



Environment and Natural Resources Trust Fund

M.L. 2024 Final Work Plan

General Information

ID Number: 2024-048

Staff Lead: Noah Fribley

Date this document submitted to LCCMR: July 30, 2024

Project Title: Turtle Island Skywatchers – Minnesota Research and Data Visualization

Project Budget: \$200,000

Project Manager Information

Name: Annette S. Lee

Organization: Native Skywatchers Inc

Office Telephone: (612) 314-9717

Email: nativeskywatchers@gmail.com

Web Address:

Project Reporting

Reporting Schedule: June 1 / December 1 of each year.

Project Completion: June 30, 2026

Final Report Due Date: August 14, 2026

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 03e

Appropriation Language: \$200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Native Skywatchers Inc. to engage youth in environmental stewardship by collecting images and acoustic data from turtles and other culturally significant animals and their habitats, evaluating the differences in these soundscapes across landscapes, and sharing the results through scientific storytelling and online platforms.

Appropriation End Date: June 30, 2027

Narrative

Project Summary: Turtle Island Skywatchers - Innovative Research and Data Visualization project works to protect Minnesota water, wildlife, and natural resources while empowering Indigenous youth as leaders and all citizens as researchers.

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

The Native Skywatchers research and programming initiative has been recording, mapping, and sharing Indigenous sky and earth place-based knowledge for sixteen years. From NASA to Fond du Lac Tribal College to the Minnesota Department of Education, the Native Skywatchers Summer Workshops for Educators, has decades of experience at the forefront of working at the intersection of science, culture, and art for the benefit of all. Native Skywatchers has served over 300,000 people and continues as a leader in Indigenous science methodology and research with long-term broad impacts.

This project, "Turtle Island Skywatchers", is an expanded version of existing successful programming called "We are Stardust" and its related branch, "Ocean Voices-Sea and Stars". Support from the LCCMR trust fund would allow Native Skywatchers to three additional MN-based cohorts of underrepresented students to experience cutting-edge research that gets them out into the Minnesota wild. Youth engage with authentic data and scientific tools. Citizens participate.

Each national park has a unique soundscape, made up of a distinct blend of animals, human, and physical sound sources. Recent investigations have documented that turtles, and many understudied species previously believed to be mute, communicate with diverse sounds which can be used to study their behavior.

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.

Turtles are of great importance to many Indigenous traditions. Recent investigations have documented that turtles & many understudied species previously believed to be mute, communicate with diverse sounds. Paired visual and acoustic recordings are essential data collection methods to document this behavior.

This is a three-fold science research-based project at the intersection of research and community.

- (1) Collect images and acoustic data from turtles and their habitats, analyze the data, and explore research questions.
- (2) Data visualization of Minnesota place-based animals especially related to Indigenous constellations, climate crisis, and environmental stewardship.
- (3) Engage residents of Minnesota in a citizen science research-based call to action. Raw data collected by our team will be streamlined into an easy-to-participate online initiative.

Students will participate in co-learning cohorts that start with a research project and expand into three critical components: science, culture, and art. The deep dive into science will include investigations, data collection, and analysis on endangered species of turtles in Minnesota such as the Blanding's turtle. The science research will include: data acquisition, information management, and analysis. Research, monitoring, and evaluation to increase understanding of terrestrial & aquatic contaminants using MN-DNR LiDar data, etc. is important. Proof of concept work that is urgent & critical.

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?

By connecting Indigenous youth, science research & cultural knowledge, Native Skywatchers works to revitalize our relationships to the ecosystem. This participatory relationship is based on environmental stewardship which is embedded in our Indigenous Knowledge System thinking. Project outcomes are:

- Document acoustic repertoire of turtles

- Characterize patterns in acoustic behavior of turtles and other species
- Evaluate differences in soundscapes and acoustic behavior between urban and protected, wilderness habitats
- Redefine a research group by including professional scientists, Indigenous knowledge holders, students, teachers, and citizen scientists of Minnesota.
- Disseminate results to stakeholders and parties

Project Location

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

Statewide

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: Turtle Research – Environmental Stewardship through Acoustic Data Collection & Analysis

Activity Budget: \$100,000

Activity Description:

Primary Research Objective: Evaluate turtle (and related placed-based culturally significant species like birds, frogs, etc.) acoustic behavior in the context of different human impacts.

Just as Galileo turned his telescope to the heavens, we are turning our ears to Minnesota waterways to use new methods to listen to what lies beneath the surface. The study of sound in nature is inherently interdisciplinary and includes considerations of ecology, physics, climate, and human activity. Our approach will merge ideas to support the exploration of underwater habitats and document sounds that have never been heard by human ears. We will deploy paired autonomous acoustic recorders and motion-activated camera traps in both urban and undisturbed turtle habitats which will record continuously over longer durations (e.g. 1 week - 1 month). Acoustic recorders will be deployed in terrestrial or aquatic habitats and camera traps in terrestrial habitats. Final field site selections will be completed in July 2024, with specific sites chosen based on the presence of species of interest (e.g. protected or culturally significant animals). Data will be used to compare species' presence in different habitats (e.g. urban vs. forested) and to investigate patterns related to daily, lunar, and seasonal cycles.

Activity Milestones:

Description	Approximate Completion Date
Methodology-Working with Dr. Ferrara's published data set of turtle vocalizations; compare with project Blanding turtles	July 31, 2024
Kickoff with Leadership Team – 4-day intensive training and acknowledgements; planning, learn skills, deployment, data collection..	September 30, 2024
Initial Data Collection - Deploy acoustic recorders and camera traps with Native Skywatchers Teen Researchers	September 30, 2024
Continued Data Collection and Planning Meetings for Fall cohorts	September 30, 2024
Dissemination - Compile 'Best of' project assets (audio & visuals) ; use on project website with resources	December 31, 2024
Continued Cohorts - Youth research teams, Peer mentors train new youth researchers, Sustainable model achieved.	July 31, 2025
Dissemination - Compile 'Best of' project assets (audio & visuals) ; use on project website with resources	December 31, 2025
Dissemination - Publication of Ongoing Results	December 31, 2025
Data Analysis - Turtle Island Skywatchers teen researchers analyze acoustic data with active researchers	May 31, 2026
Formative and Summative Evaluation; Reflection and Progress on Outcome Inventory	June 30, 2026
Dissemination - Compile 'Best of' project assets (audio & visuals) ; use on project website with resources	June 30, 2026
Dissemination - Publication of Results - Dec. 2026	June 30, 2026

Activity 2: Scientific Storytelling – Mapping Scientific Data with Cultural Stories that Inspire Stewardship

Activity Budget: \$60,000

Activity Description:

Native Skywatchers has a proven record of leading interdisciplinary co-learning cohorts that bring together science, culture, and art. Our framework is called 'Two-Eyed Seeing'. It means to honor the Western way of knowing with one

eye and Indigenous way of knowing with the other eye but to see with both eyes for the benefit of all" (Marshall 2012). The gift of multiple perspectives is key.

The focus of this Activity is to support a deep dive into scientific storytelling based on existing datasets and maps like USGS Water Quality and MN Pollution Control Agency. Ojibwe and Dakota Star Maps feature native Minnesota wildlife and place-based teachings. Stewardship is embedded. We will create land and water story maps that speak to the paired relationship 'As it is Above, It is Below' or Kapemni (in Dakota). Interconnectedness. For example, Keya is the Turtle constellation in Dakota. We can build a story map connecting the celestial and the terrestrial that asks questions, raises curiosity, and ignites wonder... where are turtles located, what are impacts due to contaminants in water, how might habitat be threatened by climate change. Other culturally relevant animals are wolves, moose, eagles, loons, mountain lions, cranes, bears... Maps come alive!

Activity Milestones:

Description	Approximate Completion Date
Research and Preproduction-Finalize Visual Experience Strategy based on existing Datasets, Maps, Surveys, LiDAR	September 30, 2024
Create Sample Story Maps - Used to share with cohorts. Resource and Model Design Process	December 31, 2024
Create Visuals-Audio: Storyboards & Scripts for Story Mapping Animations, Communicate Science &Awe; use LiDAR data	June 30, 2025
Sound Design & Production Boards: Using in part Field recordings & journals from students, Create Animated Infographic	December 31, 2025
Advanced Compositing & Final Multimedia Product: Final Production of Animation Shorts- Story Maps Statewide Sharing	June 30, 2026

Activity 3: Native Skywatchers Citizen Science - Zooniverse Minnesota - Leaders in Environmental Stewardship

Activity Budget: \$40,000

Activity Description:

The proposed project will deliver cutting-edge, networked technology where Minnesota students, citizen scientists and professional scientists can work together to label acoustic data for direct application to conserve protected species. We will build an online data analysis project called "Turtle Island Researchers" on the Zooniverse platform, where all Minnesotans can learn about and actively participate in this incredible research experience. Short clips of acoustic recordings and photographs will be uploaded into a custom citizen science platform (Zooniverse) so that participants can easily label the species and sounds that were present at the study site. Feedback from the community of users and stakeholders will be used to refine our approach to improve data quality and science learning. Educators from K-12 and informal education institutions will benefit.

We can significantly expand the return on investment for the millions of Minnesota taxpayer dollars spent on natural resource protection by creating a means of public access to scientific data and allowing the public to contribute to science in a valuable way. We will create pathways for collaboration between researchers, citizen scientists, and educators to participate in authentic research will ultimately lead to an improved STEM workforce required across all scientific and technological disciplines.

Activity Milestones:

Description	Approximate Completion Date
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Collect acoustic and photographic data from two sites. (1)Grand Portage- rural; (2) Mississippi River-urban	December 31, 2024
Create acoustic & photographic data workflows on Zooniverse website	January 31, 2025
Internal project review; modify based on reviewer feedback	June 30, 2025
Build and release the Beta version of "Turtle Island Researchers"	December 31, 2025
Formally launch "Turtle Island Researchers" on Zooniverse	June 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Ramona Kitto Stately	We are Still Here Minnesota	Collaborator	Yes
Carmen Gavin Vanegas	Educator - All Nations Program, South High School	Collaborators	Yes
Anna Waugh	Mississippi Park Connection	Collaborator	No
Annette S. Lee	Native Skywatchers Design Studio	Principal Investigator; Project Manager; Data Visualization Lead; Creative Director; Sound Designer; Indigenous Knowledge Holder & Expert; Western and Indigenous Scientist; Award-winning Science Communicator; Award-winning Civic Engagement Leadership	Yes
Gary Casper	Great Lakes Ecological Services; Director of Biodiversity Programs- MEQUON NATURE PRESERVE	Acoustic Field Biologist/Ecologist Research Lead-MN-WI based	Yes
Nancy Nair	South High School	Educator - All Nations Program, ESL Program, Dance Program	Yes
Kelly Carlton	Independent	2d/3d Data Visualization, Motion Design, ESRI ArcGIS, Animation	Yes
Travis Novitsky	Grand Portage State Park; Grand Portage Band of Lake Superior Tribal Nation	Park Manager; Local knowledge expert; Ojibwe cultural knowledge expert; Wildlife photography	Yes
Charles Grolla	Cass Lake Bena Schools	Cultural Knowledge Expert; Educator	Yes
Kassie Benjamin-Flicker	South High School	Teacher, Work Experience Coordinator; Indigenous Knowledge Holder	Yes
Cherie James	Oshki Ogimaag Community School	Teacher at Oshki Ogimaag Community School; Interim Director and Ojibwe Language and Culture Instructor	Yes
Anne Simonis	NOAA	Acoustic Ecology Research Lead	Yes
Angela Osuji	Shakopee Middle School	Science Teacher; 2018-19 Policy Fellow at Humphrey School of Public Affairs; Past-President, Minnesota Science Teachers Association; Chair, Minnesota Professional Educator Licensing, and Standards Board	Yes
Stan Tekila	Independent	Content Knowledge Specialist; Audio and Visual Wildlife Biologist	Yes

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.

Native Skywatchers' Plans for Dissemination are as follows:

- (1) Publication. This will include a wide spectrum of peer-reviewed journals.
- (2) Publication. This will include press (both print and digital) aimed at all audiences.
- (3) Conferences. Academic presentations at state and national conferences. This will include science-based communities, as well as education-based communities. A priority is given to Minnesota-based, K-12, and Indigenous/BIPOC-based conference communities.
- (4) Sharing. The project website will promote participation and awareness globally. Links will be included from and to multiple partner websites. Social media will be utilized when appropriate.
- (5) Relationship. Through our existing and expanding network word of mouth sharing based on trust relationships will go a long way in promoting more inclusive narrative change. Widening participation for underrepresented students and communities is one of our top goals. We believe this is the only sustainable path forward to promote changes in behavior to better protect, conserve, and enhance Minnesota's environment and natural resources.
- (6) Acknowledgement through the use of the trust fund logo and attribution language on project print and electronic media, publications, signage, etc. per the ENTRF Acknowledgement 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?

Results of this work "Turtle Island Skywatchers -MN Research..." will be shared publicly on multiple websites such as NativeSkywatchers.org and our partner organizations, like Voyageurs National Park, Voyageurs Conservancy, and Zooniverse. Minnesota educators statewide will use our visual resources created and have students participate in the Native Skywatchers Citizen Science- Zooniverse Minnesota initiative.

Demand is extraordinary for this work. Additional funding was secured for student participation from the United Way-Career Academies (June 2023-2024). Also, funding from the Heising Simon Foundation supports We are Stardust and similar programming, so there is hope for expansion if this MN-based work is strong.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
							Sub Total	-
Contracts and Services								
Carmen Gavin-Vanegas	Professional or Technical Service Contract	Educator lead - Cohort Lead - Summer Stipend - Biologist; Acoustics expertise				0.4		\$5,000
Travis Novitsky	Professional or Technical Service Contract	Culture & Local knowledge expert; Ojibwe				0.4		\$5,000
Nancy Nair	Professional or Technical Service Contract	Educator lead - Cohort Lead - Summer Stipend				0.4		\$4,000
Charles Grolla	Professional or Technical Service Contract	Indigenous Knowledge Holder collaborator				0.4		\$4,000
Kassie Benjamin-Flicker	Professional or Technical Service Contract	Educator; Indigenous Knowledge Holder collaborator; Summer Stipend				0.4		\$4,000
Teacher-Grand Portage Ojibwe School	Professional or Technical Service Contract	Cohort Lead and Cultural Knowledge; Summer Stipend				0.4		\$4,000
Ramona Kitto Stately	Professional or Technical Service Contract	Content Knowledge Specialist; Indigenous Knowledge				0.4		\$4,000
Angela Osujji	Professional or Technical	Teacher; Educator; Scholar; Science Specialty-Cohort Lead; Summer Stipend				0.4		\$4,000

	Service Contract							
Stan Tekila	Professional or Technical Service Contract	Content Knowledge Specialist; Audio and Visual Wildlife Biologist; Recordings				0.2		\$2,000
Annette S. Lee	Sub award	Principal Investigator; Project Lead				0.18		\$54,000
Anne Simonis	Sub award	Acoustic Ecology Research Lead				0.06		\$27,000
Gary Casper	Sub award	Acoustic Field Biologist/Ecologist Research Lead-MN-WI based				0.1		\$32,000
Kelly Carlton	Sub award	Data Visualizer, Motion Design, Animation, Cinematography, Typography, Branding, ESRI ArcGIS 2D/3D visualization, Visual effects, Teaching experience with youth				0.06		\$18,000
Propel	Professional or Technical Service Contract	Fiscal Agent				-		\$20,000
Leadership team	Professional or Technical Service Contract	Stipends to Leadership team for conference participation				0.02		\$2,000
							Sub Total	\$189,000
Equipment, Tools, and Supplies								
	Equipment	Hydrophone	Collect underwater acoustic data from turtles and other place-based MN animals	X				\$1,109
	Equipment	HydroMoth with IPX7 Waterproof Case	Collect underwater acoustic data from turtles and other place-based MN animals	X				\$600
	Equipment	Ambient Recorder - SM Mini 2	Soundscape recorder	X				\$1,725
	Equipment	Recorder - AudioMoth	AudioMoth, a low-cost, open-source acoustic monitoring device; Soundscape recordings	X				\$200
	Equipment	Temperature logger	HOBO Pendant MX Water Temp Data Logger					\$300

	Equipment	Temperature logger	HOBO Pendant MX Temp/Light Data Logger					\$356
	Tools and Supplies	SD cards -6	storage of audio recordings					\$160
	Tools and Supplies	locks -5	security; this item is justified and directly related to project's primary goal					\$25
	Tools and Supplies	memory	2TB SSD portable drives					\$525
	Equipment	Visual Recording Gear - Hero 12 (2)	Collect visual data (underwater & terrestrial)	X				\$1,020
	Equipment	Ds4K Trail Camera (2)	Collect visual data (underwater & terrestrial)	X				\$552
	Tools and Supplies	Memory cards (2)	Memory card for visual recording					\$53
	Tools and Supplies	Sketchbooks (20)	Field recording on site; sketching					\$120
	Tools and Supplies	Pencil sets (10)	Field recording on site; sketching					\$105
							Sub Total	\$6,850
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Cohorts travel to Research Sites, 3 cohorts per year	Travel stipends for schools					\$2,500
	Miles/ Meals/ Lodging	Lodging/Facility - for Kick off Fall 2024- GP	Lodging at Grand Portage; Hollow Rock; shared facility 2 days.					\$750
	Miles/ Meals/ Lodging	Lodging/Facility - for Kick off Fall 2024- Mpls	Facility at Ordway, Mpls. shared facility 2 days					\$750
							Sub Total	\$4,000

Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Printing	Printing/Copying	Contract administration, work products production, and semi-annual reports; Still images of Data visualization, maps, visual graphics					\$150
							Sub Total	\$150
Other Expenses								
							Sub Total	-
							Grand Total	\$200,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Equipment, Tools, and Supplies		Hydrophone	A5 Hydrophone, weight, cable, adapter; Aquarian Hydrophone; https://www.aquarianaudio.com/ ; this item is justified and directly related to project's primary goal
Equipment, Tools, and Supplies		HydroMoth with IPX7 Waterproof Case	AudioMoth is a low-cost, open-source acoustic monitoring device used for monitoring wildlife. AudioMoth is not only sensitive to audible sounds but well into ultrasonic frequency range. It records uncompressed audio from 8000 up to 384,000 samples per second onto micro SD card; this item is justified and directly related to project's primary goal
Equipment, Tools, and Supplies		Ambient Recorder - SM Mini 2	The recorder supports the following sample rates in samples per second on one or two channels: 8000, 12000, 16000, 22050, 24000, 32000, 44100, 48000, 96000; this item is justified and directly related to project's primary goal
Equipment, Tools, and Supplies		Recorder - AudioMoth	AudioMoth, a low-cost, open-source acoustic monitoring device which has been used in multiple applications, including automating the search for an elusive insect species, monitoring poaching by gunshot and listening for ultrasonic bat calls; this item is justified and directly related to project's primary goal
Equipment, Tools, and Supplies		Visual Recording Gear - Hero 12 (2)	Collect visual data (underwater & terrestrial) from turtles and other place-based MN animals; this item is justified and directly related to project's primary goal
Equipment, Tools, and Supplies		Ds4K Trail Camera (2)	Collect visual data (underwater & terrestrial); Visual inspection of audio recording source; this item is justified and directly related to project's primary goal

Non ENRTF Funds

Category	Specific Source	Use	Status	\$ Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [a87bd7e5-799.pdf](#)

Alternate Text for Visual Component

Visual examples-Native Skywatchers' & Collaborators' existing work CW from Top Left (1) Research A. Simonis; (2) G. Geller Youtube Turtle Sounds; (3) Native Skywatchers collaboration with Voyageurs National Park 2023; (4) Ojibwe & Dakota Star Maps featuring native constellations/MN wildlife 2012; (5) Map Art A.Lee 2021; (6)Research Geller&Casper...

Financial Capacity

File: [40c55d70-5f2.pdf](#)

Board Resolution or Letter

Title	File
Native Skywatchers Board Approved Resolution 3-28-23	9e59f91e-ea5.pdf

Supplemental Attachments

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

Title	File
Native Skywatchers Inc. - Financial Capacity - 2022 Financial Statement	6dc83aa4-d3d.pdf
Letter of Support - Educator - Angela Osuji	ccf1b26f-34f.pdf
Letter of Support - Educator - Carmen Gavin Vanegas	ec74b2e6-4af.pdf
Letter of Support - Mississippi Park Connection - Anna Waugh, Director	91149952-bda.pdf
Letter of Support - Bell Museum - Natalie Kennedy, Director of Statewide Engagement	1ffbec4-e26.pdf
Letter of Support - Researcher Anne Simonis	3b8722cf-18c.pdf
Combined CV Binder of Senior Personnel	89af774c-16f.pdf
Final Research Addendum	66c480b4-679.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Turtle recordings methodology updated; LiDAR data updated. Fiscal Sponsor added.

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 Commissioner's Plan.

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

Yes

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

Yes

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

No

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Propel

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No