Agriculture and Agri-Food Canada
Agriculture et Agroalimentaire Canada

SNOW CONTROL WITH SHELTERBELTS

Introduction

Windblown snow can create problems for rural communities, landowners, livestock and wildlife. Snowdrifts become hazards when they block roads, leading to safety concerns for humans, and increased mortality rates for livestock and wildlife. But properly designed and maintained mature shelterbelts can reduce these problems, capturing snow through the winter months and contributing to soil moisture retention in spring.

Shelterbelts can help curb the cost of snow removal by managing snow distribution. Reducing mechanical snow control means less labour and less fuel for operating snow removal equipment. Also, trees store carbon for long periods of time which reduces the amount of carbon dioxide emissions while at the same time providing wildlife habitat.

Snow Distribution

Shelterbelt design, age and placement will effect how a shelterbelt effects snow distribution. By adjusting the design or as the shelterbelt reaches its mature height and density, snowdrift size and placement can be manipulated. Features such as height, density, presence of a bottom gap, upwind vegetation, and fetch distance will all influence snow distribution.

Height

Shelterbelts reduce wind velocity by 1) forcing the wind to go up and over the shelterbelt, and 2) moderating the speed of the wind coming through the shelterbelt. Reducing wind speed reduces the wind's ability to push snow into drifts. Optimal wind speed reduction occurs at a distance of 2.5 times the height of the trees downwind and decreases gradually from there.

Density

Dense shelterbelts provide greater wind reduction within 10 times the height of the trees, but porous shelterbelts offer protection over a greater distance. Snowdrifts behind dense shelterbelts are usually less than 10 times the height in length.

Bottom Gap

A gap at the bottom of the shelterbelt will affect the location of the snow bank. Shelterbelts with a naturally occurring gap at the bottom, or those that have been pruned, allow more wind to move through the lower part of the canopy. This reduces wind turbulence and causes the snow to be carried further beyond the tree row before being deposited.

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Upwind Vegetation and Fetch Distance

The vegetation and the unsheltered distance upwind will affect the amount of snow trapped by the shelterbelt. The distance that the wind has to pick up and transport snow before being intercepted by a shelterbelt is called the fetch distance. A fetch distance greater than 400 m (1312 ft) makes no difference in the amount of snow trapped by caragana shelterbelts, while distances of less than 400 m reduce the amount of snow trapped.

Farmyard Shelterbelts

Farmyard shelterbelts trap blowing snow to prevent build-up in the yard and on driveways. Controlling blowing snow with trees and shrubs can prevent large drifts in the living and working areas of farmyards, reducing the labour and cost of snow removal.

Shelterbelts trap snow and improve winter conditions in the farmyard.

Since prevailing winds are usually from the north and west, up to 5 rows are recommended for these sides of the yard. The inside row should be no closer than 30 m (100 ft) from the main buildings and driveways to prevent snowdrift problems. If space is limited, the number of tree rows should be reduced rather than decreasing row spacing or planting closer to buildings.

The outside row of the shelterbelt is the most important snow trap in the farmyard shelterbelt, and should be planted to shrubs such as caragana and lilac. Inside rows should be planted to tall, dense, long-lived trees such as spruce.

Field Shelterbelts

In areas where snowfall provides a significant portion of the total annual precipitation, well-designed field shelterbelts will provide uniform snow distribution across the field, thereby trapping additional moisture in the soil. In dry years, this additional moisture may be important for crop growth.

Shelterbelts across fields distribute snow throughout the field providing spring moisture for crop production.

In areas with high amounts of snowfall, a single-tree row with a low density will distribute the snow evenly across the field and reduce the formation of deep snowdrifts. A gap at the bottom of the shelterbelt increases this effect. A multiple-row shelterbelt can also be planted, trapping snow within its rows and offering benefits such as wildlife habitat, wood and fruit products. Areas with only moderate amounts of snow may require a dense shelterbelt to trap as much snow as possible.

In drier areas, shrubs such as caragana, buffaloberry and sea buckthorn have proven to be effective in trapping snow and providing extra moisture for crops. In areas with more snowfall, green ash, Scots pine and larch have been recommended at a spacing of 1.8 m (6 ft) to give a more uniform snow distribution across the field.

To avoid erosion during spring runoff, trees should not be planted on land with a slope greater than 10% unless the adjacent land is forage. Grassed waterways or drainage channels can be constructed to control the flow of surface water.

Roadside Shelterbelts

Roadside shelterbelts trap blowing snow and reduce the occurrence of blizzard-like conditions, making for safer winter driving and reducing the burden of road maintenance.

The shelterbelt should be designed to trap blowing snow and deposit it as close to the belt as possible. The shelterbelt should therefore be fairly dense with no bottom gap. If roadside shelterbelts are planted too close to the road, snow can accumulate on the road. Shelterbelts should be placed at a distance so that prevents the microclimate effect produced by trees or shrubs from affecting road conditions. This is an important consideration since trees or shrubs planted too close may affect temperatures on the road, resulting in icy patches.

The amount of snow that needs to be trapped will affect the number of rows needed. If the fetch distance is short or if only moderate amounts of blowing snow occur, dense conifers or one row of shrubs is usually enough. But if more snow storage capacity is required, multiple rows of shrubs and/or conifers may be needed. Since two rows planted close together store practically no more snow than one row, the rows should be at least 15 m (50 ft) apart to trap the most snow.

Avoid planting shelterbelts at road intersections where they may create visibility hazards. Always check with local county, municipality or highway departments on regulations regarding the planting of new shelterbelts next to roads.

Since the length of the snow bank depends on the height and density of the shelterbelt, the belt should be placed parallel to the road at a distance of 10 times the height of the mature shelterbelt. In open areas with large fetch distances, this measurement may have to be increased.

Shelterbelts for Dugouts

Spring runoff is the main source of water for dugouts. Shelterbelts around a dugout can trap large amounts of snow, with the resulting snowmelt helping to fill dugouts. This can be an important source of water in times of drought.

Multiple rows of trees placed to the north and west of the dugout will trap the most snow. Deciduous trees should be planted at least 50 m (164 ft) from the dugout to prevent contamination from leaves and branches. Conifers and small-leaved shrubs can be planted as close as 20 m (66 ft) from the dugout as the needles or small leaves are not as likely to be carried into the dugout by the wind.

Dense trees and shrubs are recommended for planting near dugouts. Caragana should not be placed where it will experience flooding.

Species and Spacing

For more information on the selection of species available through the Prairie Shelterbelt Program and their recommended spacings, please refer to the following publications: *Trees and Shrubs for Agroforestry on the Prairies; Planning Farm Shelterbelts for the Prairies; Planning Field Shelterbelts for the Prairies; Shelterbelts for Dugouts; and Basic Shelterbelt Establishment Guidelines for Prairie Livestock Facilities.*

Siberian larch reduces the force of winter winds and provides uniform snow distribution across fields.

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