

UNIVERSITY OF MINNESOTA EXTENSION Driven to Discover**

Living Snow Fences

Gary Wyatt, Extension Educator, Agroforestry Dan Gullickson, MnDOT Snow Fence Coordinator

MAKING A DIFFERENCE IN MINNESOTA: ENVIRONMENT + FOOD & AGRICULTURE + COMMUNITIES + FAMILIES + YOUTH

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Outline:

- Current funding programs for Living Snow Fences
 - NRCS/USDA, SWCD and MnDOT
- Design of Windbreaks and Living Snow Fences
- Research
- MnDOT Living Snow Fences
- Trees and Shrubs used in LSF plantings
- Resources

Funding programs for Living Snow Fences



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County Resources for Windbreaks/LSF

- Soil and Water Conservation District
- Natural Resources Conservation Service
- County Extension Office







United States Department of Agriculture Natural Resources Conservation Service

Natural Resource Conservation Service (NRCS)

- Environmental Quality Incentives Program (EQIP)
 - Payment per lineal foot

- Conservation Reserve Program (CRP)
 - 10 to 15 year program
 - Can possibly be extended after the contract
 - Payments based on County land rental rates
 - Establishment: Pay up to 50% (trees, weed mats, water, etc.)

ONR(S

Soil and Water Conservation District (SWCD)

- Each County has an SWCD office
- Depending on State programs and grants, SWCD offices may offer cost-share or payments for tree plantings
- SWCD and NRCS offices work together to offer the best tree planting and conservation programs to landowners.





LIVING SNOW FENCE: CRP

1 shrub row:

40 to

100 feet of native forbs and grasses

(The landowner is paid on the area from the single shrub row to the highway right of way)

150 to 200 feet of native forbs and grasses

Highway





MnDOT Snow Fence Program

In an effort to reduce snow maintenance expenses MnDOT is paying farmers and landowners for snow fences.



Snow Control Cost Benefit Web Tool







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Justify snow fence payments:





Living snow fences in Minnesota (on average) is 17 times more costefficient than removal of snow on roadways.









Living Snow Fences

Standing Corn Rows/Hay Bales Structural Snow Fences



Grading











Snow Control Cost Benefit Web Tool

z.umn.edu/mndotlsf - (click on MnDOT District SF Coordinator)

DEPARTMENT OF TRANSPORTATION

Search MnDOT A to Z General Contacts

(511)

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Snow fence detail sheets, snow fence approved products list, and drift-free road design best practices

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MnDOT Districts 1, 2, and 4

Jeremy Peterson Northwest Region Blowing Snow Control Shared Services Designer 612-505-7167

MnDOT Districts 3, 8, and Metro

Brent Wilts West Central Region Blowing Snow Control Shared Services Designer 612-398-5504



MnDOT Districts 6 and 7

Trent Robbins South Region Blowing Snow Control Shared Services Designer 651-583-4521

Districts map

Our districts map (PDF) includes sub areas.



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Windbreak and Living Snow Fence Design

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What is Agroforestry?

...the *intentional* combining of agriculture and working trees to create sustainable farming systems.









Windbreaks



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REASONS TO ESTABLISH WINDBREAKS





WINDBREAKS

Plantings of single or multiple rows of trees or shrubs that redirect or modify the wind and are established for one or more environmental purposes.









Plantings should be a minimum of 150' to 200' away from the Barn. (The shrub row in this planting is nearly 300' from the barn and the spruce is 150' from the barn)

WHAT IS H?



WINDBREAK TECHNOLOGY

- Wind is reduced on the leeward side by 10 times (10H) the height of the planting.
- Some reduction of wind will occur up to 25 times (25H) the height of the planting.
- Density, shape, height is important. (spruce, cedar, maple, lilac, etc.)
- Plant perpendicular to the wind direction.

(A north, west & east windbreak in SW South Dakota cut fuel consumption by an average of 40%)





WINDBREAK AIR FLOW PATTERNS



- A portion of the air flows through the windbreak.
- The remaining air flows around the ends and over the top in a compressed manner.

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WINDBREAK DENSITY



WINDBREAK DENSITY



Windbreak density is the ratio of the **solid** portion of the barrier to the total area of the barrier.





POROSITY:

PERCENTAGE OF OPEN AREA OF SIDE VIEW







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WINDBREAK DESIGN FOR SNOW

Height and Density determines the storage capacity of the snowfence or windbreak.



PREVAILING WINDS

(WWW.CLIMATE.UMN.EDU/WIND/WINDROSECLIMATOLOGY.HTM)



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WINDBREAK LENGTH

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WINDBREAK LENGTH

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WINDBREAK GAPS



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Black Hills Spruce planted east to west, with grass buffer. (Grass/forb buffer from trees to crop is best)

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MnDOT and UM Research



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MN LIVING SNOW FENCE NOTES

- Over 3,700 sites including 1,000 miles of roadways needs protection.
- Wind can transport 15 to 45 tons of snow per meter.
- LSF can intercept and store up to 30 and 70 tons per meter.
- On average 8 people die on MN (state highways) per winter season and over 800 accidents are reported due to blowing and drifting snow.



Historic Winter 1996-1997 Resulted in FEMA Hazard Mitigation Funding for Living Snow Fencing



1999 Published-Interagency Living Snow Fence Guidebook Utilizing the Blowing Snow Transport methodology developed by Dr. Mark Seeley and Dr. Ron Tabler



Guidebook Led to 75 FEMA Living Snow Fence Installations along MnDOT Maintained Highways



snowcontroltools.umn.edu

UNIVERSITY OF MINNESOTA Driven to Discover** One Stop MyU A: For Students, Faculty, and Staff

Minnesota Drift-Free Roads Design Tool

Introduction Snowfall Data Site Conditions Fence Design Summary

Snow fences can help maintain clear roadways by capturing blowing snow upwind of a problem area and storing that snow over the winter season. This web site is formatted as a tool that will help you design a snow fence for a given problem location. Based on the geographic location you have selected, you will be given the data needed and you will input site-specific parameters. Color maps, photos, and schematics are given along the way to help you visualize concepts.





Select your location on the map or enter the latitude and longitude of your location.

Latitude	
0	
Longitude	
0	



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Cost Benefit Calculator Benefits

 Grew the standing corn row program from 17 contracts in 2013 to 43 contracts in 2014



Cost Benefit Calculator Benefits

 Helped justify the cost of installing structural snow fencing at \$72.00 per lineal foot and purchasing permanent snow fence easements





Assessing the Use of Willow Shrub Species on Living Snow Fence Designs to Manage the Damaging Effects of Salt (2015) University of Minnesota

- Shrub willows at the US Hwy 14 test plot in Waseca had a high survival rate and began capturing snow the second winter.
- One shrub willow planting will not produce enough harvestable biomass to justify the cost.
- Shrub willows grew faster than other nonwillow shrub species and have the potential in year 3 or 4 of reaching an effective snow fence height of capturing the entire mean annual snowfall.



Potential small carbon footprint to transport, plant, and maintain



Trees and Shrubs for Living Snow Fences



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Diablo Ninebark

8 to 10 feet tall





Glossy Black Chokeberry



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Fragrant Sumac



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MnDOT Snow Fence Near and Far Plantings

- I-90
- Shell Rock Watershed
- Black Chokeberry on the slope



I-90 Freeborn Shell Rock Watershed

I-90

Spring
 planting
 2023

- AmericanPlum
- American
 Cranberry



Red-Osier Dogwood

- 15 year old planting
- Fillmore Co.
- Private land
- CRP

Serviceberry/Juneberry/Saskatoon (amelanchier... *many*)

Height: 15+ feet Spread: 10+ feet Growth: moderate USDA Zone: 2-4a

Root Type: fibrous shallow Insects: May attract SWD

Many types - shrub to small trees

Currants (Red, Black) (ribes, Red = rubrum, Black = nigrum)

Height: 5 feet Spread: 6 feet Growth: Moderate USDA Zone: 3-5 Root Type: Fibrous

American Plum (prunus americanna)

Height: 10-30 feet

Spread: 8-25 feet

Growth: Moderate

USDA Zone: 2-4A

Root Type: Fibrous Shallow

(May sucker off area – Monitor)

Nanking Cherry (prunus tomentosa)

Height: 6-8 feet Spread: 6-8 feet Growth: Moderate USDA Zone: 3-6

Root Type: Fibrous

Height: 6 – 12 feet

Spread: 6 – 12 feet

Growth: Medium

USDA Zone: 3 - 9

Root Type: Deep Fibrous

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American Cranberry (Viburnum trilobum)

Height: 8 – 12 feet Spread: 8 – 12 feet

Growth: Medium

USDA Zone: 2 - 7

Root Type: Fibrous

Black Chokeberry (Aronia melanocarpa)

Height: 12 feet

Spread: 7 feet

Growth: moderate

USDA Zone: 2 - 5

Root Type: fibrous shallow

Elderberry (Sambucus canadensis)

Height: 6 - 12 feet Spread: 7 feet Growth: moderate USDA Zone: 3 - 5

Root Type: fibrous shallow

Honeyberry (Lonicera caerulea)

Height: 3 - 8 feet Spread: 3 - 4 feet Growth: moderate

USDA Zone: 3 - 8

Root Type: fibrous shallow Insects: May attract SWD Protect from birds

InnovaTree™

- A new poplar variety produced by the U of M's Natural Resources Research Institute
- A fast-growing tree!
 - Grows up to 10 feet per year
 - Disease-resistant
 - Climate zones 3-6
 - Full height: 75 feet
 - Spread: 40 feet
 - Cottonless, and no root sprouts
- Patent-pending and available for sale:
 - Hauser's Superior View Farm, Bayfield, WI
- Sign up for updates:

Innovatree.umn.edu

Resources

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www.extension.umn.edu/agroforestry

Learn About 🔻	Courses and events	Connect 👻	4-H =	About 🕶
Agroforestry				
Home > Natural resources > Forestr	y > Agroforestry			

Agroforestry combines agricultural and forestry practices to improve environmental quality, productivity and economic returns.

The University of Minnesota offers educational programs on specific agroforestry practices including:

- · Windbreaks for fields, farmsteads, and livestock.
- · Living snow fences.
- · Managing wooded pastures for trees and livestock.
- · President and hannesting new simbles needly to from woodbands

< Natural resources

Forestry

- Become a Master Woodland Owner >
- Gathering wild-grown plants and fungi >

www.fs.usda.gov/nac/practices/windbreaks.php

Agroforestry Practices

Alley Cropping
Forest Farming
Riparian Forest Buffers
Silvopasture
Windbreaks
Additional Applications

Windbreaks are linear plantings of trees and shrubs designed to provide economic, environmental and community benefits. The primary purpose of most windbreaks is to slow the wind which creates a more beneficial condition for soils, crops, livestock, wildlife and people. Windbreaks, sometimes called shelterbelts, can also function in ways not related to wind reduction. Non-wind related purposes include shade for livestock, visual screening, aesthetics, recreational opportunities, and wood and nontimber forest products. Windbreaks have also been recognized for their value in providing ecosystem services, which often extend beyond the farm. <u>Benefits</u> include enhancement of biodiversity, wildlife habitat, carbon storage, pollinator habitat, and soil and water quality protection.

Windbreaks can be and often are designed to serve more than one purpose. However, windbreaks are not a one size fits all practice. The location, orientation to the wind, height, width, <u>density</u> and species selection all play a role in determining the benefits that the windbreak will provide.

Increasingly windbreaks are being designed to provide

https://centerforagroforestry.org/

The Center for Agroforestry at the University of Missouri

The Center for Agroforestry at the University of Missouri, established in 1998, is one the world's leading centers contributing to the science underlying agroforestry, land-use management combining trees and/or shrubs with crops and/or livestock.

The six integrated temperate agroforestry practices (forest farming, alley cropping, silvopusture, riparian buffers, windbreaks, and urban food forests) can enhance land and aquatic habitats for fish and wildlife and improve biodiversity while sustaining land resources for generations to come. Agroforestry practices benefit farmers and landowners by diversifying products, markets and farm income; improving soil and water quality; sequestering carbon; and reducing erosion, non-point source pollution, and damage due to flooding. They contribute to resilience in a time of change.

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www.savannainstitute.org/

SAVANNA INSTITUTE DONATE ABOUT US Y **RESOURCES** ~ PROGRAMS ~ **EVENTS** ~ Climate **Getting Started Farm Finances** Agroforestry is one of the top ten natural Whether you are an experienced farmer, From farm management to marketing, we can climate solutions and the Midwest is one of the institutional landowner, or agroforestry help you access cost-share resources, enthusiast, we have resources and programs target regions for its adoption. Learn more understand emerging markets for tree crops, about how you can use agroforestry practices to help you get launched. Find out how to and plan for successful agroforestry adoption. for carbon drawdown as well as profit. access resources, chose tree crops for your Start off on the right foot with your finances. area, and much more. LEARN MORE LEARN MORE LEARN MORE 1 SALLARY COMPANY SIN with the the lite

z.umn.edu/Climate ready

Helping forests adapt to a changing climate

Climate change will impact various tree and plant species differently. Many trees, plants and wildlife in southern Minnesota have native ranges much further south, and therefore may be naturally more resilient to a warmer ecosystem. But the northern conifer forests are at the very southern edge of their native range, which extends far into Canada. As Minnesota gets warmer those forests will continue to creep north and out of Minnesota.

To ensure a healthy and productive forest, we'll need to use strategies for climate adaptation. These will likely include a combination of management actions to help forests stay resilient to climate stress, such as:

- Adding species that are new to the forest to increase diversity.
- Prioritizing native trees and plants that are predicted to do well.
- Nurturing targeted areas to persist much as they are today.
- Removing invasive plants and thinning forests to reduce competition.

Plant Selector: https://plantp.dot.state.mn.us/plant/

Promoting the Adoption of Snow Fences through Landowner Engagement (2022) University of Minnesota

31 Snow Fence Case Studies from Early Snow Fence Adopters

17 Living Snow Fences11 Standing Corn Rows3 Structural Snow Fences

https://farmmaps.umn.edu/#



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Our districts map (PDF) includes sub areas.



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z.umn.edu/ndsuwindbreakcookbook

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Derek Lowstuter, Forest Restoration Specialist, North Dakota Forest Service Julie Garden-Robinson, Ph.D., R.D., L.R.D.,

Food and Nutrition Specialist/Professor, NDSU Extension Kathy Wiederholt, Fruit Project Manager, NDSU Carrington Research Extension Center Esther McGinnis, Ph.D., Horticulturist/Assistant Professor,

NDSU Extension







Fruit-Bearing Windbreak Plants 1
rees
Apple (Malus spp.)4
Boxelder (Acer negundo)6
Bur Oak (<i>Quercus macrocarpa</i>)8
Pear (<i>Pyrus spp.</i>)10
Rocky Mountain Juniper and Eastern Red Cedar
(Juniperus spp.) 12
Stone Pines (Pinus spp.) 14
Walnut and Butternut (Juglans nigra and J. cinerea)
Shrubs
American Plum, Canadian Plum and Hybrids
(Prunus americana and P. nigra)
Aronia (Aronia melanocarpa or A. mitschurinii)
Cherry (Prunus spp.)24
Currants and Gooseberries (Ribes spp.)
Elderberry (Sambucus canadensis)
Hazel (Corylus spp.)
Honeyberries and Haskap (Lonicera caerulea)
Juneberry (Amelanchier alnifolia)
Seaberry/Sea-buckthorn (Hippophae rhamnoides)
Silver Buffaloberry (Shepherdia argentea)
Sumac (Rhus spp.) 40
Viburnum (Viburnum lentago and V. trilobum)

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Future Needs:

Businesses/Contractors to plant trees – LSF

- Some SWCD's are no longer selling or planting trees/shrubs
- Maintenance contractors to establish and maintain LSF's
 - Watering, pruning, coppicing, critter management, etc.
- Tree/Shrub Nurseries to grow and sell:
 - Native MN willows used in LSF MnDOT projects
 - Trees/Shrubs that are predicted to do well in our changing climate
 - Supplier for rural trees and shrubs for SWCD's and others





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Questions?

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Video on Hwy 60- Permanent Fence

