shiitake mushrooms and decorative ferns are sold for medicinal, culinary or ornamental uses. It's a form of double-cropping (like strawberries and peaches): you can generate an annual income while crop trees are being grown for wood products.

Here are some general BMPs for farm forest products.

✔ Manage a small area (<3 ha or 7 ac) intensely to produce multiple crops simultaneously.

✔ Alter the amount of light in the stands by thinning, pruning or adding trees.

✔ Intercrop existing stands of trees with annual, perennial or woody plants. Compatibility among understory and overstory plants and cultural methods is essential.

Before investing time and money in growing a specialty forest product:

▶ obtain production and processing information
▶ locate a source of technical expertise
▶ locate or develop potential markets
▶ prepare a market analysis and business plan (essential!) before starting an enterprise.

Benefits – economic and social

Some products, especially medicinals and botanicals, can have tremendous economic value, while others provide a lower but steady supplemental income.

For example…

▶ Forest-cultivated ginseng averages $44–$88 per 100 g ($200–$400/lb), depending upon how closely the product resembles wild ginseng.

▶ A cord of stovewood worth $50–$100 can produce $500 worth of shiitake mushrooms. Retail prices at time of printing range from $2–$2.65 per 100 g ($9–$12/lb).

▶ Markets for floral decoratives have been steady or increasing.

Forest farming provides opportunities to generate short-term income from existing woodlots, with minimum capital investment. This can contribute significantly to rural economic development and diversification, especially on small family farms.

Woodland gathering

Not all non-timber forest products are cultivated. Plant materials can be pruned from growing trees. If managed properly, and sustainably, this can be done year after year.

Cedar boughs can be harvested for oil production. Care must be taken to ensure that the crown is not over-pruned.

Cedar boughs

Cedar boughs are harvested for cedar leaf oil and for floral use. Production for cedar leaf oil is seasonal while production for floral use can be year-round.

Open-grown young trees with deep crowns are best for bough production.

Harvesting Cedar boughs will not jeopardize the health of trees, unless over 50% of the live crown height is removed. Harvesting of boughs from a young tree can continue for years as the tree grows in height.

Ground Hemlock

Ground Hemlock is a small evergreen shrub that is attracting international attention for its cancer-fighting agents. It grows in upland mixedwood and tolerant hardwood cover types – usually in rich, moist woodlands with a mix of hardwoods and softwoods. It has low, spreading branches 50–100 cm (20–40 in.) long, but can sometimes grow to 200 cm (6.5 ft) or more.

Buyers are interested in the last few years' growth, which extends back about 15 cm (6 in.) from the tip. By only collecting the new growth, you can usually harvest the plant in another four to five years. August to April is the best time to harvest.

The green growth of ground Hemlock contains cancer-fighting chemicals. Only the top 15 cm (6 in.) of the growing tips is harvested to sustain growth.

BMPs FOR MANAGING OLD-GROWTH CHARACTERISTICS AND WILDLIFE

Old-growth forests were common in undisturbed forests that existed throughout southern Ontario prior to the mid 1700s. Today, only a few old-growth forests remain in Ontario.

Old-growth forests provide important habitat for many species of plants and animals. Many of the management recommendations used in Ontario have been developed from guidelines for maintaining both wildlife populations and old-growth characteristics.

Many landowners want to promote wildlife and/or restore or maintain some of the characteristics of old-growth forests in their woodlot. The illustration on the next page describes the important habitat characteristics for wildlife in old-growth forests, and what you can do to promote them in your woodlot.

One of the telling features of old-growth forests are the super-canopy trees – like White Pine in the Temagami region.

Old-growth forests have thick layers of ground plants: mosses, fungi, ferns, shrubs and trees as well as thick layers of decomposing leaves and twigs.

Canopy gaps are small holes that allow light to reach the forest floor and permit trees to regenerate to form an uneven-aged stand with a variety of size classes and multiple canopy layers. To be effective, create a number of canopy gaps in your forest: >10 m (33 ft) wide (by opening 1–2% of forest canopy).

Old/large trees with >50 cm (20 in.) DBH will help create old-growth forests. Leave 27 trees/ha (9 trees/ac) and BA of 7 m^2/ha for 50+ cm.

Pits and mounds form when large trees are uprooted and mineral soil is exposed. They offer the diversity needed by some tree species to germinate.

OLD-GROWTH FOREST AND WILDLIFE HABITAT

Retain trees with stick nests that are currently or have historically been used by large raptors (Hawks, Eagles, Osprey, Owls).

Leave snag trees for wildlife habitat. Pileated Woodpeckers require cavities of about 10 cm (4 in.) in diameter for roosting or nesting.

SUPER CANOPY TREES/ISOLATED CONIFERS. They are landmarks, nesting/resting sites for birds, and refuges for bear cubs. Keep tall trees such as White Pine that reach beyond the canopy.

DECAYING WOOD. Provide habitat for many species, including Woodpeckers, Ruffed Grouse, reptiles, amphibians, and invertebrates. Allow logs and branches to decay naturally on the forest floor – leave at least 10 fallen logs/ha (4 logs/ac).

CAVITY TREES/SNAGS. Up to 25% of the wildlife in forests use cavities for rearing young, roosting, escaping predators or hibernating, e.g., Saw-Whet Owl, Flying Squirrels. Retain 6 cavity trees/ha (2–4/ac) with >25 cm (10 in.) DBH. If not available, leave trees that are declining and should become cavity trees eventually.

MAST TREES. Up to 25% of wildlife species – including Black Bear, Wild Turkey, Ruffed Grouse – eat fruit and nuts from trees. Leave trees that produce edible fruit and nuts such as Oak, Black Cherry, Basswood, Beech, Butternut, Black Walnut, Hickory and Ironwood. Retain 7–8 mast trees/ha (2.8–3.3/ac), preferably with a DBH of >25 cm (10 in.) and with large crowns.

Rodent control may be necessary when establishing tree cover.

BMPs for mitigating wildlife damage in agricultural areas

Wildlife is an important and necessary part of a healthy and sustainable landscape. However, some species like Deer, Black Bear, Wild Turkey, Coyote and Raccoon have dramatically increased in numbers over the past few decades. This can result in many conflicts with farmers who in most cases must pay both the direct cost of the damage as well as the cost of any abatement measures.

Although nuisance wildlife species are not welcome on many farms, there are a number of other species that provide substantial benefits to rural landowners. Species like Red Fox, Red-Tailed Hawk and Great Horned Owls are predators that help control rabbit, mice and vole populations. Swallows and other songbirds help control insect populations in crop fields. Other species such as Cardinal, Ruffed Grouse and Red Squirrel have little or no impact on farm operations.

Additional information and reference material on reducing negative impacts of wildlife are available from:

Ontario Soil and Crop Improvement Association
http://www.ontariosoilcrop.org/
Telephone: 519-826-4214
Fax: 519-826-4224
Email: oscia@ontariosoilcrop.org

Also consult references in Infosheets #22 and #23 of the Environmental Farm Plan, 3rd ed. and the BMP book, *Fish and Wildlife Habitat Management.*

Careful placement of forest trails and access points can help reduce the potential for serious site damage.

BMPs FOR MULTIPLE USES

Other forest values

Forests have many values other than timber, including wildlife habitat, mushroom and berry picking, medicinal plants, and recreational uses ranging from hiking, skiing and horseback riding to hunting and trails for ATVs.

Use these BMPs to maximize the enjoyment and protection of your woodland.

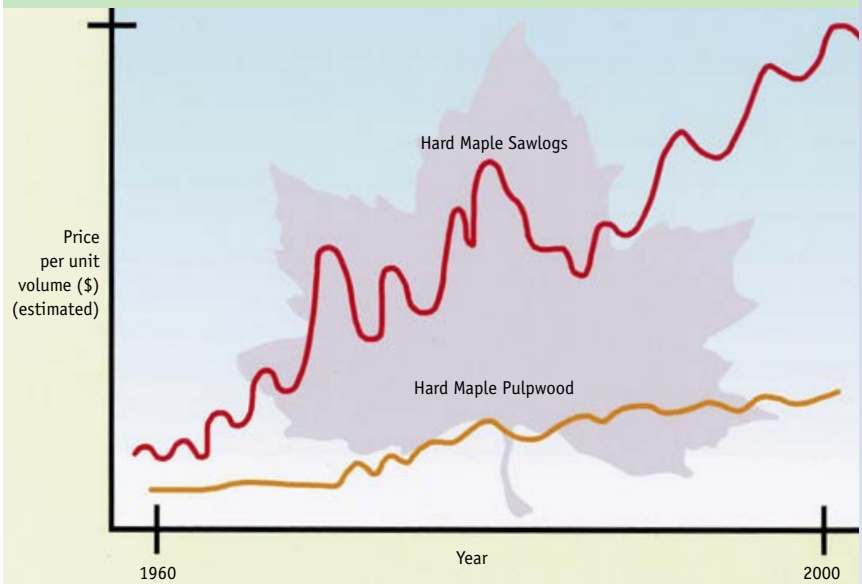
- ✔ Limit the number of trails through your woodlot. Forest access is important, but too many trails, ATVs, access roads, horses and even people compact the soil, trample vegetation, erode streambanks and disturb nesting wildlife. If streams or wetlands must be crossed by trails, limit crossings to one place, cross at right angles and consider installing a culvert or bridge.
- ✔ Be sensitive to other forest values. Responsible forest managers promote a variety of forest uses. Be aware that chainsaws, ATVs, power equipment and loose cats and dogs do impact wildlife, especially nesting birds.
- ✔ Leave some behind. When picking wild leeks, berries, mushrooms etc., leave some behind as a seed source and food for wildlife. Native ginseng has already been over-picked in southern Ontario and is now an endangered species.

- ✔ Use some revenues from forestry operations or tax rebates to work on wildlife or silvicultural projects.
- ✔ Avoid nailing signs and tree stands to trees. Nails damage trees, and are also a hazard when trees are cut or milled. There are many tree stands on the market that chain to a tree, preventing long-term damage.
- ✔ Maintain diversity. A variety of tree and shrub species provides:
  - ▶ more diverse current and future economic opportunities
  - ▶ better resilience of the forest to storms, disease and insects
  - ▶ food and shelter for more wildlife species.
- ✔ Use inventories and tree marking. Tree marking by a certified tree marker is the first step to ensuring a healthy residual stand. Traditional forest harvesting methods such as high-grading and diameter limit cuts are not only poor for future timber sales and productivity, but they also hurt recreation, hunting, wildlife habitat, and aesthetic potential.

BMPs FOR WOODLAND TYPES

In the previous section, we looked at general best management practices for woodland products. In this section, we present BMPs for forest management according to the species, composition, age, stand condition and site type of the major forest cover types discussed in the previous chapter. We'll work through each of the working groups listed in the chart on page 36.

TREND IN SAWLOG AND PULPWOOD PRICES FOR HARD MAPLE, 1960–2000



The market for good quality Maple sawlogs and veneer logs has been growing steadily over many years. High quality veneer logs have sold for $4–6 per board foot. A 36-in. 10-ft log could be worth as much as $3,000 (veneer only) at those prices!

TOLERANT HARDWOODS WORKING GROUP

BMPs FOR TOLERANT HARDWOODS AND HEMLOCK USING OPTIMUM BASAL AREA

AVERAGE DIAMETER OF 0–9 CM (0–3.5 in.)

✔ Allow stand to develop.
✔ Keep any overstory trees to enhance stand and structure.
✔ Protect the understory and the growth of tolerants.
✔ Prevent weed species from invading.

AVERAGE DIAMETER OF 10–24 CM (4–9.5 in.)

✔ Choose a crop tree every 6 metres (20 ft)
- crop trees should have clear, straight stems, no defects or disease, and broad, healthy crowns with good canopy positions.

✔ Release it on 2–3 sides.

AVERAGE DIAMETER OF >24 CM (9.5 in.)

✔ Thin stand and convert to uneven-aged management when BA is >26 m^2/ha (110 ft^2/ac).
✔ Convert from even to uneven by:
- cutting small gaps in the stand, generally around tree height in diameter, to promote new regeneration
- length of cutting cycle will depend on several factors, including marketable timber yields, contracted or landowner harvest, size of stand, and intensity of harvest
- cutting gaps in areas of larger woodlot over several harvests, starting with the removal of poorest quality stems first.

Management options for tolerant hardwoods depend on whether the stand is even- or uneven-aged.

Sapling size class in tolerant hardwoods.

Polewood size class in tolerant hardwoods.

Tolerant hardwoods are composed of hardwoods such as Sugar Maple, Beech, White Ash and Basswood with inclusions of Hemlock, White Pine and Black Cherry.

Mature age class in tolerant hardwoods.

Overmature age class in tolerant hardwoods.

Many tolerant hardwoods in southern Ontario are even-aged. The preferred age distribution is *all-aged* or uneven-aged. A mix of defective and merchantable logs is removed to encourage the regeneration of seedlings and the growth of young trees with potential.

Even-aged stands contain one 20-year age class, and all trees are generally the same size. A second age class may also be present, e.g., a mature canopy and a layer of young saplings.

Uneven-aged or all-aged stands contain three or more age classes, and a wide range of size classes. Uneven-aged management is preferred over even-aged management as harvests can be made more frequently, and stands are generally more attractive for recreation and wildlife.

If you want to encourage mid-tolerant species (Oak, Ash, Hickory, White Pine), use group selection to create openings and promote regeneration.

To retain uneven-aged structure, thin the stand with improvement cutting. When BA > 26–28 m^2/ha (110–120 ft^2/ac), remove one-third of the BA, removing undesirable growing stock or UGS stems from all diameter classes.

Most stands in southern Ontario could be harvested periodically every 10–20 years, depending on location, local climate, site quality, marketable yields and past management practices.

Well-managed uneven-aged stands have a wide age-class distribution that includes seedlings, saplings, polewood and mature trees.

Note: the above approach works best when conditions are most suited to commercial harvest practices. This approach may not be suitable for small inaccessible stands with trees in poor condition.

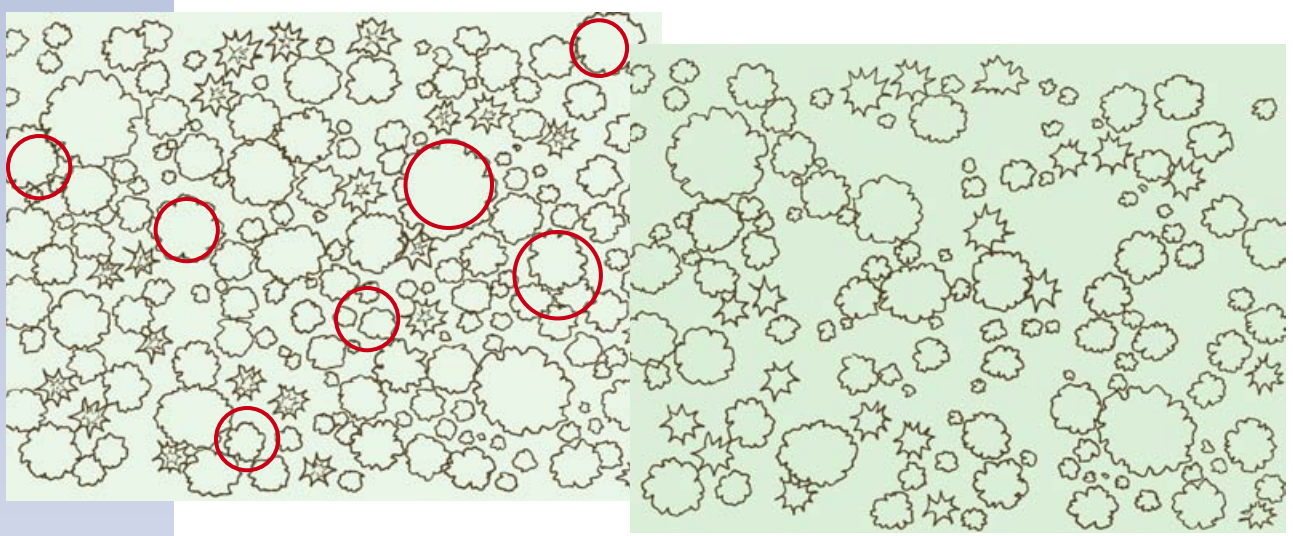
When planning an improvement cut where most of the stems to be removed are defective, include a few trees of commercial value to make the harvest operation more economically viable to the landowner and the operator.

The interval between cuts can be reduced to 7–15 years (instead of 15–30), depending on soils, climate, stand condition and approach. Staged over time, more cuts can be made to harvest sawlogs.

Crop tree selection is another approach to stand improvement. Crop trees can be selected using the following criteria:

- commercially valuable – desirable species
- straight boles or trunks
- defect-free trees
- well-shaped crowns.

Create spacing of 20 feet between crop trees with a series of improvement cuts for polewood stands and commercial cuts for stands with more marketable timber.



This illustration depicts the effect of thinning a woodlot using the crop tree approach. Undesirable and marketable trees (indicated by red circles) are removed to provide space for the crop trees.

UPLAND MID-TOLERANT WORKING GROUP

UPLAND MID-TOLERANT OVERVIEW

SPECIES COMPOSITION	SHADE TOLERANCE	SITE TYPES	STAND AGE*	SILVICULTURAL SYSTEM
• Red Oak, White Ash, Bitternut Hickory White Oak, Bur Oak, Pignut Hickory, Black Walnut, Butternut Black Cherry • May also include: Maple, Basswood, Shagbark Hickory, Red Maple, Beech and Largetooth Aspen	• Dominated by intermediate and intolerant species • Some shade-tolerant species	• Mostly found on well to imperfectly drained (fresh to moist) loamy sites – also sandy loams to clay loams	• Even-aged	• Shelterwood system – group and uniform system • Group selection

* Stand age and condition determine whether the stand is mature and ready for harvest and regeneration.

Upland mid-tolerant hardwoods are composed of valuable hardwoods with intermediate shade tolerance requirements. These stands are also known as Oak-Ash-Hickory types – commonly found in the Carolinian zone (Site Region 7E).

IF THE STAND IS LESS THAN 60 YEARS OLD	
MANAGEMENT ACTION	**BMP FOR UPLAND MID-TOLERANT SPECIES**
IF THE UNDERSTORY IS NOT PREDOMINANTLY SHADE-TOLERANT	✔ Thin stand using crop tree management (improvement cut). ✔ Choose a crop tree every 6 metres (20 ft) and release it on 2 or 3 sides. ✔ Choose trees with straight stems, no defects or diseases, large healthy crowns and good canopy positions. ✔ Make several improvement cuts until you achieve desired results.
IF THE UNDERSTORY IS PREDOMINANTLY SHADE-TOLERANT (i.e., contains Maple and Beech)	✔ Use group selection techniques. Or, ✔ Reduce the number of improvement cuts to reach desired spacing for crop trees so as to encourage regeneration of intermediates. ✔ Harvest in dry conditions (late summer or early fall) to promote scarification.
IF THE STAND IS GREATER THAN 60 YEARS OLD (60-80 YRS), IT MAY BE READY FOR HARVESTING AND REGENERATION	
IF BA >12 m^2/ha (52 ft^2/ac)	✔ Use shelterwood system. ✔ Remove overstory (gradually) in a series of harvests. ✔ Use a prep cut to remove undesirable (non-target) species, e.g., Maple and Beech. ✔ Release seed trees. Twenty years later, remove defective, smaller trees and open canopy to 50% canopy closure. ✔ Once regeneration is established, remove the canopy to release the new saplings, usually once regeneration is 4.6–6 metres (15–20 ft) tall.
IF BA <12 m^2/ha (52 ft^2/ac)	✔ Use group selection to create larger openings around mature trees.

In 2005, in some areas, Oak sold for as much as $1.20–$2.00 per board foot (veneer logs at roadside).

Upland mid-tolerant stands often originate from heavy partial cutting in a farm woodlot.

Group selection in mid-tolerant hardwood stands involves small areas of merchantable and lower quality trees being harvested to encourage regeneration of trees with low shade tolerance.

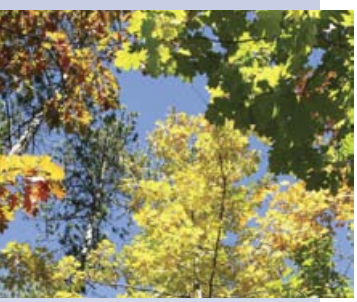
The shelterwood system – where the overstory is removed in a series of harvests – is recommended for mid-tolerant woodlots with a high basal area.

UPLAND MIXEDWOOD WORKING GROUP

UPLAND MIXEDWOOD OVERVIEW

SPECIES COMPOSITION	SHADE TOLERANCE	SITE TYPES	STAND AGE*	SILVICULTURAL SYSTEM
• White Pine, Red Oak, Red Pine, Red Maple, White Birch, White Ash, Hard Maple • Also Hemlock, Trembling Aspen, Largetooth Aspen, Jack Pine	• Dominated by intermediate and intolerant species • Some shade-tolerant species	• Mostly found on rapidly to imperfectly drained (dry to fresh) sandy sites or on shallow to bedrock (ridge sites)	• Even-aged • Fire-origin from 100 years ago	• Shelterwood system – group and uniform system • Group selection

* Stand age and condition determine whether the stand is mature and ready for harvest and regeneration.



Most upland mixedwoods originate from severe fires that followed historic Pine harvests.

Upland mixedwoods are composed mostly of White Pine, Red Pine, Red Oak and Red Maple with an assortment of other hardwoods and softwoods.

IF THE STAND IS LESS THAN 80 YEARS OLD	
MANAGEMENT ACTION	**BMPs FOR UPLAND MIXEDWOOD**
THIN STAND USING CROP TREE MANAGEMENT	✔ Choose a crop tree every 6 m (20 ft) and release it on 2 or 3 sides. ✔ Choose crop trees with straight stems, no defects or diseases, large healthy crowns and good canopy positions.
IF STAND IS PREDOMINANTLY PINE	✔ Use a density management diagram for natural Pine stands just like for Red Pine stands.
IF THE STAND IS GREATER THAN 80 (80–100 YRS)*	
IF BA IS >12 m^2/ha (52 ft^2/ac) WITH OAK AND PINE	✔ Use shelterwood silvicultural system. ✔ Remove the overstory in a series of harvests. ✔ Start with a preparatory cut, remove unwanted (undesirable or non-target species), e.g., Poplar and Birch (including Yellow Birch) and release seed trees. ✔ Remove defective, smaller trees and open up the canopy to 50% after 20 years. ✔ Once regeneration is established, remove the canopy to release the new saplings, (usually when regeneration is 4.6–6 m (15–20 ft) tall.
IF BA IS <12 m^2 (52 ft^2/ac) WITH OAK AND PINE	✔ Use group selection to create larger openings around mature trees.

* This varies with soil, site and climate. In most cases this applies to younger stands in southwestern Ontario.

Shelterwood cuts are recommended for stands that consist mostly of Pine and Oak. This encourages the maintenance of Oak and Pine in the understory.

EARLY SUCCESSIONAL WORKING GROUP – BIRCH AND ASPEN

EARLY SUCCESSIONAL OVERVIEW

SPECIES COMPOSITION	SHADE TOLERANCE	SITE TYPES	STAND AGE	SILVICULTURAL SYSTEM
• Trembling Aspen, White Birch and Black Cherry • Other common species may include mid-tolerant species, White Pine, Elm, Green Ash	• Dominated by intolerant species	• More prevalent on sandy to loamy soils, shallow sites, rapid to well-drained (dry to fresh sites)	• Even-aged	• Clearcut and shelterwood system

Poplar/Birch or intolerant hardwoods are often found in old fields or on forest sites with a history of regular disturbances such as fires and clearcut harvests.

Some areas of Ontario have relatively low amounts of *early successional forest*. In recent years, the demand for good quality Birch logs has grown.

Clearcutting mature Poplar/Birch stands is a sound management choice if you want to encourage shade-intolerant species such as Poplar, Birch and Black Cherry.

IF YOUR STAND IS 10–40 YEARS IN AGE	
MANAGEMENT ACTION	**BMP**
THIN TO MAXIMIZE GROWTH AND RELEASE BEST STEMS EVERY 10TH, 20TH AND 30TH YEAR FOR MAXIMUM GROWTH	✔ Through thinning maintain a density of 2,500, 1,250 and 625 stems/ha (1,000, 500 and 250 stems/ac). ✔ Avoid damaging remaining stems. Poplar and Birch are susceptible to infection.
IF YOUR STAND IS 40–80 YEARS OLD	
MONITOR FOR FOREST DECLINE. POPLAR AND BIRCH DECLINE RAPIDLY AT THIS AGE	✔ Harvest if necessary. Harvest when losses from mortality and decay become unacceptable.
IF YOUR STAND IS OVER 80 YEARS OLD	
CLEARCUT TO KEEP IT IN EARLY SUCCESSIONAL STAGE, OR GRADUALLY REMOVE THE OVERSTORY TO RELEASE ADVANCED GROWTH OF TOLERANT AND MID-TOLERANT SPECIES	✔ Clearcut to promote root suckering and full light for maximum growth. ✔ Favour tolerant hardwoods if present. ✔ Don't open up canopy too fast, or Poplar/Birch will seed in and out-compete other seedlings. ✔ Retain pockets of Poplar/Birch in the stand. Cut canopy gaps up to two tree heights in diameter. Cut Poplar and Birch to promote root suckering.

LOWLAND HARDWOOD WORKING GROUP

LOWLAND HARDWOOD OVERVIEW

SPECIES COMPOSITION	SHADE TOLERANCE	SITE TYPES	STAND AGE	SILVICULTURAL SYSTEM
• Soft Maple (Silver, Red or Silver/Red cross), Green Ash, Black Ash, White Ash, Shagbark Hickory • Cedar, Balsam Fir, Basswood, Cherry, White Elm, Yellow Birch	• Dominated by shade-tolerant and mid-tolerant species	• Mostly found in poorly to very poorly drained (moist to wet) deep sites	• Generally even-aged but may be uneven-aged	• Selection system

Lowland hardwoods, consisting of Ash and Soft Maple, are found in treed swamps and poorly drained woodlots adjacent to swamps.

Lowland hardwoods, while not as economically valuable as other working groups, are an important part of our landscape.

Lowland hardwoods are more suited to selection systems where improvement cuts are staged over several harvest operations.

Lowland hardwood woodlots have their own unique management challenges. Many sites are associated with water features and may be diverse in species and excellent in productivity, but are on fragile sites that require extra caution. Manage in the same manner as you would a tolerant hardwood stand.

- ✔ Be cautious when working on moist soils – operations are limited when the ground is soft.
- ✔ Focus management activities on better drained sites, if possible.
- ✔ Don't over-harvest. Removing too many trees may cause a rise in the water table, possibly killing the remaining trees.
- ✔ Overharvesting may also promote windthrow, as many lowland hardwood trees are shallow-rooted.
- ✔ Cut stumps low and avoid excessive damage as coppice regeneration is important in swamps.

WHITE CEDAR AND LOWLAND MIXEDWOOD WORKING GROUP

WHITE CEDAR AND LOWLAND MIXEDWOOD OVERVIEW

SPECIES COMPOSITION	SHADE TOLERANCE	SITE TYPES	STAND AGE	SILVICULTURAL SYSTEM
• White Cedar, Tamarack, Balsam Fir, White Spruce, Balsam Poplar, White Birch, Trembling Aspen	• Dominated by intolerant and tolerant species	• Poorly drained (moist to wet sites) – predominantly on loamy sites	• Usually even-aged	• Selection, shelterwood and clearcut

Lowland mixedwoods are more suited to selection systems where improvement cuts are staged over several harvest operations.

IF STAND IS 50–80 YEARS OLD	
STAND CONDITIONS	**BMPs FOR WHITE CEDAR AND LOWLAND MIXEDWOODS**
BA >44 m^2/ha (190 ft^2/ac)	✔ Reduce BA to 30 m^2/ha (130 ft^2/ac) by reducing the BA by one-third. ✔ Remove stems that are in multiple clumps, forked stems, stems with poorly developed crowns. ✔ Mark to release healthy single stems of above-average diameter with healthy crowns and canopy position.
IF STAND IS MATURE – 80–120 YEARS OLD	
IF THE STAND AREA IS >4 ha (10 ac)	✔ Remove Poplar and White Birch 10 years prior to planned Cedar harvest to: • reduce the likelihood they will reproduce in the Cedar stand • control other species (e.g., Birch) to avoid poor Cedar regeneration.
IF THE STAND AREA IS <4 ha (10 ac)	✔ Use shelterwood system to regenerate the stand. ✔ Reduce BA to 14 m^2/ha (60 ft^2/ac) in first cut of shelterwood. ✔ Mark trees to retain the highest quality trees with the largest crowns (best seed source). ✔ Once new Cedar regeneration is established, remove remaining trees (before regeneration is >3.1-m [10-ft] tall).
USE PATCH CLEARCUT ON STANDS <10 ha (25 ac)	✔ Cut 100 x 100-ft blocks to allow new regeneration to seed in.
USE STRIP CLEARCUT ON STANDS >10 ha (25 ac)	✔ Cut blocks 18x75 m (60x250 ft) to allow new regeneration to seed in.

White Cedar forms pure stands on shallow limestone soils in eastern Ontario and the Bruce Peninsula. Mature White Cedar stands can be difficult to maintain.

The demand for White Cedar lumber has been growing in some parts of Ontario.

White Cedar can be found growing in association with Tamarack, White Spruce, and shade-intolerant hardwoods on some lowland sites.