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*WINDBREAK/SHELTERBELT
ESTABLISHMENT*

APPENDICES 1-2

NRCS, NHCP
August 2000

NRCS, WV
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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WINDBREAK/SHELTERBELT ESTABLISHMENT

APPENDIX I

The following are explanations of the various headings for Tables 1 and 2. Refer to these tables when selecting tree and shrub species for planting in West Virginia.

¹ SOIL DRAINAGE CLASS:

Well drained: Water is removed from the soil readily but not rapidly and available to plants most of the growing season. Wetness does not inhibit growth of roots for significant periods.

Moderately Well Drained: Water is removed from the soil somewhat slowly during some periods. These soils are wet for only a short time during the growing season. They may contain a slowly pervious layer or receive periodic heavy rainfall or both.

Somewhat Poorly Drained: Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of some plants. They commonly have a slowly pervious layer or receive periodic heavy rainfall or both.

Poorly Drained: Water is removed so slowly that the soil remains saturated for significant portions or remains wet for long periods during the growing season. Free water is commonly at the surface. Poor drainage may result from high water tables, slowly pervious layers within the profile, seepage or any combination of these factors.

² SHADE TOLERANCE: Describes the relative tolerance for this plant to grow in shade conditions.

Intolerant: Will not tolerate shaded conditions.

Intermediate: Will tolerate partially shaded conditions.

Tolerant: Will tolerate full shade and usually does not prefer full sun.

³ HEIGHT AT 20 YEARS: Under good conditions the approximate height at 20 years in feet.

⁴ MATURE HEIGHT: The approximate height of the plant at maturity under good conditions.

⁵ **NATIVE:** The plants marked "yes" in this column are considered native (i.e., they occur naturally in West Virginia). This listing of species is not all-inclusive. Many more native plants occur and could be suitable for use in conservation plantings.

⁶ **WINDBREAKS SCREENS BARRIERS OR OTHER:** An entry in this column indicates that this plant is suited or could be utilized for linear plantings designed to hide unsightly areas from public view, reduce noise and wind, or for ornamental planting. Multiple row plantings should be spaced closer to the maximum range shown. Refer to the appropriate NRCS standard for more specific information concerning these types of plantings.

⁷ WILDLIFE

Food: This plant is suited to provide wildlife food in the form of either browse or fruit.

Cover: This plant is suited to provide winter or nesting cover by its growth characteristics.

Corridors: This plant is suited to use in corridors or travel lanes, including riparian corridors, through which wildlife may travel between habitat types. Planted rows should be staggered.

⁸ **WOOD PRODUCTION SPACING:** This spacing range is recommended if wood production is desired. Depending on intent and management practices, the spacing will vary. Refer to the appropriate NRCS standard for more information concerning this type of planting.

⁹ ADDITIONAL PLANT INFORMATION AVAILABLE:

Fact Sheet: Information from the USDA plants database that provides brief descriptions of a plant, its uses and often offers establishment recommendations. (Available at <http://plants.usda.gov>)

Plant Guide: These are similar to plant sheets but are usually more extensive and more narrative, and are typically referenced to source documents. (Available at <http://plants.usda.gov>)

Fact Sheets and Plant Guides are also available on the WV NRCS website at <http://www.wv.nrcs.usda.gov/standard/appendices.htm>

¹⁰ COMMERCIAL AVAILABILITY

This column indicates the availability of planting stock for a particular species as follows:

Readily: Many varieties exist and/or are routinely available through commercial, state nurseries and/or Plant Material Centers.

Somewhat Available: Somewhat limited availability of planting stock especially from commercial nurseries and may be more readily available from nurseries specializing in native plants or from regional Plant Material Centers.

Rarely: Often very difficult to locate plant stock or no known cultivated varieties exist. These species may only be available from native plant nurseries, Plant Material Centers or from localized sources.

**Table1
Shrubs Suitable for Establishment**

SHRUBS	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Approx. Height at Maturity ⁴	Native ⁵	Suitable Use(s)				Additional Plant Information Available ⁸	Remarks	Commercial Availability ⁹	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷						Wildlife Spacing
							Food	Cover	Corridors				
Alder, Smooth (<i>Alnus serrulata</i>)	Somewhat Poorly -	Tolerant	10 ft	20 ft	Yes		X		X	5-8 ft	Fact Sheet	Adapted to wetter sites and along streams below 2600 ft	Readily
Alder, Speckled (<i>Alnus rugosa</i>)	Somewhat Poorly -	Intermediate	12 ft	16 ft	Yes		X		X	5-8 ft	Fact Sheet	Adapted to wetter sites and along streams above 2600 ft	Readily
Arrowwood (<i>Viburnum dentatum</i>)	Moderately Well - Poorly	Intermediate	10 ft	10 ft	Yes		X	X	X	3-6 ft	Plant Guide	Excellent wildlife food source. Adapted to wetter conditions	Somewhat Available
Blueberry, Highbush (<i>Vaccinium corymbosum</i>)	Moderately Well - Poorly	Intolerant	6 ft	10 ft	Yes		X			3-6 ft	Plant Guide	Adapted to acidic wet conditions. Sometimes hard to establish.	Readily
Buttonbush (<i>Cephalanthus occidentalis</i>)	Somewhat Poorly - Poorly	Tolerant	10 ft	20 ft	Yes		X	X		5-8 ft	Fact Sheet	Only suited to very wet sites. Will tolerate inundation. Provides food and cover for waterfowl.	Rarely
Chokeberry, Red (<i>Photinia pyrifolia</i>)	Moderately Well - Poorly	Intolerant	5 ft	5 ft	Yes		X			3-6 ft	No	Low-growing attractive shrub and wildlife food plant. Birds utilize the fruit throughout the winter months. Frequently used as an ornamental	Readily
Crabapple, Sargent's (<i>Malus Sargentii</i>)	Well - Somewhat Poorly	Intolerant	10 ft	10 ft	No	3-6 ft	X			3-6 ft	No	Has persistent fruit that is somewhat valuable to wildlife through winter months. Attractive and hardy.	Readily
Crabapple, Southern (<i>Malus angustifolia</i>)	Well - Moderately Well	Intermediate	15 ft	25 ft	Yes	5-8 ft	X			5-8 ft	Fact Sheet	If near red cedars keep a minimum distance of 500 ft to prevent spread of cedar apple rust. Native crabapple good for wildlife.	Rarely
Cranberry, Highbush (<i>Viburnum trilobum</i>)	Moderately Well - Poorly	Intolerant	12 ft	12 ft	Yes	5-8 ft	X	X		3-6 ft	Fact Sheet Plant Guide	Attractive screen and hedgerow plant. Useful in ornamental and wildlife plantings.	Readily
Dogwood, Flowering (<i>Cornus florida</i>)	Well - Somewhat Poorly	Tolerant	30 ft	40 ft	Yes	5-8 ft	X	X		4-8 ft	Fact Sheet	Berries eaten by songbirds, grouse, turkey, quail, squirrels; browsed by deer, rabbits. Often used as an ornamental.	Readily
Dogwood, Gray (<i>Cornus racemosa</i>)	Moderately Well - Somewhat Poorly	Tolerant	10 ft	15 ft	Yes	3-6 ft	X	X		5-8 ft	Fact Sheet	Excellent for small screens, streambank stabilization and as an ornamental.	Readily
Dogwood, Redosier (<i>Cornus sericea</i>)	Somewhat Poorly - Poorly	Intermediate	10 ft	20 ft	Yes	3-6 ft		X	X	5-8 ft	Plant Guide	Excellent streambank cover. With some wildlife benefits.	Readily
Dogwood, Silky (<i>Cornus amomum</i>)	Well - Somewhat Poorly	Tolerant	12 ft	12 ft	Yes	5-8 ft	X	X	X	3-6 ft	Fact Sheet	Stoloniferous. Produces fruit in 3 -5 years. Excellent wildlife plant.	Readily
Elderberry (<i>Sambucus canadensis</i>)	Well - Somewhat Poorly	Intolerant	7 ft	7 ft	Yes		X	X	X	3-6 ft	Fact Sheet Plant Guide	Excellent all around wildlife plant. Suckers freely. Many species of birds and mammals utilize the fruit.	Readily
Hawthorn, Washington (<i>Crataegus phaenopyrum</i>)	Well - Somewhat Poorly	Intermediate	25 ft	25 ft	Yes	5-8 ft		X	X	5-8 ft	No	Provides excellent wildlife cover. Not as prone to spreading as some introduced hawthorns.	Somewhat Available
Hazelnut, American (<i>Corylus americana</i>)	Well - Moderately Well	Tolerant	10 ft	10 ft	Yes		X	X		3-6 ft	Plant Guide	Provides cover and nesting for wildlife. The leaves, twigs, and catkins are browsed by rabbits and deer.	Somewhat Available
Holly, American (<i>Ilex opaca</i>)	Well - Somewhat Poorly	Tolerant	20 ft	60 ft	Yes	5-8 ft		X	X	5-8 ft	Fact Sheet	Evergreen. It is important to plant males as well as females if berry production is desired. Used as winter cover and ornamental.	Readily
Hornbeam, American (<i>Carpinus caroliniana</i>)	Moderately Well - Somewhat Poorly	Tolerant	15 ft	40 ft	Yes		X		X	5-8 ft	Plant Guide	This species produces large amounts of seed eaten by many birds and mammals. Found along streams and rivers. Excellent riparian species.	Somewhat Available
Lespedeza, Bicolor (<i>Lespedeza bicolor</i>)	Well - Moderately Well	Intolerant	6 ft	6 ft	No		X			2 ft	Fact Sheet	This semi-woody sub-shrub provides an excellent food source for many species of wildlife. Best seeded directly.	Readily
Lespedeza, Shrub (<i>Lespedeza thunbergii</i>)	Well - Somewhat Poorly	Intolerant	8 ft	8 ft	No		X			2-3 ft	Fact Sheet	As above - This semi-woody sub-shrub provides an excellent food source for many species of wildlife. Best seeded directly.	Readily
Locust, Bristly (<i>Robinia hispida</i>)	Well - Moderately Well	Intolerant	7 ft	7 ft	Yes	3-6 ft				--	Fact Sheet	Excellent for erosion control. Minimal wildlife value. Mainly used for reclamation of mine sites. Many varieties available.	Readily
Nannyberry (<i>Viburnum lentago</i>)	Well - Poorly	Tolerant	25 ft	25 ft	Yes	5-8 ft	X	X	X	5-8 ft	Plant Guide	Excellent wildlife, hedgerow, screen and ornamental shrub suited to a variety of sites. Commercially available and common throughout WV.	Readily
Ninebark (<i>Physocarpus opulifolius</i>)	Well - Somewhat Poorly	Intolerant	10 ft	10 ft	Yes		X			5-8 ft	Plant Guide	Tolerates a wide variety of conditions including nuclear attack. Difficult to eradicate once established. Used by a variety of riparian birds.	Readily
Pawpaw (<i>Asimina triloba</i>)	Moderately Well - Poorly	Tolerant	30 ft	35 ft	Yes		X			4-8 ft	No	Site specific and often difficult to establish. Common in floodplains in the understorey. Good wildlife food source.	Somewhat Available
Pepperbush, Sweet (<i>Clethra acuminata</i>)	Well - Somewhat Poorly	Tolerant	8 ft	15 ft	Yes	3-6 ft		X		5-8 ft	No	Attractive summer-flowering shrub usually found on sandstone based soils.	Rarely
Sourwood (<i>Oxydendrum arboreum</i>)	Somewhat Poorly - Poorly	Intermediate	20 ft	35 ft	Yes		X			5-8 ft	No	Beautiful native ornamental often difficult to establish. Wildlife browse the sour tasting foliage.	Readily
Spicebush, Northern (<i>Lindera benzoin</i>)	Moderately Well - Poorly	Intermediate	12 ft	15 ft	Yes		X			5-8 ft	Plant Guide	Attractive fragrant understorey tree common throughout the state. Sometimes planted as an ornamental.	Readily

**Table1
Shrubs Suitable for Establishment**

SHRUBS	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)				Additional Plant Information Available ⁸	Remarks	Commercial Availability ⁹	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷						Wildlife Spacing
							Food	Cover	Corridors				
Steeplebush (<i>Spiraea tomentosa</i>)	Somewhat Poorly - Poorly	Intolerant	4 ft	6 ft	Yes	3-6 ft	X		X	3-6 ft	No	Rhizomatous growth form that provides dense wildlife cover relatively quickly. Usually found on wetter sites.	Rarely
Sumac, Staghorn (<i>Rhus typhina</i>)	Well - Somewhat Poorly	Intermediate	30 ft	30 ft	Yes		X			3-6 ft	Fact Sheet	Excellent wildlife food source. Sometimes serves as an ornamental because of fall foliage color. Tolerates a wide variety of conditions.	Somewhat Available
Swamp Rose (<i>Rosa palustris</i>)	Somewhat Poorly - Poorly	Tolerant	8 ft	8 ft	Yes	3-6 ft		X	X	3-6 ft	No	Prefers permanent saturation. May spread under suitable conditions.	Somewhat Available
Wild Raisin (<i>Viburnum cassinoides</i>)	Somewhat Poorly - Poorly	Tolerant	15 ft	15 ft	Yes			X	X	5-8 ft	No	Excellent wildlife shrub in wetter conditions. Suited to the eastern mountain counties.	Rarely
Winterberry (<i>Ilex verticillata</i>)	Somewhat Poorly - Poorly	Intermediate	10 ft	10 ft	Yes	3-6 ft	X	X	X	3-6 ft	Fact Sheet	Fruit is poisonous to humans. Higher elevation deciduous holly suited to the eastern mountain counties. Excellent for wildlife.	Readily
Willow, Purpleosier (<i>Salix purpurea</i>)	Well - Poorly	Intolerant	10 ft	10 ft	No	3-6 ft				--	Fact Sheet	Excellent streambank stabilization and bio engineering plant suitable to dormant whip type plantings. Many cultivars are available.	Readily
Witch Hazel (<i>Hamamelis virginiana</i>)	Well - Somewhat Poorly	Intermediate	15 ft	20 ft	Yes		X			5-8 ft	No	Good native wildlife food source. Sometimes hard to establish.	Somewhat Available
Yew, American (<i>Taxus canadensis</i>)	Well - Moderately Well	Tolerant	5 ft	5 ft	Yes	3-6 ft		X		3-6 ft	No	Used as an ornamental. Birds eat the flesh covered berries. Adapted to high elevations in the mountain counties of the east.	Readily

**Table 2
Trees Suitable for Establishment**

TREES	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)					Additional Plant Information Available ⁹	Remarks	Commercial Availability ¹⁰	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷			Wood Production Spacing ⁸				
							Food	Cover	Corridors					
Alder, European Black (<i>Alnus glutinosa</i>)	Well - Moderately Well	Intermediate	40 ft	60 ft	No	8-18 ft *			X	8-12 ft		Fact Sheet	Excellent for reclamation. Nitrogen fixer. Good for hedgerow and windbreaks where non-natives are acceptable.	Readily
Ash, Green (<i>Fraxinus pennsylvanica</i>)	Moderately Well - Poorly	Intermediate	50 ft	80 ft	Yes	8-18 ft	X		X	8-12 ft		Fact Sheet	The seeds are eaten by a number of birds and mammals. Extensively planted as a shade and ornamental tree.	Readily
Ash, White (<i>Fraxinus americana</i>)	Well - Somewhat Poorly	Intermediate	50 ft	80 ft	Yes	8-18 ft	X	X	X	8-12 ft	20 X 20 ft	Plant Guide	Excellent all purpose ornamental, wildlife, and shade tree. Has commercial timber value.	Readily
Basswood (<i>Tilia americana</i>)	Well - Moderately Well	Intermediate	45 ft	80 ft	Yes	8-18 ft	X		X	8-12 ft	10-15 ft	Plant Guide	Provides good browse. The buds are important for birds and deer in winter. Planted as a shade tree or ornamental.	Readily
Birch, Black (<i>Betula nigra</i>)	Well - Somewhat Poorly	Intolerant	40 ft	80 ft	Yes			X	X	8-12 ft		Fact Sheet	Native riparian tree. Its young twigs, buds, foliage and seeds are used by a variety of wildlife.	Somewhat Available
Blackgum (<i>Nyssa sylvatica</i>)	Well - Somewhat Poorly	Tolerant	30 ft	95 ft	Yes		X			8-12 ft		Fact Sheet	Black bears, foxes, wood ducks, wild turkeys, robins, brown thrashers, thrushes, and flickers frequently eat the fruit.	Readily
Boxelder (<i>Acer negundo</i>)	Well - Poorly	Intermediate	35 ft	60 ft	Yes				X	8-12 ft		Plant Guide	Very quick growing. Found along streams and frequently flooded areas. Relatively short lived and often disease prone.	Readily
Cedar, Northern White (<i>Thuja occidentalis</i>)	Well - Somewhat Poorly	Intermediate	25 ft	50 ft	Yes	8-16 ft		X		8-12 ft		Plant Guide	Also called Arborvitae. Popular ornamental for screens and hedgerows in limestone areas. Provides some nesting cover.	Readily
Cedar, Atlantic White (<i>Chamaecyparis thyoides</i>)	Moderately Well - Poorly	Tolerant	20 ft	90 ft	No	8-16 ft		X		8-12 ft		Plant Guide Fact Sheet	Similar to Arborvitae. A coastal species not native to WV. Tolerant of wet conditions.	Readily
Cherry, Black (<i>Prunus serotina</i>)	Well - Somewhat Poorly	Intolerant	40 ft	100 ft	Yes	8-18 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	Valuable food source for many wildlife species. Used for commercial timber and ornamental purposes on a wide variety of soils.	Readily
Chestnut, Chinese (<i>Castanea mollissima</i>)	Well - Moderately Well	Intolerant	25 ft	70 ft	No	6-14 ft	X			8-12 ft		No	Mostly planted as an ornamental. Some wildlife utilize the chestnuts.	Readily
Cucumber-Tree (<i>Magnolia acuminata</i>)	Well - Moderately Well	Intolerant	40 ft	100 ft	Yes	8-18 ft			X	8-12 ft	10-15 ft	No	Beautiful native tree common throughout WV. Minimal wildlife value. Sometimes used as an ornamental and timber species.	Readily
Cottonwood, Eastern (<i>Populus deltoides</i>)	Well - Somewhat Poorly	Intermediate	50 ft	120 ft	Yes	8-18 ft		X		8-12 ft		Fact Sheet	Fast growing and used in reclamation. Hybrids make good selections for windbreaks in multi-row installations.	Readily
Fir, Douglas (<i>Pseudotsuga menziesii</i>)	Well - Moderately Well	Intermediate	40 ft	200 ft	No	8-16 ft		X		8-12 ft		Plant Guide Fact Sheet	One of the world's most important timber species. Excellent as wildlife, windbreak, and Christmas tree.	Readily
Hackberry (<i>Celtis occidentalis</i>)	Well - Somewhat Poorly	Intermediate	40 ft	70 ft	Yes	8-18 ft	X		X	8-12 ft		Fact Sheet	Birds use the mature trees for nesting sites and feed on the fruit. Young stands also provide shelter for game birds and rabbits.	Readily
Hemlock, Eastern (<i>Tsuga canadensis</i>)	Well - Somewhat Poorly	Tolerant	20 ft	100 ft	Yes	8-16 ft		X	X	8-12 ft		Plant Guide	This tree is versatile as a hedge, large timber species, screen and wildlife tree. Different cultivars exist. Native and attractive.	Readily
Hickory, Shagbark (<i>Carya ovata</i>)	Well - Moderately Well	Intermediate	15 ft	90 ft	Yes		X			8-12 ft		No	Develops deep taproot in the first few years. Needs deep alluvial soils. Slow growing. Excellent nut producer. Some timber value.	Readily
Honeylocust (<i>Gleditsia triacanthos</i>)	Well - Somewhat Poorly	Intolerant	35 ft	80 ft	No	8-18 ft						Plant Guide	Planted as a hardy and fast-growing ornamental. Minimal wildlife value. Highly regarded in urban settings with many cultivars.	Readily
Larch, Japanese (<i>Larix kaempferi</i>)	Well - Somewhat Poorly	Intolerant	20 ft	100 ft	No	6-14 ft *						No	Deciduous conifer used primarily as an ornamental and timber trainer. Very minimal wildlife value.	Readily
Locust, Black (<i>Robinia pseudoacacia</i>)	Well - Somewhat Poorly	Intermediate	55 ft	80 ft	Yes	8-18 ft *	X		X	8-12 ft		Fact Sheet	Easy to establish. Early successional species and may be relatively short lived. Bee attractant. Nitrogen fixing species.	Readily
Maple, Red (<i>Acer rubrum</i>)	Well - Poorly	Intermediate	40 ft	90 ft	Yes	8-18 ft		X	X	8-12 ft		Fact Sheet Plant Guide	Valued as native ornamental. Early blooming and important as an early pollinator for many insects. Grows in almost any condition.	Readily
Maple, Silver (<i>Acer saccharinum</i>)	Moderately Well - Poorly	Intermediate	45 ft	80 ft	Yes	8-18 ft		X	X	8-12 ft		Plant Guide Fact Sheet	Important as cavity tree and somewhat important as a wildlife food source. May be disease prone and susceptible to storm damage.	Readily
Maple, Sugar (<i>Acer saccharum</i>)	Well - Somewhat Poorly	Tolerant	20 ft	100 ft	Yes	6-14 ft		X	X	8-12 ft		Plant Guide	Popular and long-lived shade and ornamental tree. Tolerates a wide range of conditions. Important for cavity nesting wildlife.	Readily
Mulberry, Red (<i>Morus rubra</i>)	Well - Somewhat Poorly	Intermediate	45 ft	70 ft	Yes		X		X	8-12 ft		No	Excellent wildlife tree for a variety of species especially birds. Sometimes hard to establish. Very site specific.	Somewhat Available
Oak, Chinquapin (<i>Quercus muehlenbergii</i>)	Well - Moderately Well	Intolerant	40 ft	80 ft	Yes	8-18 ft	X		X	8-12 ft		No	Rare throughout its range. Site specific to alkaline soils and limestone outcropped areas. Good riparian species.	Readily
Oak, Northern Red (<i>Quercus rubra</i>)	Well - Moderately Well	Intermediate	35 ft	100 ft	Yes	8-18 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	One of our most important and handsome oaks. Important as a wildlife food source, timber species and ornamental.	Readily
Oak, Overcup (<i>Quercus lyrata</i>)	Moderately Well - Poorly	Intermediate	30 ft	80 ft	No	8-18 ft	X		X	8-12 ft	20 X 20 ft	Plant Guide	Often planted for timber and as an ornamental and to improve wildlife habitat for bottomland restoration. Native to the mid-west.	Readily

**Table 2
Trees Suitable for Establishment**

TREES	Soil Drainage Class ¹	Shade Tolerance ²	Height at 20 Years ³	Aprox. Height at Maturity ⁴	Native ⁵	Suitable Use(s)					Additional Plant Information Available ⁹	Remarks	Commercial Availability ¹⁰	
						Windbreaks Screens Barriers or Other ⁶	Wildlife ⁷			Wildlife Spacing				Wood Production Spacing ⁸
							Food	Cover	Corridors					
Oak, Pin (<i>Quercus palustris</i>)	Moderately Well - Poorly	Intolerant	40 ft	100 ft	Yes	8-18 ft	X			8-12 ft		Fact Sheet	Adapted to wetter sites. Good mast producer and attractive ornamental. Utilized by various wildlife especially wood ducks.	Readily
Oak, Post (<i>Quercus stellata</i>)	Well - Moderately Well	Intermediate	25 ft	80 ft	Yes	8-18 ft	X		X	8-12 ft		No	Tolerates harsh conditions and drought. Slow growing and may be susceptible to chestnut blight. Sometimes used as an ornamental.	Somewhat Available
Oak, Shingle (<i>Quercus imbricaria</i>)	Well - Moderately Well	Intolerant	30 ft	45 ft	Yes	8-18 ft			X	8-12 ft		No	An ornamental and shade tree, it is suitable for hedges, screens and windbreaks. Relatively low wildlife value among oaks.	Readily
Oak, Sawtooth (<i>Quercus acutissima</i>)	Well - Moderately Well	Intermediate	50 ft	70 ft	No	8-18 ft	X		X	15-20 ft		Fact Sheet	Wildlife oak that produces heavy amounts of small acorns attractive to many animal species. Relatively fast growing.	Somewhat Available
Oak, Swamp White (<i>Quercus bicolor</i>)	Somewhat Poorly - Poorly	Intermediate	30 ft	100 ft	Yes		X		X	8-12 ft		Plant Guide	Requires moist acidic conditions. Important food for wildlife such as squirrels, black bear, ducks and turkey. Often hybridizes.	Readily
Oak, White (<i>Quercus alba</i>)	Well - Moderately Well	Intermediate	30 ft	100 ft	Yes	8-18 ft	X		X	8-12 ft	20 X 20 ft	Fact Sheet	Extremely important as a timber and wildlife food tree. Slow growing and often difficult to establish.	Readily
Paulownia, Royal (<i>Paulownia tomentosa</i>)	Well - Moderately Well	Intermediate	60 ft	70 ft	No						20 X 20 ft	No	Rapidly growing introduced species. Specialized commercial timber species. Often escapes and has no known wildlife value.	Readily
Persimmon, Common (<i>Diospyros virginiana</i>)	Well - Somewhat Poorly	Intermediate	25 ft	50 ft	Yes		X			8-12 ft		Plant Guide	Used by raccoon, opossum, and various birds, including quail, wild turkey and cedar waxwing. Slow growing and difficult to transplant.	Somewhat Available
Pine, Austrian Black (<i>Pinus nigra</i>)	Well - Somewhat Poorly	Intermediate	35 ft	100 ft	No	8-16 ft			X	6-12 ft		No	Non-native used mainly for ornamentals, screens and as a reclamation plant. Used as winter cover for various bird species.	Readily
Pine, Eastern White (<i>Pinus strobus</i>)	Well - Somewhat Poorly	Intolerant	40 ft	130 ft	Yes	8-16 ft			X	6-12 ft	6 - 8 ft	Fact Sheet	Squirrels and 16 species of songbirds have been known to eat the seed. Native pine with commercial timber and ornamental value.	Readily
Pine, Loblolly (<i>Pinus taeda</i>)	Well - Somewhat Poorly	Intolerant	50 ft	100 ft	No	8-16 ft			X	6-12 ft	6 - 8 ft	No	Extremely important timber species. Provides some cover and browse in winter months to wildlife.	Readily
Pine, Red (<i>Pinus resinosa</i>)	Well - Moderately Well	Intolerant	30 ft	80 ft	Yes	8-16 ft			X	6-12 ft	6 - 8 ft	No	Found primarily at higher elevations in the eastern counties. Used for ornamentals and reforestation and has commercial value.	Readily
Pine, Scotch (<i>Pinus sylvestris</i>)	Well - Moderately Well	Intolerant	30 ft	110 ft	No	8-16 ft			X	6-12 ft		Fact Sheet	Used in windbreaks as the central or leeward rows of multi-row plantings. Important Christmas tree species. Some wildlife use.	Readily
Pine, Virginia (<i>Pinus virginiana</i>)	Well - Moderately Well	Intermediate	25 ft	70 ft	Yes	6-14 ft	X	X		6-12 ft	6 - 8 ft	No	Native pine used primarily as pulpwood. Provides some wildlife food and cover. Sometimes used in windbreaks and screens.	Readily
Plum, Wild (<i>Prunus americana</i>)	Well - Somewhat Poorly	Intolerant	25 ft	25 ft	Yes	6-14 ft	X		X	8-12 ft		No	Native plum found throughout WV. Common along streambanks and wood lines. Fruit valued by many species of wildlife.	Readily
Poplar, Yellow (<i>Liriodendron tulipifera</i>)	Moderately Well - Somewhat Poorly	Intolerant	60 ft	120 ft	Yes		X		X	10-15 ft	10-15 ft	Fact Sheet	Fast growing. Attractive ornamental but very large. Important timber species in WV. Provides some secondary wildlife food.	Somewhat Available
Redbud, Eastern (<i>Cercis canadensis</i>)	Well - Somewhat Poorly	Tolerant	16 ft	16 ft	Yes		X			5-8 ft		Plant Guide	Many birds, including bobwhite quail, eat the seeds. Honeybees use the blossoms. Often planted as an ornamental.	Readily
Redcedar, Eastern (<i>Juniperus virginiana</i>)	Well - Somewhat Poorly	Intermediate	25 ft	80 ft	Yes	6-14 ft	X	X		8-12 ft		Fact Sheet Plant Guide	Eastern redcedar provides habitat for a variety of wildlife. Specific to limestone associated sites. Cedar-apple rust host.	Readily
Serviceberry, Common (<i>Amelanchier arborea</i>)	Well - Somewhat Poorly	Tolerant	20 ft	50 ft	Yes	6-14 ft	X			8-12 ft		Plant Guide	At least 40 bird species, rabbits, chipmunks, mice, voles, foxes, and black bears eat the fruit. Widely used as an ornamental.	Readily
Spruce, Norway (<i>Picea abies</i>)	Well - Somewhat Poorly	Intermediate	35 ft	120 ft	No	8-16 ft *			X	8-12 ft		No	Important as a windbreak, screen and ornamental. Winter cover for some resident birds. Mourning doves utilize this tree for nesting.	Readily
Spruce, Red (<i>Picea rubens</i>)	Well - Moderately Well	Tolerant	25 ft	110 ft	Yes	8-16 ft	X	X	X	8-12 ft		Fact Sheet	One of the most important timber and wildlife species in North America. Site specific above 3500 feet in eastern counties of WV.	Readily
Spruce, White (<i>Picea glauca</i>)	Well - Somewhat Poorly	Intermediate	30 ft	100 ft	No	8-16 ft	X	X		8-12 ft		Plant Guide	Important as a screen, timber and ornamental. Winter cover and food for some birds. Hybridizes freely. Native to the northeast.	Readily
Sycamore, American (<i>Platanus occidentalis</i>)	Moderately Well - Poorly	Intermediate	65 ft	100 ft	Yes				X	8-12 ft		Plant Guide	Very quick growing and large. Slow decaying leaves. Prone to disease. Found along streambanks and a variety of other sites.	Readily
Sweetgum (<i>Liquidambar styraciflua</i>)	Well - Somewhat Poorly	Intolerant	50 ft	100 ft	Yes	8-18 ft			X	8-12 ft		Fact Sheet Plant Guide	Prefers deep soils for root development. Important as a timber, wildlife and ornamental. Tolerates a variety of sites and conditions.	Readily
Walnut, Black (<i>Juglans nigra</i>)	Well - Moderately Well	Intermediate	35 ft	100 ft	Yes		X		X	10-20 ft	20 X 20 ft	Fact Sheet	Prefers deep well drained soils. Important as a timber and nut crop tree. Produces juglone that inhibits competition.	Readily

* These species may be utilized as stock trainers for high quality timber production.

Appendix 2

Criteria for Windbreak/Shelterbelt Design

Where sufficient space is available, windbreaks should contain a minimum of three rows of evergreen trees or two rows of evergreen trees and one row of evergreen or deciduous shrubs. When used the, the dense shrub row should be placed on the windward side to maximize wind and snow protection. Five to six rows are desirable to keep snowdrifts within the windbreaks.

Where drifting snow is a hazard, the windward row of plantings should be a minimum of 100 feet from the right-of-way of roads, highways, and railroads, and primary areas in need of protection unless state, county, or city regulations differ.

Where snow drifting is not a problem, the most effective planting distance from primary areas in need of protection to the inside (leeward) row should be approximately 60 feet.

Where possible, windbreaks should extend approximately 50 feet beyond areas in need of protection.

Windbreak Design and Layout

- A. Identify troublesome wind direction(s).
 - B. Identify all areas needing protection.
 - C. Inventory soils paying close attention to inclusions of difficult soils such as high/low pH or salts. Begin a starter list of species adapted to the site.
 - D. Determine if topography will cause drainage concerns either into or away from the windbreak (e.g. feedlot runoff, snowmelt, etc.)
 - E. Locate property lines, overhead and underground utilities and existing trees or shrubs which may be within or adjacent to the proposed windbreak.
 - F. Determine whether or not access roads or lanes will cause breaks in the windbreak.
 - G. Determine whether or not the proposed windbreak will obstruct the winter sun, picturesque views.
- Or oncoming traffic near driveways.
- H. Determine if cold air drainage will be impeded causing frost problems for home gardens or orchards.
 - I. Determine if use exclusion will be necessary to protect the planting from livestock or wildlife browsing.
 - J. Determine whether wildlife considerations are important to the landowner.
 - K. Avoid choosing species that may be alternative hosts for diseases, e.g. cedar-apple rust.

Orientation, Placement and Length

- A. Make a sketch (to scale) of the key items identified above.
- B. Position the windbreak as close to perpendicular to the most troublesome wind direction.
- C. For wind protection only, the tallest row needs to be 2-5H from the primary area needing protection. See Figure 1.
- D. For wind and snow protection, the most windward row needs to be between 100 and 200 feet from the windward edge of the primary protection area. Once that critical distance is met, check to see if the area needing protection is still within the 2-5H zone. See Figure 2.
- E. "One-leg" windbreaks are sufficient if the wind comes from one direction only.
- F. A "two-leg"(or more) windbreak is needed when troublesome winds deviate throughout the windy season. This type of windbreak is especially helpful for animal feeding situations. See Figure 3.
- G. Extend the windbreak 100 feet past the structures. There is a potential for end drifts of snow. See Figure 4.
- H. Try not to obstruct cool, summer breezes that may be desired by the landowner.

- I. Locate access roads from 100 to 500 feet from the ends of the windbreak to avoid snowdrift areas. If a lane must cut through a windbreak, it should cut through the windbreak at an angle to prevailing winds to prevent funneling of wind and snow drifting. See Figure 5.
- J. Avoid subsurface drain fields and septic systems. Species such as willow and poplar with aggressive root systems should not be planted within 100 feet.
- K. Avoid locating rows below power or telephone lines; allow for lateral spread of the mature crown plus 10-15 feet.
- L. Make sure all setbacks required for the farming operations are met.
- M. Locate new rows at least 50 feet from existing windbreaks (outside of the root-sapped area of the older trees and shrubs).

Number of Rows and Arrangement

- A. The objective is to reach a windbreak density > 65%.
- B. Use minimum row guidelines below to achieve desired densities:

Windbreak Type

Farmstead

2 rows - must be evergreen

Feedlot

2 rows - must be evergreen

Screens

High Traffic

6 rows - 3 rows must be evergreen

Med.-Low Traffic

3 rows - 2 must be evergreen

Visual

2 rows - 1 must be evergreen

Wildlife

5 rows - 1 must be evergreen

Field

2 rows of deciduous tree/shrub or evergreen

Living Snow Fence

Unsheltered Distance

<1000 feet

1 row of either shrub or evergreen

Unsheltered Distance

>1000 feet

2 rows - minimum one row of evergreen

Note: Additional rows may be used to enhance wildlife values, meet landowner objectives, increase diversity, improve aesthetics, and increase density

- C. Place shrubs and short trees in outer rows. See Figure 6.
- D. A single row may work in some instances, but losses from the windbreak should be considered.
- E. In snowy areas a snowtrap row of shrubs can be planted 50-100 feet to the windward side of the windbreak.
- F. Under snowy conditions, place species prone to snow breakage in leeward rows.
- G. Some suggested combinations and arrangements include:
 - For 1 row: Use a dense tall evergreen
 - For 2 rows: Medium evergreen, tall evergreen
 - For 3 rows: Dense shrub, tall evergreen, and medium evergreen
 - For 4 rows: Shrub, medium evergreen, tall evergreen, and medium deciduous or evergreen.
 - For 5+ rows: Combination of shrubs, evergreen and deciduous trees that allow snow trapping, crown development, etc.

Spacing

A. *Between rows: generally 12 to 20 feet. Make sure there is adequate room for maintenance and/or tillage equipment.*

B. *Between plant spacing in the row (Based on 20-year height)*

Low shrubs (<10 feet)

Single row 3-5'

Multiple row 3-6'

Large shrubs (> 10 feet)

Single row 5-8'

Multiple row 6-8'

Small evergreen trees (<25 feet)

Single row 5-8'

Multiple row 6-8'

Deciduous columnar trees (any height)

Single row 5-8'

Multiple row 6-8'

Low deciduous trees (<25 feet)

Single row 6-10'

Multiple row 8-14'

Tall evergreen trees (>25 feet)

Single row 8-12'

Multiple row 8-16'

Tall deciduous trees (>25 feet)

Single row 8-12'

Multiple row 10-18'

C. *Spacing should allow for crown closure within about 10 years without undue competition between adjacent plants in later years.*

D. *Stagger plantings so that the plants in one row will be planted opposite the opening of another row.*

Example:

```
X X X X X X X X
  X X X X X X X
X X X X X X X X
```

E. *Row spacing should be at least 2 feet wider than any equipment planned for between-row maintenance.*

Field Windbreak Design and Layout

A. *Optimum deposition of snow to the leeward side (where applicable).*

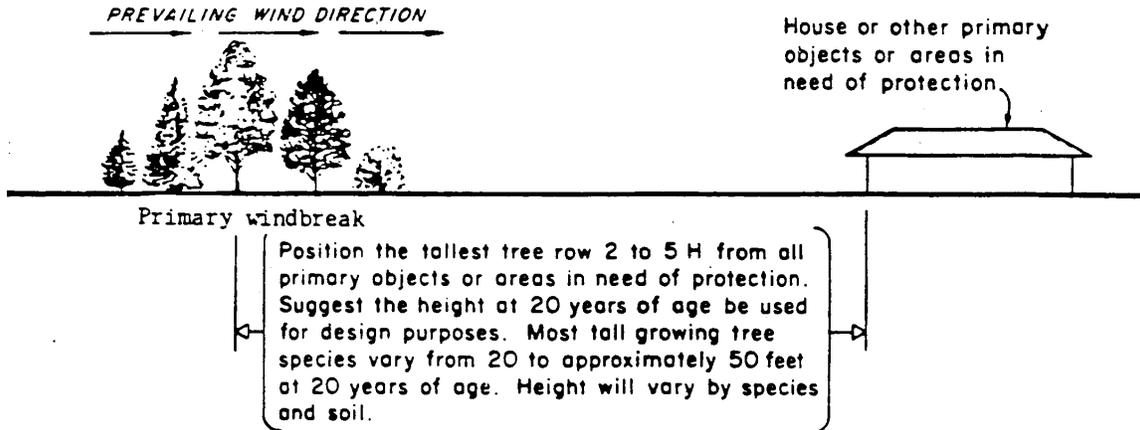
B. *Unobstructed view of oncoming traffic at road intersections; no crown or root obstruction of utility lines, etc.*

A. *Wind funnel effects through gaps minimized*

B. *Farming operations not obstructed.*

C. *Adapted species chosen for soil conditions, herbicide resistance, etc.*

**Figure 1. Cross-section of a windbreak -
Wind Protection Only.**



**Figure 2. Cross-section of windbreak -
Wind and Snow Protection Only**

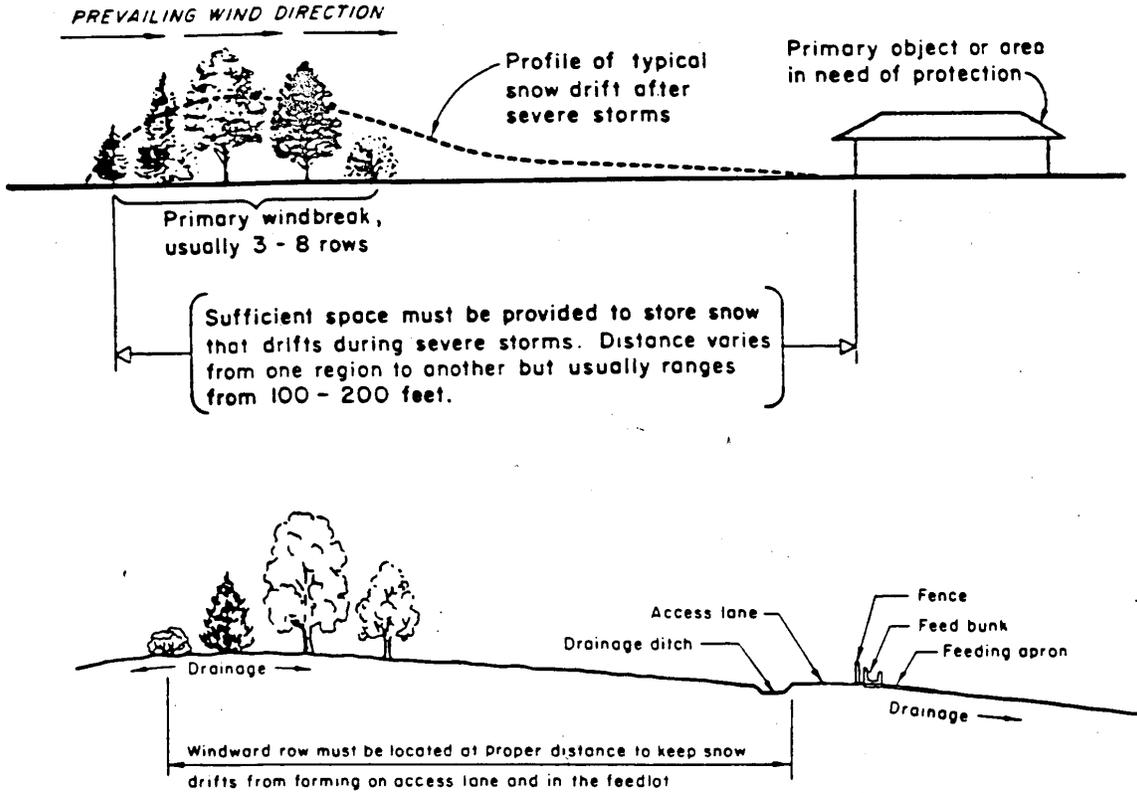


Figure 3. Area protected by windbreaks

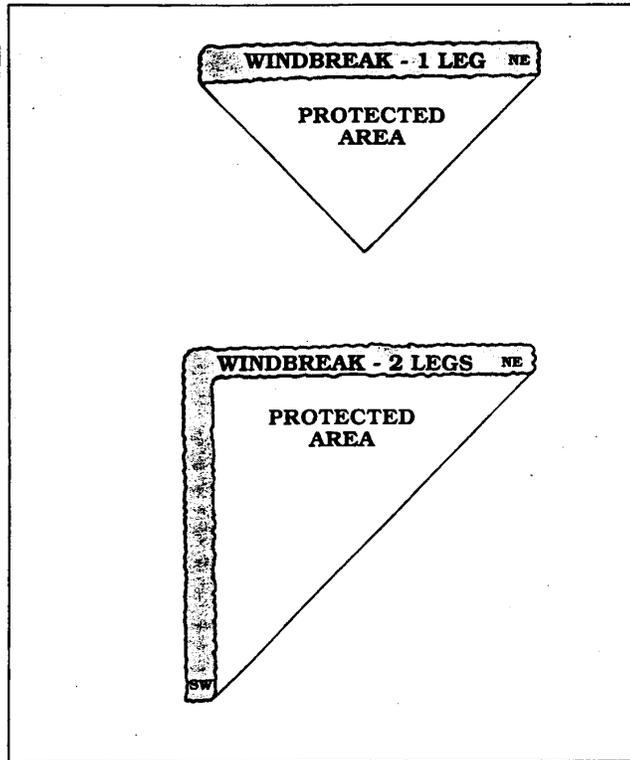


Figure 4. Typical snowdrift pattern near ends of windbreaks.

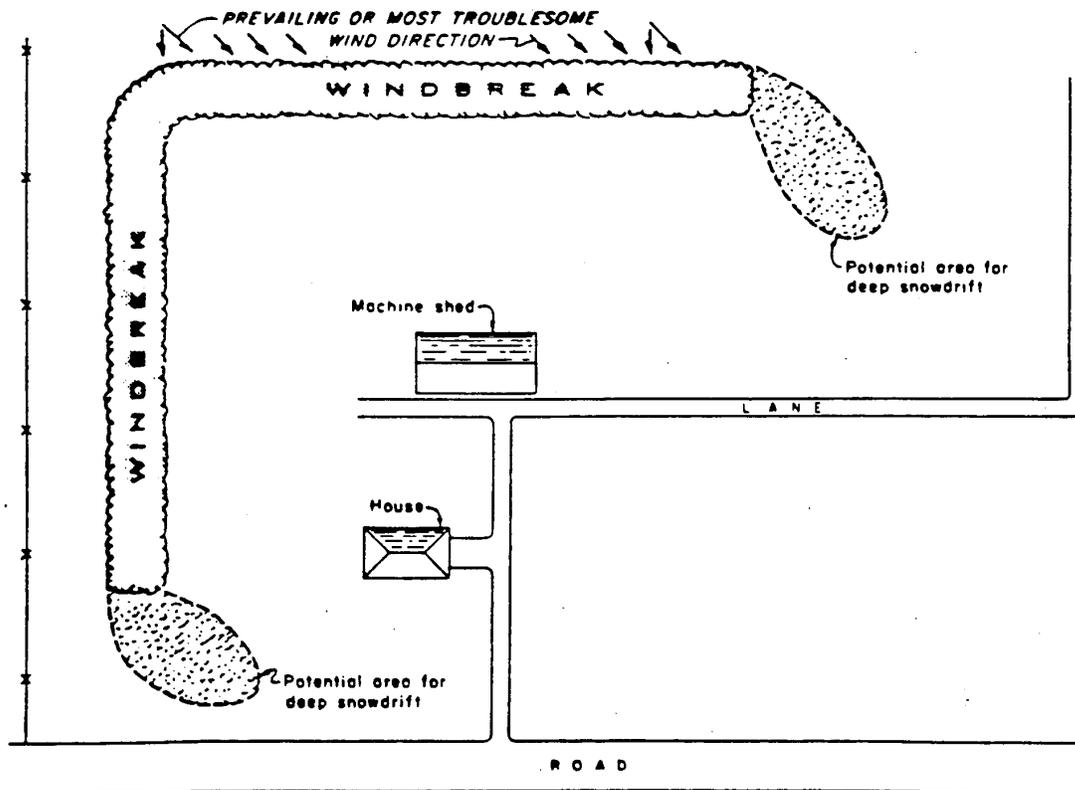


Figure 5. Access lanes and roads should be at an angle to prevailing or troublesome winds.

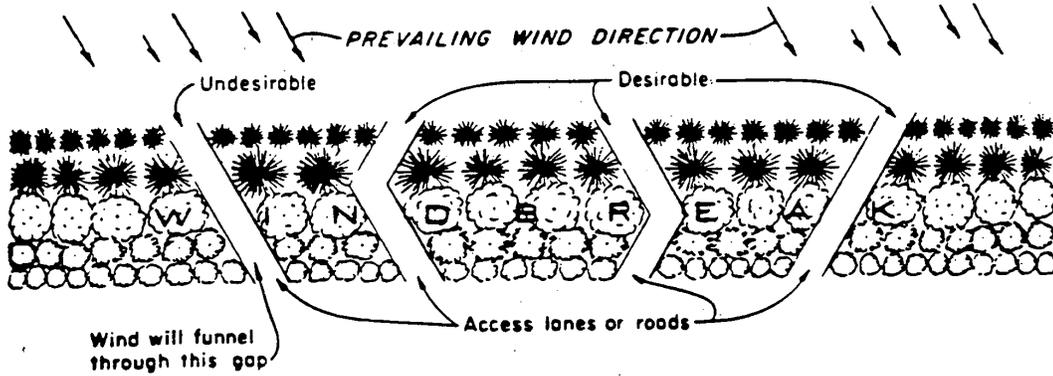
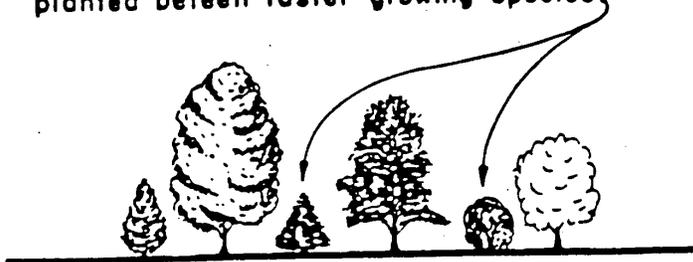


Figure 6. Placement of slower growing and shorter trees and shrubs.

INCORRECT

Slower growing and shorter growing species planted between faster growing species.



CORRECT

Slower growing and shorter growing species are planted in the outer rows.

