NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WINDBREAK/SHELTERBELT ESTABLISHMENT

(Ft.)

CODE 380

DEFINITION

Windbreaks or shelterbelts are single or multiple rows of trees or shrubs in linear configurations.

PURPOSE

- Reduce soil erosion from wind.
- Protect plants from wind related damage.
- Alter the microenvironment for enhancing plant growth.
- Manage snow deposition.
- Provide shelter for structures, animals, and people.
- Enhance wildlife habitat.
- Provide noise screens.
- Provide visual screens.
- Improve air quality by reducing and intercepting air borne particulate matter, chemicals and odors.
- Delineate property and field boundaries.
- Improve irrigation efficiency.
- Increase carbon storage in biomass and soils.
- Reduce energy use

CONDITIONS WHERE PRACTICE APPLIES

Apply this practice on any areas where linear plantings of woody plants are desired and suited for controlling wind, air quality, noise, and visual resources. Use other tree/shrub practices when wind, noise and visual problems are not concerns.

CRITERIA

General Criteria Applicable to All Purposes

The location, layout and density of the planting will accomplish the purpose and function intended within a 20-year period.

Refer to Tree/Shrub Site Preparation Standard 490, for preparing site conditions for plant establishment.

The maximum design height (H) for the windbreak or shelterbelt shall be the expected height of the tallest row of trees or shrubs at age 20 for the given site.

Species must be adapted to the soils, climate and site conditions.

No plants on the Federal or state noxious weeds list shall be planted.

Spacing between individual plants shall be based on the needed growing space for plant type and species, the accommodation of maintenance equipment, and the desired characteristics of the stem(s), branches and canopy as required for a specific purpose.

The windbreak will be oriented as close to perpendicular to the troublesome wind as possible.

The length of the windbreak will be sufficient to protect the site including consideration for the “end effect” and changes in wind direction.

Do not create blind corners at road intersections.

Avoid planting trees or shrubs where they will interfere with structures and above or below ground utilities.

Moisture conservation or supplemental watering shall be provided for plant establishment and growth where natural precipitation is too low for the selected species.

Comply with applicable federal, state and local laws and regulations during the installation, operation, and maintenance of this practice.

Refer to Tree/Shrub Establishment Standard 612, for further guidance on planting trees and shrubs.

Additional Criteria to Reduce Wind Erosion and Protect Growing Plants

The interval between windbreaks shall be determined using current, approved, wind erosion technology. Interval widths shall not exceed that permitted by the soil loss tolerance (T), or other planned soil loss objective. Calculations shall account for the effects of other practices in the conservation management system.

For wind erosion control, temporary measures will be installed to supplement the windbreak until it is fully functional.

Sites, fields, and plants are protected within an area 10 times the design height (H) on the leeward side and two times the design height (H) on the windward side of the windbreak.

Subsequent belts should be placed at 10 to 20 times the expected height of the belt at 20 years of age.

Select species that are taller than the crops being protected.

Additional Criteria to Manage Snow Deposition

The windbreak will be oriented as close to perpendicular to the snow-bearing wind as possible.

For snow distribution across a field, the windbreak density (during expected snow-producing months) shall not be less than 25 percent or greater than 50 percent. The interval between barriers will not exceed 20H.

For snow accumulation, the minimum barrier density, during expected snow-producing months, will be 50 percent.

The length of the windbreak will extend beyond the area being protected to allow for end drifts.

Windbreaks will be located so that snow deposition will not pose a health or safety problem, management constraints, or obstruct human, livestock or vehicular traffic.

Where water erosion and/or runoff from melting snow is a hazard, it shall be controlled by supporting practices.

Additional Criteria to Provide Shelter for Structures, Livestock and People

For wind protection, the minimum barrier density will be 65 percent during the months of most troublesome wind.

The area to be protected will fall within a leeward distance of 10H.

Drainage of snowmelt from the windbreak shall not flow across the livestock area.

Drainage of livestock waste from the livestock area shall not flow into the windbreak.

Recreation areas should have windbreaks that are denser than normal field windbreaks. Windbreaks should be placed to provide optimum protection from prevailing winds during the periods of heaviest expected use.

Additional Criteria for Noise Screens

Noise screens shall be at least 65 percent dense during the time of the year when noise is a problem, as tall as, and as close to the noise source as practicable.

The length of the noise screen shall be twice as long as the distance from the noise source to the receiver.

For high-speed traffic noise, the barrier shall not be less than 65 feet wide. For moderate speed traffic noise, the barrier width shall not be less than 20 feet wide.

Species selected will be tolerant to noxious emissions, sand, gravel depositions or salt spray from traffic areas.

Additional Criteria for Visual Screens

Visual screens shall be located as close to the observer as possible with a density, height and width to sufficiently block the view between the area of concern and the sensitive area.

Additional Criteria to Improve Air Quality by Reducing and Intercepting Airborne Particulate Matter, Chemicals and Odors

The windbreak interval shall be less than or equal to 10h depending on site conditions and related supporting conservation practices.

Windbreak density on the windward side of the problem source, (i.e. particulate, chemical or odor) shall be greater than 50% to reduce the airflow into the source area.

Windbreak density on the leeward side of the problem source, and windward of the area to be protected, shall be greater than 65%.

Select and maintain tree and shrub species with foliar and structural characteristics to optimize interception, adsorption and absorption of airborne chemicals or odors.

Additional Criteria for Increasing Carbon Storage in Biomass and Soils

Maximize width and length of the windbreak to fit the site.

For optimal carbon sequestration, select plants that have higher rates of sequestration in biomass and soils.

Plan and schedule replacement of biomass products throughout the lifespan of the Windbreak. Refer to Windbreak Renovation Practice Standard 650, for further guidance.

Plant and manage the appropriate plant spacing for the site that will maximize above and below ground biomass production

Minimize soil disturbance during establishment and maintenance of the windbreak/shelterbelt.

Additional Criteria for Enhancing Wildlife Habitat

Plant species selection shall benefit targeted wildlife species including pollinators.

Design dimensions of the planting shall be adequate for targeted wildlife species.

Additional Criteria for Improving Irrigation Efficiency

For sprinkler irrigation systems, the windbreak shall be taller than the spray height.

The windbreak shall not interfere with the operation of the irrigation system.

Additional Criteria to Reduce Energy Use

Orient the windbreak as close to perpendicular to the troublesome wind as possible

Use proper plant density to meet energy reduction needs.

Use plants with a potential height growth that will be taller than the structure or facility being protected.

CONSIDERATIONS

Consider enhancing aesthetics by using evergreen species or species with features such as showy flowers, brilliant fall foliage, or persistent colorful fruits.

When designing and locating a windbreak or shelterbelt, consider the impact upon the landowner's or public's view of the landscape.

Selection of plants for use in windbreaks should favor species or varieties tolerant to herbicides used in the area.

Plants that may be alternate hosts to undesirable pests should be avoided.

All plantings should complement natural features.

In areas where blowing snow and/or sand are problems, windbreaks should be located at least 100 feet away from the area to be protected.

Avoid creating wind tunnels by crossing the windbreak with roads, ditches, or driveways set at oblique angles to the wind.

If possible, place windbreaks on the windward side of ridge tops instead of the top of the ridge.

Tree or shrub rows should be oriented on or near the contour where water erosion is a concern. at

On slopes of less than 6 percent, plant field windbreaks at right angles to the prevailing winds, consistent with cropping and ownership pattern.

On slopes greater than 6 percent, plant field windbreaks on the contour consistent with the cropping and ownership patterns and as close to right angles to prevailing winds as possible.

Where water erosion and/or runoff from melting snow is a hazard, it should be controlled by supporting practices.

Wildlife and pollinator needs should be considered when selecting or siting tree or shrub species. Species diversity, including use of native species, should be considered. Refer to Hedgerow Practice Standard 422, for additional guidance.

To avoid loss of function due to species-specific pests, consider increasing species diversity, including use of native species.

Consider the invasive potential when selecting plant species.

Only viable, high quality and adapted planting stock or seed will be used.

The planting shall be done at a time and manner to ensure survival and growth of selected species.

The planting will be protected from adverse impacts such as livestock damage or fire.

Windbreaks for odor and chemical control increase in effectiveness as the amount of foliage available for intercept increases. Multiple-row, wide plantings offer greater interception potential than do smaller plantings.

When using trees and shrubs for greenhouse gas reductions, prediction of carbon sequestration rates should be made using current, approved carbon sequestration modeling technology.

A shelterbelt can be used as a travel corridor to connect existing patches of wildlife habitat.

In cropping systems select windbreak and shelterbelt species that minimize adverse affects to crop growth (e.g. shade, allelopathy, competing root systems or root sprouts).

Do not plant closer than 30 feet from the edge of the right-of-way.

Where space permits, extend windbreaks 50 feet beyond areas to be protected to minimize eddying effects.

Avoid creating frost pockets with field windbreak plantings. Where danger of frost can be a problem, prune lower limbs of the plantings to allow for adequate air drainage.

Consider including isolation on all plantings for a minimum of 8 feet or the width of the cultivation equipment plus 4 feet. Minimize fire hazards by keeping isolation strips clear of crop residues, weeds and trash. An isolation strip will help to protect the planting from fire, exclude grass and weeds, and help to control rodent invasion.

Protect windbreaks from livestock through the use of adequate fencing where needed. Refer to Practice Standard 382 - Fencing.

If an irrigation system is required for the windbreak, it shall be designed and installed prior to planting. Most field windbreaks need supplemental irrigation for the first three years after planting.

Windbreaks may alter temperature, thus have a beneficial effect for energy use.

Water Quantity

Decreased wind velocity and flow over protected areas near windbreaks can increase in infiltration and soil moisture due to decreased surficial evaporative demand. Transpiration of large vegetation (trees) will draw down soil moisture within and in the proximity of the windbreaks.

Snow catch can increase the amount of water infiltrated and seasonally increase soil moisture. Localized areas of extensive snow catch or drift could be subject to an increase in infiltration and deep percolation during snowmelt, which could act to elevate a water table.

Water Quality

In areas of heavy snow fall increased local soil water due to concentrated snow catch areas may lead to rising water tables and induce a salinity problem where one did not exist prior to the windbreak establishment.

A location of a feedlot or the windbreak should be such that snow drift on the side opposite the direction of the prevailing winds does not occur in an area where snow melt would be carried across the feedlot area. Runoff from snowmelt across a feedlot would have the potential to detach, solubilize and/or transport sediment, nitrates, phosphates, pathogens, metals, and organic substances.

Wind erosion should be reduced by the windbreak. Creep, saltation, and suspension of the sediment are the specific mechanisms of wind erosion, which will be affected. A reduction in the detachment and transportation of sediment leads to reduced amounts of sediment reaching watercourses. Decreases in sediment yield to watercourses are dependent on the reduction of wind erosion due to the windbreak.

In areas where salt deposits exist or ground waters are saline, some considerations must be given as to how to avoid contamination of unaffected areas by sources of salinity. Species selection could be important to lower saline water tables and to escape inducing salinization of soils and surface or interflow waters.

Characteristics of a windbreak which can be controlled in order to improve overall water quality

include height and density of the windbreak, spacing between windbreaks (primary, secondary, etc. windbreaks), and orientation of the windbreak with respect to the prevailing and troublesome winds.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The following actions shall be carried out to ensure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

Replacement of dead trees or shrubs will be continued until the windbreak/shelterbelt is functional.

Supplemental water will be provided as needed.

Thin or prune the windbreak/shelterbelt to maintain its function.

Inspect trees and shrubs periodically and protect from adverse impacts including insects, diseases or competing vegetation. The trees or shrubs will also be protected from fire and damage from livestock and wildlife.

Periodic applications of nutrients may be needed to maintain plant vigor.

REFERENCES

Bentrup, Gary 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.

Brandle, J.R. etal. 1988. Windbreak technology. Agric. Ecosyst. Environ. Vol. 22-23.