# Final Abstract

Final Report Approved on November 20, 2026

## M.L. 2021 Project Abstract

For the Period Ending June 30, 2026

**Project Title:** Long-Term Efficacy of Invasive Removal in Floodplain Forests

**Project Manager:** Mike Anderson

**Affiliation:** Macalester College

**Mailing Address:** 9550 Inver Grove Trail

**City/State/Zip:** Inver Grove Heights, MN 55076

**Phone:** (651) 696-6230

**E-mail:** andersonm@macalester.edu

**Website:** https://www.macalester.edu/

**Funding Source:**

**Fiscal Year:**

**Legal Citation:** M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 06b

**Appropriation Amount:** $25,000

**Amount Spent:** $24,151

**Amount Remaining:** $849

**Sound bite of Project Outcomes and Results**

This study found that one-time removal of invasive buckthorn and honeysuckle enhanced abundance of ash seedlings in a floodplain forest for at least 4 years, in both the presence and absence of white-tailed deer, even as invasive buckthorn recovered to pre-removal levels.

**Summary of Project and Outcomes**

Floodplain forests provide many ecosystem services to Minnesotans. These ecosystems also face many threats to their long-term stability. Emerging tree parasites like Emerald Ash Borer (EAB) are increasing mortality rates of floodplain tree species, while competition from invasive shrubs and herbivory from overabundant white-tailed deer are inhibiting the growth of the seedlings that might someday replace them. This study examined the long-term efficacy of a one-time removal of invasive shrubs (buckthorn and honeysuckle), in terms of enhancing seedlings of floodplain tree species, both in the presence and absence of native white-tailed deer, which were controlled using exclosure fences. Following shrub removal, we established permanent monitoring plots in which we measured abundance, height and cover of native tree seedlings, native herbs, and invasive plants. Measurements were repeated in years three and four following shrub removal.

Removal of invasive shrubs enhanced abundance of ash seedlings, which remained higher in removal than control areas four years after shrub removal. Invasive removal also appeared to increase the number of plant species present in the forest herb layer, an effect that was also still present four years after shrub removal. Ironically, invasive removal also appeared to enhance the recovery of buckthorn, which increased to a greater degree in removal than control areas, especially in the absence of deer. During the project, an outbreak of EAB killed all the adult ash trees in our study. However, since this did not appear to impact our experimental groups differently, our experimental comparisons appear to be accurate.

Overall, one-time removal of invasive shrubs seemed to create a window of opportunity for ash seedlings and native herbs that has lasted for four years beyond the removal itself. Removal of deer had very few effects in our study.

**Project Results Use and Dissemination**

The results of this study are currently being written up in a manuscript to be submitted for peer-review and publication in the restoration ecology literature. In summer of 2027 we will also work with our student crew to prepare a short press release to be published in Friends of the Mississippi River's newsletter, and a short video to be hosted on the field station's website. In February 2027, Anderson will attend a workshop of land managers and restoration ecologists to present results of the project.

# Environment and Natural Resources Trust Fund

M.L. 2021 Approved Final Report

## General Information

**Date:** November 23, 2026

**ID Number:** 2021-091

**Staff Lead:** Noah Fribley

**Project Title:** Long-Term Efficacy of Invasive Removal in Floodplain Forests

**Project Budget:** $25,000

## Project Manager Information

**Name:** Mike Anderson

**Organization:** Macalester College

**Office Telephone:** (651) 696-6230

**Email:** andersonm@macalester.edu

**Web Address:** https://www.macalester.edu/

## Project Reporting

**Final Report Approved:** November 20, 2026

**Reporting Status:** Project Completed

**Date of Last Action:** November 20, 2026

**Project Completion:** June 30, 2026

## Legal Information

**Legal Citation:** M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 06b

**Appropriation Language:** $25,000 the first year is from the trust fund to the commissioner of natural resources for an agreement with Macalester College to begin a long-term scientific study at the Ordway Field Station to provide information to land managers on protecting Minnesota's floodplain forests from combined threats of overabundant deer, invasive shrubs, and earthworms. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered. A report on the results of the long-term study must be submitted at the end of the appropriation and an update must be submitted five years after the appropriation ends or at the study's conclusion, whichever is first.

**Appropriation End Date:** June 30, 2025

## Narrative

**Project Summary:** This funding will begin a long-term scientific study that will provide much-needed information for land managers protecting Minnesota's floodplain forests from threats of overabundant deer, invasive shrubs and earthworms.

**Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.**

Floodplain forests – forests that are flooded for a portion of every year – provide many services that Minnesotans value along the rivers of our home state. The roots of trees and shrubs absorb pollutants from river water and bind soil, helping control flooding and prevent erosion. Their dense crowns evaporate excess water, and provide critical habitat and protection to resident and migrating bird species.

Floodplain forests also face multiple threats. Competition from invasive shrubs prevents establishment of the seedlings that provide the next generation of forest canopy. Overabundant deer eat many of the seedlings that escape such competition. And invasive earthworms create soil conditions that favor the invasive shrubs.

Effective ecosystem management requires understanding not only what threats exist, but also how they interact with each other. While removal of invasive shrubs, for example, may alleviate competition on native seedlings, it may also provide easier access for deer. Still, shrub removal may decrease earthworm populations, providing more nutrients for native seedlings. The balance of such interacting threats can differ in different ecosystems, so it is important that land managers have information specific to ecosystems they are trying to protect. Such information is not yet available to floodplain forest managers in Minnesota.

**What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.**

We propose a scientific study of interactions between invasive shrubs, deer, and earthworms in a floodplain forest along the Mississippi River at Macalester College's "Ordway" Field Station. Our conservation partner – Friends of the Mississippi River (FMR) – will be removing invasive shrubs in 30 acres of Ordway's floodplain forest in 2021. Our proposal adds a scientific component to this restoration that will provide valuable information to floodplain managers across the state.

Removing invasive species from an area provides scientific opportunities to unambiguously measure their effects, and the effectiveness of their removal. This study will take advantage of these opportunities in two ways: 1) by measuring the effects of deer and invasive shrubs on survival and growth of tree seedlings and herbs, and 2) by measuring the effect of invasive shrub removal on invasive earthworm populations. Ordway is an excellent location for such a study, as it contains one of the most common floodplain forest types in Minnesota, has an overabundance of deer, and has a large earthworm population. The shrub species we are studying – buckthorn and honeysuckle – are also listed among the University of Minnesota's Invasive Terrestrial Plants and Pests Center's 15 top priority species.

**What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?**

This study will investigate important threats to Minnesota's floodplain forests, and provide information relevant to their effective management. We will address:

1. The individual effects of deer browsing and non-native invasive shrubs on native plants.
2. How the effects of deer browsing and non-native invasive shrubs depend on each other.
3. How deer and shrubs affect non-native invasive earthworm populations.
4. Whether native plant communities naturally recover when non-native invasive shrubs and/or deer are removed.
5. How long any positive effects of shrub and/or deer removal are likely to last.

## Project Location

**What is the best scale for describing where your work will take place?**

Region(s): Metro

**What is the best scale to describe the area impacted by your work?**

Statewide

**When will the work impact occur?**

In the Future

## Activities and Milestones

### Activity 1: Experiment development

**Activity Budget:** $23,000

**Activity Description:**
This study will require careful design, which begins with selection of appropriate field sites. To provide replication, several suitable sites at least 10 meters x 10 meters will be identified within the 30-acre restoration area. Site selection will be based on presence and evenness of invasive shrubs, earthworms and deer activity across the site. Selection will be conducted by Ordway and FMR personnel, in order to provide as wide a range of expertise as possible. Once sites are chosen, experimental plots (2 meters x 2 meters) will be situated within them such that the plots are as similar as possible in elevation, soil type, invasive shrub cover, and native vegetation.

Once plots have been established, experimental treatments will be applied. Invasive shrubs will be removed from half of each chosen site. Then, in half of each half-site (invasives removed/not removed) one 3 meter x 3 meter deer 'exclosure' fence will be built to prevent deer access. Exclosure construction will be conducted by Ordway personnel, who have experience in this activity.

A report on the results of the long-term study will be submitted at appropriation's end, and an update submitted five years afterward or at project's end, whichever is first.

**Activity Milestones:**

| Description | Approximate Completion Date |
|---|---|
| Construction of deer exclosure fences | July 31, 2022 |
| Selection of appropriate field sites and planning of experimental treatments | July 31, 2022 |
| Removal of invasive shrubs from field plots | September 30, 2022 |
| Submit Final Report | September 30, 2024 |
| Submit update report, end of project or 5 years after appropriation end | September 30, 2024 |

### Activity 2: Baseline data collection

**Activity Budget:** $2,000

**Activity Description:**
In year 1, when the study is established, data will be collected by Ordway personnel after sites are selected, but before invasive shrubs are removed. These will represent the 'baseline' state of each plot prior to the experiment.

Vegetation, light, and earthworm populations will be measured at baseline, then once per year in June every year thereafter. All measurements will follow protocols that have been used successfully by Ordway personnel for several years. Vegetation measures will focus on the number and size of native tree seedling species, but will also include the most common herb species, and several diversity measures of the whole understory plant community. Light will be measured as percent of sky visible in canopy photographs taken at 1 meter above the ground. Earthworm populations will be measured using a standard liquid mustard extraction method.

LCCMR funds will be used for year 1 data collection activities, but long-term data collection will be funded through Ordway's regular budget.

**Activity Milestones:**

| Description | Approximate Completion Date |
|---|---|
| Collection of baseline data: vegetation, light, earthworm populations | July 31, 2022 |

## Project Partners and Collaborators

| Name | Organization | Role | Receiving Funds |
|---|---|---|---|
| Jerald Dosch | Macalester College | Co-PI for the project | Yes |
| Alex Roth | Friends of the Mississippi River | Conducting restoration activities that the proposed project seeks to measure the effects of. | No |
| Karen Schik | Friends of the Mississippi River | Conducting restoration activities that the proposed project seeks to measure the effects of. | No |

## Dissemination

**Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.**
We will disseminate the results of our work in several ways. Whenever possible, we will include contributions from Macalester students.

1. After at least 2 years of exclosure and data collection, we will write and submit a scientific paper to a high impact restoration journal such as Restoration Ecology for dissemination to the wider restoration community.

2. We will present both preliminary and final findings at local and/or regional conferences - such as the Upper Midwest Invasive Species Conference - to reach both practitioners and landowners interested in restoration. Anderson and Dosch have institutional funds available for this.

3. We will create a short video explaining the project and demonstrating the results, and share it on the Ordway website.

4. We will create a short write-up to be shared in Friends of the Mississippi River's newsletters and social media, reaching over 12,000 people.

5. All dissemination products stemming from this project will adhere to the ENRTF Acknowledgement Requirements and Guidelines.

## Long-Term Implementation and Funding

**Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?**
While we propose to use LCCMR funding to cover the costs of establishing this study, the study will continue long-term. Initial costs include materials for building deer exclosures, and salary for hiring extra student workers and covering extra faculty and staff time commitments during the first year's site selection, data collection, and exclosure construction activities. Once established, long-term data collection will be performed during Ordway's regular research activities and fall comfortably within our budget. Year 1 and longer-term data will be analyzed during Ordway's regular research activities. Results will be written and submitted for publication in the conservation literature.

## Budget Summary

| Category / Name | Subcategory or Type | Description | Purpose | Gen. Ineligible | % Benefits | # FTE | Classified Staff? | $ Amount | $ Amount Spent | $ Amount Remaining |
|---|---|---|---|---|---|---|---|---|---|---|
| **Personnel** | | | | | | | | | | |
| Student Researcher | | Assist with and learn research activities | | | 9% | 0.19 | | $6,050 | - | - |
| Student Researcher | | Assist with and learn research activities | | | 9% | 0.19 | | $6,050 | - | - |
| Jerald Dosch | | Supervisor/Co-PI | | | 9% | 0.08 | | $9,215 | - | - |
| Mike Anderson | | Project Manager | | | 9% | 0.08 | | $565 | - | - |
| | | | | | | | **Sub Total** | **$21,880** | **$21,880** | **-** |
| **Contracts and Services** | | | | | | | | | | |
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| **Equipment, Tools, and Supplies** | | | | | | | | | | |
| | Tools and Supplies | 5 pounds of organic mustard powder | Extract earthworms from soil for measuring abundance | | | | | $100 | - | $100 |
| | Equipment | 240' of 1" PVC piping | Permanently mark corners of measurement plots | | | | | $100 | $100 | - |
| | Equipment | Heavy-duty zipties, 2000 | Connectors for fencing; Remove deer access from experimental plots | | | | | $200 | - | $200 |
| | Equipment | 500 feet of heavy wire fencing | Removal of deer access from experimental plots | | | | | $1,300 | $1,150 | $150 |
| | Equipment | Fenceposts for 12x 40' perimeter exclosures | Remove deer access from experimental plots | | | | | $1,100 | $836 | $264 |
| | | | | | | | **Sub Total** | **$2,800** | **$2,086** | **$714** |
| **Capital Equipment** | | | | | | | | | | |
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| **Acquisitions and Stewardship** | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| **Travel In Minnesota** | | | | | | | | | | |
| | Other | Transport boats to field site | Move 2 boats from storage to field site: 42 miles round-trip * 2 boats * $1.75/mile | | | | | $150 | $150 | - |
| | Other | Fuel and maintenance of 2 boats, 30 1-mile round trips | Transport materials and personnel to field sites | | | | | $170 | $35 | $135 |
| | | | | | | | **Sub Total** | **$320** | **$185** | **$135** |
| **Travel Outside Minnesota** | | | | | | | | | | |
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| **Printing and Publication** | | | | | | | | | | |
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| **Other Expenses** | | | | | | | | | | |
| | | | | | | | **Sub Total** | **-** | **-** | **-** |
| | | | | | | | **Grand Total** | **$25,000** | **$24,151** | **$849** |

## Classified Staff or Generally Ineligible Expenses

| Category/Name | Subcategory or Type | Description | Justification Ineligible Expense or Classified Staff Request |
|---|---|---|---|

## Non ENRTF Funds

| Category | Specific Source | Use | Status | $ Amount | $ Amount Spent | $ Amount Remaining |
|---|---|---|---|---|---|---|
| **State** | | | | | | |
| | | | **State Sub Total** | **-** | **-** | **-** |
| **Non-State** | | | | | | |
| | | | **Non State Sub Total** | **-** | **-** | **-** |
| | | | **Funds Total** | **-** | **-** | **-** |

## Attachments

### Required Attachments

*Visual Component*

File: 22fa5596-837.docx

*Alternate Text for Visual Component*

Satellite photo of the project area (circled in red), which encompasses a >1 mile length of Mississippi River floodplain forest. Note that the most ready access to the project area from the field station building (address marker) involves boat transportation across River Lake....

*Financial Capacity*

File: f05b93b6-c32.pdf

### Supplemental Attachments

*Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other*

| Title | File |
|---|---|
| Letter of support from Friends of the Mississippi River | 126cd07a-0a0.pdf |
| Ordway Field Station Research Addendum | dc358d02-ec6.docx |
| Background Check | 5ba21b52-941.pdf |
| Technical Report of Preliminary Findings | 5ad01815-3fb.docx |

## Difference between Proposal and Work Plan

*Describe changes from Proposal to Work Plan Stage*

The project end date has changed from 2021 to 2022, to allow time to submit a report to LCCMR.

The size of study plots and exclosures has been decreased, and their number increased, in the project description (see Research Addendum).

## Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

**Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?**

N/A

**Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?**

Yes, I understand the Commissioner's Plan applies.

**Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?**

No

**Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?**

N/A

**Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?**

N/A

**Does your project include original, hypothesis-driven research?**

Yes

**Does the organization have a fiscal agent for this project?**

No

# Work Plan Amendments

| Amendment ID | Request Type | Changes made on the following pages | Justification For Amendment Request (word limit 75) | Date Submitted | Approved | Date of LCCMR Action |
|---|---|---|---|---|---|---|
| 1 | Completion Date | Previous Completion Date: 09/30/2024<br>New Completion Date: 06/30/2025 | Administrative correction due to incomplete final deliverables. | December 9, 2025 | Yes | December 9, 2025 |
| 2 | Completion Date | Previous Completion Date: 06/30/2025<br>New Completion Date: 06/30/2026 | NF making change to reflect new final reporting schedule. | December 19, 2025 | Yes | December 19, 2025 |

# Status Update Reporting

## Final Status Update August 14, 2026

**Date Submitted:** October 28, 2026

**Date Approved:** October 29, 2026

**Overall Update**
Our broad goal in this proposal was to initiate a long-term study of a one-time restoration effort in a floodplain forest ecosystem. LCCMR funding was needed for the labor and materials required to establish this study. This broad goal has been accomplished. Our stated outcomes included five specific research questions, four of which have been addressed using data collected from this project so far. The fifth is still in process, having been postponed by unseasonable flooding in summer 2024. Data collection for this project is ongoing, in accordance with our original proposal, and will continue into the foreseeable future. Production of deliverables is also ongoing. We are currently in the process of analyzing data and writing a manuscript describing our findings so far, which we will submit to the peer-reviewed journal Restoration Ecology within the next year. Following data analysis, we will also report our findings formally at an appropriate professional conference, and informally through the other two deliverables in our original proposal: a press release in Friends of the Mississippi River's newsletter, and a video to be posted on the Ordway Field Station website.

**Activity 1**
We have completed analysis of the data collected for the first 4 years of this project. Results so far indicate that one-time removal of invasive shrubs has modest but positive effects on some aspects of the native plant community. The most strongly impacted variables were abundance of ash seedlings, and species richness of the herb layer. Neither effect was altered by presence/absence of white-tailed deer, and deer had very minimal effects on any measured native community variable. Invasive shrub removal and deer exclosure also had positive effects on growth of buckthorn, itself, which increased over time to a higher degree in areas in which it had been removed and, within those areas, increased to a greater degree in deer exclosed plots. Despite this increase in one of the invaders targeted for removal, our one-time removal effort did seem to create a window of opportunity for ash seedling recruitment and increase of native species richness in the herb layer. Repeated removal efforts seem likely to widen this window. The lack of interactive effects with deer suggest a low potential for unpredictable effects of invasive shrub removal that can stem from altered deer activity.

**Activity 2**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Dissemination**
This summer, we completed the second round of data collection following application of our experimental treatments. We viewed two rounds as a minimal requirement for any reportable findings. We are currently in the process of conducting a thorough analysis, and have begun to draft a manuscript to be submitted to the peer-reviewed journal Restoration Ecology within the next year. Once analysis is complete, and we have a good idea of our findings and conclusions, we will additionally report our results both formally and informally via the deliverables included in our original proposal. Formal reporting will be through a professional conference attended by Anderson in the summer or fall of 2027. Informal reporting will be through a note in the Friends of the Mississippi River's newsletter, as well as through a video posted to the Ordway Field Station website. The website is currently being redesigned, and we have initiated plans with video production personnel.

For the purposes of updating LCCMR on our findings so far, I have prepared and attached a detailed technical report. I emphasize that these findings are preliminary and subject to revision following a more thorough analysis.

# Status Update Reporting

## Status Update March 1, 2026

**Date Submitted:** March 16, 2026

**Date Approved:** March 30, 2026

**Overall Update**
This project is complete and I am currently working with an honor's student to analyze the data. The final report will be submitted at the end of the semester, in May. Afterward, the student and I plan to submit her paper for publication in the peer-reviewed journal Restoration Ecology.

**Activity 1**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Activity 2**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Dissemination**
This project is complete and I am currently working with an honor's student to analyze the data. The final report will be submitted at the end of the semester, in May. Afterward, the student and I plan to submit her paper for publication in the peer-reviewed journal Restoration Ecology.

# Additional Status Update Reporting

## Additional Status Update August 14, 2025

**Date Submitted:** December 12, 2025

**Date Approved:** December 19, 2025

**Overall Update**
In summer 2025 post-treatment data were collected for seedling abundance and height, abundance of herb layer plant species, and growth of ash adult trees. These data are currently being analyzed in collaboration with an honor's student, who will write the results up as her thesis. I will submit a copy of this as the final report for this project in May 2026. Her thesis will also form the basis for a manuscript to be submitted for peer review and publication following submission of our final report.

**Activity 1**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Activity 2**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Dissemination**
In summer 2025 post-treatment data were collected for seedling abundance and height, abundance of herb layer plant species, and growth of ash adult trees. These data are currently being analyzed in collaboration with an honor's student, who will write the results up as her thesis. I will submit a copy of this as the final report for this project in May 2026, and her and I will work together to submit her thesis as a manuscript for peer review and publication after that.

# Additional Status Update Reporting

## Additional Status Update November 14, 2024

**Date Submitted:** December 12, 2025

**Date Approved:** December 19, 2025

**Overall Update**
The two activities we set out to accomplish at the beginning of the project are complete. The experiment is established, baseline data has been collected, and post-treatment data collection is now possible.

Dissemination of our results has not been accomplished yet, because of delays varying in cause related to every step of the project (see below for details). These data will be collected at the first opportunity, and dissemination products developed as described in out original proposal.

**Activity 1**
This activity is complete. The experimental plots were established and baseline data collected in July 2022. Invasive shrubs removed from half of these plots in January 2023, and exclosure fences were constructed (one per plot) in July 2023.
*(This activity marked as complete as of this status update)*

**Activity 2**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Dissemination**
Results of our experiment have not been disseminated yet, due to delays at each step of the project. Project initiation was delayed by the COVID-19 pandemic in 2020-2021. Site selection was accomplished in summer 2022, but removal of invasive shrubs could not happen until January 2023, due to the need for heavy removal equipment that requires soils to be frozen in this floodplain environment. This pushed exclosure construction, which necessarily had to occur after invasive shrub removal, back to summer 2023. Our first opportunity to collect post-treatment data was therefore summer 2024, during which atypical late-season floods shut us out of our data collection window. We plan to collect these data in summer 2025, at which point work on the dissemination products will begin.

# Status Update Reporting

## Status Update September 1, 2024

**Date Submitted:** December 12, 2025

**Date Approved:** December 19, 2025

**Overall Update**
The two activities we set out to accomplish at the beginning of the project are complete. The experiment is established, baseline data has been collected, and post-treatment data collection is now possible.

Dissemination of our results has not been accomplished yet, because of delays varying in cause related to every step of the project (see below for details). These data will be collected at the first opportunity, and dissemination products developed as described in out original proposal. The final report will be submitted in May of 2026, and the results will also be submitted for publication in a peer-reviewed journal after that.

**Activity 1**
This activity is complete. The experimental plots were established and baseline data collected in July 2022. Invasive shrubs removed from half of these plots in January 2023, and exclosure fences were constructed (one per plot) in July 2023.
*(This activity marked as complete as of this status update)*

**Activity 2**
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**Dissemination**
Results of our experiment have not been disseminated yet, due to delays at each step of the project. Project initiation was delayed by the COVID-19 pandemic in 2020-2021. Site selection was accomplished in summer 2022, but removal of invasive shrubs could not happen until January 2023, due to the need for heavy removal equipment that requires soils to be frozen in this floodplain environment. This pushed exclosure construction, which necessarily had to occur after invasive shrub removal, back to summer 2023. Our first opportunity to collect post-treatment data was therefore summer 2024, during which atypical late-season floods shut us out of our data collection window. We plan to collect these data in summer 2025, at which point work on the dissemination products will begin. The final report will be submitted in May of 2026, and the results will also be submitted for publication in a peer-reviewed journal after that.

# Status Update Reporting

## Status Update March 1, 2024

**Date Submitted:** February 28, 2024

**Date Approved:** July 12, 2024

**Overall Update**
Since our last report in September 2023, no movement toward our objectives has been possible, due to seasonal restrictions and the pause in our implementation timeline created by covid. We plan to finalize the experimental design and collect preliminary post-treatment data this summer. Post-treatment data for the whole experiment will be collected in summer 2025. We are currently in discussion with collaborators at Friends of the Mississippi River about the possible necessity of implementing one more shrub removal round before we collect full post-treatment data. This is due to the rapidity with which invasive shrubs have regrown following initial removal.

**Activity 1**
Since our last status update in September 2023 there has been no chance in this activity. Our remaining goals under this activity are to add fencing to the remaining 40 exclosures, and collect data. Both activities will be conducted with our summer research crew in June and July this year. Additionally, the speed with which invasive shrubs have bounced back following initial removal raises the possibility that we will require at least one more round of removal before we can collect reliable post-treatment data.

Dissemination of results is not possible yet, since we have not collected post-treatment data. The earliest we can begin moving toward this goal will be after this summer.

**Activity 2**
This activity was previously marked complete.
*(This activity marked as complete as of this status update)*

**Dissemination**
Again, dissemination will not be possible until post-treatment data are collected this summer. Following this summer's data collection and analysis, we will disseminate preliminary results in the form of a video to be shared on FMR's website, and an announcement to be shared via FMR's newsletter. At least one more year of post-treatment data will need to be collected before we will have results reportable through publication or professional meetings.

# Status Update Reporting

## Status Update September 1, 2023

**Date Submitted:** September 1, 2023

**Date Approved:** September 27, 2023

**Overall Update**
Our major steps forward in this reporting period include: 1) construction of 20 deer exclosures for permanent vegetation monitoring (100% complete), 2) construction of an additional 40 deer exclosures for monitoring of seedling recruitment (80% complete), and 3) completion of baseline data collection from earthworm specimens.

We have not begun work on any dissemination products yet, due to the early stages of the project, but expect to begin this in summer of 2024.

**Activity 1**
Activity 1: Experiment Development

Our main progress toward this activity in the reporting period was construction of exclosure fences. This year was the earliest this could be accomplished, since it was necessary to wait until after invasive shrubs had been removed from our treatment plots, which occurred in January. Following this, PI Anderson and Director Dosch worked with our summer student research crew to implement a paired exclosure design superimposed on our removal/control plot design. We constructed 20 2.5x1.5 m exclosure fences, each paired with a nearby open plot, for permanent monitoring of vegetation changes. Additionally, we installed fence posts and prepared fencing for another 40 exclosures paired with nearby open plots for monitoring of seedling recruitment. Fencing will be installed on these latter exclosures next summer, as we ran out of time this summer.

The remaining milestones in this activity are concerned with reporting results, which is not possible yet due to the fact that the project is still in early stages.

**Activity 2**
Activity 2: Baseline Data Collection

Most of the baseline data were collected last summer, during our summer research season. The exception was earthworm measurements. Last summer, earthworms were collected from each treatment plot and preserved in 70% ethanol. Over the winter and spring of 2023, these specimens were identified to species, counted, and weighed in order to calculate and compare vital population statistics for each of our treatment plots.
*(This activity marked as complete as of this status update)*

**Dissemination**
At this point we have not created any dissemination products. This is due to the project being in early stages. Our plant is to begin this next year, after the erection of the final exclosures. The first products we will create will include a short video describing the project that will be hosted on our website, and a short write-up describing the project that will be published in the newsletters and social media accounts of Friends of the Mississippi River.

# Status Update Reporting

## Status Update March 1, 2023

**Date Submitted:** February 28, 2023

**Date Approved:** March 9, 2023

**Overall Update**
Our main accomplishment since our last progress report in September 2022 was removal of the invasive shrubs from the experimental field plots. Now that those have been removed, we can move forward with construction of exclosure fences and collection of further data in summer of 2023.

**Activity 1**
Activity 1: Planning the experiment
Our original plan for this activity consisted of 5 goals. These goals, and the update from our work since our last progress report in September 2022, are listed below.

1. Removal of invasive shrubs from field plots
Update: This was completed in January 2023.

2. Construction of deer exclosure fences
Update: For practical reasons, this could not be done until the invasive shrubs were removed. It will be done by Ordway personnel in the summer of 2023 as part of our regular crew tasks. No further expenses will be incurred.

3. Selection of appropriate field sites and planning of experimental treatments
Update: This was finished in June 2022.

4. Submit Final Report
Update: This will be done after we collect two years of follow-up data.

5. Submit update report
Update: This will be done after we collect five years of follow-up data.

**Activity 2**
Activity 2: Baseline data collection
This was completed in July 2022. We will collect a new round of data following establishment of the exclosures in June 2023 as part of our regular summer crew activities. No further expenses will be incurred.

**Dissemination**
As we have no results yet, we have not begun work on any of our proposed dissemination projects.

# Status Update Reporting

## Status Update September 1, 2022

**Date Submitted:** September 1, 2022

**Date Approved:** September 6, 2022

**Overall Update**

The five outcomes we proposed for this project all involve measuring the effects of removal of invasive shrubs and deer from portions of our floodplain forest. Prior to their actual removal, however, we first needed to establish a rigorous field design for our experiment, and collect the baseline data that we will use to quantify the change over time associated with removal of each factor. Establishing the field design and collecting the baseline data were our major goals for this year. We completed both, but we had to make a couple adjustments to our original plan. These are described in more detail below, but included a change of experimental design, and removing one of the variables we originally planned to measure from our study.

**Activity 1**

Activity 1: Planning the experiment

Our original plan for this activity consisted of 5 goals. These goals, and the update from our work this summer, are listed below.

1. Removal of invasive shrubs from field plots

Update: This is scheduled to take place in the fall of 2022, under the direction and finances of our partner organization, Friends of the Mississippi River.

2. Construction of deer exclosure fences

Update: For practical reasons, this cannot be done until the invasive shrubs are removed. It will be done by Ordway personnel in the summer of 2023 as part of our regular crew tasks. No further expenses will be incurred.

3. Selection of appropriate field sites and planning of experimental treatments

Update: This was our major goal for this activity this summer. We finished it in June 2022. Logistical considerations related to the removal of invasive shrubs necessitated a change of design from our original plan, but the new design should not result in a loss of statistical power.

4. Submit Final Report

Update: This will be done after we collect two years of follow-up data.

5. Submit update report

Update: This will be done after we collect five years of follow-up data.

**Activity 2**

Activity 2: Baseline data collection

Our original plan for this activity was two-fold: 1) to select study plots within each of our experimental treatments for continued monitoring, and 2) to measure several variables within each chosen plot, prior to the removal of invasive species, in order to establish the baseline differences between our treatment and control areas. Variables we originally planned to measure included: cover of native herbs and shrubs, cover of invasive shrubs, biomass of invasive shrubs after removal, canopy cover, earthworm abundance and biomass, soil nitrogen and carbon.

In August 2022, we completed collection of all planned variables except soil nitrogen and carbon, and biomass of invasive shrubs. Soil samples have been collected and await processing at the UMN Research Analytical Lab. On-site conversations with removal crew personnel made it clear that our original plan - to collect and weigh all above-ground tissues of invasive shrubs in each of our study plots - will be extremely impractical. We are therefore removing it from our planned data collection. We do not expect it to impact our ability to detect the effects of invasive shrub removal.

**Dissemination**

As we have no results yet, we have not begun work on any of our proposed dissemination projects.