**PROJECT TITLE: Control Snowdrift Using Living Fences to Protect Wildlife**

**I. PROJECT STATEMENT**

*Background*

Wildlife is an essential part of the ecosystem. Minnesota is home to a variety of wildlife, including about 83 mammal species and 319 bird species. Most of the wildlife lives in the forest and wetland. However, 98% of native forest and wetland were lost during the exploitation of Minnesota in the past over 100 years, and there were about 25,000 acres of wetland and 13,000 acres of forests converted into farmland between 2008 and 2012. Loss of trees and vegetations reduces the shelters for wildlife during winter storms. Without the blockage of plants, blowing and drifting snow develops, making it hard for wildlife to find food because of snow coverage. As a result, living through the winter becomes more challenging, especially for harsh winters like the past one. The Department of Natural Resources in the Whitewater Wildlife Management Area has received many reports of wildlife mortality due to the storms in 2018-2019 winter, and most of the dead animals are fawns born last summer. It has also been reported that many deer mortality cases happened due to the hitting by cars when the deer crossed the roads to find land with less snow coverage.

*What is living snow fence?*

Living snow fences are plants that are aligned to trap snow as it blows across field. The plants can be trees, shrub, native grasses, wildflowers, or even a few rows of crops intentionally left behind.

*The benefit of living snow fence*

The low visibility and difficulty of foraging on snow-covered land caused by blowing snow and snowdrift are the main threats to wildlife during winter storms. Snow fences serve as barriers that control blowing and drifting snow. Compared with man-made structures, living snow fences need less maintenance and have many ecological benefits: they can provide food resources and nesting spots for birds; animals, such as deer and rabbits, can reside and feed young ones in living snow fences and shelter from predators; and such fences can create stable habitat, which is critical for attracting and preserving wildlife.

*Objectives of this study*

The objectives of this proposal are to create an efficient and economic living snow fence design (in terms of plant species, density, spatial distribution, etc.) by studying the impacts of the fences on blowing snow and snowdrift. Such design will maximize the ecological benefits under the limitation of economy cost (e.g., occupied farm land, reduced crop yield, maintenance cost, etc.). By broadly applying the outcomes of this project across Minnesota, we expect to invoke the awareness of landowners on preserving wildlife in winter.

*Research tasks*

To achieve the above objectives of this project, we will: 1) test different designs of living snow fences under various environment conditions; 2) establish a database on the relation between fence design and snow distribution; 2) find the optimal design; 3) deploy the optimized living snow fences in the field; 4) monitor the wildlife activities around the fences; 5) publish our research outcomes and outreach to the general public and Minnesota landowners.

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1 Title:** Find optimal design of living snow fences.  **Description:**We will collect data from field observation and laboratory experiment to quantify the effects of living snow fences on blowing and drifting snow. We will find the optimal snow fence design for a variety of terrain and climate conditions across Minnesota. We will develop a model to obtain fast and accurate ground snow distribution for given living snow fence design, and we will associate the capitalization of ecology resources for the balance between economy and ecology.  **ENRTF BUDGET: $69,989** |  |

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| **Outcome** | **Completion Date** |
| 1. Data collected from field observations across Minnesota. | March 31, 2021 |
| 2. Data collected in laboratory experiments in SAFL. | March 31, 2022 |
| 3. Optimized living snow fence design for different places across Minnesota. | June 30, 2022 |
| 4. A model that can get fast and accurate result about snow distribution. | Dec. 31, 2022 |

**Activity 2 Title:** Test the optimized living snow fence in the field.

**Description:** We will apply our living snow fence design at different sites in the field. Field investigation will be conducted in winter storm events to validate its effect on snowdrift control. We will keep monitoring the activities of wild animals in and around the fences during winter to see how the living snow fences protect wildlife, especially in winter storms.

**ENRTF BUDGET: $99,986**

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| **Outcome** | **Completion Date** |
| 1. Deployment of living snow fences in the field. | Oct. 31, 2022 |
| 2. Field investigation of snow drift control in winter storm events. | March 31, 2023 |
| 3. Report of wildlife activities monitored around the fences. | March 31, 2023 |

**Activity 3 Title:** Publishresearch outcomes and outreach to Minnesota landowners for public awareness.

**Description:**We will build an online platform for sharing our research outcomes, including the model for fence design, data collected from experiments, and wildlife monitoring data to the state agencies, research institutes, and the public. We will reach out to Minnesota landowners through tutorials and demonstrations to assimilate the idea of wildlife preservation in winter.

**ENRTF BUDGET: $29,996**

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| **Outcome** | **Completion Date** |
| 1. An online platform for data publication. | June 30, 2022 |
| 2. Tutorials and demonstrations to the public. | June 30, 2023 |

**III. PROJECT PARTNERS AND COLLABORATORS:**

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

This project is scheduled to be completed within three years in accordance with the activities and completion dates listed above, but the ecological benefits to Minnesota will be long-term. Once the optimized living snow fence design is obtained, it can be used for many years. Meanwhile, new designs can continue to be made using the design approach developed in this project. Extended monitoring of wildlife activities is optional for understanding the effect of living snow fences in the long run. One of the main goals of this project is to invoke the wildlife protection awareness of Minnesotans, and the work proposed here is one of many possible solutions for Minnesota landowners. We expect that more Minnesotans will be inspired by our work.

**V. SEE ADDITIONAL PROPOSAL COMPONENTS:**

**A. Proposal Budget Spreadsheet**

**B. Visual Component or Map**

**F. Project Manager Qualifications and Organization Description**