Final Abstract

Final Report Approved on December 12, 2025

M.L. 2022 Project Abstract

For the Period Ending June 30, 2025

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

Project Manager: Neil Smarjesse

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

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Website: https://www.nps.gov/miss/index.htm

Funding Source:

Fiscal Year:

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

Appropriation Amount: $430,000

Amount Spent: $398,298

Amount Remaining: $31,702

Sound bite of Project Outcomes and Results

This multifaceted project has greatly impacted the way our Natural Resource Managers within the Mississippi National River and Recreation Area view the impact and importance of beaver activity on floodplain forest regeneration. Through extensive research we can use learned Best Management Practices to protect and enhance the Mississippi River's resources.

Overall Project Outcome and Results

Beaver populations and lodge locations were successfully documented 2021-2024 along the 72 mile stretch of the Mississippi National River and Recreation Area to understand relative population densities. An initial corridor-wide survey was done during 2021. Annual beaver lodge and cache surveys were completed via foot, watercraft, and/or fixed-wing aircraft. Each active beaver lodge was identified and mapped using real-time GIS software. This data resulted in the Beaver Monitoring Plan for the Mississippi National River and Recreational Area, National Park Service Unit. Surprisingly, this did not show any evidence that beaver were negatively impacting cottonwood or having a significant role in limiting recruitment of young trees or growth of mature trees.

The lack of cottonwood seedlings across all plots is a particularly notable finding. While this study provides no direct evidence that beaver are limiting cottonwood regeneration, this absence does not rule out their potential role.

Implications for Natural Resource Managers:
Based on the information collected in the annual beaver lodge and cache surveys, we successfully developed 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. We will plant or protect cottonwood seedlings in suitable microsites while monitoring beaver populations and their impacts on regeneration patterns. Additionally integrating beaver-induced disturbances into long-term forest management and restoration strategies to support biodiversity

Adaptive Silviculture for Climate Change:
Cumulatively, monitoring was successful done for 1,200 saplings planted in 18 1/10th acre plots in Saint Paul in 2020. This effort quantified 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). Results are detailed in the Master's thesis (attached)

Project Results Use and Dissemination

Masters thesis (see attached)

An abstract (attached) to present the "Twin Cities Beaver Project: population and distribution in the Mississippi National River and Recreational Area" has been accepted by the 10th International Beaver Symposium.

Presentations about this work were given at the Midwest Fish and Wildlife Conference in January 2024

Ten tours for almost 100 people and 13 webinars or presentations were given to over 650 people about the ASCC plots

Presentation at the 2023 Great Lakes Science for National Parks Symposium

Windmuller-Campione, M.A. (2023). Adaptative Silviculture at Crosby Farms. Field Tour and Presentation for National Park Service

Environment and Natural Resources Trust Fund

M.L. 2022 Approved Final Report

General Information

Date: December 15, 2025

ID Number: 2022-275

Staff Lead: Lisa Bigaouette

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

Project Budget: $430,000

Project Manager Information

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

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Project Reporting

Final Report Approved: December 12, 2025

Reporting Status: Project Completed & Additional Update Approved

Date of Last Action: December 12, 2025

Project Completion: June 30, 2025

Legal Information

Legal Citation: M.L. 2022, Chp. 94, 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 ⅓ 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 MNRRA 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 MNRRA 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 MNRRA.
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

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	$ Amount Spent	$ Amount Remaining
Personnel										
							Sub Total	**-**	**-**	**-**
Contracts and Services										
Mississippi Park Connection	Subaward	Mississippi Park Connection will be providing on-the-ground coordination and technical consulting for this project.				1.5		$100,000	$92,697	$7,303
Conservation Corps of MN and IA	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	$85,500	-
University of Minnesota	Subaward	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	$214,886	$12,114
Aerial Flight Surveys	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	$2,247	$7,753
							Sub Total	**$422,500**	**$395,330**	**$27,170**
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	-	$1,500
	Tools and Supplies	Exclosure Supplies	Tree tubes or fencing will be used to exclose trees from herbivory.					$3,000	$2,968	$32
							Sub Total	**$4,500**	**$2,968**	**$1,532**

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	-	$3,000
							Sub Total	**$3,000**	**-**	**$3,000**
Other Expenses										
							Sub Total	**-**	**-**	**-**
							Grand Total	**$430,000**	**$398,298**	**$31,702**

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						
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	$16,031	$1,969
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	$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	$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	$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	$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	$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	$47,000	$28,000
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	$9,500	$7,000
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	$22,500	-
			Non State	**$426,000**	**$389,031**	**$36,969**

			Sub Total			
			Funds Total	**$426,000**	**$389,031**	**$36,969**

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...

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, 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
MISS Beaver Camera Trap Field Report 2022	ed83f5a8-982.pdf
Urban beaver lodge with dock	b7339cf3-3d9.jpe
Beaver project powerpoint presentation, May 2023	b5f978cf-a53.pptx
Slide presented at the Metro Conservation Network mid-year meeting on June 21, 2023	7d7281b0-6ff.pptx
MISS Beaver Camera Trap Report September 2023	628c3fc4-3da.docx
Beaver at lodge on Pike Island, Fort Snelling. Summer 2023	4991bbe2-0ee.docx
Tulip poplar starting to leaf out in February. Photo credit Abby Daniels	9f451dd4-e9f.jpe
Tulip poplar starting to leaf out in February 2024. Photo credit Abby Daniels.	724aaf6b-351.jpe
Beaver project poster presented at the 2024 Midwest Fish and Wildlife Conference	f709b26b-9aa.pdf
MISS Beaver Trap Camera Field Report 2023	d351dbb5-e45.docx
2024 Field Report	419a2993-a62.docx
MPC Fall News Letter	236a95f0-0c1.pdf
Implications for management of floodplain forests in the northern section of the Upper Mississippi River System in the face of a changing climate	a024ab7c-ade.pdf
International Beaver Symposium 2025 ABSTRACT_TIMM_BRIDGETTE	d45244c5-596.pdf
MNRRA Beaver Monitoring Plan 2025	549b3bd1-770.pdf
Understanding North American beaver ecology and herbivory impacts in the Twin Cities' floodplain forest	befe37ae-7f8.pdf
MISS 2024 – BEAVER HERBIVORY - VEGETATION SURVEY PROTOCOL	21cc3ee8-f49.pdf
Herbivory Full data combined 2024_analysis	525adfa1-bf3.xlsx
Nick Parrott MS Thesis Presentation	9bd7114c-ca8.pdf

Savanna Henning, Biological Sciences Technician, National Parks Service, on Beavers and Floodplain Forest Resiliency - Minneapolis Riverfront News - Minneapolis Riverfront Neighborhoods. (millcitytimes.com)	ac08672b-e56.pdf
2023 Biotech Facebook Post, September 2023	17d13fcb-79f.pdf
At St. Paul's Crosby Farm Park, see the future of Minnesota forests, STRIB Aug. 2023	e23cf6bb-3ac.pdf
Beaver-tastic Research in the Mississippi River News, Fall 2023/Winter2024	55f87b86-1f1.pdf

Media Links

Title	Link
Savanna Henning, Biological Sciences Technician, National Parks Service, on Beavers and Floodplain Forest Resiliency - Minneapolis Riverfront News - Minneapolis Riverfront Neighborhoods. (millcitytimes.com)	https://gcc02.safelinks.protection.outlook.com/?url=http%3A%2F%2Fmillcitytimes.com%2Fnews%2Fsavanna-henning-biological-sciences-technician-national-park.html&data=05%7C01%7CNancy_Duncan%40nps.gov%7C4916c0df5c2f4dd6479408dac73772cf%7C0693b5ba4b184d7b9341f32f400a5494%7C0%7C0%7C638041338232469844%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=EC0a348HfI46bUynAPxID0%2FKA9gE4FqMSNh8W76EKDQ%3D&reserved=0

2023 Biotech Facebook Post, September 2023	https://www.facebook.com/100064813595882/posts/pfbid0uWS49QVTD1W1btTWEh1G2u8PDveYevKog4h5HaTWLeb2LUbGmzzEz8PwGpQpiDp7l/?mibextid=Nif5oz
At St. Paul's Crosby Farm Park, see the future of Minnesota forests, STRIB Aug. 2023	https://www.startribune.com/st-paul-crosby-farm-regional-park-see-the-future-of-minnesota-forests-adapt-climate-change/600298134/
Beaver-tastic Research in the Mississippi River News, Fall 2023/Winter2024	https://static1.squarespace.com/static/5ad6b802a9e0287694992efa/t/6515defba192ac07252b45fa/1695932177480/2023-24+Fall+Winter+Newsletter.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 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?

N/A

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

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

Not acknowledged

Work Plan Amendments

Amendment ID	Request Type	Changes made on the following pages	Explanation & justification for Amendment Request (word limit 75)	Date Submitted	Approved	Date of LCCMR Action
1	Project Manager	Previous Manager: Nancy Duncan (nancy_duncan@nps.gov) New Manager: Neil Smarjesse (neil_smarjesse@nps.gov)	Nancy Duncan is retiring at the end of this week.	February 21, 2024	Yes	March 1, 2024

Additional Status Update Reporting

Additional Status Update September 16, 2025

Date Submitted: December 11, 2025

Date Approved: December 12, 2025

Overall Update
Recommended best management practices (BMPs) were successfully developed and incorporated into two documents: 1) a Master's thesis and 2) Beaver Monitoring Plan and map. These documents are included in the attachments and details on how the information gained through this project can promote successful climate-adapted floodplain forest canopy restoration (Outcome 1). BMPs were disseminated to stakeholders and land managers (Outcome 2) at regional scientific and management meetings and during the Master's thesis presentation. Additional dissemination at an international scientific conference is planned for the fall/winter.

Assessments of beaver populations were done for more seasons that anticipated: from 2021 to 2025 we conducted field work to collect the data required to establish a beaver population estimate, including observations via boat or foot, aerial cache surveys, and estimates of family group size by means of remote camera. This successful effort met the project outcome of mapping beaver activity in the Mississippi National River Recreation corridor and directly informs habitat management.

We also completed vegetation assessments of floodplain forest areas at risk of beaver herbivory, with particular attention to cottonwood, a preferred nesting tree for bald eagles. This enabled successful climate-adaptive tree species assessment to meet site-specific management objectives.

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)

Activity 3
This activity was previously marked complete.
(This activity marked as complete as of this status update)

Activity 4
This activity was previously marked complete.
(This activity marked as complete as of this status update)

Dissemination
Dissemination of project results have been successful and are ongoing.

Since our last update, a graduate student successfully defended their Masters thesis (see attached presentation pdf), which included an audience of researchers, local and state partners. National Park Service and Mississippi Park Connection personnel were invited.

An abstract (attached) to present the "Twin Cities Beaver Project: population and distribution in the Mississippi National River and Recreational Area" has been accepted by the 10th International Beaver Symposium. This will be presented by a graduate student, reach an international audience of hundreds of researchers and managers. University of Minnesota is supporting the travel and LCCMR/ENRTF will be fully acknowledged.

This project included work and data collection that are part of doctoral research by Bridgette Timm. Hence, dissemination activities will continue with their graduate work and outputs.

Status Update Reporting

Final Status Update August 14, 2025

Date Submitted: November 18, 2025

Date Approved: November 21, 2025

Overall Update
Recommended best management practices (BMPs) were successfully developed and incorporated into two documents: 1) a Master's thesis and 2) Beaver Monitoring Plan and map. These documents are included in the attachments and details on how the information gained through this project can promote successful climate-adapted floodplain forest canopy restoration (Outcome 1). BMPs were disseminated to stakeholders and land managers (Outcome 2) at regional scientific and management meetings and during the Master's thesis presentation. Additional dissemination at an international scientific conference is planned for the fall/winter.

Assessments of beaver populations were done for more seasons that anticipated: from 2021 to 2025 we conducted field work to collect the data required to establish a beaver population estimate, including observations via boat or foot, aerial cache surveys, and estimates of family group size by means of remote camera. This successful effort met the project outcome of mapping beaver activity in the Mississippi National River Recreation corridor and directly informs habitat management.

We also completed vegetation assessments of floodplain forest areas at risk of beaver herbivory, with particular attention to cottonwood, a preferred nesting tree for bald eagles. This enabled successful climate-adaptive tree species assessment to meet site-specific management objectives.

Activity 1
Beaver populations and lodge locations were successfully documented 2021-2024 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 were completed via foot, watercraft, and/or fixed-wing aircraft. Each active beaver lodge was identified and mapped using real-time GIS software.

Based on the information collected in the annual beaver lodge and cache surveys, we successfully developed 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.

Three outputs have been uploaded related to Activity 1: first, a poster from the Midwest Fish and Wildlife Conference 2023 that presents the mapping results for beaver impact in the river corridor, second a pdf of the draft "Beaver Monitoring Plan for the Mississippi National River and Recreational Area, National Park Service Unit," and a thesis "Implications for management of floodplain forests in the northern section of the Upper Mississippi River System in the face of a changing climate." Collectively they provide the information and describe in greater detail how Activity 1 was successfully achieved.
(This activity marked as complete as of this status update)

Activity 2
The occurrence of beaver and deer herbivory was successfully assessed shoreline and riparian surveys at defined lodge/den locations throughout the corridor. This was done via two approaches: 1) establishment of forest inventory plots to quantify the regeneration, sapling, and overstory stratum to test for differences in common forestry metrics in areas of floodplain forest that were more and less accessible to beaver foraging, and 2) active beaver herbivory was

documented whenever possible during each annual beaver survey and vegetation transects.

Two outputs have been uploaded related to Activity 1: first a pdf of the draft "Beaver Monitoring Plan for the Mississippi National River and Recreational Area, National Park Service Unit," and a thesis "Implications for management of floodplain forests in the northern section of the Upper Mississippi River System in the face of a changing climate." Together, these two documents they provide the information and describe in greater detail how Activity 2 was successfully achieved.

We did not detect any evidence that beaver were negatively impacting cottonwood or having a significant role in limiting recruitment of young trees or growth of mature trees. Future management and monitoring recommendations are detailed in attached documents.
(This activity marked as complete as of this status update)

Activity 3
A Master's thesis (see attachments) was completed that successfully completed Activity 3. Cumulatively, monitoring was successful done for 1,200 saplings planted in 18 1/10th acre plots in Saint Paul in 2020. This effort quantified 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). Results are detailed in the Master's thesis.

Silvicultural responses were examined through the Adaptive Silviculture for Climate Change (ASCC) experiment at Crosby Farm Regional Park in St. Paul, MN. Treatments of various adaptations to future climates were implemented, with over 20 native and near-native species planted across mortality gaps created by emerald ash borer induced mortality. Survival and growth varied by treatment and species; silver maple, sycamore, and river birch showed strong performance across treatments, while southern-adapted species exhibited lower survival. Resprouting individuals, particularly among sycamore and elm, demonstrated substantial growth potential, suggesting an important but variable mechanism of forest recovery. Together, these studies highlight the critical role of both biotic disturbance and proactive management in maintaining and restoring resilient riparian forests in a changing climate.
(This activity marked as complete as of this status update)

Activity 4
An initial set of overarching floodplain forest restoration management recommendations are discussed and detailed in project outputs, namely the attached "Beaver Monitoring Plan for the Mississippi National River and Recreational Area, National Park Service Unit," and the Masters thesis "Implications for management of floodplain forests in the northern section of the Upper Mississippi River System in the face of a changing climate,"

Management practice discussion and recommendations were developed based on extensive literature review looking at how beaver impact a large, controlled urban river system that is losing floodplain forest. Perhaps surprising to some, we did not detect evidence that beaver are negatively impacting floodplain forest dynamics, including survival and recruitment of cottonwood. The lack of cottonwood seedlings across all plots is a particularly notable finding. The complete absence of cottonwood regeneration, despite suitable overstory conditions in some plots, underscores a critical gap in recruitment that may not be recoverable without targeted management intervention. Actively plant or protect cottonwood seedlings in suitable microsites. Monitor beaver populations and their impacts on regeneration patterns. Integrate beaver-induced disturbances into long-term forest management and restoration strategies to support biodiversity and structural heterogeneity.
(This activity marked as complete as of this status update)

Dissemination
Dissemination of project results have been successful and are ongoing.

Since our last update, a graduate student successfully defended their Masters thesis (see attached presentation pdf), which included an audience of researchers, local and state partners. National Park Service and Mississippi Park Connection personnel were invited.

An abstract (attached) to present the "Twin Cities Beaver Project: population and distribution in the Mississippi National River and Recreational Area" has been accepted by the 10th International Beaver Symposium. This will be presented by a graduate student, reach an international audience of hundreds of researchers and managers. University of Minnesota is supporting the travel and LCCMR/ENRTF will be fully acknowledged.

This project included work and data collection that are part of doctoral research by Bridgette Timm. Hence, dissemination activities will continue with their graduate work and outputs.

Additional Status Update Reporting

Additional Status Update April 10, 2025

Date Submitted: April 10, 2025

Date Approved: April 16, 2025

Overall Update

In 2024, vegetation surveys were conducted by NPS MISS biological science technicians at all active beaver lodges to assess what woody species beavers had a preference towards. After vegetation surveys were completed, hair snares were placed at each lodge to collected hair samples for further analysis. Both of these activities were highly successful despite flooding and difficult conditions.

Lodge activity surveys were conducted during spring, and vegetation surveys were heavily delayed due to atypical flooding in July. Much of the work got done in August and September and generally, the collected data is being compiled for analysis by U of MN researchers. Some preliminary data has been analyzed, showing beaver herbivory preference, which is one of our main goals. Hair snare deployment and sample collection was done throughout the fall and in the winter months. We had an extremely high success rate 17/18 deployed snares collected positive beaver hair samples. Really excellent work by our biotechs.

Activity 1

- Cache surveys were conducted Fall 2024

- This completes the cache surveys related to the grant

- Mapping is in progress. A map will be developed for the final grant report.

Activity 2

MIlestone 3 update. Field data was completed during the 2024 field season. Data is currently being analyzed by UMN researchers to determine where cottonwood regeneration is being most severely impacted by beaver herbivory. A map is currently being worked on and on track to be completed by June, project completion date.

Activity 3

Five year data was successfully collected in November 2024. Data was completed by February of 2025. Analysis is continuing on going and Nick Parrot who is the graduate student is working on analysis of data. Preliminary data are highlighting high survival (> 85%) of the resistance and resilience with some species having 100% 5-year survival. In the transition treatment, American sycamore had high survival. There were some impacts of the 2024 summer flood. Additional, data analysis is on-going and Nick Parrot will be defending his thesis during the summer of 2025. These data will be used to make recommendations for activity 3.

Activity 4

The results of our data collection are still be analyzed and progress on developing the BMP's is in flux at this time. UMN researchers are currently comparing cottonwood herbivory data and beaver population trends throughout the 72 mile park to write these BMP's. A draft BMP will be completed by mid-May and reviewed by UMN researchers. BMP's will still be completed by June. Preliminary observation during data collection show a beaver herbivory preference for sandbar willow as preferred forage. European buckthorn was also common throughout our survey efforts, which can severely limit floodplain forest regeneration. We think that as regeneration is being suppressed by invasive plants, and beaver herbivory is occurring on larger diameter cottonwoods, there is a lack of regeneration due to a reduction in reproducing mature trees and areas for regeneration to occur. Sandbar willows appear to compete well with buckthorn and regenerate readily through resprouts, post beaver forage.

Dissemination
Added 2024 Field Report. Added MPC Fall Newsletter.

Additional Status Update Reporting

Additional Status Update March 6, 2025

Date Submitted: April 10, 2025

Date Approved: April 16, 2025

Overall Update
In 2024, vegetation surveys were conducted by NPS MISS biological science technicians at all active beaver lodges to assess what woody species beavers had a preference towards. After vegetation surveys were completed, hair snares were placed at each lodge to collected hair samples for further analysis. Both of these activities were highly successful despite flooding and difficult conditions.

Lodge activity surveys were conducted during spring, and vegetation surveys were heavily delayed due to atypical flooding in July. Much of the work got done in August and September and generally, the collected data is being compiled for analysis by U of MN researchers. Some preliminary data has been analyzed, showing beaver herbivory preference, which is one of our main goals. Hair snare deployment and sample collection was done throughout the fall and in the winter months. We had an extremely high success rate 17/18 deployed snares collected positive beaver hair samples. Really excellent work by our biotechs.

Activity 1

- Cache surveys were conducted Fall 2024
- This completes the cache surveys related to the grant
- Mapping is in progress. A map will be developed for the final grant report.

Activity 2

- Randomly selected sites were checked for beaver activity in spring and early summer 2024
- Herbivory transect surveys were conducted at 22 active lodges
- Data analysis is in progress
- Findings will be provided in the final grant report

Activity 3
Measured weekly phenology including partnering with Mississippi Parks and the National Park Services during flooding to maintain weekly measurements on over 100 tree species to monitor development during the 2024 growing season

End of growing season measurements completed on ASCC plots resulting in 5 years of data since planting

Over 150 plots surveyed during the growing to quantify current floodplain forest composition, structure, and health in relations to beaver lodges

In each plot overstory and regenerating trees were assessed for herbivory.

Understory plant measurements were also made to capture greater understanding of floodplain forest communities

All data has been entered

Undergraduate research student working on data for her honor's thesis (not funded from this project) representing additional learning and training opportunities

Activity 4

- This is a joint effort and is in progress.

- Something will be developed for the final report

Dissemination

Added 2024 Field Report. Added MPC Fall Newsletter.

Status Update Reporting

Status Update March 1, 2025

Date Submitted: April 10, 2025

Date Approved: April 16, 2025

Overall Update
In 2024, vegetation surveys were conducted by NPS MISS biological science technicians at all active beaver lodges to assess what woody species beavers had a preference towards. After vegetation surveys were completed, hair snares were placed at each lodge to collected hair samples for further analysis. Both of these activities were highly successful despite flooding and difficult conditions.

Lodge activity surveys were conducted during spring, and vegetation surveys were heavily delayed due to atypical flooding in July. Much of the work got done in August and September and generally, the collected data is being compiled for analysis by U of MN researchers. Some preliminary data has been analyzed, showing beaver herbivory preference, which is one of our main goals. Hair snare deployment and sample collection was done throughout the fall and in the winter months. We had an extremely high success rate 17/18 deployed snares collected positive beaver hair samples. Really excellent work by our biotechs.

Activity 1

- Cache surveys were conducted Fall 2024
- This completes the cache surveys related to the grant
- Mapping is in progress. A map will be developed for the final grant report.

Activity 2

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- Herbivory transect surveys were conducted at 22 active lodges
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Understory plant measurements were also made to capture greater understanding of floodplain forest communities

All data has been entered

Undergraduate research student working on data for her honor's thesis (not funded from this project) representing additional learning and training opportunities

Activity 4

- This is a joint effort and is in progress.

- Something will be developed for the final report

Dissemination

Added 2024 Field Report

Status Update Reporting

Status Update September 1, 2024

Date Submitted: October 17, 2024

Date Approved: October 23, 2024

Overall Update
2024 over all updates mainly include progress on vegetation surveys. A total of 7 sites have been completed to date with the anticipation of 17 more to be completed by the end of the year. Permitting requirements to access each site was required and has taken time or has limited where surveys can be conducted. Helicopter flights are planned for cache surveys and will occur later in autumn once leaves have fallen.

This summer, with the help of University of Minnesota researchers and monitoring volunteers, we monitored the 1,200 saplings planted in 18 1/10th acre plots in Saint Paul that are a part of the Adaptive Silviculture for Climate Change network. Planted in 2020, our goal is to quantify 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).

Activity 1
1. Identify initial locations of active and inactive beaver colonies 10/31/2022
a. Completed

2. Each summer and fall map lodge/bank den location and digitize impounded areas 10/31/2024
a. On going process but have a database with all lodge locations documented since 2021. Beaver impounded areas are not common in this system and have not been digitized.

3. Annually estimate beaver lodge population and relative food cache density via multiple methods 10/31/2024
a. Beaver Cache data have been collected for 2022, 2023 and is planned for 2024.

4. A beaver monitoring plan will be developed and incorporated into MNRRA Resource Management protocol. 6/30/2025
a. In progress

Activity 2
Assessment of beaver forage activity on tree seedlings, saplings, and overstory. 10/31/2024
o Small scale assessments at the individual active lodge sites are in progress – 7 sites completed with 17 more planned.
o Field work was delayed due to extreme flooding and no access to sites until flood stage lowered. We are on track to complete this task.
Quantification of beaver forage selection and potential impact on cottonwood regeneration. 6/30/2024
o Data collection is in progress.
o Methods were tested in 2023 and required modifications.
o Small scale assessments at the individual active lodge sites are being collected in summer/autumn 2024 and will be analyzed in winter 2024.
Map where herbivory is significantly limiting recruitment and growth of cottonwood trees. 6/30/2025
o Small scale assessments are in progress

Activity 3

Measurements included height, diameter at the base (basal diameter), dbh (diameter at breast height), percent canopy cover, and an overall health rating. Measuring soil moisture will determine how saplings respond to annual flooding. On a subset of saplings (400 saplings), we measured phenology to quantify the timing of growth and development. On a further subset of these saplings (200), we measured photosynthesis to quantify responses to varying light and moisture levels.

We have begun to compile information from the first 3 years of this project into a comprehensive report. The report will include lessons learned and recommendations for climate-adaptive stewardship of floodplain forest, and will be shared widely with land managers throughout the Mississippi National River and Recreation Area and beyond.

Activity 4

During the summer of 2024, graduate student Nick Parrott sampled floodplain forest ecosystems along the Mississippi River to better understand vegetation composition, structure, and the influence of beaver herbivory. Sampling locations focused on areas that were accessible by boat., publicly owned across the MISS, and are located close to a beaver den. The sites were further subdivided into areas that would be accessible by beaver (closer to the river) and areas that are less likely to be accessible by beaver (farther away). This resulted in approximately 15 stands being selected of various sizes with additional plots located within each of the sub-section of stands. Within each plot, data on the overstory (including super canopy trees that could be greater than 100 feet tall and have diameter at breast height (DBH) greater than 30 inches), the midstory, the regenerating layer (seedlings and saplings), and the herbaceous and shrub layer were sampled to get a complete picture of the vegetation. Data has yet to be entered however initial experience during sampled highlighted a range of forest conditions and range of beaver impacts. Data is set to be entered during fall of 2024 with subsequent analysis.

Dissemination

Ten tours for almost 100 people and 13 webinars or presentations were given to over 650 people about the project, all of which recognized the Legislative-Citizen Commission on Minnesota Resources (LCCMR) as a funder. A highlight of the tours was a visit from NPS Director Chuck Sams, who was accompanied by St. Paul Mayor Melvin Carter.

Status Update Reporting

Status Update March 1, 2024

Date Submitted: April 3, 2024

Date Approved: April 10, 2024

Overall Update

We are continuing to work on Outcome 1, making good progress towards our final products. A beaver assessment and data collection with an eye to achieving population estimates was continued this past summer and fall, with lots of camera trap data acquired which is currently being reviewed and analyzed. Plans are in place for another season of data collection looking at beaver activity and potentially geotagging a few to find monitor their movements. That would be an additional monetary match from the National Park Service in the amount of $6100.

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 was developed this past field season and will be implemented Summer/Fall of 2024. Sample transects were developed and methodology tested at the Crosby Farm Regional Park site in preparation for more extensive sampling this coming summer and fall.

A climate-adaptive tree species assessment, tailored to meet site-specific management objectives in the 54,000 acres of MNRRA is ongoing with these trees being tracked in terms of growth, survival and overall health. This long-term study is critical to determine optimal species to plant.

Activity 1

Data collection is ongoing to quantify beaver populations and lodge locations along this stretch of the Upper Mississippi river to better understand relative population densities. Annual beaver lodge and cache surveys were completed via foot, watercraft, and fixed-wing aircraft. Each active beaver lodge is being identified and mapped using real-time GIS software. Video of beaver activity is being reviewed and analyzed to better understand their activities.

Assessing current beaver populations and developing a population monitoring plan are key steps to developing successful floodplain forest restorations. Work is in progress to develop a beaver population and habitat monitoring plan, including methods to map areas where beaver are improving habitat and where they are negatively impacting regeneration of important tree species.

See MISS Beaver Trap Camera Field Report 2023 in Attachments for further detail.

Activity 2

This Activity will be conducted starting this coming field season, 2024. Initial work was done in 2023 to determine optimal transect surveying methodologies which will be implemented this coming summer and fall.

Activity 3

4-year survival, growth and overall health of 18 different tree species in four treatment types was measured and quantified during 2023.
Photosynthetic rates of saplings were also measured throughout the 2023 growing season.

End of growing season measurements were completed and with the warm winter phenology (timing of leaf-out, flowering and leaf fall) measurements have already begun to capture potential impact of seasonality (warming and potential later season freezing) on tree species. See attached photos of Tulip Poplar already starting to leaf out in February 2024 due to the unseasonably warm weather.

Forest land area associated with beaver has been mapped and sampling design is in development. Undergraduate employees have been hired for the summer 2024 season.

Over the past year, we have struggled with CCMI to provide reliable service. They have recently informed us that they will not be able to provide a crew until May at the earliest. Due to this, we are requesting a variance to obtain crew support through another organization. Currently, we are working on an amendment to use a different youth conservation organization such as the Student Conservation Association, as they have a long-standing relationship with Voyageurs National Park and other national parks.

Activity 4
This has not yet started.

Dissemination
Presentations about this work were given at the Midwest Fish and Wildlife Conference in January 2024 (see poster presentation in Attachments), as well as to 40 high school students at Great River School, a public K-12 Montessori school in Saint Paul; at a public Lunch & Learn presentation targeted towards NPS volunteers and staff (30 attended in-person, 14 attended virtually); and as a guest lecture at UNC-Chapel Hill to approximately 60 students enrolled in Introduction to Ecology. These presentations focused more heavily on the beaver portion of this project.

In addition, this work was presented at the 2023 Great Lakes Science for National Parks Symposium, titled "Protecting, Restoring, and Reconnecting for the Next Generation: Addressing Emerging Issues in Great Lakes Parks ", sponsored by Northland College in Ashland, WI in March 2023 as well as at the 2023 Midwest Climate Summit, which took place in February 2023 at Washington University in St. Louis. The presentation title was: Adaptive Silviculture for Climate Change Along Urban Floodplain Forests in Minnesota and was focused most strongly on the restoration piece of this project.

Status Update Reporting

Status Update September 1, 2023

Date Submitted: October 13, 2023

Date Approved: November 17, 2023

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

Following the progress made in 2022, field staff and volunteers have continued to make progress towards meeting project goals. Motion-sensor field cameras have once again been installed at various sites of known beaver activity throughout the park, with a focus on currently active beaver lodges. Transect herbivory studies were also completed to troubleshoot and further develop methodology for quantifying the impacts of beaver herbivory on local tree populations. See "MISS Beaver Camera Trap Report September 2023" in Attachments for additional detail on this year's field work.

Activity 1
We are quantifying beaver populations and lodge locations along this stretch of the Upper Mississippi river to understand relative population densities.
Having analyzed the camera data collected from the 12 macrosites which were selected for study during the 2022 field season, recommendations were made regarding new site selection as well as individual camera placement and angling. After initial deployment, cameras were checked every 1-3 weeks with limited capacity, as well as accessibility and weather condition restrictions, causing variation. Following consultation from the project's connections at the University of Minnesota, cameras will be installed only at beaver lodges and bank dens rather than other known active structures, including dams and feeding trails, to better classify individual beavers to distinct colonies. A focus on wider angle shots to better capture multiple beavers in one scene was prioritized as well. Initial deployments dates ranged from late August – September. Cameras were moved if no beaver activity was observed and new location coordinates were documented. Cameras were retrieved between October and November based on site restrictions.

Activity 2
We are assessing occurrence of beaver and deer herbivory through shoreline and riparian surveys at defined lodge/den locations throughout the corridor.
We are documenting beaver herbivory impacts on cottonwood and other riparian tree species. To determine the impact of beaver herbivory, vegetation surveys are being conducted on the regenerating layer (seedlings and saplings – most vulnerable to herbivory) and the overstory (most important for bald eagle nesting).

During the month of July 2023, NPS staff refined methodology for conducting beaver herbivory transect monitoring that will be implemented fully during the 2024 field season. Alongside researchers from the Silviculture Lab at the University of Minnesota, 3 1000-yard transects were modeled using ArcGIS software which connected Crosby Lake at Crosby Farm Regional Park with the Mississippi River.
Transect paths were found using a GPS device before being measured and marked with flagging tape. Any trees found within 1 meter of either side of the transect path were identified by species, measured for height and DBH, and

examined for herbivory. Herbivory present was classified as either apparent “beaver” or “other.” Herbivory identified as “other” was most typically considered to be deer herbivory. Overstory variable radius plots were also conducted along these paths.

Activity 3
We are monitoring 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.

We are in the middle of monitoring and have successfully monitored and assessed all seedlings for damage and mortality after spring flooding in 2023. Monitoring for phenology has occurred weekly during the growing season of 2023 and will continue through October 2023.

See STRIB article hyperlink in Attachments for additional detail.

Activity 4
This activity will take place towards the end of the project.

Dissemination
Windmuller-Campione, M.A. (2023). Adaptative Silviculture at Crosby Farms. Field Tour and Presentation for National Park Service – May 23, 2023.

Windmuller-Campione (2023). Adaptive Climate Change Management: Opportunities to Experiment and Work Collaboratively Across Disciplines. Within the Special Session on Moving Beyond Recommendations: Collaborative Approaches for Testing Climate Adaptation Strategies in the Field. Ecological Society of American, August 9th, 2023.

See Attachments page for additional dissemination info.

Additional Status Update Reporting

Additional Status Update May 24, 2023

Date Submitted: October 13, 2023

Date Approved: November 17, 2023

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

See "MISS Beaver Camera Trap Report September 2023" in Attachments for detail on this years field work.

Activity 1
See the 2023 Field Report in Attachments for further detail.

Activity 2
See the 2023 Field Report in Attachments for further detail.

Activity 3
We are in the middle of monitoring and have successfully monitored and assessed all seedlings for damage and mortality after spring flooding in 2023. Monitoring for phenology has occurred weekly during the growing season of 2023 and will continue through October 2023.

Activity 4
This activity will take place towards the end of the project.

Dissemination
See Attachments

Status Update Reporting

Status Update March 1, 2023

Date Submitted: March 2, 2023

Date Approved: April 14, 2023

Overall Update
The U of MN and NPS have met several times, generating some good ideas for data collection, and are currently getting organized for the upcoming field season. The PhD student has been completing her coursework and has begun planning for summer field work. NPS is in the process of hiring a biological technician (Masters degree) who will work with the PhD student over the next 9 months getting this project up and running. We are also hiring an intern to help with the vegetation transect and trail camera work. Initial data acquisition started last fall with an aerial cache location flight, field camera deployments at likely beaver locations and plot/tree measurements on the ASCC (Applied Silviculture for Climate Change) research plots located in the floodplain at Crosby Farm Regional Park.

Activity 1
The NPS and UMN deployed field cameras last fall at a variety of beaver sites and acquired a lot of good footage. The data has been initially screened, with more work on sorting and sifting those photos to come. The photos are a key piece of this research, showing beaver presence and activities as well as interactions with other animals around the lodge and den sites. The 2022 biological technician field work report is under Attachments, titled "MISS Beaver Camera Trap Field Report 2022". Last fall, the U of MN flew the portion of the river corridor that is part of this study to acquire pictures and locations of beaver cache sites and to get an idea of what areas of the corridor will be the most productive for this study. That flight yielded good results.

Activity 2
We have been working to determine what sites would be optimal for vegetation transect work this coming summer by locating active beaver den locations. We will be combining that data with our recently updated corridor vegetation map to determine areas most at risk of overstory loss and beaver regeneration impacts. From that information we will design and locate transect survey sites to be initiated this summer, looking at beaver vs deer browse and noting any other relevant information.

Activity 3
1,200 saplings planted in 18 1/10th acre plots in Saint Paul in 2020 were monitored in 2022 and growth/mortality recorded 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 ongoing monitoring will provide critical data on early growth and survival of potential species for restoration within floodplain forest ecosystems. Those sites were monitored and measured by the CCMI youth crew and MPC staff, with coordination by the U of MN, in 2022.

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 4
This work has not yet begun.

Dissemination
We have had one media article on this project, by the Mill City Times, which is under Attachments. The NPS has also done a few social media posts about this beaver work. Dissemination will be ramping up this field season.

Additional Status Update Reporting

Additional Status Update November 15, 2022

Date Submitted: March 2, 2023

Date Approved: April 14, 2023

Overall Update
This project has just begun due to delays getting cooperative and other agreements in place. UMS and NPS have met multiple times and are working together to get some initial camera trap data on corridor beaver.
Work has also happened on the forest climate change plots located in Crosby Farm Regional Park.

Activity 1
Field camera traps have been deployed at a number of locations in the corridor. The NPS biotech and U of MN have been collaborating about this initial piece of the study.

Activity 2
We have been working to locate active beaver dens in the corridor, based on lodge and den mapping work that occurred in 2021.

Activity 3
Measurements and survival on the ASCC plots has occurred and is ongoing.

Activity 4
This has not yet begun.

Dissemination
The NPS has done an initial social media post about this project.