Living Snow Fences

by Scott Josiah and Mike Majeski

Few Minnesotans will forget the enormous snowdrifts that piled up during the record winter of 1996-97. Closed roads and driveways, buried houses and outbuildings, plugged drainage ditches (and subsequent spring floods), farmsteads without access to emergency services, stressed and dying livestock, dumped milk, stranded motorists, closed schools and businesses, and nonstop plowing were everyday challenges. While that winter was extreme, many of these snowdrifting problems occur in the same place year after year, creating huge costs (and higher taxes) for snow removal and lost productivity. Minnesota Department of Transportation estimates that there are 4,000 problem sites totaling 1,000 miles on federal, state, and county roads in Minnesota needing snowdrift protection. Many more communities, farmsteads, and drainage ditches would benefit from the protection of living snow fences.

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What Are Living Snow Fences?

Living snow fences are designed plantings of trees and/or shrubs and native grasses located along roads or ditches, or around communities and farmsteads. These plantings create a vegetative barrier that traps and controls blowing and drifting snow.

Why Do We Need Snow Fences?

Living snow fences can be a low-cost solution to prevent drifting snow problems. Strategically placed and properly designed, these living barriers trap snow as it blows across fields, piling it up before it ever reaches a road, waterway, farmstead, or community. Living snow fences can reduce effort spent on snow management. They can be designed to spread snow across a large area or to confine it to a small storage area.

Living snow fences adjacent to roads effectively prevent snowdrifts, improve visibility, and reduce slush and ice accumulations, snow removal costs, road closures, and pavement maintenance costs. An evaluation of 18 sites in Minnesota found that reduced snow removal costs alone in an average snowfall year (32 inches) would generate benefit/cost ratios ranging from 9:1 to 46:1 (Tabler, 1997).

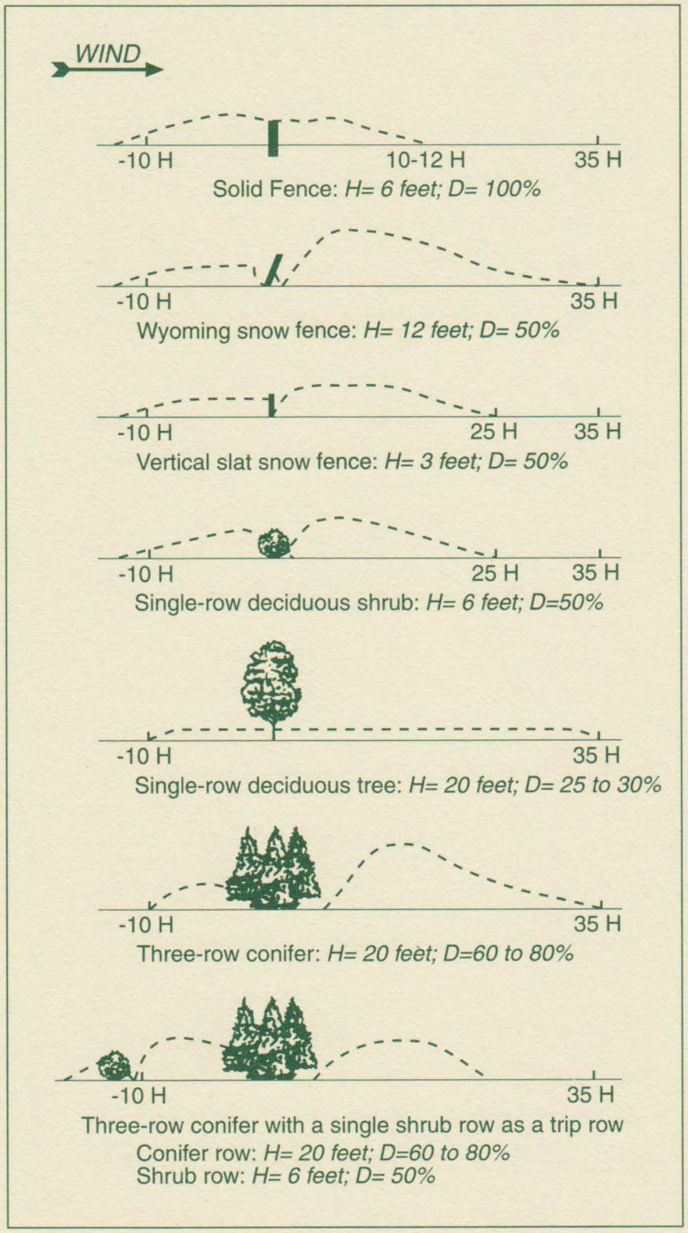
Besides trapping snow and reducing removal costs, living snow fences also provide

- greater road visibility and driver safety, reducing vehicle accidents and injuries;
- more open, better functioning drainage systems and reduced spring flooding;
- improved wildlife habitat;
- livestock protection;
- reduced soil erosion;
- more beautiful farms and rural landscapes;
- visual screens, and
- up to 20% reduction in energy costs.

Designing Living Snow Fences

Important considerations for effective snow fence designs are height, length, setback distance, density, and species. These factors contribute to the function of the barrier and determine the snow storage capacity for a specific site. *Figure 1* illustrates a variety of snow fence designs.

FIGURE 1: Different designs for living snow fences (H=height of snow fence, D= density).



Adapted from *Windbreaks for Snow Management*, (EC 96-1770) University of Nebraska Cooperative Extension.

Height

Barrier height is measured by the tallest row in a planting. Barrier height affects snowdrift depth and length. Height depends on the species planted in conjunction with soils and climate in the planting area.

Snow storage capacity can be manipulated by barrier height. Doubling the snow fence height quadruples snow storage capacity (Figure 2). Ideally, snow storage capacity should equal snow transport (the amount of moving snow), which is calculated from snowfall, fetch, and evaporation. Fetch is the open, unimpeded distance contributing blowing snow to a downwind location. Some snow will evaporate as it is blown around, with more than half of the relocated snow evaporating over a transport distance of about two miles.

Benefit/cost ratios are maximized when snow control systems are designed for the average year. Because of the long fetch distances typical of most of the 18 sites evaluated in southern Minnesota, Tabler (1997) concluded that a 10-foot (3.0 meter) structural fence with 50% density is needed to provide adequate storage over an average winter. A more conservative plan would be a 12-foot (3.7 meter) structural fence, which would provide sufficient capacity 95 years out of 100 (Tabler, 1997).

Density

Since living snow fences are generally less "dense" than structural snow fences, they would have to be taller in order to catch the same amount of snow as the structural snow fences described above. The density of a snow fence relates to how much wind blows through it. A snow fence with 50% density will allow half of the wind to blow through. Drift dimensions vary with the density of the fence. A barrier that is 70% porous (on average) creates an average snow deposition area of 37 times the height of the barrier—downwind of the snow fence. A 10-30% porous fence would deposit snow much closer to the barrier itself—approximately 15 times the height of the snow fence. (Figure 3). Living snow fence barrier density is determined by the species, number of rows, spacing between rows, and spacing of plants within the row. For example, closely spaced rows trap and store less snow than more widely spaced rows. It is critical to consider winter density of vegetation, since deciduous material is much less dense in the winter.

Length

Fence length determines the length of the area that can be protected. However, snow storage at the ends of a living snow fence is significantly less than near the center. The ends of the snow fence should extend 30 degrees (out from either side of the prevailing wind direction) beyond the area to be protected, to ensure adequate protection of the target area and allow for varying wind directions. For example, research on potential snow fence sites in southern Minnesota determined that the prevailing wind direction is 310 degrees true north (Tabler, 1997).

Setback Distance

Barrier density and height are most important in determining the placement of the living snow fence in relation to the road or area being protected. The barrier should be placed as close to the road or protected area as possible, but far enough away so that the downwind drift edge does not reach the area to be protected (Figure 3). Snow fences planted too close to the area to be protected can result in heavy snows being deposited on roads and buildings.

Species

Generally, shrubs and short trees are used for living snow fences, although larger trees and native grasses can be incorporated into effective designs. It is important to match the species to the site characteristics and to the overall goals for the barrier, and to maintain diversity within the planting. Many guides to species selection are available, see Resource information at the end of this publication.

FIGURE 2: Snow fence height and snow storage capacity. Doubling the snow fence height quadruples the amount of snow stored.

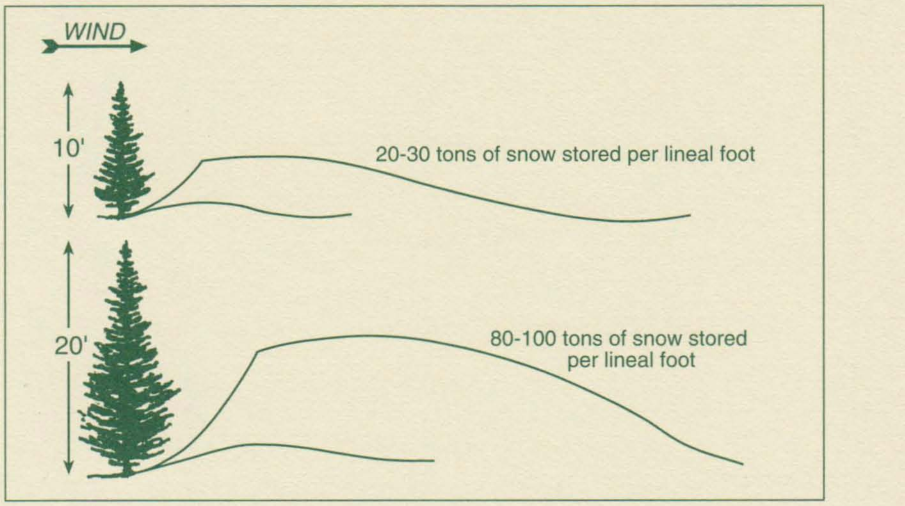
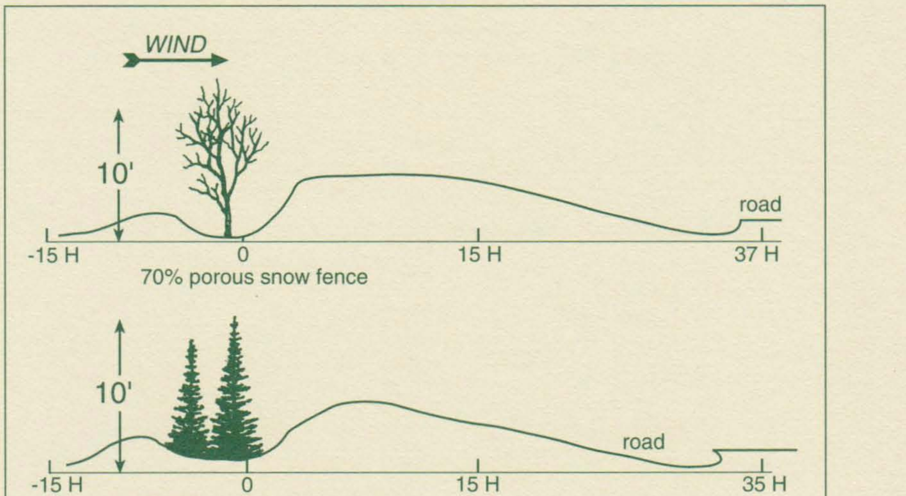


FIGURE 3: Snow fence density and height control snow deposition distance. The more porous the snow fence, the longer the deposition distance.



Building a Living Snow Fence Program

A living snow fence program to protect critical sites that will benefit both landowners and the public requires a local partnership. The key to success is county level agencies, organizations, and landowners working together to identify blowing and drifting snow problem areas, and to develop creative approaches to establish living snow fences in these areas. Because living fences need to be placed a significant distance from the road or area needing protection, private landowners must be active members of the partnership. And because they are protecting roads and benefitting the public, landowners generally need to be adequately compensated for costs and inconveniences caused by a living snow fence on their property.

For More Information

Information about designing, establishing, and maintaining living snow fences in Minnesota available from:

University of Minnesota Extension Service
www.extension.umn.edu

The Center for Integrated Natural Resources and Agricultural Management, University of Minnesota:
612-624-4299; Fax 612-625-5212;

Minnesota Department of Transportation Forestry Division: 612-779-5084.

www.extension.umn.edu

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