EXPECTED 20-YEAR TREE HEIGHTS

and Windbreak Suitability Group Descriptions

HOW TO USE:

General descriptions of windbreak suitability groups (WSG) and the reasons to have suitability groups are found on pages 1-7. Specific tree heights at twenty years by species for each suitability group are found on pages 8-13 for Major Land Resource Area (MLRA) 55 and 56 and on pages 14-19 for MLRA 53, 54, and 58. *An asterisk (*) in the tables on pages 8-19 indicate that additional varieties are most likely suitable for the same sites as is the "parent" species that is listed. Those approved cultivars, varieties, hybrid crosses, and subspecies are found on pages 20-21.* The legend for Windbreak Suitability Groups begins on page 21.

GENERAL

Windbreaks are often planted on land that did not grow trees originally. Knowledge of how trees perform on such land can be gained only by observing and recording their performance after planting. Many favorite windbreak species are not indigenous to the areas in which they are planted. Some are not native to North America, as indicated by their common names: Russian olive, Amur honeysuckle, Siberian elm, Nanking cherry, and Siberian peashrub. Within this document, species that are native to at least some location in North Dakota are shown as {**Native to ND}.**

Each year millions of dollars are invested in windbreaks. Annual maintenance and renovation costs are also considerable. Planning windbreaks requires accurate and reliable information on soil-windbreak interpretations to assure adequate windbreak performance and to satisfy the human expectations.

Control of competing vegetation is essential for successful windbreak establishment. Supplemental moisture is often necessary in many soils in semiarid regions.

Soil properties such as pH, salinity, and sodicity affect the likelihood that a particular woody plant will do well on a given site. Soils with pH values exceeding 7.8 exhibit greatly reduced species adaptability and growth rate. Salinity affects tree growth to a greater degree than pH. Only a few species, such as Russian-olive or buffaloberry, can survive or do well on moderately saline soils (8-16 mmhos/cm). Over half the species climatically suited to North Dakota do poorly on slightly saline soils (4-8 mmhos/cm). Even very slightly saline soils (2-4 mmhos/cm) affect growth rates and ability of some trees to withstand additional stresses. Sodicity, in the absence of salinity, generally reduces the success of tree plantings because of the characteristic restrictive soil layers associated with sodicity.

SPECIES SUITABILITY

Each tree or shrub species has certain climatic and physiographic limits. Within these limits, a tree may be well or poorly suited because of soil characteristics. Windbreak suitability groups are developed to assure satisfactory individual species performance under specified conditions of soil, climate, and physiography. Species are grouped

according to expected height growth at 20 years, given good management. Good management includes the control, or near control, of competing vegetation.

Windbreak suitability groups are a guide for selecting species best suited for different kinds of soils and for predicting height growth and effectiveness. They may be used to select plants for windbreaks, recreation, wildlife plantings, ornamental or environmental plantings, afforestation, reforestation, and critical area plantings. To find out to which suitability group a soil is assigned refer to the soil listing filed in Section II of the electronic Field Office Technical Guide (eFOTG). Please note: When species are known to be adapted to North Dakota climatic conditions, but little is known about the range of soil conditions on which they can grow, these tables have shown them suitable for only the best conditions for that species.

WINDBREAK SUITABILITY GROUPS (WSG)

All soil series, phases, or soil map units are placed in 10 groups of similar soils. Groups 1, 2, 4, 6, and 9 are further divided into subgroups. In addition, all groups provide information by groupings of MLRAs. MLRAs 53, 54, and 58 are grouped as one unit. MLRAs 55 and 56 are grouped as another unit. Counties that are split by an MLRA or specific species limitation may use either interpretation.

Soils are grouped into the following 10 general groups. A short description of each group is given, including limitations or problems in establishment and growth.

Group 1

Description
These are deep, well drained to somewhat poorly drained soils that receive beneficial moisture from favorable landscape positions, flooding, runoff from adjacent land, or they have a beneficial seasonally high water table during the spring. Soils within this group are generally fine sandy loam to silty clay loam.

Limitations
High pH will have an effect on the selection of species on some soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Occasionally, somewhat poorly drained soils may have excessive water for some species. ***Approved cultivars etc.***

Subgroups
1--Noncalcareous soils *(Locations: flats, swales, concave landscape positions)*
pH 6.1-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Arnegard, Bowbells, Svea, Gardena, Embden, Parshall, and Swenoda

1K--Calcareous soils. *(Locations: flats, microhighs)*
pH 7.4-8.4
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Hamerly, Fram, and Bearden

Group 2

Description
Soils in this group are deep, poorly drained or very poorly drained, and excessively wet or ponded during the spring or overflow periods. Wetness limits the selection of species suitable for planting on these soils and may reduce the growth rate.

Limitations
Wetness, high pH, and drainage will have an effect on the selection of tree and shrub species for soils in this group. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs. Spring planting may be delayed because of wet conditions. Soil blowing is a concern on the sandy and organic soils.

Subgroups
2--Noncalcareous/nonmuck soils *(Locations: depressions, flood plains, channels)*
pH 5.6-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils: undrained Tonka, drained Parnell, and drained Dimmick.

2K--Calcareous soils*. (Locations: flood plains, micro highs, channels)*
pH 7.5-8.3
Salinity - none to slight; Sodicity - none to slight

Typical soils: Borup, Colvin, Regan, and Vallers

2H - Muck soils. *(At least 8 inches of muck or peaty muck at the surface)*
(Locations: isolated depressions, Seeleville on side slopes)
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Eramosh, Markey, Rifle, Seeleville

Group 3

Description
Soils in this group are deep, well-drained loamy texture soils with moderate and moderately slow permeability. *(Locations: uplands)*

Limitations
Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas.
pH 6.1-7.8,
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Shambo, Williams, Barnes

Group 4

Description
Soils in this group are moderately deep and deep, have loamy surface textures with clayey subsoils, have slow or very slow permeability, and occur on uplands.

Limitations
High clay content and water availability have an effect on the selection of tree and shrub species for these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas.

Subgroups
4 - Loam over clay. *(Locations: uplands)*
pH 6.1-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Belfield, Aberdeen, cl and sicl Savage, cl and sicl Regent

4C-Deep and moderately deep clayey throughout the soil profile. *(Locations: uplands)*
pH 6.6-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils: drained Fargo, Lawther, Moreau, Nutley, Wahpeton,

Group 5

Description
Soils in this group are deep, with loamy and sandy texture. This group typically includes soils that normally have adequate soil moisture.
(Locations: uplands, fans, and terraces)

Limitations
Competition from grass and weeds and abrasion from soil blowing are the principal concerns in establishing and managing trees and shrubs on these soils.
pH 6.1-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils Egeland, Lanona, Livona, Talley

Group 6

Description
Soils in this group are well-drained, mostly loamy textures, and moderately deep over sand, gravel, bedrock, and other layers that can severely restrict root growth. They have low or moderate available water capacity.

Limitations
Droughtiness will have an effect on the selection of tree and shrub species for use on these soils. Competition from grass and weeds is the principal concern in establishing and managing trees and shrubs on these soils. Water erosion is a concern on the gently sloping to moderately steep areas. Supplemental watering may be needed for establishment. *Note: Soils with only 14-20 inches of loam over sand and gravel will exhibit reduced tree growth and vigor.*

Subgroups
6D - Moderately deep soils over bedrock or cemented layer *(Locations: uplands)*
pH 6.1-7.8,
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Amor, Edgeley, Reeder, Sen, and Vebar

6G - Moderately deep soils over sand and/or *gravel* *(Locations: terraces, outwash channels)*
pH 6.1-7.3
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Bowdle, Fordville, Manning, and Stady

Group 7

Description
Soils in this group are deep, excessively to moderately well drained, sandy in texture, typically have low to very low available water capacity, and do not normally have adequate moisture. *(Locations: uplands, flood plains, terraces, fans)*

Limitations
Drought conditions and abrasion from soil blowing are the principal concerns in establishing and managing trees and shrubs on these soils. Specialized site preparation (due to hummocky sand that is subject to blowouts) and specialized planting methods (vegetation between the rows is normally left undisturbed) are needed to establish trees and shrubs. Supplemental watering may be essential for successful establishment.
pH 6.1-7.8
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Beisigl, Lihen, Maddock, and Telfer

Group 8

Description
Soils in this group are calcareous at or near the surface. They do not receive beneficial moisture from run-on, flooding, or seasonal high water tables.
(*Locations: upland ridges, knolls, and fans)*

Limitations
High calcium content and competition from grass and weeds are the principal concerns in establishing and managing for trees and shrubs on these soils. Water erosion is a concern on gently sloping to moderately steep areas.
pH 7.4-8.4
Salinity - none to slight; Sodicity - none to slight

Typical Soils: Buse, Chama, Cherry, Langhei, Patent, Zahill, Zahl, and Zell

Group 9

Description
Salinity and/or sodicity affect soils in this group.

Limitations
Concentrations of salt and/or restrictive soil layers will severely affect the establishment, vigor, and growth of trees and shrubs on these soils.

Subgroups
9C - Saline and/or sodic soils with no seasonal high water tables-clayey.
(Locations: uplands, fans, and terraces)
pH 5.6-7.3
Salinity-slight to moderate; Sodicity-high

Typical Soils: Daglum, Nahon

9W - Saline and/or sodic soils with a high water table. *(Locations: flats, swales)*
pH 6.6-8.4
Salinity-moderate; Sodicity-low to high

Typical Soils: Bearden saline, Regan saline, Vallers saline

9L - Saline and/or sodic soils with no seasonal high water table-loamy. *(Locations: uplands, fans, and terraces)*
pH 5.2-7.3,
Salinity-slight to moderate; Sodicity-high

Typical Soils: Cavour, Noonan

Group 10

Description
Soils in this group have one or more characteristics, such as soil depth, texture, drainage, channeled phases, available water capacity, slope, or salt toxicity which severely limit planting, survival, or growth of trees and shrubs.

Limitations
Soils in this group are usually not recommended for farmstead and feedlot windbreaks, field windbreaks, afforestation, and plantings for recreation and wildlife.

Windbreak suitability group 10 soils include:

all shallow soils
all undrained phases of very poorly drained soils
all soils with less than 20 inches of loamy fine sand or coarser surface material
all strongly saline soils
all WSG 2H, 3, 4, 5, 6D, 9C, 9L soils on slopes greater than 15%
all WSG 4C, 8 soils on slopes greater than 8%
all WSG 7 soils on slopes greater than 6%

Onsite investigations may reveal that tree and shrub plantings can be made with special treatments to overcome the specific limitations making the soil a WSG-10 (hand planting, no till planting, mulching, supplemental water, or other specialized site treatments). The selection of species must be tailored to the soil conditions existing at each site. Limiting conditions and the specialized treatments required to overcome these limitations must be documented on the planting plan.

When an onsite investigation reveals that the site conditions, such as erosion risk, droughty conditions, or high pH can be modified and improved, species should be selected from the windbreak suitability group that the soil would most likely fall into after correcting the limiting factors. For example, for a shallow soil over bedrock, trees or shrubs would be selected from group 6; an excessively wet soil would most closely match group 2. Rarely can modification of onsite soil conditions be considered an appropriate long-term response. Modification costs money and usually requires considerable maintenance throughout the life of the tree or shrub.

Experience has shown that when windbreaks are placed on slopes greater than 15 percent, erosion control and moisture management measures need to be considered. Machine planting of windbreaks becomes limiting and the impact of slope on placement of windbreaks must also be considered in designing a windbreak. Even when establishment is successful, long-term survival and effectiveness is often reduced.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS																	
* Almond, Russian	4-6	3-4				4-6	4-5	4-5	3-4								
Prunus tenella	xxx	xxx				xxx	xxx	xxx	xxx								
* Buffaloberry, Silver **{Native to ND}**	11-13	8-12				10-12	7-10	7-10	7-9	4-6	4-6		4-5	4-5	4-5	4-5	
Shepherdia argentea	***	***				***	***	***	***	***	***		***	***	***	***	
Caragana (Peashrub, Siberian)	9-11	8-10				8-10	8-9	8-9	8-10	7-9	7-9		5-7	4-5	4-5		
Caragana arborescens	***	***				***	***	***	***	***	***		***	***	***		
Cherry Mongolian	5-6					4-6											
Prunus fruticosa	xxx					xxx											
Cherry, Nanking 2/	6-8					5-7											
Prunus tomentosa	xxx					xxx											
* Chokeberry, Black	4-8					3-6											
Aronia melanocarpa	xxx					xxx											
* Chokecherry, Common **{Native to ND}**	11-14	9-12				10-12	8-10	7-9	8-10	7-9	7-9						
Prunus virginiana	***	***				***	***	***	***	***	***						
* Cotoneaster, European 12/	10-12	8-11				9-11	6-8	5-7	6-7								
Cotoneaster integerrimus	xxx	xxx				xxx	xxx	xxx	xxx								
Cotoneaster, Peking 12/	8-10	7-9				7-9	6-8	5-7	6-7								
Cotoneaster acutifolia	xxx	xxx				xxx	xxx	xxx	xxx								
Cranberry, Highbush **{Native to ND}**	6-10																
Viburnum trilobum	xxx																
Currant, Black **{Native to ND}**	4-6					4-6											
Ribes americanum	***					***											
Currant, Golden **{Native to ND}**	5-7	4-6				5-6	4-6	4-6	3-6	3-5	3-5		3-4				
Ribes aureum	***	***				***	***	***	***	***	***		***				
Dogwood, Gray **{Native to ND}**	6-8					5-7											
Cornus racemosa	xxx					xxx											
Dogwood, Redosier **{Native to ND}**	6-8		6-8		5-6	5-7	4-6	4-6									
Cornus sericea	xxx		xxx		xxx	xxx	xxx	xxx									

* Indicates species which have approved cultivars or hybrids listed on pages 20-21.
*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS (cont)																	
* Dogwood, Silky	8-10		6-8		6-8	8-10	8-10	8-10									
Cornus amomum	xxx		xxx		xxx	xxx	xxx	xxx									
* Forsythia, Meadowlark	7-11	6-8				7-9	5-7	5-7	6-8								
Forsythia europa x F. ovata 'Meadowlark'	xxx	xxx				xxx	xxx	xxx	xxx								
Hazel, American **{Native to ND}**	6-8					6-8											
Corylus americana	xxx					xxx											
*Honeysuckle, Blueleaf (Freedom)'	8-10	7-9				7-9	6-8	6-8	5-7	4-6	4-6		4-5	4-5	4-5		
Lonicera korolkowii `Freedom'	xxx	xxx				xxx	xxx	xxx	xxx	xxx	xxx		xxx	xxx	xxx		
* Honeysuckle, tatarian 4/	8-10	7-9				8-10	6-8	6-8	5-7	5-7	5-7		5-6	4-5	4-5		
Lonicera tatarica	***	***				***	***	***	***	***	***		***	***	***		
* Indigo, False **{Native to ND}**	7-9	6-8	7-9	6-8	6-8	5-7	4-6	4-6									
Amorpha fruticosa	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx									
Juneberry (Saskatoon Serviceberry) **{Native to ND}**	6-8					5-7	5-6	5-6									
Amelanchier alnifolia	xxx					xxx	xxx	xxx									
Lilac, Common	10-12	8-10				10-11	8-9	8-9	7-9	5-7	5-7		5-6	5-6	5-6		
Syringa vulgaris	***	***				***	***	***	***	***	***		***	***	***		
* Lilac, Late	10-12	8-10				8-11	7-9	7-9									
Syringa villosa	***	***				***	***	***									
Lilac, Peking	12-15	10-13				10-13	10-13	10-13	8-10	6-8	6-8		6-8				
Syringa pekinensis	***	***				***	***	***	***	***	***		***				
* Plum, American 2/ **{Native to ND}**	7-9					8-10	7-9	6-8	5-9	4-7	4-7						
Prunus americana	***					***	***	***	***	***	***						
Rose, Hansen Hedge	4-6	4-6				4-6	4-6	3-4	3-4	2-4	2-4						
Rosa rugosa 'Hansen'	***	***				***	***	***	***	***	***						
Rose, Woods **{Native to ND}**	4-5	4-5				4-5	4-5	3-4	3-4	2-4	2-4						
Rosa woodsii	***	***				***	***	***	***	***	***						
Sandcherry, Western **{Native to ND}** 3/	4-6					4-6			4-5	3-5	3-5						
Prunus pumila besseyi	xxx					xxx			xxx	xxx	xxx						

* Indicates species which have approved cultivars or hybrids listed on pages 20-21.
*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS (cont)																	
Sea-buckthorn (Seaberry) *Hippophae rhamnoides*	9-11 ***	9-11 ***				7-9 ***	7-9 ***	7-9 ***	6-8 ***				4-5 ***	4-5 ***	4-5 ***	4-5 ***	
Silverberry **{Native to ND}** *Elaeagnus commutata*	6-8 ***	6-8 ***				5-7 ***	5-7 ***	5-7 ***	5-7 ***	4-5 ***	4-5 ***		3-5 ***	3-5 ***	3-5 ***	3-5 ***	
Snowberry 11/ **{Native to ND}** *Symphoricarpos occidentalis*	1-3 ***					1-3 ***	1-3 ***	1-3 ***	1-3 ***								
* Sumac, Aromatic *Rhus aromatica*	5-10 ***	4-7 ***				5-8 ***	4-7 ***	4-7 ***	4-7 ***	3-6 ***	3-6 ***						
* Sumac, Skunkbush **{Native to ND}** Rhus trilobata	3-7 ***	3-6 ***				3-6 ***			3-6 ***	2-5 ***	2-5 ***						
Sumac, Smooth **{Native to ND}** *Rhus glabra*	8-12 xxx					5-10 xxx											
Viburnum, Nannyberry **{Native to ND}** *Viburnum lentago*	12-16 xxx					10-12 xxx	6-8 xxx	6-8 xxx									
Willow, Bebbs **{Native to ND}** *Salix bebbiana*	15-20 ***		12-18 ***		12-18 ***		13/ ***	13/ ***									
* Willow, Purple-osier *Salix purpurea*	10-15 ***		10-15 ***		10-15 ***	7-12 xxx	13/ ***	13/ ***									
*Willow, Sandbar **{Native to ND}** *Salix interior*	7-9 ***		7-9 ***		5-7 ***	4-6 xxx	13/ ***	13/ ***									

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*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS TREES																	
Apricot, Manchurian 2/ *Prunus armeniaca*	12-14 xxx					11-13 xxx	10-12 xxx	10-12 xxx	10-12 xxx								
* Ash, Green **{Native to ND}** *Fraxinus pennsylvanica*	21-26 ***	19-24 ***				20-25 ***	16-20 ***	16-20 ***	15-19 ***	14-18 ***	14-18 ***		14-18 ***	9-11 ***	9-13 ***		
Aspen, Quaking **{Native to ND}** *Populus tremuloides*	27-32 xxx	22-27 xxx					13/ xxx	13/ xxx									
Basswood (American Linden) 6/ **{Native to ND}** *Tilia americana*	20-25 xxx					15-21 xxx											
Boxelder **{Native to ND}** *Acer negundo*	20-25 ***	18-23 ***				19-24 ***											
Buckeye, Ohio *Aesculus glabra*	15-20 xxx					12-18 xxx											
Cherry, Black *Prunus serotina*	20-25 xxx					15-20 xxx											
* Cottonwood Species **{Native to ND}** *Populus spp.*	40-48 xxx	38-45 ***					13/ xxx	13/ xxx									
* Crabapple, Manchurian *Malus mandsurica*	18-20 xxx					16-18 xxx	15-17 xxx	14-16 xxx	12-15 xxx	9-12 xxx	9-12 xxx						
Crabapple, Siberian *Malus, baccata*	18-20 xxx					16-18 xxx	15-17 xxx	14-16 xxx	12-15 xxx	9-12 xxx	9-12 xxx						
* Elm, Siberian *Ulmus pumila*	28-35 ***	28-35 ***				26-32 ***	22-26 ***	21-25 ***	20-25 ***	17-22 ***	17-22 ***		14-18 ***	10-12 ***	10-12 ***		
* Hackberry, Common **{Native to ND}** *Celtis occidentalis*	20-25 xxx	18-23 xxx				20-25 xxx	16-18 xxx	16-18 xxx	15-18 xxx								
* Hawthorn, Arnold *Cratageus anomala*	14-18 xxx	11-12 xxx				10-12 xxx	8-10 xxx	8-10 xxx	10-12 xxx	8-10 xxx	8-10 xxx						
Hawthorn, Downy *Cratageus mollis*	10-12 xxx	8-10 xxx				9-11 xxx	7-9 xxx	7-9 xxx	8-10 xxx								

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xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS TREES (cont.)																	
* Maple, Amur *Acer ginnala*	12-14 xxx					11-12 xxx											
Maple, Tatarian *Acer tataricum*	12-14 xxx					11-12 xxx											
Oak, Bur **{Native to ND}** *Quercus macrocarpa*	20-25 xxx	18-23 xxx				18-20 xxx	16-18 xxx	16-18 xxx	14-16 xxx								
* Pear, Ussurian (Harbin) *Pyrus, ussuriensis*	16-18 xxx					16-18 xxx			11-13 xxx								
* Poplar, Hybrid Species *Populus spp.*	40-48 xxx						13/ xxx	13/ xxx									
Poplar, White *Populus alba*	33-40 xxx					25-35 xxx											
Russian-olive *Elaeagnus angustifolia*	~~15-19~~ ZZZ	~~13-17~~ ZZZ		~~12-15~~ ZZZ		~~15-19~~ ZZZ	~~12-15~~ ZZZ	~~12-14~~ ZZZ	11-14 ***	11-14 ***	11-14 ***		11-14 ***	6-8 ***	8-10 ***	6-8 ***	
Walnut, Black 1/ 6/ 9/ *Juglans nigra*	22-28 xxx					17-21 xxx											
Willow, Laurel *Salix pentandra*	25-30 xxx		20-25 xxx		20-25 xxx		13/ xxx	13/ xxx									
Willow, Missouri River (Heartleaf) **{Native to ND}** *Salix eriocephala*	25-30 xxx		20-25 xxx		20-25 xxx		13/ xxx	13/ xxx									
Willow, Peachleaf **{Native to ND}** *Salix amygdaloides*	20-25 xxx		18-23 xxx		18-23 xxx		13/ xxx	13/ xxx									
* Willow, White *Salix alba*	30-35 xxx		20-25 xxx		20-25 xxx		13/ xxx	13/ xxx									

ZZZ indicates that Russian olive cannot be planted on the indicated windbreak suitability groups. Russian olive can be planted on windbreak suitability groups 6D and worse if no other species are appropriate.

* Indicates species which have approved cultivars or hybrids listed on pages 20-21.
*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 55, 56

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS																
	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
CONIFERS																	
Juniper, Rocky Mountain **{Native to ND}**	11-13	10-12				12-15	10-12	10-12	9-11	8-10	8-10	7-9	7-9	6-9	6-9		
Juniperus scopulorum	***	***				***	***	***	***	***	***	***	***	***	***		
Larch, Siberian	16-20					15-18			13-16								
Larix sibirica	xxx					xxx			xxx								
Pine, Ponderosa **{Native to ND}**	18-22	15-17				18-22			15-20	14-16	14-16	12-15	11-14				
Pinus ponderosa	***	***				***			***	***	***	***	***				
Pine Scotch	18-20					15-18			15-18	12-14	12-14						
Pinus sylvestris	xxx					xxx			xxx	xxx	xxx						
Redcedar, Eastern	11-13	10-12				12-15	10-12	10-12	9-11	8-10	8-10	7-9	7-9	6-9	6-9		
Juniperus virginiana	***	***				***	***	***	***	***	***	***	***	***	***		
Spruce, Black Hills	16-20					15-18	10-15	10-15	8-13								
Picea glauca densata	***					***	***	***	***								
Spruce, Colorado Blue	16-20					15-18	15-18	15-18	10-15								
Picea pungens	***					***	***	***	***								

* Indicates species which have approved cultivars or hybrids listed on pages 20-21.
*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS																	
* Almond, Russian	4-6	3-4				4-6	4-5	4-5	3-4								
Prunus tenella	xxx	xxx				xxx	xxx	xxx	xxx								
* Buffaloberry, Silver **{Native to ND}**	8-12	8-12				8-11	6-8	6-8	4-7	4-5	4-5		3-5	3-5	3-5	3-5	
Shepherdia argentea	***	***				***	***	***	***	***	***		xxx	***	***	***	
Caragana (Peashrub, Siberian)	8-10	8-10				8-10	7-8	5-6	7-9	6-8	6-8		4-5	3-5	3-5		
Caragana arborescens	***	***				***	***	***	***	***	***		***	***	***		
Cherry Mongolian	5-6					4-6											
Prunus fruticosa	xxx					xxx											
Cherry, Nanking 2/	6-8					5-7											
Prunus tomentosa	xxx					xxx											
* Chokecherry, Common **{Native to ND}**	10-12	8-10				8-10	7-9	6-8	6-8	4-6	4-6						
Prunus virginiana	***	***				***	***	***	***	***	***						
* Cotoneaster, European 12/	10-12	8-11				9-11	5-7	4-6	4-6								
Cotoneaster integerrimus	xxx	xxx				xxx	xxx	xxx	xxx								
Cotoneaster, Peking 12/	6-8	5-7				5-7											
Cotoneaster acutifolia	xxx	xxx				xxx											
Currant, Black **{Native to ND}**	4-6					3-5											
Ribes americanum	***					***											
Currant, Golden **{Native to ND}**	5-7	4-6				5-6	3-5	3-5	3-5	3-5	3-5						
Ribes aureum	***	***				***	***	***	***	***	***						
Dogwood, Redosier **{Native to ND}**	6-7		6-7		4-6	4-6	4-6	4-6									
Cornus sericea	xxx		xxx		xxx	xxx	xxx	xxx									
* Forsythia, sp.	6-10	5-7				6-8	4-6	4-6	5-7								
Forsythia europa x F. ovata' Meadowlark'	xxx	xxx				xxx	xxx	xxx	xxx								
Honeysuckle, Blueleaf	8-10	7-9				7-9	5-7	5-7	4-6	3-5	3-5		2-4	2-4	2-4		
Lonicera korolkowii `Freedom'	xxx	xxx				xxx	xxx	xxx	xxx	xxx	xxx		xxx	xxx	xxx		
* Honeysuckle, tatarian 4/	8-10	6-8				7-9	6-8	6-8	5-7	4-6	4-6		4-6	4-6	4-6		
Lonicera tatarica	***	***				***	***	***	***	***	***		***	***	***		

* Indicates species which have approved cultivars or hybrids listed on pages 20-21.
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xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS																
	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS (cont)																	
* Indigo, False **{Native to ND}**	6-8	5-7	6-8	5-7	2-3	4-6											
Amorpha fruticosa	xxx	xxx	xxx	xxx	***	xxx											
Juneberry (Saskatoon Serviceberry) **{Native to ND}**	5-6					4-6	3-5	3-5									
Amelanchier alnifolia	xxx					xxx	xxx	xxx									
Lilac, Common	8-10	8-10				7-9	6-7	5-6	6-8	4-6	4-6		4-6	3-5	3-5		
Syringa vulgaris	***	***				***	***	***	***	***	***		***	***	***		
* Lilac, Late	8-10	6-8				7-9	5-7	5-7									
Syringa villosa	***	****				***	***	***									
Lilac, Pekin	10-12	8-12				8-12	6-10	6-10									
Syringa pekinensis	***	***				***	***	***									
* Plum, American 2/ **{Native to ND}**	5-8					6-8	5-7	5-7	4-6								
Prunus americana	***					***	***	***	**								
Rose, Hansen Hedge	4-5	4-5				4-5	3-5	3-5	3-4	2-4	2-4						
Rosa rugosa 'Hansen'.	***	***				***	***	***	***	***	***						
Rose, Woods **{Native to ND}**	4-5	4-5				4-5	3-5	3-5	3-4	2-4	2-4						
Rosa woodsii	***	***				***	***	***	***	***	***						
Sandcherry, Western **{Native to ND}** 3/	4-6					4-6			3-5	2-4	2-4						
Prunus pumila besseyi	xxx					xxx			xxx	xxx	xxx						
Sea-buckthorn (Seaberry)	8-10	8-10				6-8	6-8	6-8	5-7				3-5	3-5	3-5	3-4	
Hippophae rhamnoides	***	***				***	***	***	***				***	***	***	***	
Silverberry **{Native to ND}**	5-7	5-7				5-7	5-7	5-7	4-6	4-5	4-5		3-5	3-5	3-5	3-4	
Elaeagnus commutata	***	***				***	***	***	***	***	***		***	***	***	***	
Snowberry 11/ **{Native to ND}**	1-3					1-3	1-3	1-3	1-3								
Symphoricarpos occidentalis	***					***	***	***	***								
* Sumac, Skunkbush **{Native to ND}**	3-9	3-7				3-9	3-7	3-7	3-7	3-5	3-5			3-5	3-5		
Rhus trilobata	***	***				***	***	***	***	***	***			***	***		

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*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS															
	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS SHRUBS (cont)																	
Viburnum, Nannyberry **{Native to ND}**	10-14					8-10	5-7	5-7									
Viburnum lentago	xxx					xxx	xxx	xxx									
Willow, Bebbs **{Native to ND}**	12-15		10-14		10-14												
Salix bebbiana	***		***		***												
* Willow, Purple-osier	8-13		8-13		8-13												
Salix purpurea	***		***		***												
* Willow, Sandbar **{Native to ND}**	5-6		5-7		5-7												
Salix interior	***		***		***												

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xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS																
	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS TREES																	
Apricot, Manchurian 2/	10-12					9-11	8-10	8-10	8-10								
Prunus armeniaca spp.	xxx					xxx	xxx	xxx	xxx								
* Ash, Green **{Native to ND}**	18-22	16-20				17-21	14-18	14-18	13-16	12-15	12-15		8-9	8-10	8-12		
Fraxinus pennsylvanica	***	***				***	***	***	***	***	***		***	***	***		
Aspen, Quaking **{Native to ND}**	25-30	20-25															
Populus tremuloides	xxx	xxx															
Boxelder **{Native to ND}**	15-18	13-15				13-16											
Acer negundo	***	***				***											
Cherry, Black	18-20					15-18											
Prunus serotina	*xxx*					*xxx*											
* Cottonwood Species **{Native to ND}**	38-46	34-42															
Populus spp.	xxx	***															
* Crabapple, Manchurian	15-16					13-16	13-15	13-15	10-12								
Malus. manshurica	xxx					xxx	xxx	xxx	xxx								
Crabapple, Siberian	15-16					13-16	13-15	13-15	10-12								
Malus baccata	xxx					xxx	xxx	xxx	xxx								
* Elm, Siberian	24-30	24-30				22-27	16-20	16-20	20-25	16-20	16-20		10-12	9-11	9-11		
Ulmus pumila	***	***				***	***	***	***	***	***		***	***	***		
* Hackberry, Common **{Native to ND}**	18-22	16-20				17-21	15-17	15-17									
Celtis occidentalis	xxx	xxx				xxx	xxx	xxx									
* Hawthorn, Arnold	12-16	10-14				11-13	8-10	8-10	11-13	7-9	7-9						
Cratageus x anomala	xxx	xxx				xxx	xxx	xxx	xxx	xxx	xxx						
Hawthorn, Downy	10-12					9-11	6-8	6-8									
Cratageus mollis	xxx					xxx	xxx	xxx									

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xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS / SCIENTIFIC NAME OF TREES & SHRUBS	20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS																
	1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
DECIDUOUS TREES (cont.)																	
Maple, Amur *Acer ginnala*	10-12 xxx					9-10 xxx											
Maple, Tatarian *Acer tataricum*	10-12 xxx					9-10 xxx											
Oak, Bur **{Native to ND}** *Quercus macrocarpa*	17-20 xxx	15-18 xxx				17-20 xxx	14-16 xxx	14-16 xxx	12-15 xxx								
* Pear, Ussurian (Harbin) *Pyrus, ussuriensis*	15-17 xxx					15-17 xxx			10-12 xxx								
* Poplar, Hybrid Species *Populus spp.*	40-45 xxx																
Poplar, White *Populus alba*	28-35 xxx					20-30 xxx											
Russian-olive *Elaeagnus angustifolia*	~~13-16~~ ZZZ	~~12-15~~ ZZZ		~~10-13~~ ZZZ		~~12-15~~ ZZZ	~~10-12~~ ZZZ	~~10-12~~ ZZZ	11-14	10-12 ***	10-12 ***		8-9 ***	6-8 ***	6-8 ***	5-7 ***	
Willow, Laurel *Salix pentandra*	20-25 xxx		15-20 xxx		15-20 xxx												
Willow, Missouri River (Heartleaf) **{Native to ND}** *Salix eriocephala*	21-23 xxx		17-20 xxx		17-20 xxx												
Willow, Peachleaf **{Native to ND}** *Salix amygdaloides*	18-23 xxx		16-21 xxx		16-21 xxx												
* Willow, White *Salix alba*	20-25 xxx		18-23 xxx		18-23 xxx												

ZZZ indicates that Russian olive cannot be planted on the indicated windbreak suitability groups. Russian olive can be planted on windbreak suitability groups 6D and worse if no other species are appropriate.

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xxx Indicates species that require good site prep and effective weed control until canopy closure.

EXPECTED TREE HEIGHTS AT 20 YEARS BY WINDBREAK SUITABILITY GROUPS MLRA 53, 54, 58

COMMON NAME OF TREES & SHRUBS SCIENTIFIC NAME OF TREES & SHRUBS	- - - - - - - - - - 20-YEAR TREE AND SHRUB HEIGHTS BY WINDBREAK SUITABILITY GROUPS - - - - - - - - - - 1	1K	2	2K	2H	3	4	4C	5	6D	6G	7	8	9C 10/	9L 10/	9W 10/	10
CONIFERS																	
Juniper, Rocky Mountain **{Native to ND}** *Juniperus scopulorum*	10-12 ***	9-11 ***				10-12 ***	9-11 ***	9-11 ***	8-10 ***	7-9 ***	7-9 ***	7-9 ***	6-8 ***	5-7 ***	5-7 ***		
Larch, Siberian *Larix sibirica*	14-18 xxx					13-16 xxx			12-15 xxx								
Pine, Ponderosa **{Native to ND}** *Pinus ponderosa*	16-20 ***	14-16 ***				16-20 ***			13-18 ***	12-14 ***	12-14 ***	11-13 ***	11-13 ***				
Pine Scotch *Pinus sylvestris*	16-18 xxx					14-17 xxx			14-17 xxx	11-13 xxx	11-13 xxx						
Redcedar, Eastern *Juniperus virginiana*	10-12 ***	9-11 ***				10-12 ***	9-11 ***	9-11 ***	8-10 ***	7-9 ***	7-9 ***	7-9 ***	6-8 ***	5-7 ***	5-7 ***		
Spruce, Black Hills *Picea glauca densata*	16-20 ***					15-19 ***	10-15 ***	10-15 ***									
Spruce, Colorado Blue *Picea pungens*	16-20 ***					15-19 ***	10-15 ***	10-15 ***									

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*** Indicates species which will do well with only good site prep and 1-3 years post plant weed control.
xxx Indicates species that require good site prep and effective weed control until canopy closure.

APPROVED CULTIVARS, VARIETIES, HYBRID CROSSES AND SUB SPECIES

LEGEND
Common Name
Approved cultivars etc.

Shrubs

Almond, Russian
Prunus tenella 'Regal' 5/

Buffaloberry, Silver
Shepherdia argentea 'Sakakawea' 5/

Chokeberry, Black
Aronia melanocarpa 'McKenzie'

Chokecherry, Common
Prunus virginiana var. 'Schubert'

Cotoneaster, European
Cotoneaster integerrimus 'Centennial' 5/

Dogwood, Silky
Cornus amomum 'Indigo'

Forsythia
Forsythia europea x F. ovata 'Meadowlark'

Honeysuckle, Arnolds Red
Lonicera tatarica 'Arnolds Red'

Honeysuckle, Blueleaf
Lonicera korolkowii 'Freedom'

Honeysuckle, Tatarian
Lonicera tatarica 'Arnolds Red'

Indigo, False
Amorpha fruiticosa 'Survivor'

Lilac, Late
Syringa villosa 'Legacy' 5/

Sumac, Aromatic
Rhus aromatica 'Konza'

Sumac, Skunkbush
Rhus trilobata 'Bighorn' 5/

Willow, Purpleosier
Salix purpurea 'Streamco' (does not sucker)

Willow, Sandbar
Salix interior 'Silver Sands'

Trees

Ash, Green
Fraxinus pennsylvanica 'Cardan' 5/

Cottonwood, Species
Populus x euroamericana (Siouxland Cottonwood) 7/

Crabapple, Manchurian
Malus mandshurica 'Midwest' 5/

Elm, Siberian
Ulmus pumila 'Dropmore'

Hackberry, Common
Celtis occidentalis 'Oahe' 5/

Hawthorn, Arnold
Crataegous anomala 'Homestead' 5/

Pear, Ussurian (Harbin)
Pyrus ussuriensis 'McDermand'

Poplar, Hybrid
Populus x canescens (Tower Poplar)
Populus x jackii (Northwest Poplar)8/
Populus 'Walker'
Populus x euramericana (Robusta Poplar) 1/
Populus x euramericana (Imperial Poplar) 5/
Populus x euramericana (Norway Poplar) 1/
Populus x euramericana (Raverdeau)

Willow, White
Salix alba 'vitellina' (Golden Willow)
Salix alba 'chermesina' (Red Twig Willow)
Salix alba 'Flame' (Flame Willow) 9/

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USDA-NRCS PLANTS Database. 2001. http://plants.usda.gov/.

Note: When differences existed between references, the PLANTS database was used for resolution.

LEGEND FOR WINDBREAK SUITABILITY GROUPS

***** This species of plant has cultivars, varieties, hybrid crosses, or sub species that are also appropriate for planting wherever the parent species is recommended. See the attached list for the approved cultivars, varieties, hybrid crosses, or sub species.

xxx This species is suitable for cultivated plantings only. Site preparation consists of complete control of competing vegetation prior to planting. Usually this vegetation control is completed the season before planting in order to harvest and store water in the soil. Chem fallow or tillage are common site preparation methods. Competing vegetation, especially vigorous sods are controlled throughout the life of the planting or until canopy closure. Control methods may consist of tillage, mulches, chemicals, or synthetic weed control fabrics.

******* This species is suitable for cultivated and noncultivated plantings. Noncultivated plantings are those plantings where little, if any, weed control is performed beyond the third year after planting.

Site preparation for noncultivated plantings may be performed a year before planting in order to store additional water, or it may be performed just before, or right at planting time (i.e. strip till, chemical burn down, scalping). Examples of noncultivated plantings are wildlife plantings, scattered shrub plantings, windbreak plantings where little weed control is anticipated, or plantings where onsite erosion potential is high. Noncultivated plantings would likely become fully sodded within 1-4 years after planting to trees or shrubs. Survival and vigor of a noncultivated planting will be reduced from the heights listed on pages 8-19.

Note: The difference between cultivated and noncultivated plantings is not the planting method used, but rather the extent and duration of weed control expected after the trees and shrubs have been planted.

No xxx or ******* or tree height figures means the tree or shrub is **not suitable** for planting on those suitability groups.

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FOOTNOTES FOR WINDBREAK SUITABILITY GROUPS

1/ Suitable for plantings south of Interstate 94.

2/ This species has a serious decline in vigor in 10 years or less.

Species would benefit from coppice regeneration when showing decline.

3/ This species has a serious decline in vigor after 5 years.

Species would benefit from coppice regeneration when showing decline.

4/ This species has a high susceptibility to the honeysuckle aphid which results in witches broom and potential death of the plant. It is suitable, but some released varieties show greater aphid resistance.

5/ Variety released jointly by NRCS Plant Materials Center, Agricultural Research Service, and individual land grant Universities.

6/ This species is suitable for planting in the area listed **only** if planted where protected by mature windbreaks, forest stands, or microclimates protected by topographic features. Certain individual plants will do well and others will die. Generally slow-growing plants survive best.

7/ Though resistant to leaf blight (rusts) it is very susceptible to canker diseases and suffers severe dieback and death at an early age.

8/ Though somewhat resistant to canker diseases, it is very prone to leaf blight (rusts).

9/ This species should only be planted in MLRA 56.

10/ To reduce the negative effects of salinity, herbaceous vegetation should be maintained between the rows and to within a few feet of each tree or shrub. Bare soils will make the salinity problems worse.

11/ This plant is not suitable for windbreaks. It is too short to be effective.

12/ Subject to fire blight. Use cautiously, especially in areas where fire blight is prevalent.

13/ All of the willows, native cottonwood, hybrid poplars, and aspen can be considered for planting on specific individual WSG 4 and 4C soils once an on-site evaluation has confirmed the presence of sufficient moisture to ensure establishment and long term survival. The following soils within MLRA 55 and 56 have the potential for cottonwood, hybrid poplars, aspen, and willow production pending investigation results: Wahpeton, Fargo, Fargo silty clay, Fargo clay, Grano-drained, Dovry, poorly drained and Ludden. Tree heights, for these particular species, found under WSG-1 can be used for height estimates when planted on appropriate WSG-4 and 4C soils. Willows, cottonwoods, hybrid poplars, or aspen are not to be planted on other WSG 4 and 4C soils.

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