

BMPs FOR AFFORESTATION

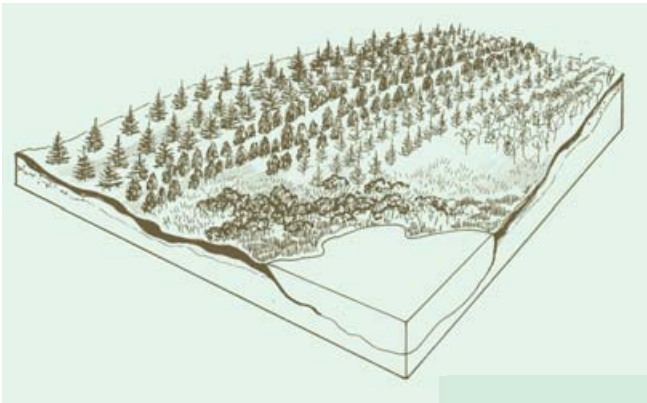
You can do many things with new trees in old farm field sites. This section will help you sort through the options to find what might work on your site, help you choose what to plant, and explain BMPs for plantings of conifers, as well as hardwoods and specialty trees.

Afforestation is the conversion of bare or cultivated land into forest. This term is often used interchangeably with *reforestation* which, technically speaking, is the restoration of a forest that has been removed by fire or harvest.



Agroforestry alternatives for open farm field sites include options for:

- creating new forest stands and adding to existing ones
- creating treed barriers
- growing crops between rows of trees
- pasturing livestock
- adding shelter to woodland areas
- establishing nut groves
- growing Christmas trees
- growing nursery stock.



Intensively managed, high-value plantations may be appropriate on more productive sites.

Plantations are quite suitable for marginal lands in agricultural southern Ontario.



AFFORESTATION OPTIONS



Bobolink nest in fencerows, hayfields and pastures.

As you learn more about the opportunities for replanting open farm fields, remember that your decisions should reflect:

- ▶ your objectives – often there will be more than one way to achieve your objectives
- ▶ the site you intend to plant – every site is different and any given site will usually support a range of species
- ▶ your resources – planting can require a considerable investment of time and money.

There are many types of plantations, from single species planted in a grid pattern to multiple species planted randomly. Each type has its advantages. See the following chart for help in choosing the type that will best help you achieve your objectives.



Open fields can be an aesthetically appealing part of the landscape.

AFFORESTATION OPTIONS

SPECIES

DESCRIPTION

PURE CONIFER
(1 species)



- timber production, Christmas trees
- easiest to manage
- may be more susceptible to disease and insect outbreaks
- high potential for economic harvest of timber products

PURE CONIFER
(2 or more species)



- timber production, Christmas trees
- more diversity – mixed stands may be better at withstanding varying environmental conditions
- lower yields of timber per unit area of individual species
- one species can provide cover and shelter to another
- easier to match species to local site conditions
- may be lower commercial yield of wood products
- potential for undesirable competition between species

MIXED CONIFER
AND HARDWOOD



- mixing of species with similar site and shade requirements
- conifers are easier to establish
- similar benefits to two or more conifer species
- lower potential for economic harvest of timber products
- more difficult to schedule thinning to benefit all species
- some species suppress others due to different growth rates

PURE HARDWOOD
(single or multiple
species)



- timber production, nut production
- hardwoods require more intensive management for successful establishment
- highest value of timber per unit area of desired species

MAPLE ORCHARD



- future maple syrup production
- easy access and tubing installation
- spacing can be controlled, promoting crown development
- can integrate with conifers and shrubs for protection
- established windbreaks or shelterbelts can protect the orchard

WILDLIFE
PLANTING



- mast trees, roost trees
- White Pine in a shelterbelt
- mixed canopy layers should benefit more species

NURSE CROP
PLANTING



- under-planting one species below another
- can supply a diversity of products – a crop of one species followed by a future tree crop

CHOOSING WHAT TO PLANT

Choosing the right species is a matter of selecting those that:

- ▶ are adapted to your open field conditions
- ▶ will grow to meet your objectives and provide you with the benefits you seek
- ▶ are available from a nursery in the quantity and at the price you want.

Not every species will be suited to the often extreme conditions for your open field planting site. Open field sites frequently have:

- ▶ full sunlight
- ▶ degraded soils
- ▶ high winds
- ▶ competition from other vegetation
- ▶ temperature and moisture extremes.

After you evaluate your site and determine your management objectives, you will probably find that there are a number of suitable species for your open field site. From these options, choose the species that is best and available.

When looking for nursery stock, keep these key concerns in mind. Are they:

- ▶ available when needed?
- ▶ available in the quantity needed?
- ▶ from a seed source adapted to the regional climate?
- ▶ the right stock type and quality?
- ▶ competitively priced?

NATIVES VS EXOTICS

Problem non-native species are not limited to introduced insects, disease and understory plants. Many exotic tree and shrub species continue to be planted and grown across southern Ontario. Some can cause significant ecological problems such as:

- ▶ increased disease and pest presence, e.g., Scots Pine and European Pine Shoot Beetle
- ▶ displacement of native species and disruption of natural ecosystems, e.g., Norway Maple, European Alder, European White Birch, Tartarian Honeysuckle, Multiflora Rose
- ▶ *hybridization* with natives, e.g., White Mulberry, European Highbush Cranberry.

A very few *exotic species* have proven to be benign and even beneficial. Two examples are Norway Spruce and European Larch, which are often used in plantation trees and/or windbreaks. They may meet your specific objectives without disrupting neighbouring natural communities. Remember to ask for seed sources that are proven to be adapted to the climate in your area.



Conifer species are often better suited to afforestation conditions than hardwoods and shrubs.



Norway Maple can displace native trees.

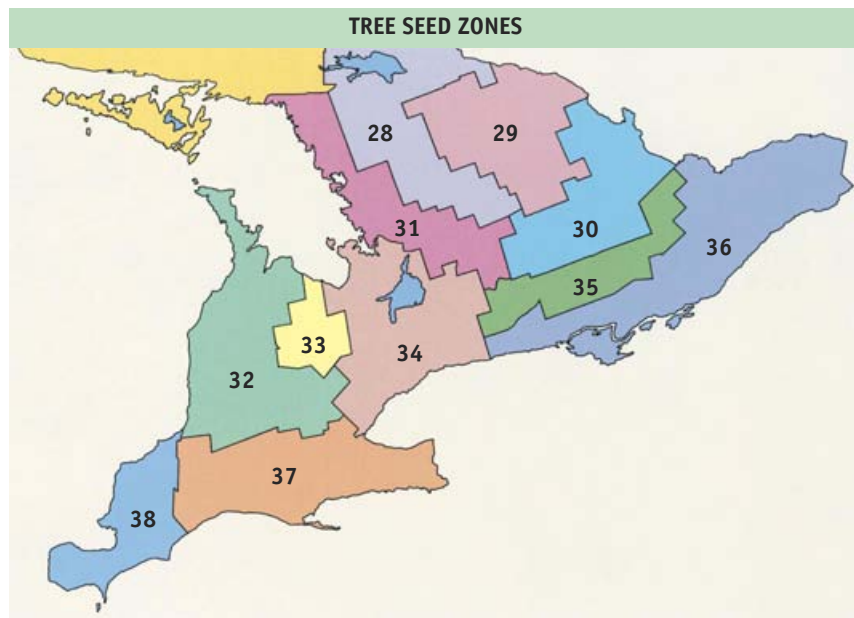


Norway Spruce is a beneficial exotic species.

CHOOSING GOOD PLANTING STOCK

SEED SOURCE

Trees have evolved over thousands of years to be genetically adapted to their local climate. Your seedlings need to be grown from locally adapted seed. No amount of tending, fertilization, or irrigation will help an ill-adapted tree grow as well as a tree that is adapted to the climate.



The Ontario Ministry of Natural Resources has developed tree seed zones to help people choose stock grown from suitable native seed sources. Seed collected from anywhere within a zone can be planted safely within the same zone.

A nursery supplier can usually locate seedlings grown from an appropriate seed zone for your land. Being able to choose the best source for your site requires that seed source particulars are known. This is not the case every time. Always ask your supplier about seed source, whether you're buying one tree or ten thousand.

If you cannot find seedlings grown from your seed zone, consider delaying planting or seek out additional information from a forestry professional on the implications of planting out-of-zone stock. Remember, the most expensive planting is a failed planting.

STOCK TYPE

There are two main types of nursery stock available: bare root and container.

Bare Root Stock

- ▶ seedlings usually two to three years old
- ▶ often most appropriate for southern Ontario open field sites
- ▶ careful handling is essential to prevent root damage

Container Stock

- ▶ seedlings grown in a small container, which is planted along with the tree to form a compost plug to hold roots
- ▶ seedlings usually one to two years old
- ▶ often not suitable for open field sites
- ▶ seedlings may not grow well under grass or weed competition
- ▶ less perishable as the roots are protected by soil and the container

Direct seeding is a third option with some species such as Red Oak and Black Walnut, provided competing vegetation is well-controlled.

STOCK QUALITY

When you pick up your seedlings, examine the roots and buds for:

- ▶ healthy green foliage on conifers
- ▶ firm, live buds on unflushed hardwoods and larches
- ▶ undamaged stem tissue
- ▶ balanced seedlings – a good amount of roots to support a moderate-sized shoot with a sturdy stem (good caliper)
- ▶ moist stock with no mould or sour odours
- ▶ roots with fine white hairs.



High quality stock is more likely to survive and thrive in the extreme conditions found in open planted fields.

Larger container stock is available at some nurseries and may have application in smaller, higher-value plantings.

Depth to mottled zone indicates the depth of a fluctuating, seasonal soil water table. Tree roots can obtain available soil water above and within the mottled zone during the growing season.

Soil characteristics can vary greatly, sometimes in a relatively small area. If your planting site is large or if it varies in topography, then you may be dealing with a number of site types.

MATCHING TREE SPECIES TO SITE CONDITIONS

Tree seedlings will perform poorly, or die, if planted off-site. Replanting trees can be expensive and time-consuming, so it's essential to understand your site conditions before you purchase seedlings. Choosing a species adapted to your site and that will meet your objectives is the key to successful planting and the future woodland it creates.

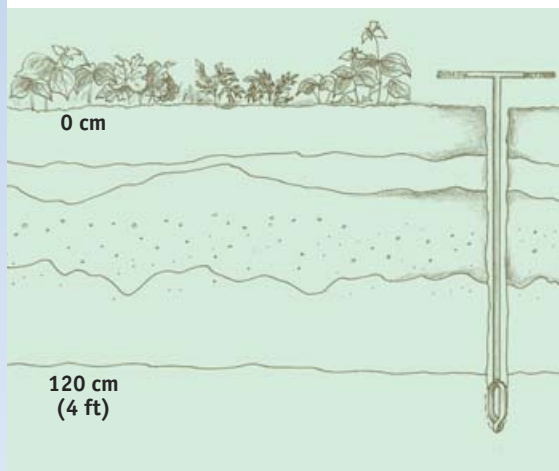
As discussed previously, there are four main factors that dictate which species have the best chance of survival on any given site. These are:

- ▶ depth to seasonal water table
- ▶ soil texture class
- ▶ presence of carbonates
- ▶ depth to bedrock or other root-restricting layers.

Tables are available to help you judge hardwood and softwood species suitability. Here's how to use them.

1. Select sites for soil inspection.
2. Test for free carbonates by dripping a 10% hydrochloric acid solution (dilute muriatic acid) onto the soil. If the soil reacts to the acid, carbonates are present and planting Red Pine should be avoided.
3. Dig with shovel or auger.
4. Hand-texture soil material from several depths, e.g., 0–10 cm (up to 4 in.), 30–40 cm (12–16 in.).
5. Measure depth to mottles, carbonates, bedrock or other root-restricting layer.

If a compacted or impenetrable layer of stone or bedrock is found, adjust suitability rating down one suitability ranking for each species.



How to assess soils in order to match species to site:

- use auger or shovel to check 120 cm (4 ft) depth
- determine soil texture throughout 120 cm
- use dominant texture group in top 70 cm (2.3 ft) for table on page 49
- find depth of mottled zone – if present
 - no mottles = >150 cm (5 ft) column
 - if an isolated layer of mottles in this area is found, treat as 100–150 cm (3.3–5 ft) depth to mottles
- use 10% HCl – to determine layer with free carbonates
- note depth to root-restricting layer or bedrock.

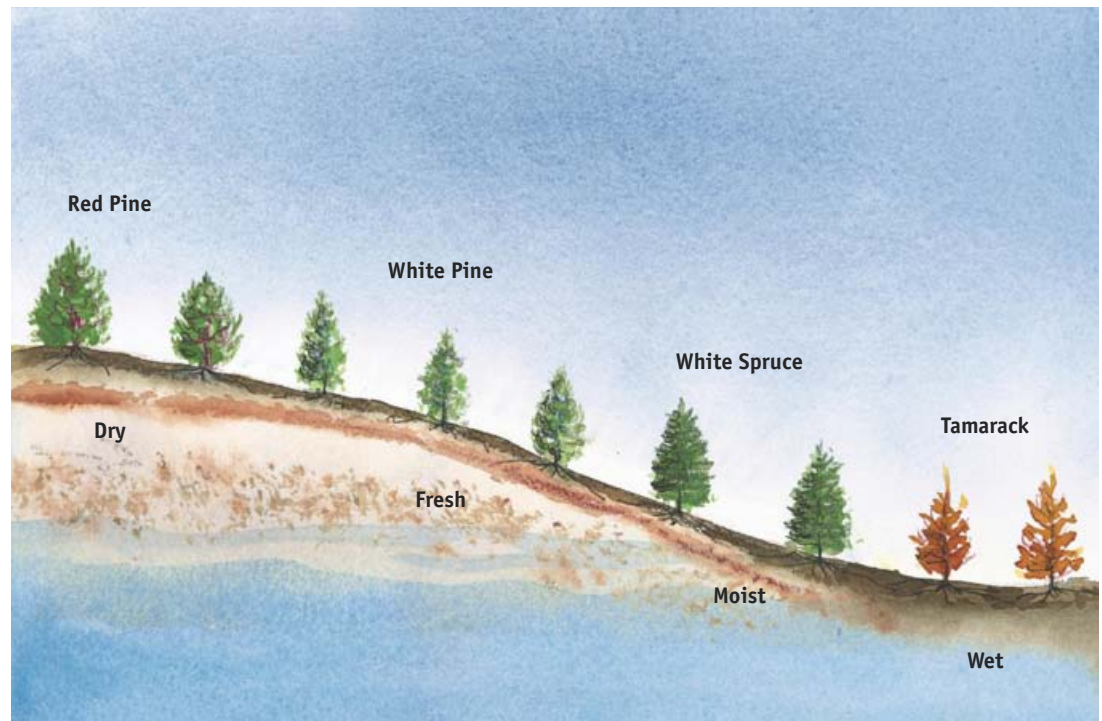
DEPTH TO MOTTLES	>150 cm (>60 in.)	100–150 cm (40–60 in.)	80–99 cm (31–39 in.)	50–79 cm (20–30.5 in.)	20–49 cm (8–19 in.)	0–19 cm (0–7.5 in.)
TEXTURE GROUP						
SHALLOW TO BEDROCK (<50 cm [20 in.])					Pr* Or Pj Mr Sw Mh Ta Le Ce	Sw Ms Ce Ta
GRAVELS/GRAVELLY SANDS AND LOAMS	Pr* Or Pw* Mr Sw Sn Le Ce	Pr* Or Pw* Mr Sw Aw Sn Mh Le Ce	Pr* Or Pw Aw Sw Mr Sn Mh Le Ce	Pr* Or Pw Aw Pw Aw Sw Mr Sn Mh Le Ce	Pw Ms Sw Or Sn Aw Ce Mr Ta	Sw Ms Ce Or Ta Ag
SANDY	Pr Or Pw Aw Sw Mh Sn Mr Le Ce	Pr Or Pw Mr Sw Mh Sn Aw Le Ce	Pr Or Pw Aw Sw Mr Sn Mh Le Ce	Pr Or Pw Aw Sw Mr Sn Mh Le Ce	Pw Or Sw Aw Sn Ms Ce Ag Ta	Sw Ms Ce Ag Ta Or
LOAMY	Pr* Aw Pw* Or Sw Mh Sn Wb Le Mr Ce	Pr* Aw Pw* Or Sw Mh Sn Wb Le Mr Ce	Pr* Aw Pw Or Sw Mh Sn Wb Le Mr Ce	Pw Aw Sw Or Sn Mh Le Wb Ce Mr	Pw Ms Sw Mr Sn Aw Ce Or Ta Ag Wb	Sw Ms Ce Ag Ta Or
CLAY LOAMS	Pr* Or Pw Or Sw Mh Sn Wb Le Mr Ce	Pr* Aw Pw Or Sw Mh Sn Wb Le Mr Ce	Pr Aw Pw Or Sw Mh Sn Wb Le Mr Ce	Pw Aw Sw Or Sn Mh Le Wb Ce Mr	Pw Aw Sw Or Sn Mh Ce Wb Ce Mr	Sw Ms Ce Ag Ta Or
CLAYS	Pw Sw Sn Le Ce	Pw Sw Or Sn Mh Le Wb Ce Mr	Pw Aw Sw Or Sn Mh Le Wb Ce Mr	Pw Aw Sw Or Sn Mh Ce Wb Mr	Pw Aw Sw Or Sn Ms Ce Ag Ta	Sw Ag Ce Ms Ta Or

*if carbonates are present within 50 cm (20 in.), do not plant (Red Pine or White Pine)

Species key:

- Conifers Pr – Red Pine Sw – White Spruce Ce – White Cedar Pj – Jack Pine
- Sn – Norway Spruce Ta – Tamarack Pw – White Pine Le – European Larch
- Hardwoods Mh – Sugar Maple Mr – Red Maple Ms – Silver Maple Aw – White Ash
- Ag – Green Ash Or – Red Oak Wb – Black Walnut

Suitability rating: a rating of suitable species survival and early height growth. If species is not listed, do not plant!
For example: **Pw** – Most suitable **Pw** – Very suitable Pw – Suitable



In uniform sandy textures, the soil moisture regime usually changes from dry to wet when you move downslope from the top to the bottom of the knoll. Species suitability to site conditions closely follows soil moisture regime.

Agroforestry plantations play an important role in the southern Ontario landscape, because they:

- provide opportunities for growing products and protecting the environment
- sequester carbon from the atmosphere
- offer good economic potential
- rehabilitate shallow or highly erodible sites
- accelerate the process of succession to natural forests
- add diversity to the local area
- increase forest interior and edge wildlife habitat
- connect natural areas to fragmented or isolated woodlots
- can provide recreational opportunities
- reduce soil erosion and hold water.

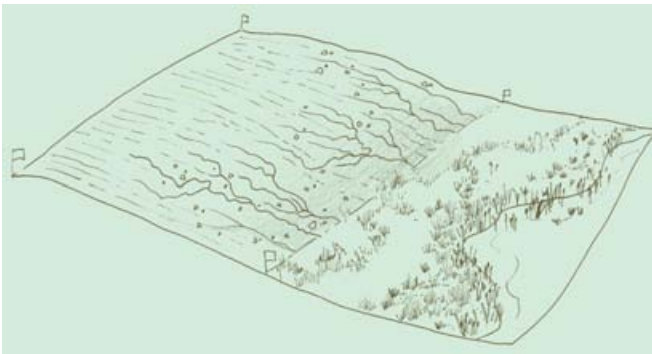
BMPs FOR PLANTATION ESTABLISHMENT

Good tree planting doesn't start with a shovel and a tree. Begin planning at least one year in advance.

✓ **Create a planting plan** for your site and include a:

- ▶ description of your objectives
- ▶ map of where the trees will go
- ▶ planting arrangement and tree spacing
- ▶ good estimate of how many trees you will need.

Seedlings can be sourced from private nurseries, county nurseries and conservation authorities.



Check site conditions. Match plantation type and species to local site conditions.

DETERMINING HOW MANY TREES TO ORDER

The number of trees you need to order is related to:

- ▶ the size of the area you want to plant
- ▶ the number of trees per unit area (planting density)
- ▶ your objectives for the plantation
- ▶ your budget.

✓ **Order your seedlings early!** Some species sell out quickly. Many nurseries take advance orders.

✓ **Locate any additional help** you may need such as:

- ▶ site preparation – often needs to be done the fall prior to planting
- ▶ planters – hiring planters or using a planting machine is appropriate for large numbers of trees
- ▶ post-planting tending – will your site need vegetation or pest (rodents, deer) control?

A plantation starts off at a certain density that decreases over time through management or mortality. Choosing the right initial planting density influences the rate of growth, and ultimately when the plantation will need thinning.

PLANTATION DENSITY – RANGES

PLANTATION DENSITY	HIGH	MEDIUM	LOW
NUMBER OF TREES	<ul style="list-style-type: none"> • 2000–2500/ha (800–1000/ac) 	<ul style="list-style-type: none"> • 1000–2000/ha (400–800/ac) 	<ul style="list-style-type: none"> • <1000/ha (400/ac)
SPACING <ul style="list-style-type: none"> • BETWEEN TREES • BETWEEN ROWS 	<ul style="list-style-type: none"> • 2–3 m (6.5–10 ft) • 2–3 m (6.5–10 ft) 	<ul style="list-style-type: none"> • 2.5–3 m (8–10 ft) • 2.5–3.5 m (8–12 ft) 	<ul style="list-style-type: none"> • >3 m (10 ft) • >5 m (16 ft)
PURPOSE	<ul style="list-style-type: none"> • sawlogs and poles 	<ul style="list-style-type: none"> • sawlogs and veneer 	<ul style="list-style-type: none"> • veneer, nuts, syrup, specialty forest products
SPECIES SUITABILITY	<ul style="list-style-type: none"> • most conifers – Red Pine, White and Norway Spruce, White Cedar, European Larch 	<ul style="list-style-type: none"> • conifers and hardwoods, (e.g., Red Oak and Red Pine, or White Pine and Black Walnut) 	<ul style="list-style-type: none"> • Maple orchards • nut-tree and veneer orchards • intercropping and alley cropping operations • ginseng, herbs, mushrooms
MANAGEMENT IMPLICATIONS	<ul style="list-style-type: none"> • higher labour needed to establish • minimal labour for weed control • moderate labour for thinning and pruning 	<ul style="list-style-type: none"> • moderate labour required to plant • moderate labour required for weed control • moderate need for thinning • high labour requirement for pruning 	<ul style="list-style-type: none"> • moderate labour required to plant • high labour requirement for weed control • low need for thinning • high labour requirement for pruning
COST AND PROFIT POTENTIAL	<ul style="list-style-type: none"> • higher establishment cost • low maintenance cost • little or no profit with first thinning • moderate long-term profit potential 	<ul style="list-style-type: none"> • moderate establishment cost • moderate maintenance cost • high long-term profit potential 	<ul style="list-style-type: none"> • moderate establishment cost • moderate maintenance cost • high short- and long-term profit potential



High-density White Spruce plantation.



Medium-density White Pine plantation.



Low-density Maple orchard.

Plantations are usually established in rows. The distance between the rows, and between the trees in the rows, determines the planting density. You can calculate the number of seedlings required per acre with the following formula:

$$\text{Number of trees per acre} = 43,560 \text{ (ft}^2\text{)} / (\# \text{ ft between rows} \times \# \text{ ft between trees in the row})$$

TREE NUMBERS FOR COMMON ROW AND TREE SPACING DISTANCES			
SPACING BETWEEN		NUMBER OF TREES	
TREES metres (ft)	ROWS metres (ft)	PER HECTARE	PER ACRE
1.8 (6)	1.8 (6)	2989	1210
1.8 (6)	2.5 (8)	2244	908
2.5 (8)	2.5 (8)	1682	681
3 (10)	3 (10)	1076	436
3.5 (12)	3.5 (12)	746	302

OPTIONS FOR SITE PREPARATION

Before you plant, ensure that your planting site is ready for trees. Although site preparation can be costly, it's usually a necessary expense that helps ensure seedling survival and therefore reduces unnecessary replanting and excessive tending costs. Good site preparation can improve compacted soils, help site drainage problems (flooded in spring, dry in summer), and reduce heavy field vegetation.

The type of site preparation needed is a function of the type of planting, species selected, site conditions, and the level of competition.

Hardwoods are normally planted on more productive sites that support greater levels of competing vegetation, and therefore are more demanding and generally require more intensive site preparation. Conifers can often survive on sites with less intensive site preparation.

Careful planning of site preparation methods and timing is necessary to ensure your planting is successful. Factors like heavy rainfall, slope and topography, soil stoniness and texture can influence your decisions. Consult someone with experience in planting trees.



Once you've prepared your site, it's time to plant the trees.

SITE PREPARATION OPTIONS

TYPE OF SITE PREPARATION	METHOD	DESCRIPTION
CHEMICAL	spot spraying	<ul style="list-style-type: none"> • apply a small amount of herbicide to individual planting sites to kill existing vegetation prior to planting • use a backpack sprayer • is better suited to smaller planting operations
	band spraying	<ul style="list-style-type: none"> • tow power sprayer behind a tractor or ATV • apply herbicide in bands, which become planting rows
	boom spraying	<ul style="list-style-type: none"> • apply herbicide to the entire planting area using an agricultural boom sprayer • allows control of vegetation over entire area
MECHANICAL	brush cutting	<ul style="list-style-type: none"> • may be necessary on some overgrown sites • is often used prior to and in combination with other site preparation methods (mechanical and chemical)
	ploughing or furrowing	<ul style="list-style-type: none"> • may not be necessary on all sites • used to break up sod layer • often used in combination with discing • plough to depth of 25 cm (10 in.) • follow contours of land • wait at least a week after herbicide application • will often improve drainage
	discing	<ul style="list-style-type: none"> • produces a smooth surface • aerates soil and promotes rooting
COVER CROPS	sowing white clover or rye grass	<ul style="list-style-type: none"> • can be an alternative to herbicides • won't out-compete planted trees • helps control competing vegetation • helps stabilize the soil, preventing erosion • helps conserve soil moisture • helps fertilize the soil



Mounding is a site preparation used on poorly drained sites. Seedlings are planted on the mound formed beside the deep, dead furrow to maximize depth to saturated soil conditions.

OPTIONS FOR PLANTING

Season

✓ Plant trees in:

- ▶ early spring as soon as soil can be worked and before tree leaves flush
- ▶ early fall after leaf drop and before frost – this is less common than spring planting, and depending on the site, frost-heaving can be a problem

Nursery Stock Handling

Good stock handling is important for seedling survival.

✓ Handle gently (don't throw or stack trees).

✓ Keep seedlings cool (<10 °C [50 °F]), moist, and with good air circulation in storage and when shipping. Also:

- ▶ on the site, use tarps, water and shade
- ▶ while planting, use bags or buckets to hold trees.

Planting

✓ Place roots in a sufficiently deep hole or slit – not bent or balled up.

✓ Position root collar of tree at soil surface.

✓ Firm the soil around roots with no air pockets.

✓ Plant trees straight, not at an angle that will cause lateral buds to compete with leader, which is evidence of poor planting.

Bare-root seedlings must be carefully handled to avoid damage.



Roots are especially fragile. Keep cool and moist: even brief exposure to warm, dry winds can kill roots. Dip roots in water, but do not soak or they may drown.



Machine planting is appropriate for relatively level sites and stone-free deeper soils. Local planting agencies or contractors may have them available for your use.

OPTIONS FOR POST-PLANTING MAINTENANCE

The trees you plant will need tending to maximize their chances of survival.

Herbicide Application

- ▶ controls competing vegetation, providing more light, moisture and nutrients to the seedling
- ▶ the most effective and often cheapest method is band or spot spraying
 - ▷ band spraying – requires a power boom sprayer
 - ▷ spot spraying – requires a backpack sprayer, small area around trees are sprayed
- ▶ should be done annually for three or four years, until trees are free-to-grow from competing vegetation

For information on recommended herbicides and licensing requirements, contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs. OMAFRA Publication 75, *Guide to Weed Control*, has been the definitive source of weed control information for more than 50 years.

Tillage

- ▶ can be applied to whole or partial site
- ▶ may improve soil aeration
- ▶ may improve soil drainage
- ▶ easily combined with chemical site preparation

Mowing

- ▶ a low-cost method to control competing vegetation
- ▶ easy to do (with the right equipment), but may be less effective
- ▶ may require more than one “treatment” per year – usually early season, mid-summer, and early fall

Mulch

- ▶ suppresses competing vegetation, allowing more light, moisture, nutrients to reach the tree
- ▶ offers many options – wood chips, straw, compost, newspaper, commercial plastic or organic fabrics/moulds
 - ▷ some mulches are more effective than others
- ▶ can be installed yourself
- ▶ an option for slopes where mechanical tending is difficult
- ▶ labour-intensive – some plastic or paper products are difficult to keep anchored
- ▶ may require some mowing between the rows to reduce cover for animals



The use of pesticides to control weeds, insects and disease is strictly regulated. Ontario landowners who want to do their own pesticide applications must first obtain an Ontario Growers Pesticide Safety Certificate.

Call 1-800-652-8573 for more information.

Follow the recommendations in OMAFRA Publication 75, *Guide to Weed Control*.

Tree Shelters

- ▶ protect trees from tending and animal damage
- ▶ involve staked plastic mesh or tubes that are placed around trees
- ▶ can be installed by landowner, but are labour-intensive
- ▶ may be higher cost per acre than other methods
- ▶ not a substitute for tending of competing vegetation
- ▶ must have some airflow to prevent a greenhouse effect in the fall when trees should be going dormant



Using a backpack sprayer or wick applicator can be an effective method of controlling the vegetation around each tree. A 1-metre vegetation-free radius around each tree will also help deter rodent “girdling” (injuring the bark) at the base of the tree.



Mulching around young seedlings suppresses weeds, reduces moisture losses, and improves seedling survival rates. The high costs of commercial mulch make it better suited to small projects.

Tree shelters are an expensive but effective method to protect high-value transplant stock (whips and saplings).

Note that not all species grow well in tree shelters. Consult a forestry professional.

BMPs FOR ADDRESSING PLANTATION PROBLEMS

Establishing the plantation is not without risk. There are many things that can go wrong and it's unrealistic for you to expect that every tree will survive. Planted trees are vulnerable to a number of stresses that can impact their survival.

Normally it takes two to five years for the trees to reach a free-to-grow stage. Successful plantations should exhibit at least 65% survival of healthy trees well-distributed over the planting site. Infilling can be done in the early years after the initial planting, when required. Verify the most appropriate species for the site prior to replanting.

COMMON SITE-RELATED PROBLEMS AND SOLUTIONS

SITE-RELATED PROBLEMS

SOLUTION

MOISTURE PROBLEMS –
EXCESS OR DROUGHT



- be aware that some moisture problems can't be corrected
- irrigate/water trees
- match species to site
- prepare site (ploughing, furrowing) to break up compacted soils
- subsurface drainage

COMPETITION FROM
WEEDS AND GRASS



- apply herbicide application
- use mulch or tree shelter

INSECTS AND DISEASE



- monitor plantation
- consult with a forestry professional
- determine type of insect or disease
- determine if control is required
- infill as necessary

BROWSING – DEER
AND LIVESTOCK WILL
DAMAGE TREES



- keep livestock out of plantation (while trees are young)
- plant less palatable species
- plant lure species

RODENT DAMAGE



- control grass and other vegetation to reduce populations
- consider use of tree guards to reduce damage

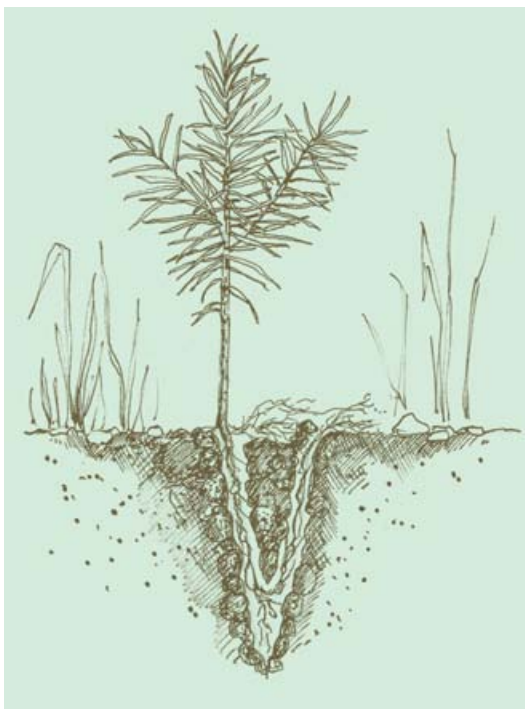
ESTABLISHMENT-RELATED PROBLEMS

Some problems are caused by poor planting and cultural practices.

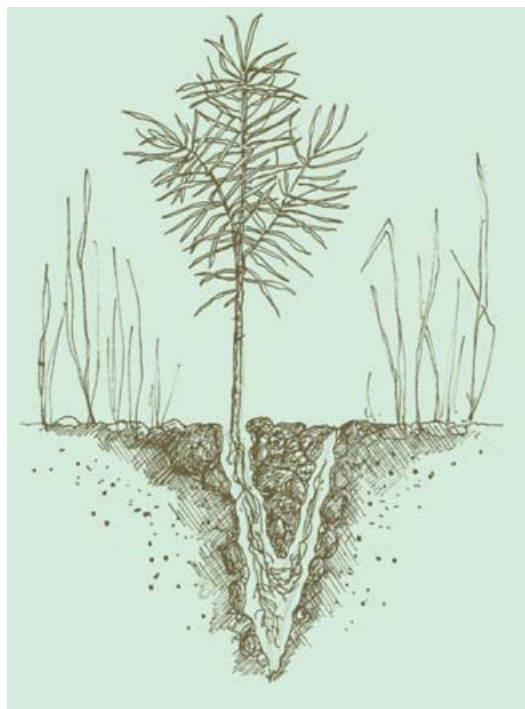
Poor planting may result in exposed roots, seedlings that are planted too deep or too shallow, and severely leaning trees.

Poor stock quality can mean dried-out seedlings, seedlings that were stored at too high a temperature, and nursery problems during packing or poor handling practices between storage and planting.

Poor species selection means you've planted the wrong trees for your site.



Poor planting will result in unnecessary mortality.
The seedling above has exposed roots.



This seedling had its roots set properly.

- ✓ **Choose the right tree for the site and prepare and tend the site appropriately.**
Your goal is to minimize any human causes of seedling mortality.
- ✓ **Monitor your plantation carefully.** Trees are not considered free-to-grow until they grow above competing vegetation. This could take three to five years in some cases. Monitor seasonally for problems and unusually high mortality, which could be caused by insects or rodents. Replant if necessary to achieve your goals. A good rule of thumb is to infill if survival rate is less than 65%.

Growing Christmas trees offers opportunities for additional income from the farm. Many "U-Cut" operations provide a unique experience for families who may come back to the same operation year after year.

BMPs FOR CHRISTMAS TREES AND TRANSPLANT STOCK

The practice of growing Christmas trees can be profitable. Tree crops can be grown on:

- land that's unsuitable or not used for other crops
- open space or areas surrounding a home – this may also benefit landowners by helping reduce wind speeds and provide energy savings.



Livestock producers often use larger transplant stock to hasten the establishment of shelterbelts around livestock facilities.

CHRISTMAS TREE SPECIES AND SITE PREFERENCES

CROP	SOIL	MOISTURE	SOIL FERTILITY
SCOTS PINE	sandy	dry sites	infertile sites
SPRUCE	sandy loam to clay loam	fresh/moist	fertile
BALSAM FIR	clay loam to clay	fresh/moist	fertile (acid soils)
FRASER FIR	clay loam to clay	fresh	fertile
CANAAN FIR	clay loam to clay	fresh	fertile

GROWING CHRISTMAS TREES AND TRANSPLANT STOCK

✓ Plan your plantings for an annual harvest:

- ▶ divide your available land into blocks and plant a block each year
- ▶ ensure a continuous harvest by having plantings, which have been established annually, over a period coinciding with the rotation length for the species.

✓ Plan density with these considerations:

- ▶ density varies with plantation layout, species type, as well as the planned spacing between trees and rows
- ▶ desired access around the perimeter of the planting block
- ▶ sufficient space for equipment, e.g., tractors, mechanized shearer
- ▶ densities can range 2000–3000 trees per hectare (800–1200/ac).

✓ Meet fertilizer requirements by:

- ▶ preparing a nutrient management plan
- ▶ being aware that the need for fertilizer amendments will depend on the tree type grown and soil fertility
- ▶ conducting a soil fertility test
- ▶ consulting with experienced growers and qualified specialists

✓ Control pests effectively and safely:

- ▶ ensure you have pesticide applicator certification or hire a custom operator
- ▶ control weeds to reduce competition for soil nutrients and moisture
- ▶ prevent damage caused by animal pests that live in weedy vegetation
- ▶ reduce the likelihood of a fire hazard
- ▶ make pruning and harvesting of trees easier
- ▶ monitor regularly for insect damage and diseases
- ▶ take measures to protect crop trees from mammals and birds.

✓ Prune and shear:

- ▶ prune to selectively remove entire branches
- ▶ shear to trim and shape the branch tips
- ▶ prune at different times of the year and according to species requirements
- ▶ prune to keep the base of the tree free of branches.

✓ Time harvests according to targeted market:

- ▶ cut and wrap trees for off-site sales in time for transport to market (late-November and all of December).

Planting in a sequence of “blocks” can help you produce a continuous harvest.



The goal of shearing is to trim the branch tips to shape the tree to the desired profile.

For more information, see the Christmas Tree Farmers of Ontario website at <http://www.christmastrees.on.ca>.

BMPs FOR ESTABLISHING HARDWOOD PLANTATIONS

Hardwood plantations offer unique agroforestry opportunities, and interest in them has been increasing since the 1960s. Generally, hardwood seedlings are more expensive than conifers, require higher quality sites, and are considerably more difficult to establish. As a result, most hardwood plantations tend to be only a few acres in size. These plantations, however, can exhibit good growth and have the potential for high-value forest products, such as sawlogs, syrup and edible nuts.

Hardwoods may be planted in plantations, with conifers in mixedwood plantings, or under thinned conifer plantations. Plantations with a mix of species may be less susceptible to outbreaks of disease and insects. However, the economic return from mixed plantings may be significantly less than that from a single-species plantation.

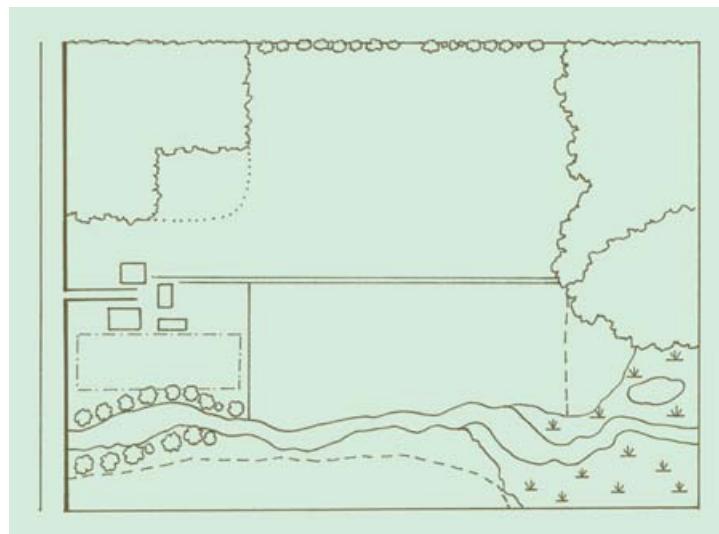
Hardwoods are more demanding in their site requirements. Carefully matching site conditions to species requirements is a must for establishment success. Failure to do so will inevitably result in mortality and higher establishment costs.

Hardwood trees most often prefer deep, fertile, moist but well-drained soils. In all probability these soils will also be the best agricultural croplands.

More productive (better) sites favour single high-value species planting. Lower quality, less productive sites favour a mixture of species.



This is a 15-year-old Black Walnut plantation on a highly productive site.



Check the soils information in your management plan. Hardwoods prefer deep, well-drained soils.

PREPARING AND MAINTAINING THE HARDWOOD PLANTING SITE

Weeds and other competition will need to be controlled for at least three years. When planting hardwoods, site preparation is most often required for effective weed control.

For best results, prepare the planting site in the fall or late summer of the year prior to planting. Chemical weed control applied two to three weeks prior to mechanical site preparation is usually quite effective. However, mechanical disturbance after chemical weed control can sometimes lead to unpredictable shifts in competing vegetation.

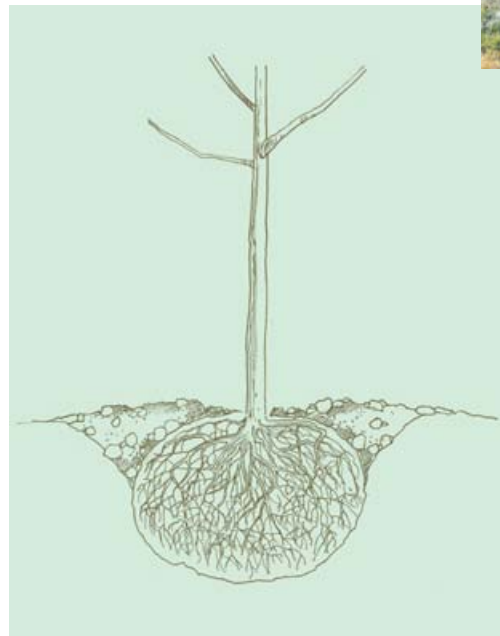
Chemical weed control alone can work, but isn't as successful as mechanical and chemical weed control in combination. Chemical weed control can include:

- ✓ **band spraying** on areas where ploughing and discing are not feasible
- ✓ **spot spraying** individual planting sites in areas where other forms of spraying and site preparation are not appropriate
 - ▶ kill the vegetation in a radius of at least 1 metre (3.3 ft)
 - ▶ larger areas have lower risk of stem girdling.

Planting success is directly related to planting stock quality and handling.

Transplant Stock

- ✓ Remember that **site preparation and tending** are still important.
- ✓ Consider **transplanting hardwoods** from existing nearby woodlots or fence rows
 - ▶ don't transplant low-vigour saplings from shaded areas.
- ✓ **Cut lateral roots** with a spade the season prior to transplanting to increase success.
- ✓ **Choose healthy trees** that are 1.2–2.4 metres (4–8 ft) high.
- ✓ **Transplant after leaves have dropped** in the fall or early spring when the frost is out of the ground.
- ✓ Expect some mortality and **replant as necessary**.



General recommendations are:

- **root ball width: 23–30 cm (9–12 in.) per inch of tree diameter**
- **root ball depth: 15–76 cm (6–20 in.) per inch of tree diameter.**



These Sugar Maple saplings were transplanted from a nearby woodlot in a leafless condition.

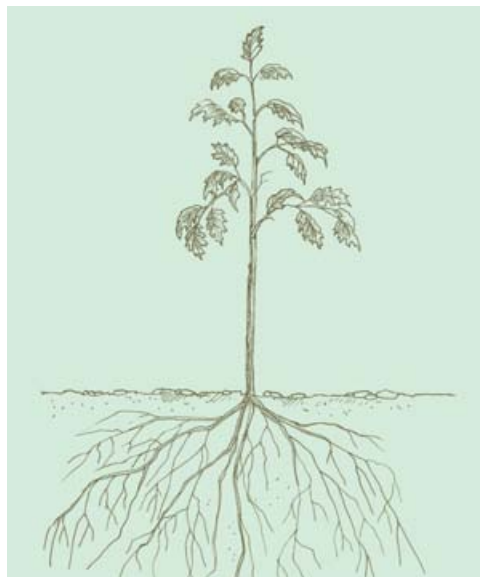
TRANSPLANT DIFFICULTY RATING BY SPECIES OF HARDWOOD (<5 cm or 2-inch in diameter – tree whips, i.e., branchless trees)

EASY	Silver Maple, Sugar Maple, White Ash, Green Ash, Honey Locust, Elm, Poplar
MODERATE	Bur Oak, Birch, Hackberry, Red Maple, Hawthorn, Red Oak, Black Cherry, Kentucky Coffee Tree, Shumard Oak, Willow
DIFFICULT	Ironwood, Chinquapin Oak, Hickory, Sassafras, Tulip Tree, Walnut, White Oak, Staghorn Sumac, Beech

Nursery Stock

Seedling size is generally more important than seedling age. Trees should have a balanced *root-to-shoot ratio*. The root needs to be of sufficient size to support the upper portion as well as provide adequate water and nutrients. Typically, larger seedlings tend to do better than smaller ones.

SPECIES	PREFERRED MINIMUM STEM LENGTH	PREFERRED ROOT-COLLAR DIAMETER
BLACK WALNUT	30 cm (12 in.)	1 cm (0.4 in.)
BUTTERNUT	30 cm (12 in.)	1 cm (0.4 in.)
SUGAR MAPLE	60 cm (24 in.)	.8 cm (0.3 in.)
RED OAK	50 cm (20 in.)	.8 cm (0.3 in.)
BLACK CHERRY	50 cm (20 in.)	.8 cm (0.3 in.)

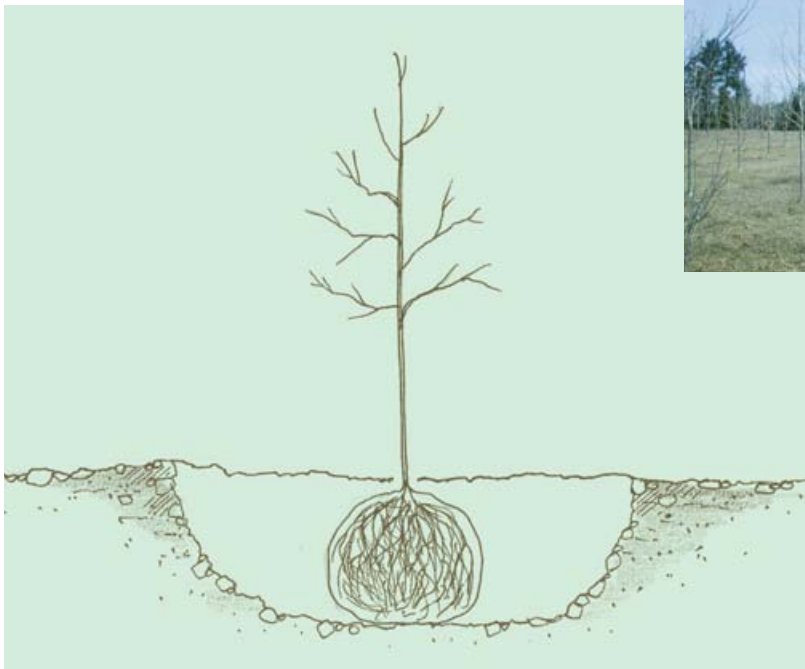


Seedlings can be purchased from a commercial nursery. Ensure that the ones you buy are healthy and stay healthy. Plant as soon as possible after purchasing. Do not let unplanted seedlings dry out.

Planting Hardwoods

On most sites, hand planting is preferable to machine planting, but it's not always practical. Machine planting can work, but ensure that the planter has been modified to handle larger hardwood stock.

- ✓ If furrows are used, **don't plant hardwoods in the bottom of furrows** (due to the potential for frost-heaving and excessive moisture).
- ✓ Take extra precautions to **plant vertically and ensure roots are buried** in as natural a position as possible.
- ✓ **Prune roots** if roots are longer than 15 cm (6 in.).
- ✓ **Use the wedge method** for hand planting.
- ✓ **Create larger holes** for transplant stock.



Proper planting is essential for tree survival. You will need to prepare a larger hole for transplant stock than nursery stock. Try to dig a hole that is double or triple the size of the root ball. If possible, moisten hole prior to planting to reduce the risk of post-plant water migrating away from the root ball. Cleanly cut any damaged roots to help healing.



Established Sugar Maple plantation.

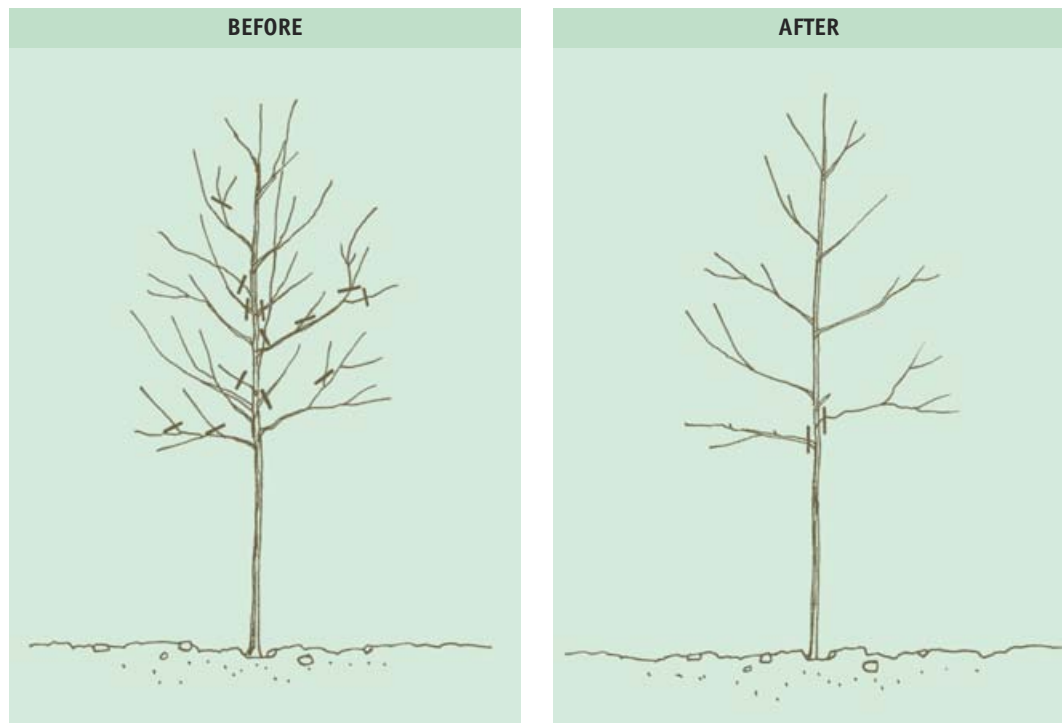


This Red Oak plantation is thriving on land previously used to grow annual crops.

Pruning Hardwoods

Pruning is necessary to promote height growth. Hardwoods that aren't pruned tend to develop large spreading crowns and forked leaders.

- ✓ **Prune often and lightly** as opposed to periodically and heavily:
 - ▶ this will minimize impacts on diameter growth
 - ▶ start in year 3 after planting
 - ▶ remove the lower branches.
- ✓ **Prune multiple leaders** to one dominant stem.
- ✓ **Do not prune in the year planted.**
- ✓ **Prune during the dormant season** (for most species).



Hardwood trees need to be correctly pruned in order to promote height growth. In this diagram the tree on the left has a large, upwardly growing branch that should be removed. The lower branches on this tree should also be cut every two or three years.

BMPs FOR SPECIALTY TREE PLANTINGS

CASE STUDY: ESTABLISHING A MAPLE ORCHARD IN AN OLD HAY FIELD

The landowner established a Maple orchard on a small unused hay field adjoining an existing Maple bush (approximately 2.4 hectares or 6 acres). In the fall of 1991 and 1992, approximately 600 Sugar Maple saplings were planted.

Stock

- ▶ transplant stock from edge of nearby woodlot – only healthy, well-growing trees were selected
- ▶ diameters were 1.25–2 cm (.5–.75 in.) and heights were 1.2–1.8 metres (4–6 ft)

Site Preparation

- ▶ field was not cultivated prior to planting – planting spots were prepared with herbicide prior to planting

Planting

- ▶ trees were hand-planted in the fall
- ▶ about 10% of the trees died and were replaced in 1995 – most died on the site with shallowest soils

Maintenance

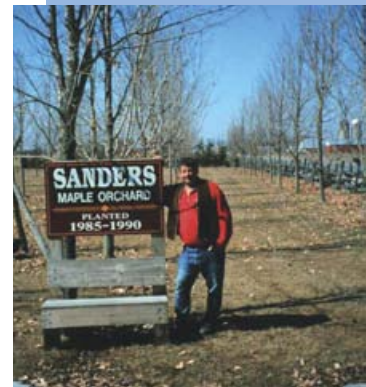
- ▶ vegetation was controlled around the trees with herbicide – then grass between rows was cut once per year in the summer
- ▶ tree collars were installed to help reduce rodent damage

1995–2004

- ▶ trees were pruned
- ▶ some fertilizer was applied

Lessons Learned

- ▶ poorer quality sites are more susceptible to problems – the 2002 dry summer killed many trees in the driest section of the field, and irrigation may have saved the trees had this been feasible
- ▶ growth has been good on better areas – some trees have a diameter of 13 cm (5 in.)
- ▶ pruning is important to train the tree to grow up instead of out – you can prune right after the period of active sap flow in the spring
- ▶ ploughing and disking may have helped establishment and growth, and post-planting weed control



This landowner successfully established a Maple orchard on a small field.

SILVER MAPLE



RED MAPLE



SUGAR MAPLE



Bark, key, leaf and twig of various Maples

Additional References

The Maple Orchard Directory for Ontario is an excellent reference for those interested in establishing a Maple orchard. This document includes inventory information on existing Maple orchards in Ontario as well as advice from experienced Maple orchard growers. It was assembled by the Ontario Ministry of Agriculture, Food and Rural Affairs, and the Ontario Maple Syrup Producers' Association.

ESTABLISHING HARDWOODS UNDER A JACK PINE COVER CROP

Since 1960 in eastern Ontario, many Jack Pine plantations have been planted to protect soils that were marginal for agricultural crops. Most of these plantations are ready for thinning or have been thinned. An existing conifer plantation with or without a hardwood understory can be an ideal location for establishing a plantation.

Jack Pine is a good cover crop because:

- ▶ in Site Region 6E, the species will establish and grow well on sand, sandy loams and loams. It also survives well on shallow soils over bedrock.
- ▶ the smothering of grass beneath the Pine trees and the buildup of Jack Pine needles form a good seedbed for hardwoods
- ▶ the sparse nature of the foliage enables light to get through to the forest floor – light is necessary for the survival and growth of young hardwood seedlings on the forest floor
- ▶ when thinned, Jack Pine does not respond by growing rapidly to fill in the openings – thus, the openings provide adequate growing space for young hardwoods, which begin to grow quickly following release.

Guidelines for Establishing a Sugar Bush with a Jack Pine Nurse Crop

- ✓ **Remove every other row in the Jack Pine plantation** (usually when it's 15–20 years old).
- ✓ About 8–10 years later, if satisfactory natural regeneration is present, **remove the remaining Jack Pine, leaving the Pines around the border for wind protection.** If the stand is well-protected by other forest stands, it wouldn't be necessary to leave a belt of conifers for wind protection.
- ✓ If natural regeneration of hardwoods is inadequate, **supplement by planting them!**



These hardwoods are growing under Jack Pine cover.