Environment and Natural Resources Trust Fund
2018 Request for Proposals (RFP)

Project Title: **ENRTF ID: 100-C**

Providing Enduring Ecology Experiences for all Minnesota Middle-Schoolers

Category: C. Environmental Education

Total Project Budget: $ 308,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2018 to June 2021

Summary:

Cedar Creek will use local scientific data in a freely-available, interactive web-based learning application and virtual field trip to teach ecology and environmental awareness to Minnesotas 200,000 middle school students.

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Sponsoring Organization: U of MN - Cedar Creek Ecosystem Science Reserve

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Visual mock-ups of BigBio virtual lab and companion activity for teachers

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____%

PROJECT TITLE: Providing enduring ecology experiences for all Minnesota middle-schoolers

I. PROJECT STATEMENT

Cedar Creek Ecosystem Science Reserve (henceforth, Cedar Creek) is a world-renowned scientific field station whose 75 years of research have changed the way we look at the natural world. Cedar Creek hosts approximately 5000 local students annually on field trips, but has the potential to impact hundreds of thousands more through innovative approaches that provide access and enhanced educational resources to classrooms statewide. Current demands on our public education system make it difficult for schools – particularly ones with limited funding or that are geographically isolated – to give their students experiences that bring science, data and the natural world to life. Yet, these experiences are key to developing a citizenry that values and understands the world they live in. Our goal is to connect Minnesota's 200,000 middle-school students to the natural world, to immerse them in Cedar Creek's scientific research, and to promote the actions they can take to cultivate a sustainable lifestyle in a biodiverse environment. We will partner with Andamio Games, a nationally-recognized, Minnesota-based leader in educational, science-focused game design, to develop a learning experience that enhances and expands our field trips. Cedar Creek has extensive data and tested educational materials, and Andamio has the expertise and resources to transform them into an engaging, effective learning application with the power to change how Minnesotan youth interact with the natural world. This application will be free and highly interactive, and will:

1. Provide Minnesota science teachers with standards-based activities that extend, reinforce and promote the learning their students do on field trips to Cedar Creek and serve as engaging lessons for remote classrooms.
2. Present a narrated tour of the Cedar Bog Lake Trail, either as a stand-alone ecological investigation into Minnesota's biomes or as a resource to introduce and support the experience of visiting field trip classes.
3. Recreate field station experimentation in a virtual workspace where students imagine, design and conduct their own ecological experiments using real data collected in ongoing long-term experiments at Cedar Creek.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Educational Resource Library for Field Trips and Remote Classrooms **Budget: $81,000**

Cedar Creek has an extensive set of activities used to teach about biodiversity, water quality, human impacts and other topics onsite. Initially, we will restructure five of these into learning resources that not only meet state science standards but also directly prepare students for and reinforce the hands-on activities done on in-person field trips. These resources will form the backbone of a digital library of education materials that will be expanded over time and made available to teachers across the state. At the heart of this library will be Cedar Creek data and results (updated annually). Classes will be encouraged and supported to work with local scientific data, presented in a form that is interactive, accessible and engaging for middle-school students. After the proposed funding period is completed, Cedar Creek staff will continue to grow the library with activities from our field station, as well as provide opportunities for other environmental organizations to contribute resources. Success will be evaluated through teacher dialogue at Cedar Creek, and teacher and student surveys (in-person and online).

Outcome	Completion Date
1. Adapt 5 existing lessons into companion resources for field trip students and standards-based activities for classrooms statewide	*March 2019*
2. Create publicly-accessible digital library on Cedar Creek website	*April 2019*
3. Evaluate activities via online and in-person feedback from teachers and students	*June 2020*

Activity 2: Guided Companion Tour of Minnesota's Three Biomes **Budget: $77,000**

Many urban students have their first experience "in the woods" when their class comes on a field trip to Cedar Creek. For some, going this far out of their comfort zone can be a frightening or stressful experience. Previous students have suggested that an effective way to improve learning outcomes would be to share a video tour of Cedar Creek's natural areas before field trips. That way, students know what to expect before they arrive and can

focus on learning rather than being worried about what they will experience. We will incorporate narration with professional video and aerial drone footage to produce a guided tour that introduces the educational focal points of the Cedar Bog Lake Trail, the cornerstone experience of field trips to Cedar Creek. The trail will be filmed in all four seasons and the video will be integrated into the digital library. It will include embedded quiz questions to reinforce ecological concepts and encourage additional exploration. These tours can be shown in classrooms before a field trip to alleviate anxieties and build excitement, viewed after field trips to explore seasonal changes, reinforce concepts, and build a sense of place, and be used to encourage return visits. Success will be evaluated through usage numbers and locations, quiz answers submitted by students, and follow-up surveys with teachers.

Outcome	Completion Date
1. Film Cedar Bog Lake trail using both aerial drone and hand-held video	*January 2020*
2. Develop interactive field trip experience and add to Cedar Creek website	*August 2020*
3. Evaluate use and utility through use metrics, and teacher and student feedback	*June 2021*

Activity 3: Virtual Environmental Field Station Exploration **Budget: $150,000**

High-quality research, particularly data modeling and interpretation, is at the heart of Cedar Creek's mission. Several experiments have been running continuously for decades and are popular destinations for visiting field trip groups, including "Big Biodiversity" which explores the importance of biodiversity in plant communities. We will build a virtual, scenario-based field station where students design and perform their own ecological experiments using data pulled from the real Big Biodiversity experiment. Students will be able to change variables like rainfall, temperature and nutrient levels, and investigate their impact in virtual "plots" containing different combinations (biodiversity levels) of plant species. A key component of the virtual experience will challenge students to identify an activity they can do in their community to promote environmental stewardship as a result of their experimental findings. These student actions will be stored without identifying information in a section of the digital library for other students and the public to access. Ultimately, we plan to expand the virtual field station platform to promote investigation of additional long-term experiments and data from Cedar Creek.

Outcome	*Completion Date*
1. Convert existing Cedar Creek data into middle-school accessible formats	*January 2019*
2. Create virtual field station and add to Cedar Creek website for free student access	*June 2020*
3. Evaluate impact and engagement through use metrics and teacher and student feedback	*June 2021*

III. PROJECT STRATEGY

A. Project Team/Partners

Dr. Caitlin Barale Potter (Education and Outreach Coordinator, Cedar Creek), Project Manager; Lead for Activity 1
Adam Gordon (President, Andamio Games), Lead for Activity 3; Co-Lead for Activity 2
Dr. Katrina Schleisman (Instructional Designer, Andamio Games), Instructional Lead for entire project
Ryan Brown (Brown & Company Video Production), Collaborator, Co-Lead for Activity 2

B. Project Impact and Long-Term Strategy

This project will transform Cedar Creek's existing field trip programming into a meaningful, interactive experience that will reach hundreds of thousands of middle-school students across the state. From an initial digital library of of five activities and one simulation experiment, we will grow our educational resources into a comprehensive library that classrooms can use to access, explore and engage with cutting-edge science. The application and resource library will remain freely available and will be regularly updated with data, activities and information.

C. Timeline Requirements

Three years of support are needed to develop and construct the materials outlined in this proposal, and to promote and evaluate the educational products.

2018 Detailed Project Budget

Project Title: *Providing enduring ecology experiences for all Minnesota middle-schoolers*

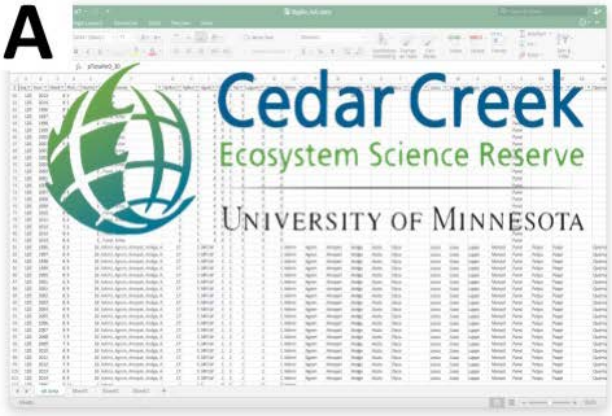
IV. TOTAL ENRTF REQUEST BUDGET, 3 years

BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**AMOUNT**
Personnel: Temporary and Casual: two temp/casual employees at Cedar Creek ESR for ~14 hrs/week: one for 2 years (2018-2020) to assist with curriculum conversion (Activity 1), virtual field trip narration and development (Activity 2), and data processing for virtual field station (Activity 3), and one for 3 years (2018-2021) to additionally assist with promotion and evaluation of final products to MN teachers. (92% salary, 8% benefits)	$63,000
Professional/Technical/Service Contracts: Andamio Games: Digital learning game design and software engineering company. Will develop educational app platform for companion lessons (Activity 1 - $30,000) and virtual field trip (Activity 2 - $15,000) and student data and conservation actions (all Activities). Will develop virtual field station and accompanying collaborative activities (Activity 3 - $150,000). **Total: $195,000** Brown & Company: Video production and editing for virtual field trip (Activity 2). **Total: $50,000**	$245,000
Equipment/Tools/Supplies: *N/A*	N/A
Acquisition (Fee Title or Permanent Easements): *N/A*	N/A
Travel: *N/A*	N/A
Additional Budget Items: N/A	N/A
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$308,000

V. OTHER FUNDS *(This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)*

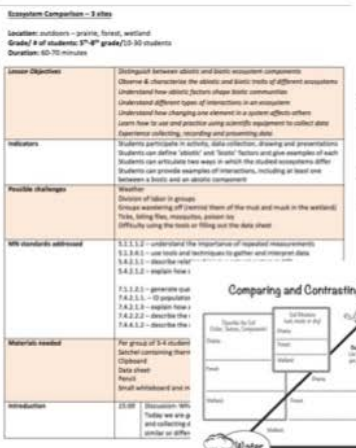
SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period: Andamio Games' ongoing Phase II National Science Foundation award (#1660091) is developing the simulator-based virtual lab and associated teacher tools that will be adapted for use in Activities 1 & 3, lowering the risk and improving the quality of this LCCMR project.	$ 728,000	*Secured*
Other State $ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: University of Minnesota: Indirect costs associated with this proposal	$ 101,000	*Secured*
In-kind Services To Be Applied To Project During Project Period: At the conclusion of the project, Andamio Games will provide a perpetual license to CCESR for Andamio Games' FORGE development platform that will enable CCESR to self-maintain the learning applications designed and delivered for the project. Updates to FORGE and support documentation will be included.	$30,000	*Secured*
Past and Current ENRTF Appropriation: *N/A*	N/A	
Other Funding History: *N/A*	N/A	

A

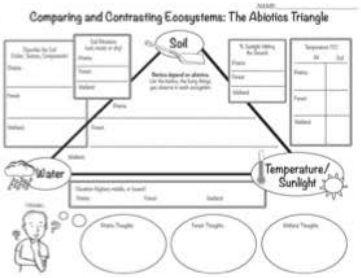


1. Restructure Cedar Creek data and activities into middle-school level resources.

B



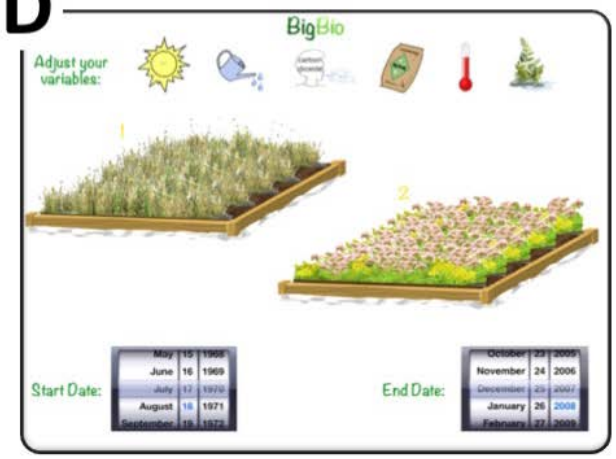
2. Create digital library of free, standards-based activities.



C

3. Produce narrated tour of Cedar Bog Lake trail in all four seasons, for use as a stand-alone ecology investigation or as a resource to support field trip experiences.

D



4. Create virtual field station for students to conduct their own simulation experiments using data from Cedar Creek's long-term research experiments.

Figure legend: (A) A sample of one of Cedar Creek's long-term datasets – not quite middle-school friendly yet! (B) Example of standards-based lesson plan (for teachers) and worksheet (for students) which will be part of the digital library. (C) Schematic of Cedar Bog Lake trail and images of Cedar Bog Lake in different seasons (photo credits: Jacob Miller, Caitlin Potter). (D) Andamio's mock-up of "Big Biodiversity" virtual field station interface designed for independent student learning.

Project Manager Qualifications:
Dr. Caitlin Barale Potter is the education and outreach coordinator at Cedar Creek. Her background is in scientific research and field ecology, and she has been involved in science education and outreach since age 12. She develops and directs Cedar Creek's education programs, including on-site field trips, in-school programming, educator professional development workshops and science communication courses. She also leads several citizen science research projects at Cedar Creek and is experienced at connecting non-scientists and budding scientists to data and field research. Her role on the proposed project will be to manage all three activities, with a special focus on adapting existing Cedar Creek lessons and data, promoting the web application and digital library to teachers, and evaluating use of the products generated by this project.

Adam Gordon, who will oversee the technical team developing the learning app and virtual field station, is the President of Andamio Games. He has been involved with the research, development and commercialization of educational technology since 2001, and is currently the Principal Investigator for a 2-year National Science Foundation funded project to develop a virtual lab game that teaches high school level photosynthesis and cell respiration.

Organization Descriptions:
Cedar Creek Ecosystem Science Reserve: Cedar Creek is a University of Minnesota field research station known world-wide for its contributions to modern ecology, biodiversity research, and the long-term consequences of human-driven environmental change. Its property contains natural habitats representing all three of Minnesota's biomes. These two facets make it an ideal location for Minnesotan students of all ages to study and explore the world around them. Through our K-12 education programs, approximately 5000 students interact with Cedar Creek scientists, research and facilities annually to learn ecology through hands-on field investigations. Additionally, we hold regular educator professional development workshops to help teachers bring our science to life in their classrooms. Our overarching goal is to be an inspiring catalyst and outstanding resource for lifelong science education in Minnesota, and to help our community better understand scientific principles, processes and concepts.

Andamio Games: Andamio Games is a Minneapolis company that develops mobile games that help middle- and high school students engage with and master hard-to-grasp science concepts. It was spun-off in 2014 by Adventium Labs, a nationally recognized Minneapolis-based research and development company, to commercialize the results of two NIH Small Business Innovation Research (SBIR) awards. Their team of research scientists, instructional designers, and education experts make learning games that are a combination of scaffolded lessons, interactive labs, and a patented method of collaborative problem solving.