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TECHNICAL SUMMARY

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PROJECT COST:

\$137,534



Shrub willow living snow fences catch snow blowing across agricultural fields and keep it off highways.

Shrub Willows Make for Effective, Inexpensive Snow Fences in Minnesota

What Was the Need?

Drifting and blowing snow challenges winter drivers in rural Minnesota. Living snow fences offer a strategy to reduce the need for plowing and salting rural highways. These barriers consist of trees, shrubs, grasses or even corn planted upwind of roadways that catch snow before it reaches the roadway.

Landowners need incentives to plant and maintain these fences because of the time required, plant mortality and the sacrifice of productive cropland to nonmarketable plants. Currently only 20 miles of privately owned land adjacent to state highways that experience severe snowdrifts feature living snow fences.

A [2012 study](#) of living snow fences provided MnDOT with a payment calculator used to compensate landowners for installation and maintenance costs, and included a recommendation to identify species of plants that may be especially cost-effective to serve as snow fences in Minnesota.

While typical snow fence plants like dogwood or cranberrybush shrubs can take from five to 20 years to establish themselves as useful snow-catchers, shrub willows grow more quickly, adapt well to various climates, are easy to plant and offer potential as a marketable biomass crop.

What Was Our Goal?

Researchers aimed to evaluate the potential of shrub willow living snow fences for Minnesota by identifying appropriate varieties for snow fences, analyzing planting designs effective for trapping snow, and evaluating the costs and benefits of using these species.

What Did We Do?

Investigators selected a stretch of U.S. Highway 14 in Waseca, Minnesota, that experiences significant snowdrift. In spring 2013, they installed three varieties of shrub willows side by side in two-row and four-row snow fence configurations of about a quarter-mile in length. These short-rotation woody crops should reach effective size in as few as three years.

In April 2014, investigators coppiced the shrubs, cutting them down to the ground to encourage branching and bush density. Late in 2014, researchers measured shrub height and porosity using a chroma-key procedure adapted to willows by researchers from the State University of New York in Syracuse. Investigators measured snowdrift at the planting sites in late 2014 and again in 2015, evaluating the snow-trapping ability in relation to willow establishment and growth.

Researchers also compared the growth of shrub willows to native willows and conventional living snow fence selections such as dogwood and cranberrybush shrubs. Investigators planted each of these varieties in a plot at Waseca in spring 2013 and measured establishment and growth in the fall of 2013 and 2014.

Researchers planted shrub willows as living snow fences along U.S. 14 in Waseca, Minnesota. The hybrid willow shrub fences, which cost much less to install than traditional snow fence plants and grow to serviceable size several years faster, trapped up to 3 metric tons of snow in their second season.

“Shrub willow living snow fences could be easily adopted by landowners working with MnDOT. These shrubs are a fast-growing system that could provide benefits in just two years.”

—**Diomy Zamora**,
Extension Educator/
Extension Professor,
Forestry, University of
Minnesota Extension

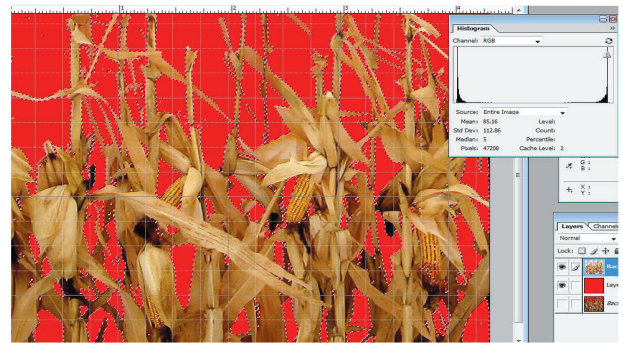
“The innovation is the simplicity of it. Shrub willows are easy to plant, grow more quickly and are less labor-intensive than other snow fence plants.”

—**Dan Gullickson**,
Natural Resource Program
Coordinator, MnDOT
Office of Environmental
Stewardship

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The chroma-key method for measuring snow fence plant porosity entails holding a red backdrop behind a plant, photographing the plant and using standard photo processing software to determine the percentage of space screened by the plant.

What Did We Learn?

The shrub willows had high survival and growth rates after two growing seasons. The coppiced snow fences had little impact on drifting snow during the first winter, but during the second winter each shrub willow plot was collecting 2 to 3 metric tons of snow.

Investigators believe that after three or four growing seasons, shrub willow living snow fences will catch the entire mean annual snowfall on this site. Shrub height and porosity influence snow capture: As height increases over time, porosity decreases and the snow fences trap more snow. Four-row designs captured more snow than two-row plantings.

After evaluating hybrids, native willows and conventional living snow fence plants, researchers found that all willows outperformed traditional species. Fish Creek, the hybrid willow shrub variety successful in New York, also succeeded in Minnesota, but native willows offer comparable growth and may better suit applications in Minnesota.

In the four-row configuration recommended by researchers, costs to raise, furnish, plant and mulch were about \$3.60 per plant, dramatically less than the contract bid cost for traditional living snow fence species of about \$50.50 per plant.

The project report also considered whether living snow fences of this sort could be used to produce harvestable biomass. Average living snow fence stands are generally not long-lived enough to produce enough harvestable biomass to justify the expense of cutting and hauling. However, if these were implemented on longer stretches, biomass harvestable from living snow fences might effectively compete with field-scale biomass production.

What's Next?

The willow species recommended by this study will be evaluated after installation as a living snow fence at a new construction site scheduled for 2017 on U.S. 60 between Windom and Mountain Lake, Minnesota.

As a potential future study, investigators recommend comparing volume of road salt use before and after snow fence installation. Finally, root systems of willows are notorious for propagating broadly, and work is needed to identify appropriate buffer distances from cropland root systems and underground drain tile.

This Technical Summary pertains to Report 2015-46, “Assessing the Use of Shrub-Willows for Living Snow Fences in Minnesota,” published November 2015. The full report can be accessed at mndot.gov/research/TS/2015/201546.pdf.