



Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-275

Staff Lead: Michael Varien

Date this document submitted to LCCMR: June 16, 2022

Project Title: Beavers, Trees and Climate - Increasing Floodplain Forest Resilience

Project Budget: \$430,000

Project Manager Information

Name: Nancy Duncan

Organization: National Park Service - Mississippi National River and Recreation Area

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Project Reporting

Date Work Plan Approved by LCCMR: June 27, 2022

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2025

Final Report Due Date: August 14, 2025

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Art. , Sec. 2, Subd. 03m

Appropriation Language: \$430,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with the National Park Service, Mississippi National River and Recreation Area, to identify solutions for saving floodplain wildlife habitat from beaver herbivory, changes in climate, and emerald ash borer.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: Climate change, beaver herbivory and Emerald Ash Borer are significant threats to upper Mississippi floodplain forests. Our extensive partnership is identifying solutions to save floodplain wildlife habitat before it disappears.

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

This 72-mile stretch of the Mississippi River is home to 60+ nesting bald eagle pairs, is the flyway for nearly 1/3 of North American migratory birds and contains habitat for federally endangered species. However, herbivory, climate change, and emerald ash borer (EAB), are causing wide-spread mortality in the overstory and a lack of natural regeneration of native seedlings. How to manage these issues and promote a healthy forest is an ongoing concern among natural resource managers along the river.

Interrelated impacts of increased beaver herbivory, climate change, and forest pests like EAB result in loss of important forest canopy species, including cottonwood. This impacts bald eagle nesting as 80% of eagles nesting along this stretch nest in cottonwood. Lack of regeneration also leads to invasion by reed canary grass and buckthorn, increasing future restoration costs. This proposal brings together multiple public agencies, land managers, foresters, researchers, and volunteers working to improve floodplain forest restoration and protection outcomes. We've seen that targeted planting and protection of naturally germinating seedlings from herbivory can increase regeneration, but need more data to create a set of best management practices for effective and efficient floodplain forest restoration.

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.

Working together, we can improve naturally regenerating and planted tree survival along the Mississippi River. We must act quickly to prevent undesirable species filling gaps created by Emerald Ash Borer (EAB) devastation. Natural regeneration is critical to floodplain canopy restoration, and targeted tree planting can reestablish canopy in areas lost to EAB and invasive species. This proposal will create best management practices (BMPs) for successful floodplain forest canopy restoration and wildlife habitat enhancement.

Grant funding will identify beaver locations in MNRRRA and determine where beavers provide beneficial aquatic and terrestrial wildlife habitat and where they negatively impact naturally regenerating seedlings and mature, seed producing trees. Funding will support data collection of seedling survival, growth, and long-term success of planted climate-adapted native seedlings (funded through Wildlife Conservation Society grant match). This proposal will create best management practices (BMPs) for successful floodplain forest canopy restoration and wildlife habitat enhancement.

This project will improve restoration outcomes in 25 cities, 5 counties, 2 state-wide and several federal agencies by increasing knowledge about: 1) beaver herbivory impacts on natural regeneration and 2) adaptive forest management for climate change in plantings. A successful project will evaluate land management options that impact wildlife habitat and water quality.

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?

Outcome 1: Determine best management practices to promote successful climate-adapted floodplain forest canopy restoration

Products include:

Set of draft BMPs

A beaver assessment, population estimates and monitoring plan, including a map of areas where beavers are improving habitat within the MNRRRA corridor.

A vegetation assessment of floodplain forest areas at risk of beaver herbivory, with a particular eye to cottonwood, a preferred nesting tree for bald eagles.

A climate-adaptive tree species assessment, tailored to meet site-specific management objectives in the 54,000 acres of MNRRRA.

Outcome 2: Disseminate BMPs with stakeholders, including 40+ Minnesota land managers

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?

During the Project and In the Future

Activities and Milestones

Activity 1: Beaver population assessment and impact map along the MNRRA corridor.

Activity Budget: \$106,000

Activity Description:

Activity 1a: Quantify beaver populations and lodge locations along this stretch of the Upper Mississippi river to understand relative population densities. An initial corridor-wide survey was done during 2021. Annual beaver lodge and cache surveys will be completed via foot, watercraft, and/or fixed-wing aircraft. Each active beaver lodge will be identified and mapped using real-time GIS software. Beaver data gathered for this project can be related to other beaver population work done in other National Park units in the region.

Activity 1b: Develop a beaver population and habitat monitoring plan including methods to map areas where beaver are improving habitat and areas where beaver are negatively impacting regeneration of important tree species.

Floodplain forest ecosystems are disturbance dependent. Many of the tree species are relatively short-lived. However, disturbance intensity, frequency, and timing has shifted within the UMRS. One of the main disturbance agents is hypothesized to be beavers. No beaver population monitoring assessment currently exists along this stretch of the Mississippi nor are there data on beaver abundance or activity mapping. Assessing the current beaver population and developing a population monitoring plan are key steps to developing successful floodplain forest restorations.

Activity Milestones:

Description	Approximate Completion Date
Identify initial locations of active and inactive beaver colonies	October 31, 2022
Each summer and fall map lodge/bank den location and digitize impounded areas	October 31, 2024
Annually estimate beaver lodge population and relative food cache density via multiple methods	October 31, 2024
A beaver monitoring plan will be developed and incorporated into MNRRA Resource Management protocol.	June 30, 2025

Activity 2: Quantify beaver vs deer herbivory at a statistically pre-determined subsection of areas where there are known beaver dens or lodges.

Activity Budget: \$74,000

Activity Description:

We will assess occurrence of beaver and deer herbivory through shoreline and riparian surveys at defined lodge/den locations throughout the corridor. Annual records of foraging activity and tree species selection will be assessed via GPS/GIS mapping and records of diet selection, eg. species, size, location, distance to river edge.

We will document beaver herbivory impacts on cottonwood and other riparian tree species. This will determine where beaver play a significant role in limiting recruitment and growth of mature trees. A vegetation assessment will indicate where beaver herbivory is damaging floodplain forest health at scale. Beaver herbivory appears to be limiting recruitment and growth of key floodplain tree species within the corridor. Though numerous land managing partners working along the Mississippi River have anecdotally reported the issue, its extent is unmeasured. To determine the impact of beaver herbivory, vegetation surveys will be conducted on the regenerating layer (seedlings and saplings – most vulnerable to herbivory) and the overstory (most important for bald eagle nesting).

Activity Milestones:

Description	Approximate Completion Date
Quantification of beaver forage selection and potential impact on cottonwood regeneration.	June 30, 2024
Assessment of beaver forage activity on tree seedlings, saplings, and overstory.	October 31, 2024
Map where herbivory is significantly limiting recruitment and growth of cottonwood trees.	June 30, 2025

Activity 3: Refine proposed best management practices for climate-adapted management of floodplain trees.

Activity Budget: \$213,500

Activity Description:

After mortality from EAB, public land managers are worried about establishment of non-native invasives like European buckthorn in natural areas. Creating an adaptive management assessment with consideration for climate change and herbivory will give managers data to inform decisions for tree planting in floodplain forests.

We will monitor 1,200 saplings planted in 18 1/10th acre plots in Saint Paul in 2020 with the goal of quantifying differences in growth, survival, physiology (how saplings respond to shade), and phenology (timing of plant development) of eighteen different native tree species across four different treatments - resistance, resilience, transition, and control (no-treatment). This will provide critical data on early growth and survival of potential species for restoration within floodplain forest ecosystems. During the grant period, we will have 5 growing seasons worth of data, generally when a seedling is considered established. We will utilize this data to inform the development of the best management practices in restoration and maintenance of floodplain forests.

Activity Milestones:

Description	Approximate Completion Date
Quantify 5-year survival, growth, overall health of 18 different tree species in four treatment types.	June 30, 2025
Measure the phenology (timing of leafout, flowering and leaf fall) on 400 saplings	June 30, 2025
Measure photosynthetic rates of 200 saplings at least 3 times throughout the growing season	June 30, 2025

Activity 4: Develop draft BMPs which will be refined as research progresses. This will take place across all activities.

Activity Budget: \$36,500

Activity Description:

This project proposes to develop an initial set of overarching floodplain forest restoration BMPs addressing tree canopy loss and beaver impacts on restoration efforts to determine: 1) where beaver exclusion or deterrence should be used, 2) what climate-adapted tree species would be most successful when replacing ash and potentially cottonwood, 3) what benefits beaver may be providing to the environment along large rivers, 4) what types of exclusion or deterrence/repellence are most effective with beaver, and 5) how to begin a decision making process for successfully restoring floodplain forests with high overstory mortality while coexisting with beaver.

BMPs will be more fully developed based on extensive literature review looking at how beaver impact a large, controlled urban river system that is losing floodplain forest due to EAB, lack of keystone tree species regeneration and climate change. This will define how to work holistically with resource management partners throughout the 72-mile corridor to implement best practices for restoring the tremendous amount of floodplain forest lost to EAB, as well as determine how best to improve cottonwood regeneration that has dramatically decreased over the past 20 years. The final result will be a set of BMPs that will evolve over time

Activity Milestones:

Description	Approximate Completion Date
• Develop an initial draft set of draft BMP's based on extensive literature review and early results from the ASCC study.	June 30, 2023
• Refine these BMPs as the study progresses based on research, observations and findings	June 30, 2025
Finalize initial BMPs using what was learned over the course of this study	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
PhD Student	Univ of MN Dept of Fisheries, Wildlife and Conservation Biology	With assistance from NPS and U of MN faculty, design and implement beaver project, conduct field work, collect and analyze data, write up findings, conclusions and recommendations. Write up findings for peer-reviewed publication. Present work at conferences and other venues.	Yes
Research Assistant	U of MN Dept of Forest Resources	Graduate student (M.S.). With assistance from U of MN and MPC, this person will conduct field work, collect vegetation data and write up results and conclusions from vegetation portion of the study.	Yes
Environmental Stewardship and Volunteer Manager	Mississippi Park Connection (MPC)	Project coordination including staff, volunteers, and field work; for vegetation piece of study (floodplain forest/tree regeneration success work).	Yes
Dr Marcella Windmuller-Campione, PhD, Assistant Professor of Silviculture	University of Minnesota Department of Forest Resources	Project co-coordinator and provides oversight and technical assistance for forestry/tree portion of study.	Yes
Dr. Steve Windels, Wildlife Biologist,	National Park Service, Voyageurs National Park	Training and technical assistance for beaver portion of study; loan of beaver supplies as available/needed.	No
Dr. Joseph Bump, Associate Professor	University of Minnesota, Dept. of Fisheries, Wildlife and Conservation Biology	Work with PhD student providing technical assistance on beaver portion of the study.	No
Adam Robbins, Natural Resources Supervisor	Saint Paul Parks and Recreation - Natural Resources	Provide technical assistance on project including beaver locations/locations of damaged trees and damaged floodplain regeneration along the Mississippi within St. Paul, MN	No
Leslie Brandt, Climate Change Specialist	U.S. Forest Service/Northern Institute of Applied Climate Science (NIACS)	Technical assistance on vegetation portion of project.	No
Scott Hagen, Natural Resources Specialist	Dakota County Parks	Technical assistance with project; provide locations of beaver colonies and beaver damaged trees within the Mississippi floodplain in Dakota County.	No
Jody Yungers, Director, Recreation and Parks Department	City of Brooklyn Park	Provide project support including locations of beaver damaged trees along the Mississippi River in the City of Brooklyn Park.	No
Robert Fashingbauer, Area Wildlife Manager	MN Dept. of Natural Resources	Technical assistance, providing known beaver and beaver damaged tree locations along the Mississippi River, river backwater areas and the Vermillion River in the southern end of the study corridor.	No

Dr. Thomas Parr, Network Program Manager	National Park Service, Great Lakes Network Inventory and Monitoring	Provide general technical assistance with study design, data analysis and NPS report writing and publication, as needed.	No
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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.

LCCMR will receive credit and acknowledgement in all the following dissemination actions:

Data on beaver and adaptive management will be shared with local and state partners to contribute to the knowledge base of specific local partners and statewide natural resources managers. MPC and NPS will host an annual land managers meeting to bring 30+ public agencies and nonprofits that manage land within the MNRRA corridor to discuss data and assessments.

Collaborations with the US Forest Service as well as the University of Minnesota will bring this work statewide to other floodplain forests across the state. Assessments will be made available for public use on the National Park Service’s website.

Share data- publications, NPS/MPC webpages, social media, enews, partnership meetings (30 land agencies).

The National Park Service will work with the Great Lakes Inventory and Monitoring Group, the Great Lakes area research arm of the NPS, to get this information disseminated within the NPS and elsewhere.

The National Park Service and Mississippi Park Connection will acknowledge project funding from LCCMR in all social media posts referencing about this research.

Volunteers and University students will be engaged in all aspects of this work and co-managed by the National Park Service, Mississippi Park Connection and U of MN. LCCMR will receive recognition of support at volunteer events as well as through E-Newsletter publications, the NPS/MPC social media sites, and our annual print newsletter.

The U of MN/PhD student will produce 2 papers for publication describing this project and results, with credit given to LCCMR for providing funds to accomplish this research. This student may also give presentations at professional meetings during their tenure.

An adaptive management chapter will be added to MNRRA’s forest management assessment used by many cities/counties.

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?

Periodic beaver monitoring will be incorporated into MNRRA management plans to provide information on changes in beaver populations and geographic distribution. These data, paired with trends in herbivory species, will inform resource managers on the state of floodplain tree recruitment and need for protection and/or restoration efforts for

floodplain forest species in the Mississippi corridor. This creates successful management of the riparian forest-climate-beaver ecosystem.

Monitoring of the climate-adapted plantings will provide a blueprint for floodplain restoration in a changing climate – something natural resource managers up and down the river need, and which will be applicable across the state.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Develop Sonar Data Mapping on Three Rivers to Assess Suitability for Native Mussel Habitat	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03j	\$200,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
							Sub Total	-
Contracts and Services								
Mississippi Park Connection	Sub award	Mississippi Park Connection will be providing on-the-ground coordination and technical consulting for this project.				1.5		\$100,000
Conservation Corps of MN and IA	Professional or Technical Service Contract	Support from a Conservation Corps Crew will support herbivory surveys, monitoring, and establishment management for tree planted at Crosby Farm Regional Park.				3		\$85,500
University of Minnesota	Sub award	This would support a full-time PhD student for 3 years and a part-time graduate student for 1 year. It would also support technical consulting with a Professor in the UMN Forestry Department.				4.2		\$227,000
Aerial Flight Surveys	Professional or Technical Service Contract	The U of MN will seek a contract for aerial flight surveys that will identify beaver populations. This will cover aerial surveys along the river to locate and identify beaver populations during the course of the project.				0.03		\$10,000
							Sub Total	\$422,500
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies (flagging, tape, gloves for volunteers and other misc supplies)	These items will facilitate volunteer groups.					\$1,500
	Tools and Supplies	Exclosure Supplies	Tree tubes or fencing will be used to exclose trees from herbivory.					\$3,000
							Sub Total	\$4,500
Capital Expenditures								
							Sub Total	-

Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Publication Fees	Publishing fees (\$1,000/year) for the results and findings.					\$3,000
							Sub Total	\$3,000
Other Expenses								
							Sub Total	-
							Grand Total	\$430,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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Non ENRTF Funds

Category	Specific Source	Use	Status	\$ Amount
State				
			State Sub Total	-
Non-State				
In-Kind	National Park Service Voyageurs National Park: GS-12 Wildlife Biologist salary/benefits	Will consult on beaver monitoring assessment, data planning, etc. Will support the PhD student in project design and implementation.	Secured	\$18,000
In-Kind	National Park Service - Mississippi National River and Recreation Area: GS-11 Natural Resource Program Manager salary/benefits	Working together with the wildlife biologist for Voyageurs and the Forestry Professor at the University of Minnesota, Nancy Duncan will be the project manager for this proposal.	Secured	\$102,000
In-Kind	National Park Service - Mississippi National River and Recreation Area: GS-05 seasonal Biotechnician salary/benefits	This seasonal staff at the National Park Service will support field work, vegetation monitoring, and mapping data.	Secured	\$75,000
Cash	National Park Service - Mississippi National River and Recreation Area: Rental car, gas	The National Park Service will rent a car for the biotechs, PhD and graduate student to use for field work related to this project each year.	Secured	\$9,000
Cash	Mississippi Park Connection - Federal Service Call Grant and Cooperative Agreement	Mississippi Park Connection will support the project by matching time through the Conservation Corps of MN and IA crew with a 50-50 match. This will double the amount of time that they work on the project.	Secured	\$63,000
In-Kind	Mississippi Park Connection volunteers - 600 hours/year@ \$25.43/hour	Volunteers will be involved in this project every step of the way. From vegetation surveys to tree monitoring to supporting the beaver assessment, volunteers will support.	Secured	\$45,000
Cash	Graduate Student through a U.S. Forest Service Grant	The U.S. Forest Service has supported the graduate student position named in this proposal with funding for years two and three as well as tuition. This provides a 2-1 match for this LCCMR request.	Secured	\$75,000
In-Kind	Northern Institute for Applied Climate Science (U.S. Forest Service).	Leslie Brandt, PhD is a project collaborator on this project.	Secured	\$16,500
Cash	National Park Service - Mississippi National River and Recreation Area: purchase of trail cameras	These will be used to document beaver movements and activities at selected den/lodge locations within the MNRRA corridor as well as to track any predation or other actions that may happen.	Secured	\$22,500
			Non State Sub Total	\$426,000
			Funds Total	\$426,000

Attachments

Required Attachments

Visual Component

File: [cca8e270-fcf.pdf](#)

Alternate Text for Visual Component

This visual shows a stand of 50 cottonwood planted 7 years ago that was completely cut down by beaver earlier this year. It also has a photo depicting measuring floodplain tree regeneration, a photo of a beaver swimming carrying a stick, and a photo of an eagle in flight. It describes how Mississippi River floodplain forest is being lost to emerald ash borer, climate change, and beaver herbivory, the lack of data on beaver, as well as the lack of data on how to successfully achieve floodpla...

Optional Attachments

Support Letter or Other

Title	File
Support Letter - Saint Paul Parks and Recreation	81dea924-7a8.pdf
Support Letter - Department of Natural Resources	c9c24047-49a.pdf
Support Letter - Brooklyn Park	b6161b4b-18d.pdf
Support Letter - U.S.. Forest Service - Northern Institute of Applied Climate Science	6a022a6e-149.pdf
Support Letter - Dakota County	cc944a79-acb.pdf
Not Applicable	b45961d3-482.docx
Background Check 2022-275, signed form	0b4a31ad-f23.pdf
2022-275 Peer Review Research Addendum	e0e7cb75-79a.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Moved \$22,500 in budget from equipment (camera traps) to funding Conservation Corps of MN & IA (CCMI) crew time so we can do more on the ground work via that youth crew. NPS purchased camera traps (\$22,500) with 2021 year-end money when it looked like our project budget would be cut, so the amount NPS spent on purchasing cameras was added to the match section.

All Activities and Milestones have had some revisions, with a new Activity added for development of draft BMPs to use as the research hypothesis as was suggested by Peer Review. See the Peer Review Research Addendum for more detail.

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 agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

N/A

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

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



Beavers, Trees and Climate – Increasing Floodplain Forest Resilience

The Mississippi River floodplain forest is at risk of losing critically important trees that are home to 60+ nesting bald eagle pairs, is the flyway for nearly $\frac{1}{3}$ of North American migratory birds and contains habitat for federally endangered species. Beaver herbivory, climate change, and forest pests like EAB are contributing to habitat loss. No data is available on how extensive beaver damage is or how to restore the forest under these new pressures. This project will provide vital best management practices to land managers to protect and restore this habitat before it is lost forever.

Activities:

1. Estimate beaver population and distribution.
2. Create vegetation assessment of floodplain areas at risk of beaver herbivory, targeting cottonwood, a preferred nesting tree for bald eagles.
3. Develop best management practices for climate-adapted management of floodplain trees.
4. Share information with forest and natural area managers for management application and the general public.

Outcome 1: Determine best management practices to promote successful floodplain forest canopy restoration for wildlife habitat through natural regeneration and manual plantings.

Outcome 2: Disseminate BMPs with stakeholders, including 40+ Minnesota land managers.



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