

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE SPECIFICATION GUIDE SHEET  
TREE/SHRUB ESTABLISHMENT  
(ac.)  
CODE 612**

Planning and installation of tree and shrub plantings shall adhere to the Natural Resources Conservation Service (NRCS) conservation practice standard "Tree/Shrub Establishment" (612), in the South Dakota Technical Guide (SDTG).

Tree and shrub plantings designed under the Tree/Shrub Establishment standard are different than windbreaks/shelterbelts or wildlife plantings. This standard is primarily for forestry plantings but slight modifications of design will enable tree or shrub plantings to serve additional purposes such as carbon sequestration, wildlife habitat, or enhancing aesthetics while still addressing the main purpose of the planting.

Material in this document provides guidance for designing tree or shrub plantings for a variety of purposes that meet Tree/Shrub Establishment standards.

Supporting documents needed to plan and install a successful tree/shrub planting include:

"Expected Tree and Shrub Heights at 20 Years", Section II, SDTG;

Woodland Technical Note No. 38 - "Tree and Shrub, Handling, Planting, and Care";

Woodland Technical Note No. 37 – "Tree and Shrub Characteristics for Riparian or Specialty Plantings."

### **SPECIES ADAPTABILITY TO SOIL AND SITE CONDITIONS**

All species must be adapted to the site and the intended purpose. To determine if an area is suitable to support woody plants, consider the topographic position of the proposed site and the soils that make up the site. Sites, where trees and shrubs grow best, include north or north-east aspects, toe-slope positions, riparian areas, and areas that receive additional water through run-on or beneficial high water tables. To determine which trees and shrubs are adapted to non-forested sites, identify which Conservation Tree/Shrub Group the soil is assigned to and refer to "Expected Tree and Shrub Heights at 20 Years" in Section II of the SDTG. Tree and shrub species shall be selected that are compatible with the soils on which they will be planted, and the expected 20-year height will achieve the intended purpose of the planting. Be aware of changes in soil properties within the planting site as it may require a species change.

"Expected Tree and Shrub Heights at 20 Years" contains a listing of species commonly planted in South Dakota. Those species suited for each Conservation Tree/Shrub Group show an expected height in 20 years. If there is no height range value, the species is not recommended for planting on soils in that group. If there is an "x" in a group, there is no height data available, but the species should be suitable for the group.

For naturally forested sites, consider indigenous species. Refer to Forestland Interpretations in Section II of the SDTG.

Table 1 provides information for selecting species for various forestry plantings. For purposes other than forestry refer to SDTG standards Windbreak/Shelterbelt Establishment (380), Upland Wildlife Habitat Management (645), or Forest Riparian Buffer (391).

### **PLANTING STOCK QUALITY**

To determine appropriate quality of planting stock for establishing trees and shrubs refer to planting stock requirements on page 2 of Woodland Technical Note No. 38.

Refer to Woodland Technical Note No. 38, page 3 for guidance on proper storage, handling, and care requirements necessary to maintain viable planting stock.

### **SITE PREPARATION**

Site preparation shall be sufficient for establishment and growth of selected species. Planting sites for naturally forested areas must be prepared according to the standard Forest Site Preparation (490). Adequate seed or advanced reproduction needs to be present or provided for when using natural regeneration to establish a stand on these sites.

When prescribed burning is done for site preparation, all applicable laws and regulations will be followed. The landowner is responsible to obtain any required permits, and develop and follow an approved burn plan. Prescribed burning may be required for natural regeneration of serotinous cone species and for site preparation for other species.

To determine an appropriate and sufficient method of site preparation for all other areas, refer to Woodland Technical Note No. 38, pages 3-6, for site preparation alternatives based on conditions encountered in the area of the planting.

### **PLANTING OPERATION**

Trees and shrubs may be planted by hand or with a suitable planting machine. Choose a planting method appropriate for the site conditions and for the particular stock used. Bare-root seedlings should not be exposed to the air for more than 30 seconds.

Refer to Woodland Technical Note No. 38, pages 7-10.

All plantings that use bare-root stock or cuttings shall be completed in the spring as soon as possible after the frost leaves the ground but no later than June 1. Bare-root conifers should be planted by May 15.

Containerized and balled and burlapped stock may be planted in frost free ground provided soil moisture is adequate.

### **SETBACKS AND EASEMENT AREAS OF UTILITIES**

Tree/shrub plantings shall not compromise the integrity of property lines, above and below ground utilities, fences, right of ways, drainage tiles, or buildings.

For setback distances from roads, property lines or buildings follow the guidance in the standard "Windbreak/Shelterbelt Establishment" (380). In all cases, if local units of government have established more restrictive setback distances, then the more restrictive regulations will apply.

### **DESIGN CONSIDERATIONS FOR ALL PURPOSES**

Planting and seeding rates will be adequate to accomplish the planned purpose. Tree and shrub spacing is related to the purpose of the planting, the site, and the size of maintenance equipment.

If necessary, establish and maintain adequate firebreaks to prevent catastrophic loss of the planting. See NRCS practice standard "Firebreak" (394) for design recommendations.

Species diversity should be considered to avoid loss of function due to species specific pests.

When compatible with landowner objectives and site capabilities, use native trees and shrubs whenever possible. Do not use plants considered invasive. Refer to Woodland Technical Note No. 37 to determine which plants are considered native to South Dakota.

During the establishment period (usually three to five years), timely application of supplemental water may greatly improve tree and shrub survival. Even with irrigation, plants must match the conservation tree/shrub groups of the soils at the site.

Regularly examine the planting to check on growth rates, health and vigor of trees and shrubs, disease or insect problems, weed control needs, level of animal damage, and the need for pruning or thinning. Refer to Woodland Technical Note No. 38, pages 16-18 for information on how to address some of the problems that can occur within tree and shrub plantings.

## DESIGN CONSIDERATIONS FOR FOREST PRODUCTS

### Wood Products

Select species to fit objectives of the landowner and capabilities of the site; refer to Table 1. Whenever compatible with landowner objectives and site potential use a variety of species.

Initial stocking rates and establishment success shall be adequate to ensure a fully stocked stand. The following rates shall be used for tree plantings. Adjust rates within listed ranges for desired objectives, site conditions, maintenance requirements, and species needs.

	<u>Plants/acre</u>	<u>Spacing (feet)</u>
Hardwoods (sawlogs)	436 - 680	8 x 8 to 10 x 10
Conifers (sawlogs)	545 - 908	6 x 8 to 8 x 10
Biofuels, firewood	908 - 1210	6 x 6 to 6 x 8
Christmas Trees	1210 - 1742	5 x 5 to 6 x 6

For timber production, the tree density is adequate if there are 400 to 500 live seedlings per acre at the end of the second growing season.

Space shall be provided as necessary for access roads, harvesting, firebreaks, and management purposes.

### Fruit and Nut Production

Apple, Cherry, Apricot, Buffaloberry, Western Sandcherry, Juneberry, Chokecherry, Highbush Cranberry, and Seaberry fruit production, and walnut nut production are all possible within parts of South Dakota. Spacing for this type of production resemble the spacing found in an orchard (16-20 feet between rows and 3-12 feet between plants) to provide access for harvest and maintenance.

## DIRECT SEEDING TO ESTABLISH A FOREST STAND

An alternative method of regenerating a forest is direct seeding. Direct seeding is useful on sites where access, terrain, or drainage makes planting seedlings impossible. While the initial cost is less than planting seedlings, the results are usually less predictable and more time is required for stand establishment. Unfavorable climatic conditions following seeding may cause complete failure. Until more data on the viability of this planting method in South Dakota becomes available, review and approval of each site, planting plan and maintenance schedule will have to be obtained from the NRCS state resource conservationist.

Adaptable hardwood species for direct seeding include green ash, silver maple, bur oak, hackberry, basswood, and black walnut.

Mature, viable seed can be collected from quality seed bearing trees. Seed should be from within 150 miles, north to south of the planting site.

Sites will be tilled to expose mineral soil for seed germination. Create a firm, weed free seedbed. Seed can be planted anytime between October and April when soil conditions allow; do not plant on frozen soil. Fall seeding eliminates the need for stratification.

Seed can be planted/sown by hand or mechanically. Large seeds such as acorns and walnuts should be seeded at a depth twice their diameter. Lighter seeds such as ash and maple can be broadcast and worked into the soil or seeded one-quarter inch deep. After seeding cultipack, roll, or drag the entire site to completely cover the seed and achieve good seed to soil contact.

Consider using a mixture of different species when seeding. For oak and walnut, a full seeding is a minimum of 5,000 seeds per acre. When direct seeding with other species included in the mix, design for 15,000 seeds per acre. Due to moisture stress, weed competition, and high predation losses for most South Dakota tree plantings, this higher initial planting rate is designed to increase the likelihood that the desired trees will fully "capture" the site and attain a closed canopy within a reasonable time frame.

## **NATURAL REGENERATION**

Natural regeneration of hardwood species is an establishment option on floodplain soils, which originally were in forest cover. An adequate source of seed from nearby seed bearing trees must be present upwind of the site.

On non-floodplain soils, natural regeneration of hardwoods will be an option when the site is within 300 feet of existing mature woodlands and adjacent to desirable seed sources.

Site preparation will be done according to the standard "Forest Site Preparation" (490). Prepare a clean, firm weed free seedbed prior to seed dispersal.

Natural regeneration on hardwood forested sites can be accomplished by timing and conducting timber harvesting operations to promote root suckering, stump sprouting and dispersal of natural seed. Many hardwood species will naturally regenerate through these methods if the parent trees are healthy and the canopy is sufficiently opened up.

A successful stand for natural regeneration or direct seeding would be 2,000 plants per acre, inventoried during the summer of the third growing season.

The dense initial stocking rates for all establishment methods are designed to yield a fully stocked stand, improve the form class of the trees, and to greatly increase the value for lumber, wood products and carbon sequestration. To further maximize growth, plantings for lumber production will need to be thinned.

## **DESIGN CONSIDERATIONS FOR WILDLIFE HABITAT**

When the primary purpose of a tree/shrub planting is to improve habitat for wildlife, it is best to refer to the standard "Wildlife Upland Habitat Management" (645), for specific details appropriate for the wildlife specie(s) of interest. The designs of tree/shrub plantings for other purposes can be modified to make the practice more beneficial to wildlife while still addressing the original purpose of the planting. Considerations for improving the wildlife value of tree/shrub plantings include, but are not limited to:

Provide dense areas (thickets) of suckering shrubs or conifers, especially spruce and juniper for winter thermal protection. For this purpose suckering shrubs shall be planted at a 4 x 4 or 5 x 5 foot spacing, junipers and redcedars at a 6 x 6 or 8 x 8 foot spacing and spruce at a 10 x 10 to 12 x 12 foot spacing.

Choose a variety of plants that will provide food throughout the growing season, especially during mid and late winter. Refer to Tree and Shrub Characteristics for Riparian or Specialty Plantings for individual species value as a food source. Plantings shall consist of at least one food source that provides food through late winter.

Add additional plantings of trees or shrubs that provide food or cover on the lee side of the main planting.

## **DESIGN CONSIDERATIONS FOR LONG-TERM EROSION CONTROL AND IMPROVEMENT OF WATER QUALITY**

Dense forest plantings control erosion through several mechanisms.

Canopies intercept raindrops and minimize the erosive force of the splash.

Established forests develop a duff layer that effectively protects the soil surface from the erosive energy of rain.

Extensive root systems can act to reinforce the soil creating a site less prone to slumping or mass movement.

Tree and shrub plantings can protect stream banks from the force of moving water and strengthen the soil of the stream bank with extensive root systems.

Use species that are native to the area, medium to fast growing, and deep rooting. For riparian areas, use species adapted to local flooding conditions and soil wetness.

Plants should be evenly distributed over the planting site. Place plants on the contour for slopes over three percent.

### **DESIGN CONSIDERATIONS FOR WASTE TREATMENT**

Waste treatment systems utilizing trees historically consist of hybrid poplar, cottonwood, or willow plantations located within irrigation distance of a municipal waste treatment plant. This technique has the potential to yield large quantities of wood, pulp, or biofuels while effectively treating municipal waste and perhaps saving extensive waste treatment plant modifications. This technology is rapidly changing. Ensure that the most recent information is used for the planting and design of the planting.

### **DESIGN CONSIDERATIONS FOR REDUCTION OF AIR POLLUTION**

Tree and shrub plantings can reduce air pollution in two ways - by reducing the wind velocities across the source of the pollutant and by intercepting pollutants that have moved off site onto the leaves, twigs, and bark of the woody plants.

Plantings for this purpose shall be as long as possible and perpendicular to the source of the air pollutant to intercept as many pollutants as possible. Tree densities listed for Forest Products are to be used. Where possible, use the tallest trees appropriate for the site. Tall trees can intercept more of the laterally moving air mass. Multiple rows of tall trees provide additional benefits since they contain more living matter that can intercept drift.

Trees and shrubs can have an impact on odor concentrations or the perception of odor intensities. Certain combinations of density and plant heights at certain distances from the odor source can cause winds to move the odor higher into the atmosphere where it can be diluted. Planting densities and heights may reduce the wind blowing across the odor site and limit the distance to which the odor will travel.

Trees and shrubs can act as a visual screen. Sometimes odors are not perceived as severe if the source is not visible.

### **DESIGN CONSIDERATIONS FOR SEQUESTRATION OF CARBON**

Carbon sequestration can be realized through several different mechanisms; cessation of soil tillage, accumulation of carbon in roots and upper tree mass, and accumulation of a duff layer. Generally speaking, maximum carbon sequestration can be expected through:

- Close spacing that maximize plants per acre without unduly causing plant stress that could lead to early mortality. Use the higher tree densities for wood products listed above.

- Establishing a variety of species to reduce risk of catastrophic loss and improve environmental benefits.

- Establishing long-lived trees.

- Planting trees that will grow large with extensive and deep root systems.

- Harvesting woody material for lumber or alternative fuels.

- Minimizing of tillage within the planting to only that necessary for establishment.

### **DESIGN CONSIDERATIONS FOR ENERGY CONSERVATION**

Trees can save energy many ways: (1) through shade, reducing the need for air conditioning, (2) through breaking the force of the winter winds, lowering heating costs, and (3) by serving as a renewable source of fuel.

Proper location of large spreading deciduous trees can reduce heat gain through windows during the summer while not detracting from heat gain in the winter. Generally trees for this purpose

should be planted on the east or west sides of the building. Be sure tree(s) are spaced far enough from the house to prevent problems as the tree matures.

Planting trees or shrubs to shade the air conditioner can save up to 10 percent in cooling costs. Be sure that trees or shrubs do not block airflow to the conditioner.

### **DESIGN CONSIDERATIONS FOR ENHANCED AESTHETICS**

Plans for landscape and beautification plantings should consider foliage color, season and color of flowering, and mature plant height. Contact local nursery, community forestry, or University Extension personnel for species or varieties suitable for landscaping and beautification.

All plantings should compliment natural features.

### **OPERATION AND MAINTENANCE**

#### Weed Control

Competing vegetation will be controlled until the woody plants are established. To determine an appropriate form of weed control, refer to Woodland Technical Note No. 38, pages 10-13.

Provide at least a three foot diameter competition free zone around all woody plantings.

If mulches are used, follow Mulching (484).

If herbicides are used, apply them only when needed and handle with care. Follow all label directions and precautions.

If mechanical means are used, care should be taken to avoid physical damage to plantings. Keep tillage depths shallow to avoid root damage.

#### Replanting

Replanting will be required when survival is inadequate. Replants shall maintain the intended function of the planting and be compatible with soils and climate. Growth rates of replants (within three years) are usually such that little if any size difference is noted after 10 years. Refer to Table 1 – Required Survival Percentages for a Successful Tree Planting on page 19 of Woodland Technical Note No. 38.

#### Disease, Insects, Weather and Animals

Trees and shrubs will be protected from fire, insects, disease, and animals until established. Damaging pests will be monitored and controlled. To determine ways to prevent or control damage due to disease, insects, weather, or animals, refer to Woodland Technical Note No. 38, pages 16-18.

Use supplemental water, mulching, root dips, geo-textile mats, tree shelters, and tree shades as necessary to ensure adequate survival.

TABLE 1

SPECIES GENERALLY SUITABLE FOR VARIOUS PURPOSES					
Species	Wood Production	Poles and Posts	Christmas Tree Plantations	Firewood Plantings	Waste Treatment or Carbon seq.
Austrian pine ( <i>Pinus nigra</i> )			X		
Colorado blue spruce ( <i>Picea pungens</i> )			X		
Douglas fir ( <i>Pseudotsuga menziesii</i> )			X		
Eastern redcedar ( <i>Juniperous virginiana</i> )		X			
Ponderosa pine ( <i>Pinus ponderosa</i> )	X	X	X		
Rocky Mountain juniper ( <i>Juniperous scopulorum</i> )		X			
Scotch pine ( <i>Pinus sylvestris</i> )			X		
White fir ( <i>Abies concolor</i> )			X		
White spruce <sup>1/</sup> ( <i>Picea glauca</i> )	X		X		
Basswood ( <i>Tilia americana</i> )	X				
Black walnut ( <i>Juglans nigra</i> )	X <sup>2/</sup>				
Bur oak ( <i>Quercus macrocarpa</i> )	X			X	
Cottonwood ( <i>Populus deltoides</i> )	X			X	X
Green ash ( <i>Fraxinus pennsylvanica</i> )	X			X	X
Hackberry ( <i>Celtis occidentalis</i> )	X			X	X
Honeylocust ( <i>Gleditsia triacanthos</i> )				X	X
Hybrid poplars ( <i>Populus sp.</i> )					X
Siberian elm ( <i>Ulmus pumila</i> )				X	
Silver maple ( <i>Acer saccharium</i> )	X			X	X
Willows ( <i>Salix sp.</i> )					X

<sup>1/</sup> includes Black Hills spruce.<sup>2/</sup> only in MLRA 102A

**Table 2: Various Spacing and Planting Densities for Tree and Shrub seedlings (feet)**

Spacing	Plants per/ac.								
5 x 5	<b>1742</b>	8 x 5	<b>1089</b>	10 x 5	<b>871</b>	12 x 5	<b>726</b>	14 x 5	<b>622</b>
6 x 6	<b>1210</b>	8 x 6	<b>908</b>	10 x 6	<b>726</b>	12 x 6	<b>605</b>	14 x 6	<b>519</b>
7 x 7	<b>889</b>	8 x 7	<b>778</b>	10 x 7	<b>622</b>	12 x 7	<b>519</b>	14 x 7	<b>444</b>
		8 x 8	<b>681</b>	10 x 8	<b>545</b>	12 x 8	<b>454</b>	14 x 8	<b>389</b>
		8 x 9	<b>605</b>	10 x 9	<b>484</b>	12 x 9	<b>403</b>	14 x 9	<b>346</b>
		9 x 9	<b>538</b>	10 x 10	<b>436</b>	12 x 10	<b>363</b>	14 x 10	<b>311</b>
				10 x 11	<b>396</b>	12 x 11	<b>330</b>	14 x 11	<b>283</b>
				11 x 11	<b>360</b>	12 x 12	<b>303</b>	14 x 12	<b>259</b>
						12 x 13	<b>279</b>	14 x 13	<b>239</b>
								14 x 14	<b>222</b>