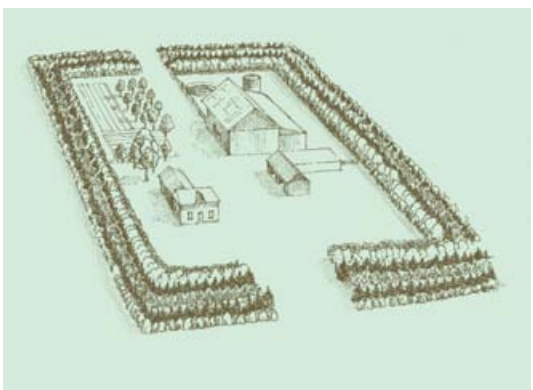
BMPs FOR WINDBREAKS, SHELTER-BELTS AND TREED FENCEROWS

Windbreaks, shelterbelts and treed fencerows are vegetative barriers that reduce or eliminate the undesirable impacts of excessive wind. They consist of one or more rows of trees or shrubs in open field areas or adjacent to buildings.

Properly designed and oriented, they benefit crop and livestock productivity. For example, they:

- shelter livestock from storms and cold winds – turning energy into meat instead of heat
- provide summer shade for grazing livestock
- increase crop productivity – protecting crops from storms, providing better growing conditions, and making more moisture available during droughty conditions.

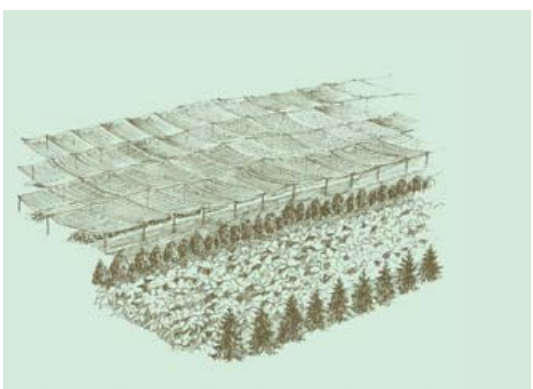
A windbreak consists of one to five rows of trees or shrubs. Shelterbelts have six or more rows.



Mixed shelterbelts, with rows of conifers and hardwoods, are planted around farmsteads to reduce energy costs.

Mixed shelterbelts are also planted along cropland boundaries to protect crops and connect natural areas.

Treed fencerows are described in detail in the first volume of this BMP series, *Woodlot Management*.



Conifer field windbreaks can be planted to protect high-value crops such as ginseng and tobacco.

Conifer windbreaks around cropland can improve crop yields and increase productive woodland acreage.

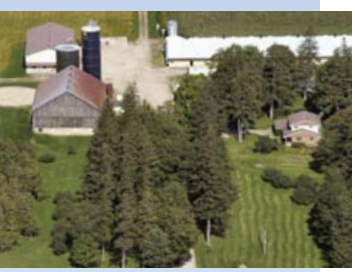
Windbreaks and shelterbelts more than make up for the loss of productive land they occupy. Additional wide-ranging benefits include:

- ► reduced soil erosion by wind and water
- ► reduced dust levels (e.g., from roads and farming activities)
- ► reduced noise from nearby road traffic
- ► increased rates of crop growth and yields
- ► improved moisture distribution over fields
- ► enhanced livestock health and performance
- ► increased odour control when planted around livestock facilities
- ► reduced home heating and cooling costs (i.e., 10–30%)
- ► improved snow management for roadways, driveways and farmyards
- ► some snow trapping, which can enhance water collection for ponds or aquifers
- ► increased economic opportunities (e.g., timber and firewood)
- ► enhanced wildlife habitat and biodiversity
- ► reduced greenhouse gas emissions through carbon sequestration.

Shelterbelts and windbreaks contain perennial plants. Careful planning should start one year prior to planting.

Treed Fencerow
- **natural**

Windbreak
- **5 rows or less of trees or shrubs**
- **planted**



Shelterbelt
- **6 rows or more of trees or shrubs**
- **planted**

Plan carefully: once windbreaks and/or shelterbelts are planted, they cannot easily be relocated.

PRINCIPLES OF WIND AND SHELTER

VEGETATION HEIGHT, POROSITY, DENSITY AND ORIENTATION

Windbreaks and shelterbelts reduce wind speed at the ground by lifting winds over the vegetative barrier and/or reducing wind speed as it penetrates and passes through the vegetation.

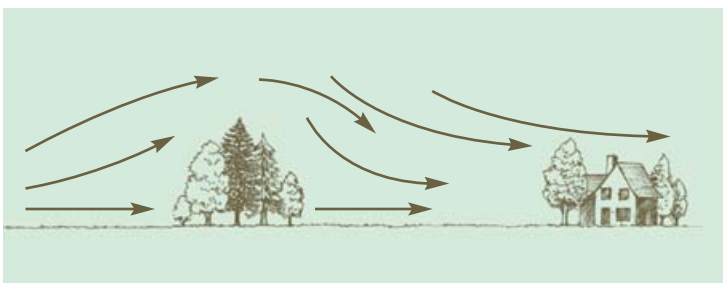
Vegetation height and *porosity* are the two main factors that influence the protected zone.

Height influences the distance over which the trees will have an effect. The planting will reduce wind speed and increase crop growth for a distance of 15–20 times the height of the trees. The height of the windbreak or shelterbelt is determined by the:

- species
- growing conditions
- age of the tree.

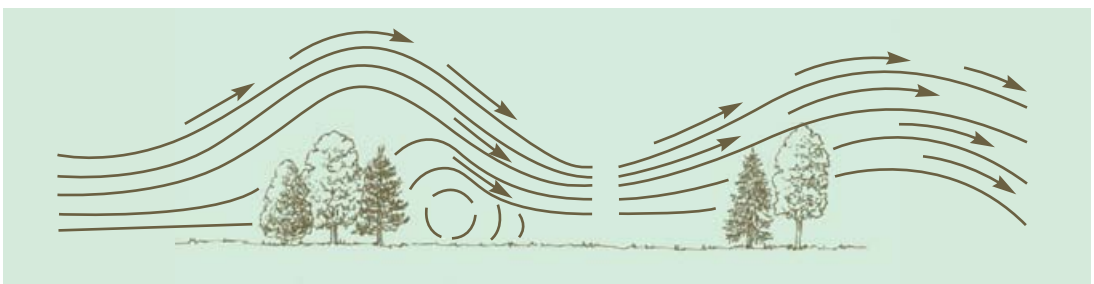
Porosity is the amount of air space in a cross-sectional view of a windbreak. The air space allows wind to move through the barrier.

Density is the opposite of porosity. For example, 60% density is 40% porosity.



The taller the windbreak, the greater the area it protects. Wind speed is reduced upwind to five times windbreak height, and downwind to 15 times windbreak height.

This single-row windbreak has been thinned to a desirable 50% porosity.



Windbreaks and shelterbelts that are too dense may create turbulence on the downwind side, which can cause crop damage and reduce yield. A barrier allowing some wind flow through it can have a zone of reduced wind speed that could stretch for many times (10–20 times) the total tree height. A porosity of 40–60% gives the longest shelter zone on either side of the windbreak.

Density and **orientation** determine how much a windbreak slows the speed of the wind and the size of the area protected. These:

- affect the kind of snow distribution that results from the windbreak
- are also determined by the type of tree and time of year
  - deciduous species tend to be less dense closer to the ground
  - the porosity of a conifer planting can be altered by pruning the lower branches in order to modify their effect on snow distribution
- are also affected by in-row and between-row spacing
  - typically in-row spacing can range from 1 metre (3 ft) apart for shrubs, to 2.4–3.6 metres (8–12 ft) apart for trees
  - between-row spacing can range 2.4–6 metres (8–20 ft).

For maximum effectiveness, you should orient your windbreak and shelterbelts at right angles to prevailing or most troublesome winds.

WINDBREAKS AND SHELTERBELTS FOR PROTECTION OF SOILS AND CROPS

Fine sands and silt soils with little crop residue cover are most vulnerable to wind erosion. When cropped with soybeans or silage corn, and when residue cover is insufficient, these soils are at even greater risk of eroding.

Field windbreaks and shelterbelts provide a zone of wind speeds that can extend 20 times the height of the windbreak or shelterbelt. By reducing wind speed, they help reduce soil erosion and trap eroding soil particles. Crop yields are improved up to 10 times the height of the windbreak or shelterbelt.

Wind erosion is a function of wind speed. A 10% reduction in wind speed can result in a 28% decrease in erosion. A 20% reduction in wind speed will reduce erosion by more than 49%.

Attaining optimal wind erosion control takes a concerted effort. Deploy a suite of BMPs, such as field windbreaks, residue cover and cover crops.

Wind erosion reduces soil productivity in the long term and damages crops in the short term.

Soil Erosion Factors

Reducing soil erosion takes a concerted effort and usually several BMPs, including windbreaks and shelterbelts where appropriate.

When establishing windbreaks or shelterbelts, remember these key factors:

- soil texture – fine-textured soils (fine sands and silts) are most vulnerable to soil loss
- soil moisture – drier soils are more vulnerable to erosion than wetter sites
- soil aggregation – soils with a mix of particle sizes are less vulnerable than non-aggregated soils
- vegetative cover – soils with a vegetative cover are protected from the effects of wind, rain and snow.

Land management practices such as conservation tillage leave more crop residue on the soil surface, which offers additional protection from the effects of wind.

Soil erosion can be controlled most effectively when a number of conservation practices are used as components of an overall strategy. Windbreaks and shelterbelts can play key roles to minimize wind-related erosion. See the BMP book, *Field Crop Production*, for more ideas.

Site Requirements

Windbreak and shelterbelt species have specific site requirements that should not be neglected when deciding what species to plant. As with crops, these factors play an important part in determining how successful your windbreak or shelterbelt will be in protecting crops and livestock.

Site requirements include:

- plant hardiness zone of species selected for planting
- soil texture class, pH and drainage
- plant species' height at maturity
- plant rate of growth
- crown width and root development
- shade and salt tolerances
- flood tolerance.

Sandblasting and the desiccation of specialty crops can be reduced by windbreaks. Thinning of the lower branches when the windbreak has reached the right height may reduce the risk of frost.

WINDBREAKS AND SHELTERBELTS FOR SENSITIVE CROP PROTECTION

The lighter soils of southwestern Ontario support valuable crops like tomatoes, which leave little crop residue. Sandblasted seedlings or transplants may be set back or killed. Spring windbreak protection is important in this case, and single-row *deciduous trees* may not provide enough early protection.

Sensitive crops especially benefit from greater wind protection. The benefits for fruit (including pollination) are greatest. Leafy crops (vegetable and forage) benefit also, as do root and grain crops to a lesser extent. Heat-loving crops (corn, peppers, and tomatoes) mature earlier because of higher heat units and reduced wind damage to leaves.

Wind-damaged leaves force the plant to waste resources to repair the damage. Quality may also be affected. For example, celery develops more fibre and grows tougher when subjected to more wind and sandblasting.

Crop yields are increased by windbreaks and shelterbelts for two key reasons:

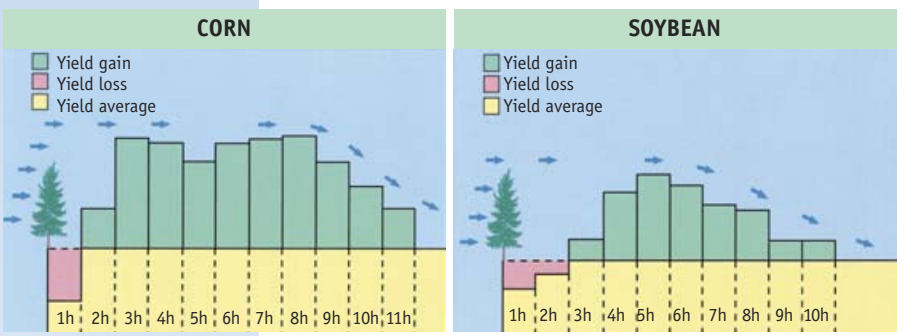
- an improved microclimate
  - ▷ reduced wind speeds and a corresponding increase in temperature
  - ▷ reduced desiccation of crops and soils
- extra moisture is available in the spring from trapped snow.

Yield benefits occur where windbreaks are present. Their significance relates to the type of crop grown:

- drought-tolerant crops like annual cereals show the lowest response
- forage crops show moderate response
- weather-sensitive and specialty crops like vegetables and and raspberries show the greatest response.

Field windbreaks and shelterbelts increase crop yields.

WINDBREAKS AND SHELTERBELTS FOR CROP YIELD INCREASES



LEGEND h = tree height

Observations at Ridgetown College in southwestern Ontario show that both corn and soybean yields increased on the downwind side of a windbreak over distances 8–12 times the height of the windbreak. Each bar represents the yield average over the distance, measured in multiples of windbreak height.

On the upwind side, yield increases were also seen 3–5 times the height of the windbreak. Yield losses were observed in the areas immediately adjacent to the windbreak. However, there was a net yield increase overall.

WINDBREAKS AND SHELTERBELTS FOR LIVESTOCK PRODUCTION

A well-thought-out and properly cared-for windbreak protects livestock in both the winter and summer and offers long-term economic benefits to you as landowner. The ideal location of a windbreak varies with the height of the trees and site-specific limitations. Prior to planting, get advice from a knowledgeable source regarding your unique situation.

Windbreaks and shelterbelts strategically placed around feedlots, livestock facilities, pastures and calving areas will reduce wind speed and:

- lower animal stress
- improve animal health
- increase feed efficiency
- protect the working environment in and around the livestock area
- screen noise and reduce odours associated with livestock operations.

Effective design for winter shelter for livestock should be:

- no more than 40% porosity
- 3–5 rows of shrubs, and 1–2 rows of dense conifers
- located approximately 30 metres (100 ft) upwind of the area needing protection.

✔ **Provide proper drainage for melting snow to reduce the level of mud in feedlot areas.**

✔ **Contain runoff from the feedlot away from the trees**, since high nitrate levels in the runoff may damage and eventually kill the windbreak.

Properly designed shelterbelts can reduce livestock feed energy requirements.

Windbreaks and shelterbelts play an important role in the protection of livestock, particularly for young animals and in areas with cold northerly winds during the winter and early spring.

The specific needs of animals dictate that special attention be given to access, snow storage, and drainage when planning a livestock windbreak. The time spent on layout, site preparation, weed control, and replanting is paid back many times throughout the life of a shelterbelt.

Caution: Horses eating wilted Red Maple (*Acer rubrum*) leaves can develop severe health problems and possibly die.

SHELTERBELTS FOR SNOW CONTROL

Windbreaks and shelterbelts are an effective tool for protecting laneways.

Shelterbelts can be designed for snow control and easier access to animals, buildings, and forage and grain storage facilities during the winter months. Windbreaks and shelterbelts can trap snow, preventing its movement toward laneways and buildings. Trapped snow occurs in deep, narrow drifts.

A well-designed shelterbelt system will:

- collect snow in low-use areas and keep it out of high-use areas
- save on fuel expenses
- reduce equipment wear
- save on the amount of labour required for snow removal and livestock feeding.

The distribution of trapped snow can be managed through shelterbelt design. More porous shelterbelt designs lead to a shallow and longer downwind distribution of snow. A less porous shelterbelt will result in a deep and short snow drift. Porosity can be managed by varying tree species and spacing between or within tree rows or by pruning.

Shelterbelts established at least 30 metres (100 ft) away from a building or farmstead make for an ideal living snow fence. Note that for buildings with natural ventilation, at least 60 metres (196 ft) should be left from the buildings to allow for adequate air circulation.

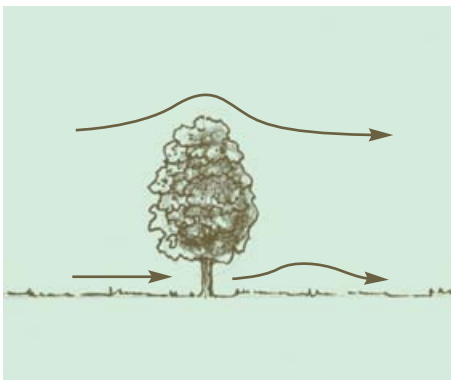
If trees are to be used to protect roads:

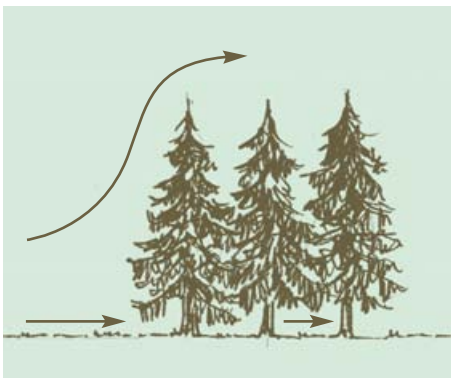
- use a dense shelterbelt placed at least 30 metres (100 ft) away from the roadway

OR

- create a scouring effect, which removes snow from a roadway, by locating the shelterbelt close to the roadway but removing the branches from the bottom 2 metres (6.5 ft). This forces more wind to move through the lower part of the canopy, and carry the snow beyond the road.

To increase the porosity of the shelterbelt, use deciduous trees and/or increase spacing between the trees.





Snow distribution patterns are affected by shelterbelt height, density, and bottom gap. In the upper illustration, a highly porous, deciduous, single-tree windbreak with a bottom gap will distribute snow evenly up to 35 times the height of the trees. This is a desirable feature when snow cover is needed to increase soil moisture, without the moisture being concentrated close to the shelterbelt.

In the lower illustration, a solid-fence effect is created by planting a very dense shelterbelt of a conifer, like Spruce, which has low-to-the-ground branch habits. This design will form snow drifts, with the majority of the snow depth being deposited within 5–8 times the height of the shelterbelt.

TREES FOR ODOUR CONTROL

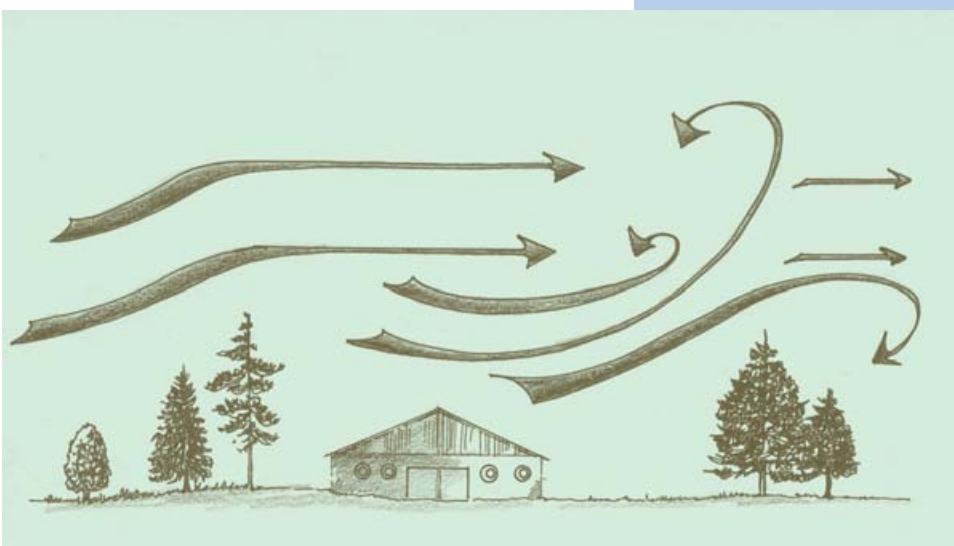
Farmyard dust and odour can be "screened" by windbreaks and shelterbelts. Levels of dust particles and odour carried by wind can be reduced by the trapping and mixing that results from windbreaks. Coniferous trees, with a large surface area provided by the many needles combined with a low porosity, are well-suited for this use.

Odour is also mitigated by windbreak placement and design. Windbreaks and shelterbelts help to control odour by:

- preventing odours from being distributed by absorbing them via leaf membranes and by micro-organisms living on plants
- reducing wind speed across manure storages, which prevents odours from being picked up by the wind and dispersed
- creating turbulence, which redirects odour plumes upward in the landscape.

Odour control should involve:

- designs that maximize wind turbulence (50% density and low porosity)
- a minimum of two rows
- a wedge-shaped design created by planting short dense shrubs with tall trees to create the wedge
- trees spaced within rows with a range of 2–6 metres (6–20 ft) and between rows of 3.5–7.5 metres (12–25 ft)
  - ▷ planting arrangement should maximize wind turbulence
- coniferous trees for year-round odour control and visual screening
- a well-landscaped livestock operation, because it's more acceptable to neighbours, possibly resulting in fewer complaints.

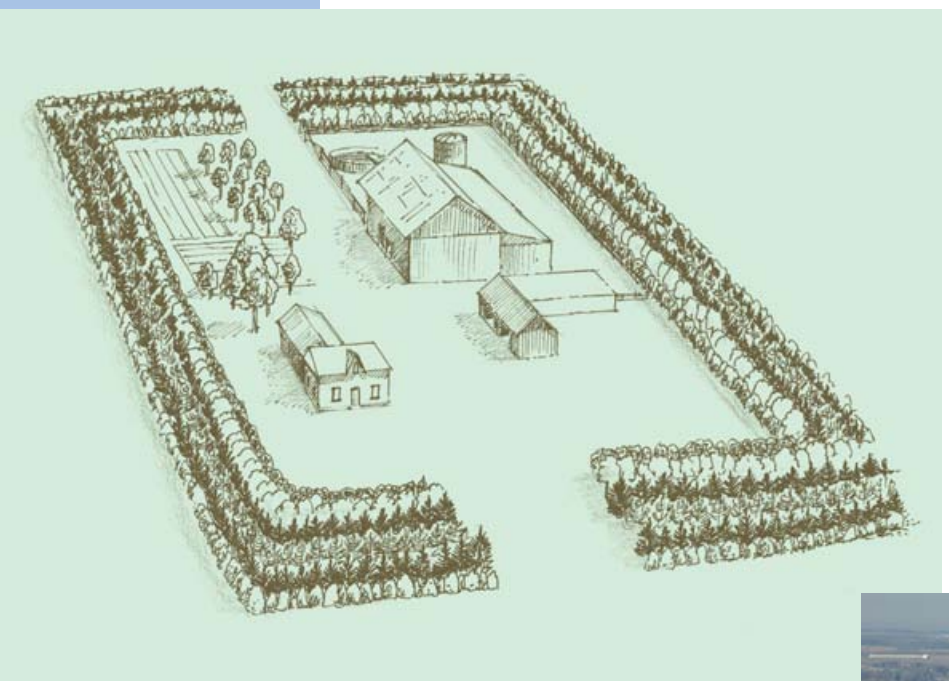


Well-planned windbreaks and shelterbelts can reduce odour by causing increased turbulence – which moves air and odour plumes up and away from the source.

SHELTERBELTS FOR PROTECTING FARMSTEADS AND REDUCING ENERGY HEATING COSTS

Farmstead shelterbelts should:

- ► trap blowing snow to prevent snow buildup in the yard or on driveways
- ► be at least three rows wide on the side(s) of the yard to protect against prevailing wind
  - ▷ where space is limited, reduce the number of rows instead of decreasing row spacing or planting closer to buildings
  - ▷ with careful management, fewer rows of healthy trees throughout may be as effective and take up less space



- ► be located so that the inside row is no closer than 30 metres (100 ft) from the main buildings and driveways to prevent snow buildup problems
- ► have the outside row of the shelterbelt planted with shrubs to act as a snow trap and the inside row planted with tall, dense, long-lived trees.

Tests in Canadian winters indicate that dense shelterbelts (two rows of conifers plus two rows of defoliated deciduous trees) reduce home heat losses by up to 25%. The amount of energy savings is proportional to the decrease in wind speed. Older homes, which allow for more air infiltration, are most sensitive to the kind of protection provided by farmstead shelterbelts.

PLANNING FOR WINDBREAKS AND SHELTERBELTS

There are eight essential steps for the design, establishment and maintenance of windbreaks and shelterbelts. The same principles also apply to planting new trees and shrubs in existing fencerows.

STEP 1 – DETERMINE YOUR OBJECTIVES

Decide which of these functions you want your windbreak or shelterbelt to perform:

- reduce soil erosion and increase crop yields
- beautify the farm and provide protection for the farmstead
- provide shelter for livestock and crops
- control odour
- reduce heating and cooling costs
- provide economic returns/opportunities.

You will often have more than one objective, which can make planning your windbreak more challenging. You may wish to consult a forestry professional.

STEP 2 – COMPLETE A SITE ASSESSMENT

A site assessment requires that you look at your soil type, the proximity of the windbreak/shelterbelt to the road and drainage, and the orientation of the wind direction.

When doing a site assessment, consider these important factors:

- continuity – no gaps if possible, because gaps create wind tunnels
- direction of prevailing winds – plant at right angles to prevailing or most troublesome winds
- distance from buildings and access lanes
- extension beyond buildings – should extend 30–60 metres (100–200 ft) beyond buildings to prevent side winds from reaching buildings
- planting a series of windbreaks – for complete protection
- soil and crop combinations to be used
- existing and possible field layouts
- desired width of sheltered zone and desired field width
- site/tree compatibility
- presence of ditches, field tiles (tile drainage) and utility lines and other obstacles
- available space
- proximity of neighbours, where odours are a factor.

STEP 3 – CHOOSE THE SPECIES AND CONFIGURATION TO MEET THE PLANNING OBJECTIVES

✔ Match tree species to site characteristics.

Select trees with the most suitable density, height and crown features. See the following charts for suggestions.

SPECIES SELECTION FOR WINDBREAKS AND SHELTERBELTS

SPECIES	HARDINESS ZONE	TEXTURE CLASS: SAND	SANDY LOAM	CLAY LOAM	CLAY	pH	DRAINAGE	DENSITY
TREES								
RED MAPLE *Acer rubrum*	3	✘	✘	✘	✘	4.5–7.5	Well to imperfect	MD
SILVER MAPLE *Acer saccharinum*	3b		✘	✘	✘	5.5–6.5	Moderately well to poor	MD
SUGAR MAPLE *Acer saccharum*	3b		✘	✘		5.5–7.5	Well to imperfect	VD
WHITE ASH *Fraxinus americana*	3b		✘	✘		6.1–7.5	Well to imperfect	MD
GREEN ASH *Fraxinus pennsylvanica*	2b		✘	✘	✘	6.0–7.5	Moderately well to poor	MD
BLACK WALNUT *Juglans nigra*	4b		✘	✘		6.6–8.0	Well to imperfect	LD
TAMARACK *Larix laricina*	1	✘	✘	✘	✘	4.8–7.5	Moderately well to very poor	MD
WHITE SPRUCE *Picea glauca*	1		✘	✘		4.6–8.0	Well to imperfect	D
NORWAY SPRUCE *Picea abies*	3a	✘	✘	✘	✘	4.6–8.0	Rapid to imperfect	MD
RED PINE *Pinus resinosa*	2b	✘	✘			4.6–6.5	Rapid to imperfect	MD
HYBRID POPLAR *Populus X*	2b		✘	✘		5.5–7.0	Well to imperfect	MD–D
RED OAK *Quercus rubra*	4a	✘	✘	✘		4.8–6.5	Well to imperfect	D
BUR OAK *Quercus macrocarpa*	4b	✘	✘	✘	✘	4.6–8.0	Well to poor	MD
EASTERN WHITE CEDAR *Thuja occidentalis*	3		✘	✘	✘	6.1–8.0	Well to poor	VD

DENSITY LEGEND: VD – Very dense, D – Dense, MD – Moderately dense, I – Intermediate, LD – Low density

SPECIES SELECTION FOR WINDBREAKS AND SHELTERBELTS

SPECIES	HARDINESS ZONE	TEXTURE CLASS: SAND	SANDY LOAM	CLAY LOAM	CLAY	pH	DRAINAGE	DENSITY
SHRUBS								
DOWNY SERVICEBERRY *Amelanchier arborea*	3b	✘	✘	✘	✘	6.1–6.5	Well to poor	D
NINEBARK *Physocarpus opulifolius*	2b	✘	✘	✘	✘	6.1–8.5	Very poor to excessive	D
RED CHOKE CHERRY *Prunus virginia*	4		✘	✘		6.1–7.5	Well to imperfect	I
AMERICAN ELDER *Sambucus canadensis*	3	✘	✘	✘	✘	6.1–7.5	Rapid to imperfect	MD
AMERICAN RED ELDERBERRY *Sambucus racemosa ssp. pubens*	3		✘	✘		6.1–8.5	Well to imperfect	MD
HIGHBUSH CRANBERRY *Viburnum opulus var. americanum*	2b		✘	✘	✘	6.6–7.5	Well to poor	D

DENSITY LEGEND: VD – Very dense, D – Dense, MD – Moderately dense, I – Intermediate, LD – Low density

Source: adapted from *Selection and Arrangement of Plants in Shelterbelts and Buffer Strips*, Andre Vezina, Pascal Desbiens and Nadine Nadeau, Institut de technologie agroalimentaire, La Pocatière Campus, 2007

Placing a windbreak too close to a roadway will result in a dumping of snow on the roadway, rather than a scouring effect. It's wise to consult your municipality before placing any windbreaks near roadways.

Two key characteristics to look for when selecting species are density and height.

Density determines how much a windbreak slows the speed of the wind and the size of the area protected. Deciduous species tend to be less dense lower to the ground. The density of conifers can be altered by pruning the lower branches to modify their effect on snow distribution.

Tree height influences the distance over which a shelterbelt will reduce the wind speed, reduce erosion, and increase crop growth. A shelterbelt will reduce wind speed and increase crop growth for a distance of 15–20 times the height of the windbreak.

STEP 4 – DEVELOP A PLANTING PLAN

✔ **Create a planting plan** on a map, diagram, or aerial photo:
- ► use the observations made in the site assessment
- ► include the species and the spacing.

Spacing, both within and between the rows, is an important part of good windbreak or shelterbelt design. Spacing greater than recommended will produce an "open windbreak," which will be slow or never "close," i.e., provide the desired protective effectiveness.

Spacings that produce a closed windbreak – one where spacing distances close too early – will produce small, weak trees that are more susceptible to damage from snow and ice loading.

Remember to consider:

- ► planning for the optimal height
- ► reducing competition from adjacent crops
- ► aiming for fast growth, winter hardiness, longevity, and resistance to windburn, insects, diseases, chemical injury, and salt sprays
  - ▷ Eastern White Cedar and Spruce meet many of these requirements.

A six-row field shelterbelt would provide multiple benefits. While many farmers in southern Ontario would be hard-pressed to accommodate a six-row shelterbelt, we present the ideal design configuration here for your consideration. (Species will vary with site type and personal preference).

Row 1: (windward side): shrubs such as Nannyberry or Wild Plum provide density low to the ground

Row 2: White Spruce or White Cedar for dense cover

Row 3: White Pine or Norway Spruce for height

Row 4: Basswood or White Ash for height

Row 5: White Spruce or White Cedar for dense cover

Row 6: shrubs (density close to the ground)

This design exploits density and height to maximize protection as well as aesthetics and recreational hunting opportunities.

STEP 5 – PREPARE THE SITE

The sketch map should include observations made in the site assessment, and indicate the location and type of planting to be planted. Note the locations of field tiles.

Site preparation is an essential step in the successful establishment of windbreaks and shelterbelts. Good site preparation techniques will help ensure that seedlings are easier to plant, and not stressed by excessive weed competition. Cover crops are extremely helpful in site preparation.

COVER CROPS: SEPTEMBER–OCTOBER

✔ **Establish a cover crop in the year prior to planting.** Cover crops are useful for preparing your site, if they're established in the year prior to planting.

Cover crops can:

► keep weeds down
► allow earlier access of machine tree planters into fields in the spring
► reduce maintenance after planting.

A good choice in cover crop is dwarf white clover, as it doesn't compete with trees for sunlight.

✔ **Prepare your planting site in the late summer and fall of the year before planting**
► springtime site preparation – just before the area is planted – is more difficult.

✔ **Mark the site in the field** with survey stakes or ribbons
► mark in-row and between-row spacings.

Some site preparation techniques include:

► mechanical methods – including tillage, mulching, cultivation and mowing
► an application of chemical herbicides – band or spot spraying
► cover crops.

TILLAGE: AUGUST–EARLY SEPTEMBER

✔ **Till soil in late August and early September**
► loosen the soil to a depth of 15–20 cm (6–8 in.) to allow for adequate root development and make easier the placing of plastic mulch, if it's going to be used.

Tillage width will differ according to the number of rows in your windbreak or shelterbelt:

► for a single row, till a width of 3 metres (10 ft)
► for a double row, till a width of 5 metres (15 ft)
► for a triple row, till a width of 8 metres (25 ft).

MULCH INSTALLATION: SEPTEMBER–OCTOBER

✔ **Stake the start and finish of each row.**

✔ **Ensure the between-row spacing remains constant**
► between-row spacing is usually 3–4 metres (10–13 ft).

✔ **Place black plastic mulch over the soil to control weeds**
► place mulch over the location of each tree row.

ORDER TREES: OCTOBER–NOVEMBER

✔ **Confirm number of trees for planting and place your order.**

MULTI-TREE WINDBREAK PLANTING

Site Preparation Plan

✔ Prepare site by tilling in late summer of year prior to planting.

✔ Broadcast white clover seed in tilled area.

✔ Once clover has established and before it goes dormant, spray 3 bands with Roundup, 3 metres apart in windbreak location.

Site Description

Topography: flat
Drainage: moderate to well
Soil: loam
Clover: clover with sprayed bands
Total hectares: 40

Planting

Plant west row with 535 White Spruce, 2-metre spacing between trees.

Plant centre row with 535 Hybrid Poplar, 2-m spacing between trees and shrubs, Sugar Maple, Ninebark, Highbush Cranberry: repeat 2-m spacing between trees and shrubs. Requires 268 Sugar Maple, 134 Highbush Cranberry, and 133 Ninebark. Total seedings to order: 1605.

Recommendation

Mulch seedling with woodchips after planting to help retain moisture during dry periods. Wood chips shouldn't touch the trunk of the tree as this may cause decay. Create a doughnut with the mulch.

STEP 6 – ORDER THE TREES

✔ **Order at least six months in advance.**

✔ **Buy plant materials from the correct seed zone** to ensure good survival and optimum growth
► consult your local conservation authority to determine your seed zone.

Commercial nurseries, some conservation authorities, and county nurseries are good sources for trees.

STEP 7 – PLANT THE SITE

Planting: Mid–April to early June

The long-term success of your shelterbelt depends on how well you plant your trees.

✔ **Begin to plant as soon as the soil can be worked, and before the tree leaves emerge**
► in southwestern Ontario, this may be as early as the beginning of April
► in eastern Ontario, this may be as late as mid-May.

✔ **Monitor the weather and soil conditions to determine start date**
► check with local planting agencies to see when they recommend starting planting.

✔ **Follow your design by carefully laying out the planting site in advance**
► use a line, or in some way mark a straight line, to ensure straight rows and make future maintenance easier.

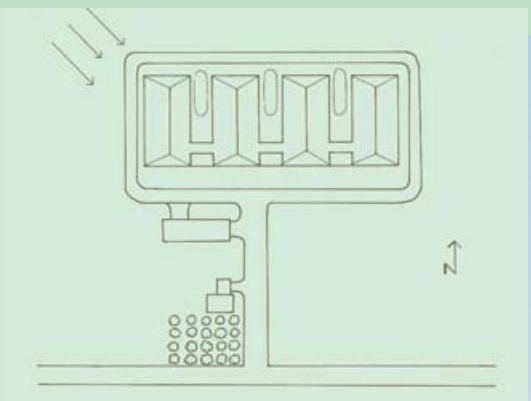
✔ **Handle stock with care**
► reduce exposure and keep seedlings moist.

✔ **Plant only as many trees as you can care for.**

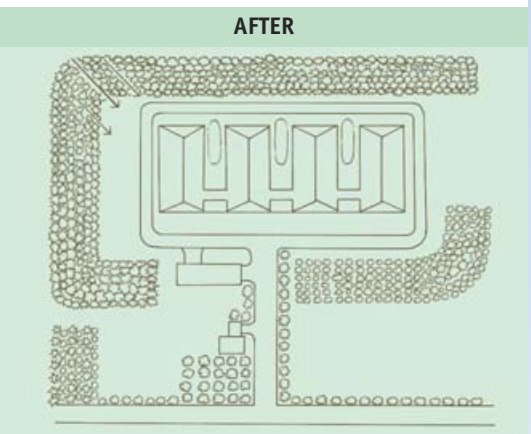
✔ **Ensure planting holes are properly excavated and no roots are left exposed after planting.**

✔ **Protect trees from livestock** as they may eat or trample newly planted trees
► fence off planting areas if necessary.

BEFORE



AFTER



These are before-and-after views of a shelterbelt and windbreak designed to protect a greenhouse operation. A combination of conifers and hardwoods is planned for the north and west sides for maximum protection from heat loss and snow loads. Deciduous trees are planted on the south and east sides to prevent winter shading of the greenhouse.

STEP 8 – MAINTAIN THE PLANTING

A windbreak or shelterbelt is considered successfully established when it can perform its desired function(s). Most will require some degree of maintenance after they are established and while they are growing.

✔ **Replace dead or damaged trees promptly.**

✔ **Cultivate for no more than three seasons** to protect expanding root systems
- ► mow after three years to reduce weed competition and control noxious weeds.

✔ **Irrigate during dry periods**
- ► in some cases, watering may not be feasible and poor survival may require refilling.

✔ **Prune to create some desired effects on snow distribution**
- ► removal of lower branches of some conifers can help create a more even distribution
- ► shelterbelts can be pruned to produce high-quality timber.

✔ **Inspect regularly for damaging agents such as disease and insects.**

✔ **Thin trees if necessary** after at least 10 years of growth, e.g., a Spruce windbreak planted at 2.5-metre (6-ft) spacing should have every second tree removed provided that the remaining trees are of good health and vigour

✔ **Control weeds through spot spraying and/or mulches**
- ► crop protection chemicals can damage or kill your planting – use practices that minimize spray drift so that herbicides don't make contact with your windbreak or shelterbelt
- ► in place of, or in addition to, chemical weed control, add wood chips or other organic mulch, 10 cm (4-in.) thick in a 1-metre (3.3-ft) radius from the base of the seedling.

Windbreaks and shelterbelts can be used to provide corridors that allow wildlife to move easily between forested areas. Forested areas provide the majority of their habitat requirements, including important food sources, bedding areas, and thermal cover for some areas. They can provide excellent viewing and hunting opportunities.

Thin and prune windbreaks to attain proper porosity.

Strategically placed birdhouses will be occupied quickly.

Electric fencing will help protect plants from browsing livestock and white-tailed deer. Repellents for rodents may be used and should be applied on tree trunks. A plastic spiral is also effective for protection from rodents and deer. Plastic spirals should be removed before the active growing season.

HARVESTING TREE PRODUCTS FROM WINDBREAKS

Your criteria for selecting species to plant in a windbreak should include not only form and function, but economic opportunity as well. Many of the agroforestry opportunities covered in this book can be attained in a windbreak.

Planting nut trees in your windbreak can yield economic as well as environmental benefits.

Field windbreaks with valuable hardwoods can be harvested at maturity for sawlogs.

Hardwoods that produce high quality timber will require more care than coniferous species. Hardwoods such as Oak, Sugar Maple, White Ash and Yellow Birch can produce quality timber if shearing and pruning are done properly.

Species such as Hybrid Poplar, Green Ash and Silver Maple are fast-growing sources of fuelwood.

Scots Pine, White Spruce and Balsam Fir are among the conifers grown for Christmas trees.

These trees are being grown in a field windbreak as transplant stock.

BEES IN THE TREES

Some species of trees and shrubs are excellent nectar producers and are important to beekeepers for honey production. However, they are often too far away from hives to be used for foraging by domesticated bees.

One way to increase honey production for beekeepers involves establishing bee trees and shrubs in windbreaks and shelterbelts surrounding crop fields. Growing trees such as Basswood or flowering shrubs with groundcover crops for nectar production is an intriguing land use concept that will increase honey production and produce other valuable agricultural and forest tree crops – making the plantings more feasible.

Planting bee-friendly trees and shrubs in windbreaks and shelterbelts can increase honey production.