Research and Assess the Farmer and MnDOT Economic and Environmental Costs and Benefits of Living Snow Fences, Including Carbon Impacts

Prepared by:

Gary Wyatt, Extension Educator
Diomy Zamora, Extension Educator
David Smith, Research Assistant
Sierra Schroder, Research Assistant
Dinesh Paudel, Research Assistant
Joe Knight, Forest Resources
Don Kilberg, Forest Resources
Steve Taff, Extension Economist
University of Minnesota

Dean Current, Program Director
Center for Integrated Natural Resources and Agricultural Management

Dan Gullickson, Forester
Minnesota Department of Transportation

Executive Summary

A living snow fence (LSF) is a type of windbreak designed to keep blowing and drifting snow off roadways, a transportation efficiency and safety concern. The Minnesota Department of Transportation (MnDOT) administers a program working with landowners to maintain standing corn rows and install LSFs in areas where blowing and drifting snow is a problem.

In 2011, MnDOT paid a total of $50,974 for LSF (tree and shrub) contracts and $42,786 for standing corn row contracts. The 2011 budget for snow and ice removal was $81,085,501 (Appendix M). MnDOT spent 0.12% of the budget for preventative LSFs to landowners.MnDOT currently has contracts with 86 landowners on these sites representing 2.3% of the problematic sites.Approximately 3,800 sites have been identified in Minnesota to be problem snow sites.

Establishing standing corn rows and LSFs improves driver visibility, road surface conditions, and has the potential to lower costs of road maintenance as well as accidents attributed to blowing and drifting snow. LSFs can also sequester carbon and can avoid carbon emissions during snow removal operations. MnDOT has paid farmers to leave standing corn rows to protect identified snow problem roadways at $1.50 per bushel above market price which may not be sufficient incentive for leaving standing corn rows. Also, with MnDOT's memorandum of understanding with the United States Department of Agriculture (USDA) to plant LSFs through the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP), now is an opportune time to review MnDOT's annual payment structure to farmers and make appropriate changes. The opportunity comes from the low adoption rate (2%) of a program with clear transportation and safety benefits. Quantifying the social constraints and the economic benefits and costs will allow the development of a new LSF payment program with the goal of increasing adoption rates in snow problem areas with positive economic net benefits.

This project has 1) Identified agency constraints to implementation of the current LSF program; 2) Evaluated farmers' willingness to establish LFSs and identify farmers/landowners constraints to adoption; 3) Estimated potential income from carbon payments; 4) Working closely with MnDOT engineers and plow operators, estimated the safety and snow removal costs and carbon emissions avoided by MnDOT through establishing LSFs; 5) Developed a calculator to estimate payment ranges to farmers that includes consideration of safety and snow removal cost savings.

Five representative study sites were selected to conduct initial focus group interviews. Following the focus group interviews, landowners participating in the MnDOT LSF program were interviewed to get their input. The areas selected were chosen to represent the variety of diverse conditions throughout the state of Minnesota. The sites included: International Falls, Breckenridge, Owatonna, Worthington, and Marshall. A total of 45 Minnesota landowners participated in five focus group discussions between January and February, 2010.

Focus group participants revealed a variety of perceived costs and constraints, and also described the conditions that would likely increase landowner adoption of the program. Specifically the life cycle costs of the LSF were most frequently mentioned including the costs associated with implementation, maintenance, rejuvenation, and removal costs. Other costs identified included the opportunity costs, costs related to changing land values, and some participants concluded the compensation was insufficient to cover all costs. Specific constraints that emerged in the discussion included risk, hassle and time constraints, and concerns about the contract. The biggest constraints to adoption of the practice were the risks associated with the maintenance of

the LSF planting including replacing lost trees and the landowner's liability to maintain the fence and the associated costs. Other constraining factors included the hassles presented by the LSF planting and additional time required to negotiate the hassles. Concerns about the rigidity and the length of the contract were final constraining factors discussed by participants.

As with other case studies documented in the literature, no universal variables influencing adoption emerged during the focused discussions. However, landowners in this study did identify several factors that positively influenced adoption of the LSF practice. These factors identified are awareness of the program, relative advantage, perception the program promotes the landowner's objectives, and incentives or compensation.

An online survey was distributed to key agency staff to better understand the perspectives of these individuals and the role played by each agency and its staff. A total of 160 agency staff completed the survey, representing the following agencies: MnDOT, Farm Service Agency (FSA), Soil Water Conservation Districts (SWCD), and Natural Resource Conservation Service (NRCS). Results across the various agencies surveyed indicate that there is great interest in the LSF program and high confidence that the program is effective. The agency staff has the technical training and competency needed to promote and implement the program; however resources such as time and funding are more limited.

Several opportunities emerge to improve the program and increase landowner adoption of the practice, specifically several opportunities exist to address the costs and constraints the landowners encounter. Recommendations for improving the program include, but are not limited to, developing more flexible contracts, offering adjustable payments, adding more competitive incentives, providing alternatives for maintenance, creating a system of insurance against risk, and decreasing landowner liability.

Landowner costs were also documented for standing corn rows and LSF plantings with trees and shrubs. Farmers who had established snow fences in the past had the following suggestions for improving the LSF payment mechanism and agreement:

- Payments need to be adjusted for inflation in land values over time (increased). Two mechanisms can be used to achieve this 1) fixed historical inflation rate which increases the payment over the length of the contract and 2) adjustable inflation rate tied to a public index which changes every year based on changes in land prices. CRP annual payments are flat over the contract and so the transportation agency would have to take on a higher share of the total annual payment over time.
- After the establishment of snow fences, there are high maintenance costs during the first, second and third years. MnDOT should consider compensating the farmers for the first 3-4 years with a higher payment to cover these elevated maintenance costs and move back to a lower rate following that period.
- Flexible criteria for determining annual payment may be required because the cost of maintenance may differ from one area to another and from one farmer to the next. Payment for maintenance activities like watering could be considered.
- Better mechanisms for targeting landowners for snow fence promotion and educational materials should be considered. Approaching landowners with concrete payment information and personal visits should be encouraged.

- Paying for the entire area between the LSF the edge of the right of way will reduce the hassle of farming around the LSF and also provide a larger conservation area with associated environmental benefits. (In earlier contracts it was not possible but it is being offered now).
- MnDOT should consider paying the cost of removing the LSF trees at the end of agreement if the landowner does not sign a new contract.
- Consideration of bonus payments for locations with high potential benefits (super-elevated curve, high accident rates, etc.)

Farmers have provided a number of suggestions related to technical improvement of the standing corn rows as well as the mechanism for payment to the farmers.

- The payment mechanism should adopt a formula which is based on yield, production costs, inconvenience factors, income or financial benefit received, and the price of corn. Paying all the farmers at the same rate in the same region was one of the main suggestions.
- Farmers would prefer a single strip of standing corn rather than the recommended 2 strips. This might improve adoption but may limit the effectiveness of the standing corn rows in catching and storing snow.

The research team recommends that the agency promote LSF planted to trees and/or shrubs over standing corn rows because of the lack of benefits during the soybean year in a corn/soybean rotation.

Trees in agricultural or forested landscapes sequester carbon dioxide in the atmosphere, a primary greenhouse gas, and store it as carbon in the form of biomass. Carbon sequestration of LSF can provide an additional benefit beyond addressing blowing and drifting snow issues. It can also avoid emission of greenhouse gasses (i.e., carbon) back to the atmosphere due to reduction in road maintenance activities linked to controlling blowing and drifting snow. Such positive impact of LSF will result in a reduction of fuel use for the trucks and other equipment used to deal with blowing and drifting snow.

The Living Snow Fence Payment Calculator is a computer program (Excel) tool which allows the user to enter inputs regarding a snow problem area or site plus enter characteristics about the site. This tool has custom features specific to MnDOT. However the tool is usable by any agency or County Engineers but will require more user input and/or construction of databases. One custom feature is district wide snow problem area prioritization maps. These allow for state and district wide prioritization based on the benefit cost ratio. The calculator can then be used for a more detailed analysis of individual snow fences. The calculator analyzes landowner costs and possible payments for LSFs and standing corn rows.

The output section of the tool provides a review of opportunity cost, transportation agency benefits, social benefits and minimum payment options. This tool will help agency staff work with local landowners to arrive at a realistic, economical and cost effective payment for land practices (LSF or standing corn rows) protecting state and local highways.

Based on this study, MnDOT could see net economic returns of over $1.3 million dollars per year if 40% of the sites inventoried blowing and drifting snow problems would be contracted to LSF practices.

A detailed list of recommendations are included in Chapter 7.