WINBREAK / SHELTERBELT ESTABLISHMENT SPECIFICATIONS

WINDBREAK / SHELTERBELT INTRODUCTION

Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations. The height of the tallest row and overall density of foliage and branches of an individual windbreak or shelterbelt planting greatly influence the size of the area that is protected or sheltered.

WINDBREAK / SHELTERBELT DESIGN

General Information

Each windbreak or shelterbelt should be designed for specific sites and objectives. Windbreaks are most effective when oriented at right angles to prevailing winds. Primary windbreaks for wind protection and snow control are usually located to the north and west of the area needing protection. The minimum number of rows for a primary windbreak will vary depending on the purpose of the planting. (See Design purpose)

Secondary windbreaks are usually located to the south and east of the area protected by the primary windbreak. Secondary windbreaks usually consist of shrubs or short trees designed to reduce the impact of the rare snowstorm from the south or east while allowing summer breezes to penetrate the protected area. A design of one or more rows is acceptable for a secondary windbreak.

The height (H) and density of a windbreak determine its ability to reduce wind speed and define the area of protection. To determine the area of protection, windbreak height (H) is determined by estimating the height of the tallest species at 20 years of age. On the windward side (the side toward the wind), the protected zone extends 2 to 5 times the height (2H-5H). On the leeward side (the side away from the wind), the protected zone may extend 10H to 30H.

Multiple-row windbreaks should have shrubs and small trees in the outer rows. Shrubs or conifers can be used in the most windward row of a multiple-row planting to provide additional soil moisture for the plants within the inner rows.

Windbreak density is the ratio of the solid portion of the barrier to the total area of the barrier. Density of the planting should be adjusted to meet landowner objectives and the purpose of the windbreak. The number of rows, the spacing between plants, and species composition are factors that control windbreak density.

Thin or prune windbreaks as needed to maintain proper density and plant health to continue its function State and local county regulations must be followed in locating plantings adjacent to highways. Windbreaks will be positioned to avoid causing visibility problems at road intersections, curves, and driveway entrances. Trees or shrubs at maturity should not spread into the rights-of-way of roads. Avoid creating blind corners at road intersections.

To prevent hazards where snow deposition is a concern, plantings made on the north and west sides of a road or highway shall have the north and west tree rows (windward rows) approximately 200 feet from the centerline of the road. When plantings are made on the south and east sides of a road or highway, the rows nearest to the road shall be approximately 80 feet from the centerline of the road.

Avoid plantings under, over, or immediately adjacent to power, telephone, and similar above or below ground facilities, or use species that will not interfere with the facility. Call **LA One Call 811** or !-800-273-3020 before planting to identify if underground utilities are located near or in the planting site. Consult utilities about required right-of-way distances from tree plantings.

Livestock shall be excluded from all windbreak/shelterbelt plantings.

Fireguards may be maintained on each side of the windbreak. Minimum width of the strips will be 8 feet from drip-lines. It is preferred that they be equal to the average row spacing.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Between-row spacing: Spacing between rows, except for twin row high-density plantings, shall be 12 to 30 feet. Spacing between rows should be at least 4 feet greater than the width of the maintenance equipment. Some species require specific between-row spacing recommendations due to rapid growth rate and overtopping growth form. Rows of conifers and deciduous trees should not be planted within 25 feet of planted cottonwoods, hybrid poplars, honeylocust, or hybrid willows, nor should they be alternated with these species within the row.

Within row spacing:

Table 1. Within row spacing (Feet)

Species	Single Row Planting	Multiple Row Planting	High-Density Planting
Shrubs	3-6	3-6	3
Conifers (Pines & E. Red cedar)	8-12	8-16	8
Small Broadleaf Trees	8-12	8-16	-
Medium to Tall Trees	8-15	10-20	-

Design Purpose

Erosion control: Windbreaks designed to control wind erosion should have a average density of 50 percent during the period when the soil is subject to soil erosion. As this period occurs most often in the spring of the year when most deciduous trees are leafless, suggests that the windbreak contain a coniferous species or a dense shrub row.

A single, complete row of trees or shrubs may be used. Additional rows may be used to meet other objectives or density requirements. See Table 1 for in-row spacing for single and multiple row plantings.

In most cases, a single windbreak will not protect the entire field. Additional windbreaks parallel to the first will need to be established at intervals across the field. Typically, the distance between windbreaks should range from 10H to 20H and can be determined from wind erosion calculation formulas.

Farmstead/feedlot protection: Windbreaks designed to provide protection to objects and areas should have a density greater than 50 percent. For wind protection, the windbreak row with the tallest tree species should be approximately 2H to 5H from all primary objects or areas needing wind protection.

For areas needing both snow and wind protection, the windward row should be at least 150 feet from areas needing protection. The area to be protected will fall within a leeward distance of 10H. On the windward side, there should be at least 50 feet between the windbreak and the road or other objects that might be within the zone of the windward drift. The ends of the windbreak should extend at least 100 feet beyond the area needing protection.

Access roads should be planned around the ends of the rows. If necessary, to go through the planting, angle the opening so as not to cause the winds to “funnel” through the opening. These angle access roads, if feasible, should be located 100 to 500 feet from the ends of the windbreak.

A primary windbreak for farmstead/feedlot protection may contain the following number of rows: 2, 3 or 4 rows

Where a sufficient area does not exist or the terrain is too rough for a multiple row planting, a primary windbreak planting may consist of two rows of eastern red cedar. A secondary planting on the south and east sides may consist of a single row of any adapted tree or shrub. For in-row spacing, see Table 1 for single and multiple row plantings.

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Screen plantings – noise barriers: Windbreaks designed for noise barriers should have a minimum density of 80 percent. Noise barriers reduce noise by deflecting the noise away from the observer, by absorbing some of the noise before it reaches the observer or both. For maximum effectiveness, plantings should be placed as close as possible to the noise source.

For reducing high speed vehicle traffic noise, barriers should be greater than 65 feet wide, and for moderate traffic speed noise, barriers should be >25 feet wide. Plantings made on the north and west sides of a road or highway shall have the north and west windward tree rows approximately 200 feet from the centerline of the road. Plantings on the south and east sides of a road or highway, the row nearest the road shall be approximately 80 feet from the centerline of the road. The center tree row will be at least 45 feet tall. Shrubs 6 to 8 feet tall next to traffic lanes should be backed by rows of trees 30 to 50 feet tall.

Noise barriers must be twice as long as the distance from the observer to the noise source. Where year- round noise reduction is desired, conifers should constitute the majority of the plantings.

No matter how severe the noise, noise barriers shall not be positioned where the barriers will cause snow deposition or drifting on the road sufficient to create a safety hazard to the traveling public. For many of these situations, a living snow fence system is often needed upwind from the observer, thereby reducing the amount of snow that could cause a problem.

Screen plantings – visual barriers: Windbreaks designed for visual barriers should have a density of 60 to 80 percent. Plantings should be at least one row of conifers or at least three rows of deciduous trees or shrubs or a combination of both. Visual barriers should be designed with species that are aesthetically pleasing to the observer.

Living barriers against airborne odor movement: Minimize the movement of odor away from an odor-producing source to a sensitive area. Tree varieties and placement for the windbreak shall be managed to maximize odor interception and dilution of air, and reduce odor leaving the source. Windbreak density on the windward side of the problem source shall be greater than 50 percent. Windbreaks designed for odor interception (downwind from the problem source) should have a density of 60 percent.

Where site conditions allow, place plantings around the entire perimeter of the odor source.

Select species based on high leaf surface roughness (plants with leaf hairs, leaf veins, small leaf size), complex leaf shapes, large leaf circumference to area ratios, and medium to rapid growth rates.

Adjust windbreak porosities/densities to meet air movement needs for naturally ventilated livestock confinement systems.

Keep the inner row of windbreak plantings from all buildings and waste storage areas at least 10 times the exhaust fan diameter or 50 feet, whichever is farther. Use wide “between row spacing” to increase particle surface area contact and foliage light levels.

Chemical Drift: Windbreaks reduce chemical drift hazards in two ways – by reducing wind velocities across the field where the chemicals are applied and by intercepting chemicals that have moved off site onto the leaves, twigs, and bark of the windbreak plants.

Due to the potential damage that chemicals cause to tree/shrubs, it is not recommended to design windbreaks specifically to intercept chemical drift.

Wildlife habitat enhancement: If the primary purpose of the planting is to improve wildlife habitat, refer to Conservation Practice 645, Upland Wildlife Habitat Management. However, the designs of windbreaks for other purposes can be modified to make the practice more beneficial to wildlife.

Considerations for the improvement of windbreaks for wildlife habitat include, but are not limited to:

- Include a variety of trees and shrubs in the planting. This will provide habitat for a large number of species, reduce the chances of disease or insect pest problems, and will increase the distribution of food throughout the growing season.

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- Provide dense areas (thickets) of suckering shrubs and conifers to provide winter thermal protection. If wildlife habitat is a concern, shrub rows can be planted as close as 6 feet between the rows to aid in establishing thickets.
- Add additional rows that provide food and cover on the lee side of the planting.
- Consider planting or leaving a 20 to 50-foot wide border of herbaceous vegetation such as grass, grain, or stubble as along the edge of a windbreak. This provides nesting, loafing, and foraging cover for wildlife.
- Provide travel corridors by extending the windbreak legs or by installing a hedge row planting.

Specialty Designs

Twin row high density: The “twin row” refers to two closely spaced rows of trees or shrubs having the same growth rate, crown characteristics, and life span. Both rows of a twin row shall consist of conifer- type species such as eastern red cedar or deciduous shrubs. Deciduous tree species are not suited and should not be used for this type of plantings.

“High density” refers to the close spacing of the trees or shrubs in each twin row. The two rows of a twin row shall be spaced 6 to 10 feet apart or the closest between row spacing possible considering the type of planting equipment used. Refer to Table 1 for in-row spacing recommendations.

There can be one to four sets of twin rows depending on the objectives. The open space between the twin rows can vary from 25 to 100 feet.

Species Composition

With the exception of eastern red cedar, no more than two rows should be planted to the same species, unless site conditions limit the number of available species. Give consideration to planting pollinating species

For multiple row plantings, consider at least two or more rows of conifers.

Often a single species will be planted in each row. Generally, this makes subsequent maintenance and renovation easier. However, single row, single species plantings are considerably more prone to failure from drought, disease, and/or insects.

Mixing compatible species within the row can reduce the severity of some insect and disease infestation and spread. Alternating species, either trees or shrubs, within the same row is recommended only if they have similar growth rate, crown characteristics, life span, and are consistent with landowner objectives. In the leeward rows, trees and shrubs may be planted in groups or segments of rows (5 or more plants of one species in a series) to enhance wildlife values or the visual resources of the site.

Species Selection

Match the species to the intended purpose(s), site/soil conditions, and other factors such as maintenance needs, wildlife use, aesthetics, etc. See **Table 2,** for species adaptability.

Priority should be given to plant materials that have been selected and tested in tree/shrub improvement programs. When possible, care should be taken that the seed sources come from the same geographic area in which the seedlings will be planted.

Seedlings grown by the Louisiana Department of Agriculture and local commercial nurseries will be acceptable. Seedlings obtained from other sources should be from seed sources within a 150-mile North-South zone of the planting site. Containerized stock from commercial nurseries must be suited for the "Hardiness Zone" of the site. This information is generally provided on a tag attached to the tree.

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Consideration must be given to the species' susceptibility to common, locally used pesticides. See **(Table 3).**

Species Planting & Seedling Care

Refer to Tree/Shrub Establishment (CPS 612) specifications.

Site Preparation

Site preparation may include the whole row, strips, or individual treatments such as mulching where the tree is to be planted. Prepare the site mechanically, by applying herbicides, or a combination of the two, refer to Tree/Shrub Site Preparation (CPS 490) specifications)

If possible, the planting site should be prepared the fall before planting.

If the site is in small grain, corn or similar clean tilled crop, and is reasonably weed free, plant trees into the stubble. It may, however, be necessary to disk a narrow strip to kill weeds or volunteer grain, or to prevent residue from clogging a mechanical planter. If fabric mulch is used, disking will be needed.

Sites in row crops should require little site preparation other than light tillage.

In areas of grass, the competing vegetation should be controlled by tillage or application of an approved herbicide 3 feet on each side of the planting row.

All invasive and brush species must be completely controlled before planting.

Soil Considerations

- Sandy Soils

When fabric mulch is not used, maintain as much organic matter on the soil surface as possible.
If necessary, plant a cover crop the summer before the trees are planted to improve soil water capacity

- Loamy, Clay Loam, and Clayey Soils

To create a desirable rooting zone and to increase moisture retention, tree rows should be deep tilled, particularly if they are compacted or have a hardpan or dense clayey subsoil within 10 inches of the surface. Plant a cover crop the following the deep till to improve soil water capacity.

Maintenance Details

Competitive vegetation will be controlled for at least 3 years after planting. Specific recommendations for vegetative control should be listed in all tree planting plans for the first 3 years.

Livestock shall be excluded from the planting area.

Protect from rodents with wire cages, tube protectors, or similar devices. Fine mesh wire on the bottom of a livestock protection fence may be also used. Mowing in and around the planting site may be necessary to prevent the creation of hiding habitat for rodents. Protection should be carried out until the trees or shrubs are fully established.

If needed, adequate protection against wind damage will be provided with the use of fabric screens, protective barriers, shingles, shakes, cones or shade cards

References:

Working Trees for Agriculture, http://www.unl.edu/nac/workingtrees/wta.pdf

Windbreak Density: Rules Of Thumb for Design, Agroforestry Notes, AF Note-36, September 2007, http://www.unl.edu/nac/agroforestrynotes/an36w03.pdf

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Table 2. Potential woody species for windbreak and shelterbelt establishment

Species Name	pH 1/	Flood Tolerance 2/	Seedling Height-in (Root Collar Diameter)	Root Length-inches (No. Laterals)	Native-Introduced	Wildlife Use 3/	Pollinator Use 4/	MLRA 131A	MLRA 131B	MLRA 131C	MLRA 131D	MLRA 33A	MLRA 133B	MLRA 134	MLRA 150A	MLRA 151	MLRA 152A	MLRA 152B	Planting/Seeding Dates 5/	coarse sand - loamy very fine sand	sandy loam - fine sandysilt	very fine sandy loam - silt	clay loam - silty clay loam	sandy clay - clay
American Beautyberry, *Callicarpa americana*	4.8-7.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Bald Cypress, *Taxodium distichum*	4.6-7.5	T	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Black Willow, *Salix nigra*	4.5-9.0	T	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Boxelder, *Acer negundo*	5.2-7.0	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Cottonwood, *Populus deltoides* - Bareroot	5.5-7.5	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X	X	X	X	12/15-3/15		X	X	X	X
Cottonwood, *Populus deltoides* - Cuttings	5.5-7.5	MT	15"-20" (3/8"-3/4")	N/A	N	X		X	X	X	X	X	X	X	X	X	X	X	12/15-3/15		X	X	X	X
Deciduous Holly (possum haw), *Ilex decidua*	3.5-6.5	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X		X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Dogwood: flowering, *Cornus florida*	5.0-7.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X		X	X	12/15-3/15		X	X	X	X
Elderberry, *Sambucus nigra*	5.0-7.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Elm: American, *Ulmus americana*	5.5-8.0	WT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Elm: cedar, *Ulmus crassifolia*	5.2-8.0	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Green Ash, *Fraxinus pennsylvanica*	3.6-7.5	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Hackberry-Sugarberry, *Celtis laevigata*	5.0-7.0	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Locust: black, *Robinia pseudoacacia*	4.6-8.2	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Locust: honey, *Gleditsia triacanthos*	6.0-8.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15		X	X	X	
Oak: live, *Quercus virginiana*	6.0-7.5	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X		
Oak: Shumard, *Quercus shumardii*	4.4-7.5	WT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15		X	X	X	
Oak: southern red, *Quercus falcata*	5.0-6.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Oat: nuttall, *Quercus nuttallii*	3.6-6.8	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Pecan: native sweet, *Carya illinoensis*	4.8-7.5	WT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X			X	X	12/15-3/15	X	X	X	X	X
Persimmon, *Diospyros virginiana*	4.4-7.0	T	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Pine: loblolly, *Pinus taeda* - Bareroot	4.5-6.7	WT	5"-14" (1/4"-3/8")	4"- 6" (Multi)	N	x			X		X	X	X	X			X	X	12/15-3/15	X	X	X	X	X
Pine: loblolly, *Pinus taeda* - Containers	4.5-6.7	WT	6"- 8" (1/8")	4"- 6" (Multi)	N	X					X	X	X	X			X	X	12/15-3/15 (10/1-4/31)	X	X	X	X	X
Plum, *Prunus sp.*	5.0-8.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	x	X	X	X	X	X	X	X	X		X	X	12/15-3/15	X	X	X	X	X
Rabbit Eye Blueberry, *Vaccinium ashei*	4.0-7.0	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	x	X	X	X	X	X	X	X			X	X	12/15-3/15		X	X	X	
Redcedar, Eastern, *Juniperus virginiana*, L	4.7-7.8	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15		X	X	X	X
Redbud:eastern, *Cercis canadensis*	4.5-7.5	I	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Red Maple, *Acer rubrum*	4.5-7.5	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	x	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Red Mulberry, *Morus rubra*	4.4-7.5	WT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	x	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	X
Sweet Gum, *Liquidambar styraciflua*	5.1-7.5	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X		X	X	X	X	X	X	X	X		X	X	12/15-3/15		X	X	X	X
Yaupon, *Ilex vomitoria*	4.5-7.0	MT	12"-24" (3/8"-1/2")	8" (4-8)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	12/15-3/15	X	X	X	X	

1/ The pH values listed indicate where these species may have the best growth potential;.

2/ I=Intolerant; WT=Weakly Tolerant; MT=Moderately Tolerant; & T=Tolerant;

3/ Benefits wildlife may provide food and/or shelter;

4/ Attracts beneficial pollinator species; & 5/ Optimum and Maximum ( ) planting dates.

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Table 3. Species / Herbicide Interaction

Chemical	Susceptibility
2,4-D	Susceptible: Ash, Black locust, Cottonwood, Honeylocust, Sumac, Sycamore, Willow
Hexazinone	Susceptible: Ash, Redbud, Elm, Hackberry, Juniper, Locust, Boxelder, Mulberry, Oaks, Osage orange, Persimmon, Willow, Partially Susceptible: Easter redcedar, Sumac,
Trifluralin	Susceptible: New transplants
Metolachlor	Partially Susceptible: Oak
Glyphosate	Susceptible: Honeysuckle, Oak, Pine, Redbud, Willow, Partially susceptible: Ash, Elm, Black locust, Sumac
Dichlobenil	Susceptible: Elm, Spruce, Sumac, Pine
Fluazifop-P	Susceptible: Boxelder, Cottonwood, Elm, Poplar,
Clopyralid	Susceptible: Boxelder, Redbud, Locust
Picloram	Susceptible: Honeylocust, Sumac, Maple, Oaks, Black locust, Plum, Partially Susceptible: Ash, Eastern redcedar
Triclopyr	Susceptible: Cottonwood, Elm, Black locust, Honey locust, Oak, Pine, Poplar, Sumac, Willow Partially Susceptible: Ash, Eastern redcedar
Dicamba	Growth suppression: Cedar, Plum, Redcedar, Yaupon, Susceptible: Ash, Cottonwood, Elm Honeylocust, Black locust, Oaks, Pine, Poplar, Sumac, Sycamore
Imazapyr	Susceptible: Ash, Boxelder, Cottonwood, Mulberry, Oaks, Persimmon, Poplar, Sumac, Sycamore, Willow Partially Susceptible: Elm, Locust, Redbud, Pine
Tree seedlings are most sensitive to drift injury after bud break; even low levels of growth regulator herbicides (2,4-D©, Banvel©, and Crossbow©) used on row crops will cause injury. Glyphosate injury to hardwood seedlings is becoming more common as this product becomes more widely used.	

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