



# Environment and Natural Resources Trust Fund

2022 Request for Proposal

## General Information

**Proposal ID:** 2022-084

**Proposal Title:** Sparking Curiosity Through Hands-on Environmental Education in Minnesota

## Project Manager Information

**Name:** Seth Thompson

**Organization:** U of MN - College of Biological Sciences

**Office Telephone:** (605) 431-7747

**Email:** thom2587@umn.edu

## Project Basic Information

**Project Summary:** We will provide teacher professional development, inquiry-based classroom activities, and sustained mentorship to deliver high quality environmental education to high school students in both the Twin Cities and Greater Minnesota.

**Funds Requested:** \$298,000

**Proposed Project Completion:** June 30 2025

**LCCMR Funding Category:** Environmental Education (C)

## 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

## Narrative

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

Many of the Minnesota's most pressing issues have an environmental basis, from the rapidly changing climate to sustaining clean water and agricultural production. Understanding our planetary system is crucial for maintaining human health and achieving a future of sustainable development. Training a diverse pool of highly skilled individuals in environmental science is imperative for tackling these complex problems in MN and beyond. Yet, entry points into an environmental science career path are not always transparent and this can be an extraordinary barrier for students without consistent exposure to STEM career pathways. This is particularly true for students that identify as first generation college students, where navigating the nuances of higher education is already a challenge. In this proposal, we aim to deliver an innovative program that integrates teacher professional development, student-driven research experiences, and career exploration opportunities to raise awareness of pathways into environmental careers for first generation college students. Our program will be structured to achieve two specific outcomes : 1) to increase awareness of possible environmental careers for potential first generation college students and 2) to promote increased interest in environmental careers by providing authentic science experiences in aquatic ecology for students and teachers.

### **What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.**

In this program, we offer authentic environmental science education to MN high school students by developing strong teacher-scientist partnerships. We will recruit teacher partners from both the Twin Cities and Greater Minnesota (with particular emphasis on communities with high potential for first generational college students) to create a learning ecosystem of world-class content experts, high school educators, and environmental professionals. This environmental education network will increase students skills, knowledge, and awareness of environmental career pathways and water conservation science. We propose a multifaceted approach combining teacher professional development, sustained student mentorship, and career exploration programs that will support a dozen teachers and over a thousand Minnesota students over the course of the project. Our teacher professional development will provide training in relevant environmental research practices (including field sampling and data analysis) that they can bring back to their classroom. Additionally, each participating teacher will be given an activity that will allow them to integrate a guided research experience focused on water quality into their classroom activities. We will support these activities with a mobile lab. By integrating these existing activities into the classroom curriculum, each participating teacher will provide authentic science education for hundreds of students annually.

### **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?**

This project will result in hands-on, outdoor education for over a thousand Minnesota High School student. Our mobile laboratory will allows us to bring this authentic science programming to rural communities that have traditionally been excluded from these types of partnerships with the University of Minnesota because of their geographic distance from the Twin Cities campus. These experiences and access to world-class scientific resources (both material and human) will promote enhanced knowledge and skills for protecting Minnesota's water. Additionally, our teacher programming will create a cohort of strong scientific mentors that will enhance our impact for years to come.

## Activities and Milestones

### Activity 1: Teacher Professional Development

**Activity Budget:** \$100,000

**Activity Description:**

Teachers will participate in short (2-3 day) field experiences with Co-PI Hamilton’s group to gain hands-on experience in biogeochemical research. These experiences will include both field and laboratory work and take place at the teachers school site, to provide an experience directly translatable to the school year. Following these “crash courses” participating teacher partners will be provided with an inquiry-based activity (and supplies) to implement with their students. In these activities students will measure various water quality parameters (oxygen, algal biomass, nutrients, water clarity) on a local system. Data will be made available through an online portal that will connect the classrooms participating across the state. In this fashion, we will create a grassroots network of teachers/students engaging in community science in MN throughout the year. During this time, teachers will learn about state-of-the art research, receive training in up-to-date laboratory methods and approaches, and work alongside professional researchers.

**Activity Milestones:**

Description	Completion Date
Recruit first cohort of teacher participants	June 30 2023
Revise teacher professional development experience from teacher feedback	January 31 2024
Recruit final cohort of teacher participants	June 30 2025

### Activity 2: Classroom Activities with Sustained Mentorship

**Activity Budget:** \$175,000

**Activity Description:**

After participating in the summer crash courses, teachers will be provided an inquiry-based curriculum to implement with their students. Students complete a guided experience by performing basic monitoring on a water body near their school (temperature, pH, oxygen, carbon, nitrogen, etc) and collecting basic data on vegetation and invertebrate community composition. Student generated data will be made publicly available through an online portal to build a network of high school students that are engaging in our program and promote data sharing among participants. Students will be able to leverage this network to analyze how changing ecosystems may impact organisms and compare their water quality measurements from their own lake to other systems in Minnesota. In addition to the classroom activities described above, members of Co-PI Hamilton’s lab will mentor extracurricular research experiences for students that wish to engage with our material beyond the classroom. After completing the guided inquiry classroom activity, we will work with teachers to identify a subset of students that are interesting in committing to an extracurricular research experience over the remainder of the school year. These students will be assigned a mentor from Hamilton’s lab and develop and complete their research project.

**Activity Milestones:**

Description	Completion Date
Create mobile laboratory to support classroom activities	January 31 2023
Deliver classroom activities to 1200 high school students	June 30 2025
Support extracurricular research experiences for 60 Minnesota high school students	June 30 2025

### Activity 3: Career Exploration

**Activity Budget:** \$23,000

**Activity Description:**

Beyond connecting students with a mentor from Co-PI Hamilton’s lab, we will host quarterly career panel discussions with environmental professionals across academia and industry. We will host these panels digitally to increase access for participations for all of our program patterns. Additionally, we can record these career panels and make them broadly available to our networks and through our online portal so that participants that are unable to join in real-time can still view the panels at their convenience. These discussions will introduce students to the many environmental career opportunities and will focus on career journeys and emphasize the steps taken to obtain an environmental career. For each career panel, we will identify a new focus theme (for example, water resource management, aquatic science research, environmental education etc) so that participants can gain understanding of the full breadth of potential careers. We will leverage our personal networks to recruit professionals to participate in these digital career panels. Finally, students from the participating classrooms will be invited to a Summer Expo hosted on the UMN campus. During this time, students will disseminate the results of their extended research projects and connect with other program participants and environmental science professionals.

**Activity Milestones:**

Description	Completion Date
Recruit potential career panel participants	December 31 2022
Launch quarterly career exploration seminar series	January 31 2023
Host annual summer symposium for participants to share their research experiences and network with professionals	June 30 2025

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Trinity Hamilton	University of Minnesota	Co-PI	Yes
Hailey Sauer	University of Minnesota	Graduate Research Assistant	No

## 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 be funded?**

We have structured our program to maximize sustainability even after the granting period ends. For example, we will provide classroom sets of materials for the inquiry activity for each teacher participant so they can continue to run their activities even after the granting period has ended. Additionally, while in person support for classroom work is preferable, we will offer continued support in the future through digital classroom visits and virtual support for future iterations of the classroom activities. We will also be able to maintain key aspects of the sustained mentorship post grant through strategic collegiate investments.

## Project Manager and Organization Qualifications

**Project Manager Name:** Seth Thompson

**Job Title:** Director of Outreach

**Provide description of the project manager's qualifications to manage the proposed project.**

Seth K. Thompson is the Director of Outreach for the College of Biological Sciences at the University of Minnesota and Co-Director of the College's Impact Exchange. He brings over a decade of experience in implementing public engagement and outreach programs to our team. Currently, he oversees the College's outreach programs, including the InSciEd Out Program Twin Cities hub, Market Science, and the SciSpark Scholars mentorship program. He has worked with the InSciEd Out program for over 5 years, developing programming from the ground up that now serve over 3,000 students annually in the Twin Cities with a focus on communities underrepresented in science. He has extensive experience working with K-12 teachers, having provided professional development programming for over 75 teacher partners and maintains strong connections with K-12 teachers and administrators across the Twin Cities. Under his leadership, the Market Science program hosted over 60 community events last year resulting in over 9,000 interactions with Minnesotans. Additionally, he has expertise in STEM education research and multiple publications relating to inquiry-based science education and STEM equity. He has mentored over 20 undergraduate researchers and several graduate students. His role in the proposed project is to oversee all programming by working with potential district partners, recruiting new teacher partners, supervising student staff (both graduate and undergraduate) and managing the budget and administrative tasks of the proposed project. Details on his current projects and a list of publications can be found on his website (<http://thom2587.wixsite.com/sciencewithimpact>).

**Organization:** U of MN - College of Biological Sciences

**Organization Description:**

The College of Biological Sciences encompasses the full breadth and depth of biology with departments and graduate programs spanning the discipline. In 2019, CBS enrolled 2,235 undergraduates and 279 graduate students and had 152 faculty. CBS research and programming were supported by over 2,000 active grants totaling over \$28 million in external funding, including awards from the National Institutes of Health, the National Science Foundation, and the U.S.

Department of Agriculture, among others.

Earlier this year, the College launched the Impact Exchange to provide centralized support and vision for the College's outreach programs and foster a more holistic approach to community engagement. The Impact Exchange will serve as a multidisciplinary hub for innovation and training, leveraging the talents found across the University of Minnesota system to bring together experts in communication, design, and science to offer innovative training in science communication for members of the University of Minnesota community that will further support the community engagement and outreach mission. This newly formed "engagement ecosystem" provides the College with a centralized effort to connect with the broader community through public events and community-embedded programs.

## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
Graduate student (Academic)		Graduate Student (academic year), Hailey Sauer: 25% academic support for all project periods. Sauer will collaborate with the Co-PIs to serve as a liaison between the Hamilton lab and the teacher partners during their classroom activities			50.2%	0.75		\$62,000
Graduate student (Summer)		Graduate Student (summer), Hailey Sauer: 50% summer support for all project periods. Sauer will collaborate with the Co-PIs to offer the summer teacher professional development and campus visit.			16.6%	1.5		\$24,000
Undergraduate student (academic)		Undergraduate students (academic): Assuming a pay rate of \$15 per hour for undergraduate students, we request support for 20 hours per week in all project years. These hours would be distributed among 2 or 3 undergraduate students that would be recruited to participate in our outreach programming as mentors for K-12 students during their independent projects. They would also be available to support teachers during their activity implementation.			0%	1.14		\$37,000
Undergraduate student (summer)		Undergraduate students (summer): 40 hours per week of undergraduate student time to be split among 1-2 undergraduates serving as research mentors during the summer teacher professional development programming. The summer students will also help develop classroom activities and coordination of the Summer Expo.			0%	0.72		\$22,000
Academic Faculty		Trinity Hamilton, PhD, Co-PI: 8% paid effort (1 calendar month) per year for all project periods. Hamilton will be responsible for managing the scientific merit of the program and the alignment of outreach programming to most recent research in geomicrobiology. Hamilton will provide scientific mentorship and supervision for graduate and undergraduate students.			26.7%	0.24		\$41,000
							<b>Sub Total</b>	<b>\$186,000</b>

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	Tools and Supplies	<p>\$75,000 in year 1 to create the mobile laboratory. An itemized description of the costs are included below:</p> <table border="0"> <thead> <tr> <th>Item</th> <th>Unit Price</th> <th>Quantity</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Price Vender Centrifuge</td> <td>\$</td> <td></td> <td></td> </tr> <tr> <td>1,350 2</td> <td>\$ 2,700</td> <td>Fisher MinilON</td> <td></td> </tr> <tr> <td>Reagent Kit</td> <td>\$ 600</td> <td>5</td> <td></td> </tr> <tr> <td>cell</td> <td>\$ 3,000</td> <td>Nanopure MiniION flow</td> <td></td> </tr> <tr> <td>4,500</td> <td>\$ 900</td> <td>5</td> <td>\$</td> </tr> <tr> <td>1,000</td> <td>\$</td> <td>Nanopure Nanopore MinilON</td> <td>\$</td> </tr> <tr> <td>1,000 1</td> <td>\$ 1,000</td> <td>Nanopure Qubit</td> <td></td> </tr> <tr> <td>Fluorometer</td> <td>\$ 4,000</td> <td>1</td> <td></td> </tr> <tr> <td></td> <td>\$ 4,000</td> <td>Fisher Water Bath</td> <td></td> </tr> <tr> <td></td> <td>\$ 450</td> <td>4</td> <td>\$</td> </tr> <tr> <td>1,800</td> <td>\$</td> <td>Fisher Hotplate/stirrer</td> <td>\$</td> </tr> <tr> <td>300 3</td> <td>\$ 900</td> <td>Fisher Vortex</td> <td></td> </tr> <tr> <td>Mixer</td> <td>\$ 275</td> <td>5</td> <td>\$</td> </tr> <tr> <td>1,375</td> <td>\$</td> <td>Fisher Shaker Table</td> <td>\$</td> </tr> <tr> <td>1,100 2</td> <td>\$ 2,200</td> <td>Fisher Portable</td> <td></td> </tr> <tr> <td>Balance</td> <td>\$ 450</td> <td>2</td> <td>\$</td> </tr> <tr> <td>900</td> <td>\$</td> <td>Fisher Portable Precision Balance</td> <td>\$</td> </tr> <tr> <td>700 2</td> <td>\$ 1,400</td> <td>Fisher</td> <td></td> </tr> <tr> <td>Compound Scope</td> <td>\$ 675</td> <td>20</td> <td></td> </tr> <tr> <td></td> <td>\$ 13,500</td> <td>Fisher Minigel</td> <td></td> </tr> <tr> <td>Electrophoresis</td> <td>\$ 400</td> <td>10</td> <td></td> </tr> <tr> <td></td> <td>\$ 4,000</td> <td>Fisher Power Supplies</td> <td></td> </tr> <tr> <td></td> <td>\$ 400</td> <td>5</td> <td>\$</td> </tr> <tr> <td>2,000</td> <td>\$</td> <td>Fisher Incubators</td> <td>\$ 550</td> </tr> <tr> <td></td> <td>\$ 1,100</td> <td>Fisher Pipette</td> <td></td> </tr> <tr> <td>Sets</td> <td>\$ 650</td> <td>10</td> <td>\$</td> </tr> <tr> <td>6,500</td> <td>\$</td> <td>Fisher MiniPCR Thermocyclers</td> <td>\$</td> </tr> <tr> <td>1,000 6</td> <td>\$ 6,000</td> <td>Carolina Beaker</td> <td></td> </tr> <tr> <td>set</td> <td>\$ 30</td> <td>10</td> <td>\$</td> </tr> <tr> <td>300</td> <td>\$</td> <td>Carolina Flask Set</td> <td>\$</td> </tr> <tr> <td>50 10</td> <td>\$ 500</td> <td>Carolina</td> <td></td> </tr> </tbody> </table>	Item	Unit Price	Quantity	Total	Price Vender Centrifuge	\$			1,350 2	\$ 2,700	Fisher MinilON		Reagent Kit	\$ 600	5		cell	\$ 3,000	Nanopure MiniION flow		4,500	\$ 900	5	\$	1,000	\$	Nanopure Nanopore MinilON	\$	1,000 1	\$ 1,000	Nanopure Qubit		Fluorometer	\$ 4,000	1			\$ 4,000	Fisher Water Bath			\$ 450	4	\$	1,800	\$	Fisher Hotplate/stirrer	\$	300 3	\$ 900	Fisher Vortex		Mixer	\$ 275	5	\$	1,375	\$	Fisher Shaker Table	\$	1,100 2	\$ 2,200	Fisher Portable		Balance	\$ 450	2	\$	900	\$	Fisher Portable Precision Balance	\$	700 2	\$ 1,400	Fisher		Compound Scope	\$ 675	20			\$ 13,500	Fisher Minigel		Electrophoresis	\$ 400	10			\$ 4,000	Fisher Power Supplies			\$ 400	5	\$	2,000	\$	Fisher Incubators	\$ 550		\$ 1,100	Fisher Pipette		Sets	\$ 650	10	\$	6,500	\$	Fisher MiniPCR Thermocyclers	\$	1,000 6	\$ 6,000	Carolina Beaker		set	\$ 30	10	\$	300	\$	Carolina Flask Set	\$	50 10	\$ 500	Carolina		Mobile laboratory				\$75,000
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	Tools and Supplies	\$3,000 per year to support consumable supplies for the teacher professional development and classroom activities. These will include lab reagents, water quality sampling supplies, filters, etc.	Program support						\$9,000
								<b>Sub Total</b>	<b>\$84,000</b>
<b>Capital Expenditures</b>									
								<b>Sub Total</b>	-
<b>Acquisitions and Stewardship</b>									
								<b>Sub Total</b>	-
<b>Travel In Minnesota</b>									
	Miles/ Meals/ Lodging	We also request \$4,832 per year to support lodging and meals for a 2-person instructional team (made up of project personnel) to travel to our out state	Program support						\$15,000

		teacher partner locations twice per project year to offer professional development programming for teachers and support classroom activities. Those costs are broken down as follows (per person, per event): • Lodging 4 nights @ \$96 per night * 4 nights = \$384 • Per Diem for 4 days @ \$55 per day * 4 days = \$220 • Total cost = \$384+\$220= \$604 *2 travels* 4 events per year = \$4,832 per year						
	Other	We request funds to supporting bussing students to the University of Minnesota Campus to participate in the summer expo. We have budgeted at \$400 (X2) per year for our outstate partners and \$200 per year to support our Twin Cities partners.	Participant Support Travel					\$3,000
							<b>Sub Total</b>	<b>\$18,000</b>
<b>Travel Outside Minnesota</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Printing and Publication</b>								
	Publication	\$3,000 to offset the publication cost of 2 open access manuscripts.	Manuscript Publication					\$3,000
							<b>Sub Total</b>	<b>\$3,000</b>
<b>Other Expenses</b>								
		Short Term Rentals: Short term rentals for vehicles to transport equipment and materials to classrooms is requested at a weekly vehicle rate of \$325 and a mileage rate of \$0.56 per mile. We request \$2,333 per project year to cover 4 trips to outstate Minnesota per year.	Vertical Rental for Mobile Laboratory					\$7,000
							<b>Sub Total</b>	<b>\$7,000</b>
							<b>Grand Total</b>	<b>\$298,000</b>

Classified Staff or Generally Ineligible Expenses

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

Category	Specific Source	Use	Status	Amount
<b>State</b>				
In-Kind	Indirect costs associated with this proposal at 35% MTDC.	Indirect costs cover both facilities costs and administrative costs that are incurred by the University of Minnesota when conducting sponsored research, instruction, and public service projects.	Potential	\$94,190
			<b>State Sub Total</b>	<b>\$94,190</b>
<b>Non-State</b>				
			<b>Non State Sub Total</b>	-
			<b>Funds Total</b>	<b>\$94,190</b>

## Attachments

### Required Attachments

#### *Visual Component*

File: [df664c87-47e.pdf](#)

#### *Alternate Text for Visual Component*

Image shows our conceptual model for recruitment ecosystems and program structures...

### Optional Attachments

#### *Support Letter or Other*

Title	File
UMN SPA Approval	<a href="#">622f25ec-eb0.pdf</a>

## Administrative Use

**Does your project include restoration or acquisition of land rights?**

No

**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?**

Yes, Sponsored Projects Administration

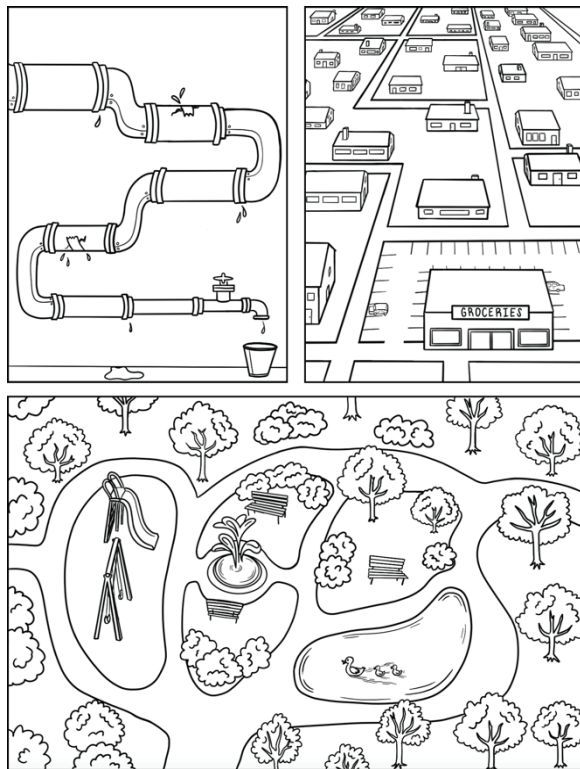


Figure 1: Conceptual diagram differentiating the different models of recruitment and retention. The upper left panel represents a traditional pipeline approach to recruitment with a single entry and exit point for environmental careers. The pathways model (upper right panel) represents multiple routes leading to a single focus point, in this case the communities store, representing environmental careers. Finally, our ecosystem model (bottom panel) focuses on a systems approach, using a park landscape to represent a complex career ecosystem. The entire park represents the career landscape, with many potential entry points and various activities (i.e. jobs/careers) within the ecosystem. Our approach focuses on cultivating an inclusive ecosystem (building a great park) that supports student engagement and success rather than focusing on getting students into a rigid pipeline with a defined outcome. It is responsive to the students' needs, has flexibility over time as students' interests change, and ultimately shifts away from a deficit model to an asset based model of student retention. Rather than asking the question "why are certain students leaking out of the pipeline" we ask the question "how can we bring new talents and experiences into our park".

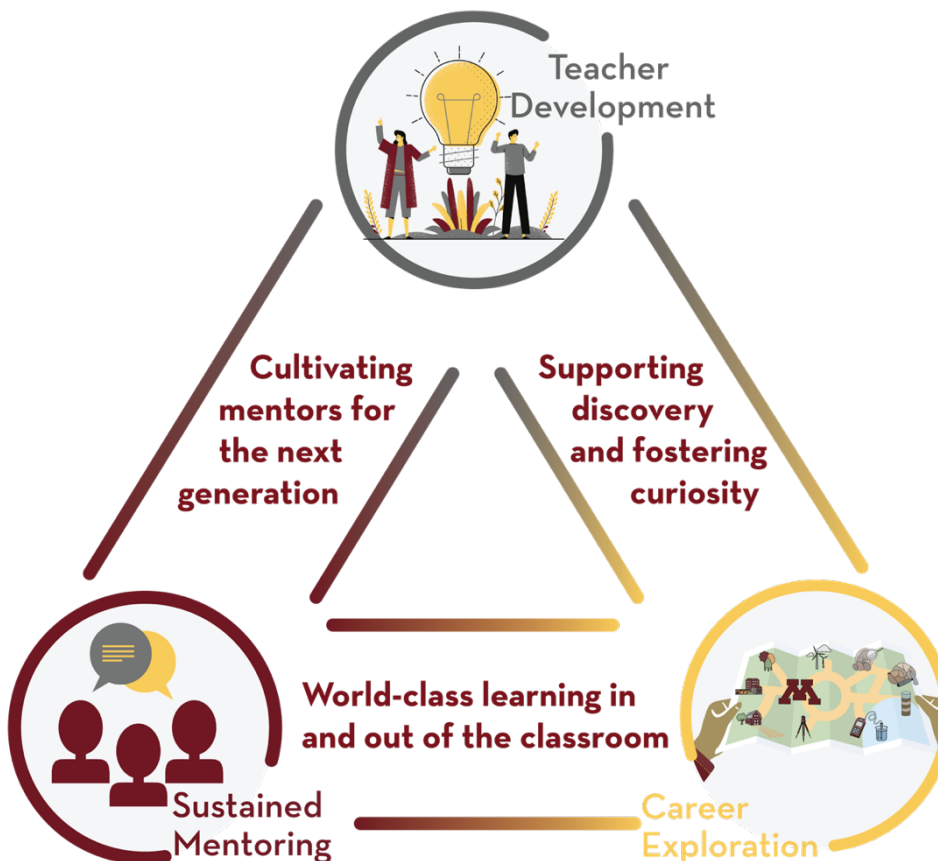


Figure 2: Conceptual diagram showing the interactions between the three core components of the project. Through these three core elements, we will build and informal education ecosystem that creates transparent pathways in environmental careers Minnesota students