Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-163

Staff Lead: Mike Campana

Date this document submitted to LCCMR: June 10, 2022

Project Title: Land-Use and Climate Impacts on Minnesota's Whitewater River

Project Budget: $199,000

Project Manager Information

Name: Andrew Wickert

Organization: U of MN - St. Anthony Falls Laboratory

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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, 2024

Final Report Due Date: August 14, 2024

Legal Information

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

Appropriation Language: $199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the St. Anthony Falls Laboratory to augment, digitize, and disseminate unique and historic topographical survey data showing changes in the Whitewater River valley to inform future land and water management.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: Augment, digitize and disseminate repeat topographic surveys of the Whitewater River valley since 1939, which provide critical information for sustainable land and water management.

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

Starting in the 1800s, Euro-Americans cleared land and plowed for agriculture, eroding fertile hilltop farmland in SE Minnesota. These eroded sediments filled river valleys, badly damaging their ecosystems and causing entire valley-bottom towns to be buried by sediment and abandoned. This problem prompted the formation of the Soil Conservation Service, forerunner of the NRCS; one of their earliest tasks was a 1939 survey of 72 valley cross sections along the Whitewater River and its forks. This early survey was repeated in 1964, 1994, and 2008; to my knowledge, no such detailed river-valley study exists anywhere else in the world. The cross-sections demonstrate river response to agricultural practices, which control the amount of sediment available to deposit in the valley floor; the construction of Lock & Dam No. 5, which raised the water level at the river's mouth and caused extensive sedimentation as the river rose to meet the new water level; and modern changes in climate and agricultural drainage. However, these unique and phenomenal records are not available to managers, scientists, or the public, and are neither organized nor archived in digital form.

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

We seek to (1) organize, archive, and make available past records of Whitewater-River-valley change; (2) link these cross-sectional surveys with historical airphotos and maps that display river-valley change over time; and (3) augment these surveys with the geometry of the pre-settlement land surface. Towards (1), we will digitally archive all original materials associated with the 1939, 1964, 1994, and 2008 surveys, convert these into a digital (GIS vector) format, and combine these with the new data to be obtained as part of this project; all data will be hosted on UMN servers and explained in a story map. Towards (2), we will use historical maps and overhead photos dating back to the 1850s to record and digitize changes in the river-valley network, river-channel characteristics, vegetation, bluff edges, and wetlands. Towards (3), we will combine ground-penetrating radar surveys with auger borings and sampling for radiocarbon dating to identify, map, and date the buried pre-Euro-American-settlement surface. Upon completion of these three activities, we will present a complete set of geospatial data on the three-dimensional change of the Whitewater River valley in response to Euro-American settlement, changing agricultural practices, dam construction and river-mouth flooding, and ongoing climate and agricultural-drainage changes.

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?

Euro-American modification to the land surface is often cited in terms of environmental policy and water resources, but is rarely quantified. These historical surveys, and our proposed augmentation of these data, will provide a one-of-its-kind data set to evaluate the efficacy of soil-conservation methods, the impacts of climate change, and the effects of lock-and-dam construction on Minnesota's landscape. We hope that scientists and natural-resource managers can study the pace and volume of land-surface and sediment-storage change in the Whitewater River valley to build better decision-making tools for future ecosystem conservation, both within southeastern Minnesota and statewide.

Project Location

What is the best scale for describing where your work will take place?
　　　　Watershed(s): Mississippi River - Winona

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: Organize, archive, and disseminate geospatial data on river-valley change

Activity Budget: $61,000

Activity Description:

Dr. Blumentritt and two undergraduate students from Winona State University will share, organize, and publish all Whitewater Valley survey materials, and will make these easily accessible by building a story map geared towards prospective users and interested community members. These materials include (1) the four historical surveys from 1939–2011 ; (2) our proposed surveys of valley change from airphotos, satellite photos, and historical maps; and (3) our proposed surveys of the pre-Euro-American-settlement surface. We will store these data in 3D GIS vector format and interpolate past valley-floor surfaces to visualize and analyze changes in sediment storage within the valley. Dr. Wickert (UMN) will aid with computational GIS components of this work, as well as with the organization of a well-formatted final data data product. These data will be hosted at UMN, along with a story map, which will provide a friendly and educational introduction to the maps and place them in the context of (1) Euro-American settlement and Indigenous-peoples' displacement; (2) landscape change; (3) soil-conservation efforts; and (4) past and ongoing scientific work to improve monitoring and management of Minnesota's lands and waters. Ms. Holger will share this story map and knowledge with Whitewater State Park visitors.

Activity Milestones:

Description	Approximate Completion Date
Disseminate original scans among team	August 31, 2022
Complete organized and geospatially rectified data sets of historical survey data and make available online	September 30, 2023
Integrate new data (airphoto and pre-settlement surface) into the data repository	April 30, 2024
Digitize past valley-floor surfaces and integrate these into the final repository	May 31, 2024
Generate story map for full data set	June 30, 2024

Activity 2: Map river-valley change using historical maps, airphotos, and satellite photos

Activity Budget: $67,000

Activity Description:

Dr. Larson will supervise one MS student (MSU Mankato) who will compile historical overhead photos and maps of the Whitewater River valley. This student will georeference sets of photos or maps as needed from each time that these have been generated, and combine these into a GIS data set that shows changes in the river valley. The PLSS maps extend back to the 1850s, before significant Euro-American impact on the landscape, and are available from the Minnesota Geospatial Commons. The airphotos date back to the 1950s and are available from the DNR. The student will digitize major features, including the river channel, forests, wetlands, and the transition between river bluffs and the valley bottom. Ms. Holger and Mr. Svien will assist the feature identification with their critical local knowledge about the valley history. These digitized maps, as well as the original photos and scans, will be organized into a geospatial database and delivered to the Winona State team in order for them to incorporate these map-view data with the cross-sectional data into the overall repository.

Activity Milestones:

Description	Approximate Completion Date
Download and georeference maps dating back to the 1850s	May 31, 2023
Download and georeference airphotos from the dating back to the 1950s	May 31, 2023

Download and (if needed) georeference high-quality satellite photos	August 31, 2023
Digitize major geographical features	January 31, 2024
Organize and share all data with the Winona State team	April 30, 2024

Activity 3: Map the elevation of the pre-settlement surface

Activity Budget: $71,000

Activity Description:

Using ground-penetrating radar (GPR), real-time kinematic GNSS (highly accurate GPS), and hand augers, Dr. Wickert (UMN), Dr. Larson (MSU Mankato), and one MS student (UMN) will map the elevation of the buried soil beneath the modern sediments. These sediments accumulated as a result of hilltop erosion during Euro-American settlement as well as floodplain aggradation due to the rising Mississippi River waters following the construction of Lock and Dam No. 5. The 1939 surveys obtained the locations of these soils in hand-augered boreholes at the survey endpoints, which Mr. Svien has located, but lack information on the depth to this soil across the valley profile. We are adding these surveys to the data set because the land-surface elevation prior to Euro-American settlement is an essential initial condition to assess the time series of total change to the Whitewater River valley network since Euro-American arrival. Due to limited information on when this past land surface began to be buried, we will radiocarbon date six samples of vegetation that was buried along with this soil.

Activity Milestones:

Description	Approximate Completion Date
GPR survey the cross sections	October 31, 2023
Ground-truth the GPR data with hand-augered tests	October 31, 2023
Obtain the radiocarbon samples	October 31, 2023
Process the GPR data to generate cross-sectional profiles of the pre-settlement surface	February 28, 2024
Provide the full organized data set to the Winona State group for data-repository integration	April 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Phillip H. Larson	Minnesota State University, Mankato	Ground-penetrating radar; historical mapping	Yes
Dylan Blumentritt	Winona State University	Data digitization, coordination, and dissemination	Yes
Lawrence Svien	Minnesota Board of Water and Soil Resources	Svien located the majority of the original 1939 survey-endpoint monuments in his master's thesis work and over many years before and after. Svien will join us in the field and help us to find these monuments and align our GPR + RTK GNSS transects with them.	No
Sara Holger	Minnesota Department of Natural Resources	Lead Interpretive Naturalist at Whitewater State Park. Holger will help to locate original documents from the 1939 Happ surveys of the Whitewater valley and to disseminate our findings and story map to park visitors.	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. Our dissemination plan comprises three components: (1) accessible and long-term archival data and other associated project outputs, (2) production of a story map for an accessible overview of this work, and (3) direct engagement by Interpretive Ranger Holger.

1. Open publication of all data and other project deliverables via the Digital Repository for the University of Minnesota (DRUM), http://hdl.handle.net/11299/166578. This resource, supported by the University of Minnesota libraries, will provide access to this information in perpetuity. University libraries' curators review all incoming submissions and work with data authors to comply with data sharing requirements in ways that make data FAIR (Findable, Accessible, Interoperable, Reusable). Data files in DRUM are written to an Isilon storage system with two copies, one local to each of the two geographically separated University of Minnesota Data Centers. The local Isilon cluster stores the data in such a way that the data can survive the loss of any two disks or any one node of the cluster. Within two hours of the initial write, data replication to the 2nd Isilon cluster commences. The 2nd cluster employs the same protections as the local cluster, and both verify with a checksum procedure that data has not altered on write. In addition, DRUM provides long-term preservation of digital data files for at least 10 years using services such as migration (limited format types), secure backup, bit-level checksums, and maintains a persistent DOIs for data sets, facilitating data citations. In accordance to DRUM policies, the (deidentified, if applicable) data will be accompanied by the appropriate documentation, metadata, and code to facilitate reuse and provide the potential for interoperability with similar data sets.

2. An explanatory overview of the data, principal findings, and the lessons learned for sustainable management of Minnesota's rivers will be provided via a story map. This story map will provide an accessible introduction to our work and outcomes that is designed to be understandable by stakeholders and community members as well as scientists and decision-makers. It will serve as a partner to the data and materials supplied via DRUM.

3. Direct engagement with the local community, led and enacted by Interpretive Ranger Holger. Ms. Holger will share the findings and their implications, in terms of both the local environment in southeastern Minnesota and the broader reach of these data to help inform river science and sustainable management. She will share our generated story map with Whitewater State Park visitors and serve as a guide through the data collected and knowledge gained. Furthermore, Ranger Holger will continue in her broader work towards engaging the community around Whitewater

State Park, working to grow appreciation of and engagement with the human and environmental history – and future – of the park, the river, and their people and region.

We will acknowledge the Environment and Natural Resources Trust Fund in all presentations, publications, and other media generated from this work. We will use attribution language and/or images as appropriate for the media form. This attribution will be consistent with the ENRTF Acknowledgment Guidelines.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

Following project completion, the full set of historic (original and digitized) and newly acquired data will be available for public download from University of Minnesota servers. In addition, the University of Minnesota will host a story map to describe these data through the multiple lenses of: (1) the history of Euro-American settlement and its impact on the landscape and Indigenous peoples, (2) the soil-conservation movement, (3) climate-change impacts on Minnesota's landscapes, and (4) modern science and its application to natural-resource conservation. No further work will be performed, and no further funds will be required to maintain data and web hosting.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Landslide Susceptibility, Mapping, and Management Tools	M.L. 2017, Chp. 96, Sec. 2, Subd. 03i	$500,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project manager		Coordinate all research teams; support GIS data organization; manage GPR data integration			26.74%	0.06		$10,322
MS Student		Pre-settlement surface mapping and associated data integration			39.8%	1.38		$60,561
IT staff		Web server and data organization and management; data and story map hosting			24.1%	0.16		$9,117
							Sub Total	**$80,000**
Contracts and Services								
Poznan Radiocarbon Laboratory	Professional or Technical Service Contract	Dating the pre-settlement surface (6 samples)				0		$2,000
Minnesota State University, Mankato	Sub award	Dr. Larson will provide the GPR and significant expertise in its use. He and his MS student and lab staff member will map past valley geography using historical maps and overhead photos. They will also collaborate in the field work. Breakdown: Personnel: $65,000 Supplies: $2000 Travel: $1000				1.02		$68,000
Winona State University	Sub award	Dr. Blumentritt and two undergraduates will digitize and organize all project data. This includes the historical surveys as well as the new pre-settlement surface mapping and the historical map and overhead photos. The Winona State team will also assist with the field work. Breakdown: Personnel: $46000 Travel: $1000				1.3		$47,000
							Sub Total	**$117,000**

Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	3 trips to the field, 1 week each, with Wickert and the MS student. This includes $400 (mileage), $600 (food) and $1000 (camping+housing)	Field work: geophysical surveying and ground-truthing					$2,000
							Sub Total	$2,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	$199,000

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
State				
-			**State Sub Total**	-
Non-State				
In-Kind	Unrecovered F&A	Support of SAFL facilities where research will be conducted.	Secured	$63,952
			Non State Sub Total	**$63,952**
			Funds Total	**$63,952**

Attachments

Required Attachments

Visual Component

File: [a7d0e3ab-a4c.pdf](a7d0e3ab-a4c.pdf)

Alternate Text for Visual Component

1. Map of the Whitewater River valley in southeastern Minnesota, showing the impacts of sedimentation and our planned use of historical maps to reconstruct past valley change.
2. Stafford Happ, leader of the original 1939 surveys, demonstrating the depth of burial of the pre-settlement soil surface.
3. Example cross section...

Optional Attachments

Support Letter or Other

Title	File
SPA Letter	[6b7700e7-5d3.doc](6b7700e7-5d3.doc)
Background Check Certification Form	[d244fd49-b74.pdf](d244fd49-b74.pdf)

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

1. Provided the budget breakdown for subcontracts to Minnesota State University, Mankato, and to Winona State University
2. Specified the project location to be in the "Mississippi River - Winona" watershed region
3. Uploaded the background check certification form
4. Described dissemination efforts and ENRTF attribution plan

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?
Yes, I agree to the UMN Policy.

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?
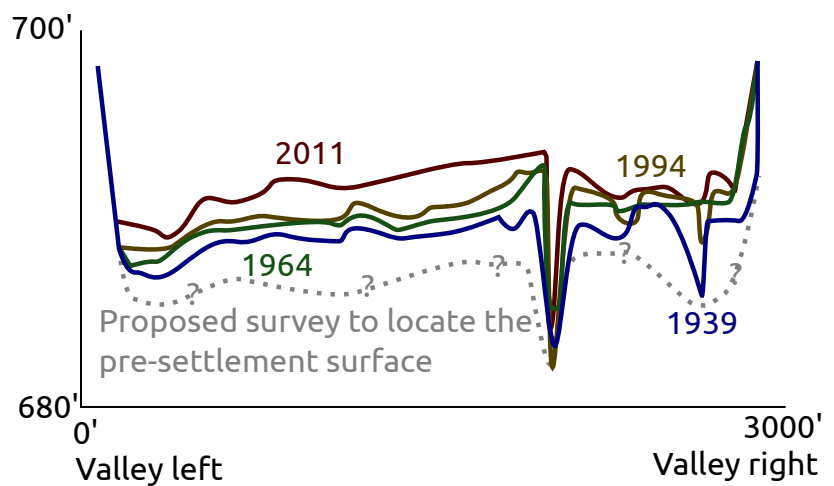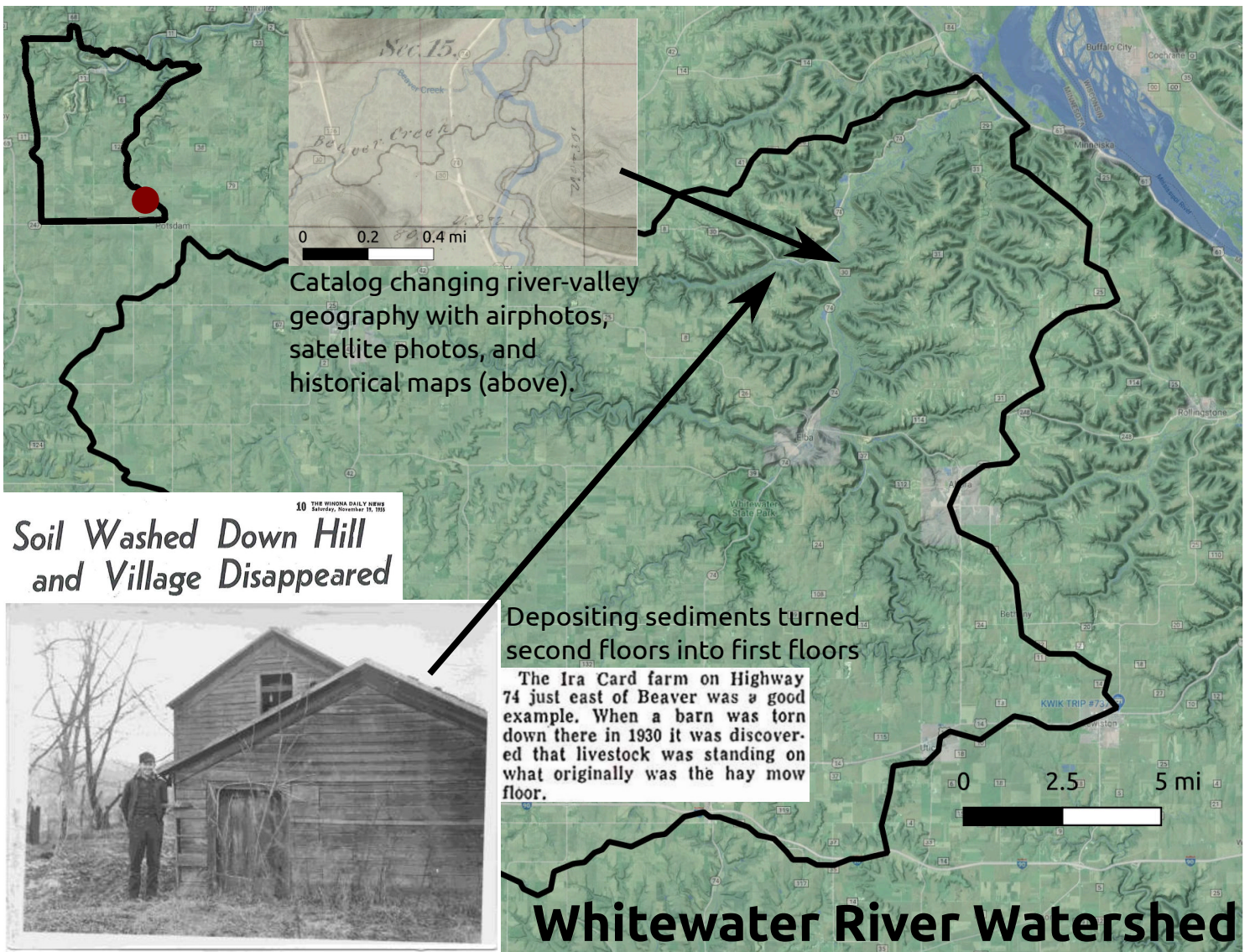N/A

Does your project include original, hypothesis-driven research?
No

Does the organization have a fiscal agent for this project?
No

Catalog changing river-valley geography with airphotos, satellite photos, and historical maps (above).

0   0.2   0.4 mi

Soil Washed Down Hill and Village Disappeared

10 THE WINONA DAILY NEWS
Saturday, November 19, 1955

Depositing sediments turned second floors into first floors

The Ira Card farm on Highway 74 just east of Beaver was a good example. When a barn was torn down there in 1930 it was discovered that livestock was standing on what originally was the hay mow floor.

0   2.5   5 mi

Whitewater River Watershed

Photo: 1940

debris transported from farm fields

~1880(?) soil

By 1940, 2-6' of eroded material covered the Whitewater River valley bottom, burying the pre-settlement soil

700'

2011

1994

1964

Proposed survey to locate the pre-settlement surface

1939

680'

0'
Valley left

3000'
Valley right

72 cross-valley surveys surveys (example above) by Stafford Happ (left) in 1939 were repeated in 1964, 1994, and 2011. These surveys are not available to the public. We will digitally archive these surveys, add map-view data (map inset, above), and use ground-penetrating radar to map the soil indicating the pre-settlement surface. All products will be publicly available online and integrated into an interpretive story map.