**PROJECT TITLE:** Bison as keystone species in Minnesota savannas

**I. PROJECT STATEMENT**

Historically, bison roamed Minnesota’s prairies and oak savannas. However, the last wild bison went extinct in Minnesota over 100 years ago and we no longer have these iconic large grazers that had major impacts on ecosystems. Bison heavily altered ecosystems through grazing and were an important source of food for large carnivores, birds, and insects. Because of this, the loss of bison may have long-term consequences on the future of these ecosystems, such as the loss of other species or services these ecosystem provide.

Recently, bison have been reintroduced to several natural areas in Minnesota. While bison were historically a part of these ecosystems, without understanding the potential cascading effects of their reintroduction will have, there could be unintended consequences, such as changes in deer and pollinator populations. As more land managers across Minnesota consider reintroducing bison, we need to understand the effects of their reintroduction if we hope to avoid negative impacts on rest of the ecosystem.

Here we will focus on how bison affect other aspects of the ecosystems they are reintroduced to, including the abundance and behavior of deer and small mammals, which share a food source with bison. Likewise, bison may affect important pollinators or ticks, which can carry Lyme disease, by changing the proportion of wildflowers or vegetation cover where insects may live. We will monitor these impacts by establishing study areas both inside and outside the bison enclosure at Cedar Creek Ecosystem Science Reserve. Cedar Creek has a long history of research on Minnesota’s ecosystems and is well positioned to answer these questions. This research on the cascading effects of bison reintroduction is essential as the role of bison in many ecosystems remains unknown. **The outcomes we plan to achieve are to: (1) Determine how bison grazing affects deer and small mammals through changing vegetation, (2) Evaluate how bison reintroduction impacts pollinators and ticks, and (3) Educate Minnesotans about bison reintroduction and oak savanna ecosystems.**

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1: Determine whether bison reduce the local abundance of deer and small mammals**  **Description:**To study the effects of bison reintroduction on savanna plant communities, we will establish 14 sampling areas both inside and outside the bison enclosure at Cedar Creek. In each area we will establish a 50 meter transect with 10 plots. In each plot we will identify all plant species and estimate their abundance. We will also sample soil nitrogen, carbon, and bulk density which may be influenced by bison and affect plants and wildlife.  We will also directly study deer and small mammals by setting up live traps along the same transect to capture small mammals. In addition, we will place a trail camera at each transect to photograph all wildlife in order to estimate their local abundance and study their behavior.  We will also study the direct effects of the changing deer and small mammal community on vegetation. Near each transect we will set up plots that allow grazing by all species, exclude large species (e.g. deer and bison), and exclude both large and small mammalian grazers. This will be done both inside and outside the bison enclosure.  To better study bison movement and habitat use across the savanna we will attach GPS collars to 25 bison. Collars will store GPS location data every 10 minutes for the entire summer. We will use these data to understand how frequently bison visit each of our plots and how long they spend there, as well as how the bison use the savanna.  **ENRTF BUDGET: $195,430** | |
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| **Outcome** | **Completion Date** |
| *1. Sampling transects, camera traps, and fenced plots established* | *July 2020* |
| *2. Collar 25 bison* | *May 2021* |
| *3. Plant, soil, and small mammal data collected* | *August 2021* |
| *4. Data analyzed and publications submitted* | *May 2022* |

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| **Activity 2: Determine whether bison increase pollinators by increasing wildflowers and how they affect ticks**  **Description:**To study the impact of bison reintroduction on other savanna species we will use the same sampling areas mentioned in the previous activity. We will study insects through sweep netting and pitfall traps along transects. Insects, such as pollinators, may be influenced by bison, as grazing reduces grasses and allows for more wildflowers to grow, increasing the abundance and diversity of pollinators. Likewise, bison grazing could affect the abundance of ticks, and thus the spread of Lyme disease, through changes in the plant community. We will sample three times each summer to capture seasonal changes in the local abundance of ticks and pollinators.  **ENRTF BUDGET: $138,570** |

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| **Outcome** | **Completion Date** |
| *1. Sample pollinators and ticks* | *August 2021* |
| *2. Pollinator and tick data analyzed and submitted for publication* | *May 2022* |

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| **Activity 3: Educate Minnesotans about bison reintroduction**  **Description:**We will educate Minnesotans about the role that bison play in savannas and other Minnesota ecosystems by providing programming for K-12 students and other visitors who come to Cedar Creek each year.  We will develop education programs to correspond with state and national academic standards and will incorporate inquiry-based activities. All programs will also highlight the historical impact of bison in Minnesota as well as the importance of bison to indigenous people and to land managers working to restore oak savanna.  While the bison are on site, we will hold public outreach programs where visitors can observe them. These will include organized tours and activities focused on the role of bison in oak savanna systems and their historical importance in Minnesota. We will share results from ongoing research at these events.  We will also host a stakeholders meeting at Cedar Creek focused on land managers currently using or considering bison as a management strategy in Minnesota. This meeting will bring together land managers from across the state to discuss how bison reintroduction may aide the restoration of Minnesota’s grasslands and savannas. At this meeting we will also work together to create best practices for bison reintroduction to meet restoration goals.  **ENRTF BUDGET: $10,000** |

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| **Outcome** | **Completion Date** |
| *1. Hold stakeholders meeting at Cedar Creek discussing bison reintroduction* | *June 2022* |
| *2. At least 6000 K-12 students and visitors benefit from educational programs* | *June 2022* |

**III. PROJECT PARTNERS AND COLLABORATORS:**

**Partners receiving ENRF funds**

Dr. Chad Zirbel, Postdoctoral research associate, Cedar Creek Ecosystem Science Reserve, University of Minnesota, Project Manager, will oversee the project and supervise work on-site at Cedar Creek.

**Partners not receiving ENRF funds**

Dr. Forest Isbell, Associate Director, Cedar Creek Ecosystem Science Reserve and Assistant Professor, University of Minnesota, Co-Investigator, co-lead all activities.

Dr. Caitlin Barale Potter, Education and Outreach Coordinator, Cedar Creek Ecosystem Science Reserve, University of Minnesota, Collaborator, co-lead Activity 3.

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

Our results will guide efforts by state and federal agencies and conservation organizations using bison to restore ecosystems across Minnesota. To maximize what is learned from reintroducing bison to Cedar Creek, we aim to maintain bison grazing as long as possible. The partnership with Northstar Bison makes this financially feasible as they provide and care for the bison each year at no cost to Cedar Creek, thus allowing the project to continue for the foreseeable future. Moreover, we have successfully attracted major federal research funding to Cedar Creek for more than three decades and will continue to seek such funding beyond the two years proposed.