APPLICATION CHECKLIST
Research, Scholarship, and Creativity Grant

Deadline February 12th

Please print and complete this checklist and attach it as the cover page of your grant application.

Faculty information

Name:_Laura Triplett__________________ Dept:__Geology______________________

Email: _ltriplet@gac.edu____________________ Rank:__Assistant Professor_____________

Checklist

☐ **Description of previous projects (and outcomes) funded by RSC grants** ***(none)***

☒ **Complete project description, including separate statements of:**

1. **Purpose.** What are the intellectual, conceptual, or artistic issues? How does your work fit into other endeavors being done in this field?
2. **Feasibility.** What qualifications do you bring to this project? What have you done/will you do to prepare for this project? What is the time period, i.e. summer, summer and academic year, academic year only? Is the work's scope commensurate with the time period of the project?
3. **Project Design.** This should include a specific description of the project design and activities, including location, staff, schedules or itineraries, and desired outcomes.

☒ **RSC Budget Proposal Form attached as last page of application**

☒ **Nine (9) copies of completed application and budget (including this checklist) to be submitted to the John S. Kendall Center for Engaged Learning (SSC 119)**

If successful, my proposal can be used as an example to assist future faculty applications. This decision will not in any way influence the evaluation of my application. Yes No (please circle one)

Measuring the effect of an invasive species on silica cycling in the Platte River, USA

1. Purpose

I propose to quantify the effect of an invasive wetland plant, *Phragmites australis*, on the biogeochemical cycling of silica (Si) in the Platte River, Nebraska. *Phragmites* is an aggressive grass species that displaces native vegetation and can reduce habitat value in fresh and brackish wetlands in North America. *Phragmites* has a high Si content relative to other wetland species, which may provide it with several competitive advantages such as more rigid shoots and resistance to disease and herbivores (Struyf and Conley, 2009). As *Phragmites* takes up Si from the shallow groundwater and stores that element in its living biomass (and, later, dead leaf litter), it decreases the amount of Si that is available for other organisms. Diatoms, for example, are a populous type of algae in fresh and marine waters that require silica to build their frustules, or shells; if more Si is sequestered on land and prevented from reaching aquatic ecosystems, it may cause a decrease in diatom abundance that leads to other ecosystem changes. Indeed, recent research indicates that changes humans have made to large rivers and watersheds, like building dams and altering terrestrial vegetation, may be decreasing the amount of silica that rivers are delivering to estuaries and oceans (Conley, 2003, Conley, et al., 2008, Humborg, et al., 2006, Triplett, et al., 2008). Decreases in silica (combined with increases in phosphorus and nitrogen, in both relative and absolute terms) have been implicated in decreased diatom abundance in places like the Gulf of Mexico and the Black Sea (Turner and Rabalais, 2003). That has led to declines in some economically-important near-shore fisheries. Therefore, developing a better understanding of the biogeochemical cycling of Si and its transfer from land to water is of broad significance.

One place that *Phragmites australis* has made troubling incursions is along the Platte River in Nebraska. The Platte River is a fascinating case study of how high water usage may lead to unanticipated geological and ecological consequences. Beginning in the 1880s, European-American settlers constructed dams and irrigation canals along the Platte River, and river water was frequently "over-appropriated", that is, permission was given for more water to be taken from the river than was available. This pattern continued well into the 1900s. Before the water diversions, the Platte was a braided river (many intertwining channels separated by transitory sandbars). The unvegetated bars were nesting habitat for many bird species and critical 'staging' areas for the migration of others, notably sandhill and whooping cranes. After the diversion, in response to decreased water flow, the river occupied fewer "braids" of the channel and woody species like willow and cottonwood began establishing on the sandbars. The resulting loss of nesting and migratory habitat has contributed to declines in bird populations. Beginning in the 1970s, massive efforts were undertaken to reclaim more water for the Platte and to bulldoze and otherwise remove the vegetation along parts of the riverbed. This strategy continues today, but recent invasives like *Phragmites* are hampering these efforts and making the restoration of "natural" conditions even more difficult.

Studying *Phragmites* on the Platte is intriguing because the sand bars have transitioned from being bare to having dense vegetation during the historical period. Therefore, silica sequestered in the sediments or soil and leaf-litter can be quantified as a flux of silica sequestered over that known time period. In most other cases, invasive species move into spaces previously occupied for a long time by other plant communities, so there is not a clear, known timeline of soil development and nutrient use. I will take soil, sediment and leaf litter samples from some of those recently-vegetated bars (and adjoining 'control' sites) to quantify the amount of silica that is now being stored in that land-plant community and is thus not reaching the river. After quantifying the silica sequestration at that local scale, I will use existing aerial photos and surveys of the river to extrapolate the amount of silica being stored in the entire reach of the Platte (hundreds of river miles) that has become vegetated since European-American settlement.

Significant amounts of time and energy are being spent by agencies such as the U.S. Fish and Wildlife Service, the U.S. Bureau of Reclamation and the U.S. Geological Survey to control *Phragmites* and other vegetation on the Platte, in order to maintain or restore natural habitat. I have contacts in those agencies who will help me identify sampling locations, and I hope that my work may help them better understand *Phragmites* incursions. To that end, I will be collaborating on this project with Dr. Karin Kettenring at Utah State University. Dr. Kettenring is an ecologist studying *Phragmites* invasion in other parts of the country to determine what makes invasive species successful and how we can best manage such invaders in wetland systems. Also, because the Platte is a major tributary to the Mississippi River, our findings for this river may be useful to understanding how landscape change has affected nutrient supplies in the Mississippi's ultimate sink, the Gulf of Mexico.

2. Feasibility

Qualifications

- Ten years of research on biogeochemical cycling in large river systems, four yeasr of which were specifically focused on silica
- Ph.D. in Geology
- Experience operating necessary analytical equipment (all now located at Gustavus in the Geology and Chemistry departments)
- Proven record of collaborating with other researchers, as shown by my publications with multiple authors

Preparation

- I have been discussing the feasibility of this project with my colleague, Karin Kettenring (Utah State University), for over one year. We have shared ideas and background knowledge throughout this period, and now feel ready to proceed with the project.
- I am in contact with staff at the U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation to identify study sites and gain necessary permission for access
- I have secured funding for a student researcher this summer from the Environmental Studies program. That student will accompany me during the sample collection and will assist with sample analysis.

Time period

The samples for this project will be collected during the height of this summer's growing season (July, 2010) during a 4- to 5-day trip to the Platte River. The student researcher will help me process and analyze the samples during the remainder of the summer and into the fall as part of his senior thesis project in Geology. All the sample analyses should be completed by the end of fall semester, and we will proceed with data analysis during January and early spring semester, 2011.

3. Project Design

Activity	Time period	Location	Staff
Field work preparation (selection of 4-6 study sites along the Platte, purchasing supplies, training on analytical equipment)	June, 2010	GAC (Geology)	myself, student
Sample collection at 4-6 different locations and associated control sites along the Platte. Five to ten soil cores and leaf litter samples will be collected at each study site.	July, 2010	Coordinated through the Grand Island, NE office of the U.S. Fish and Wildlife Service	myself, Karin Kettenring (USU), student
Sample processing and analysis	August-December, 2010	GAC (Geology and Chemistry)	myself, student
Data analysis and synthesis of results	January-May, 2011	GAC (Geology)	myself, student

References

Conley, DJ (2003) Terrestrial ecosystems and the global biogeochemical silica cycle. Global Biogeochemical Cycles 16:61-61 - 68-68.

Conley, DJ, Likens, GE, Buso, DC, Saccone, L, Bailey, SW and Johnson, CE (2008) Deforestation causes increased dissolved silicate losses in the Hubbard Brook Experimental Forest. Global Change Biology 14:2548-2554.

Humborg, C, Pastuszak, M, Aigars, J, Siegmund, H, Morth, C-M and Ittekkot, V (2006) Decreased silica land-sea fluxes through damming in the Baltic Sea catchment - significance of particle trapping and hydrological alterations. Biogeochemistry 77:265-281.

Struyf, E and Conley, DJ (2009) Silica: an essential nutrient in wetland biogeochemistry. Frontiers in Ecology and the Environment 7:88-94.

Triplett, LD, Engstrom, DR, Conley, DJ and Schellhaass, SM (2008) Silica fluxes and trapping in two contrasting natural impoundments of the upper Mississippi River. Biogeochemistry 87:217-230.

Turner, RE and Rabalais, NN (2003) Linking landscape and water quality in the Mississippi River Basin for 200 years. Bioscience 53:563-572.

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BUDGET INFORMATION

Faculty Stipend
($500 professor; $600 associate professor; $700 assistant professor)

Expenses
Faculty may apply for up to **$1500** to pay for the cost of equipment, materials, personnel, and travel associated with the project to be funded by the RSC Grant. All expenses must be necessitated by the project to be funded by the RSC Grant.

ITEM		**AMOUNT**
Equipment (e.g., transcription machine, camera, cassette recorder— but not to include computer hardware)		$100
1: Lab supplies	Cost: $100	$100
2:	Cost:	
3:	Cost:	
Materials (e.g., books, printing, software, lab supplies)		$
1:	Cost:	
2:	Cost:	
3:	Cost:	
Personnel (e.g., typist, transcriptionist, student assistant)		$
1:		
2:		
Travel Costs (cannot include conference travel, see http://gustavus.edu/finance/travel.php for allowable travel expenses)		$1063
Airfare:		
Mileage: Number of miles <u>1400</u> @ $0.62/mile (college minivan)		$868
Lodging: 3 x $25 (camping three nights)		$75
Meals: 3 days x $20/day x 2 people (myself and student researcher)		$120
Other Expenses		$150
1: Gas (not incl. in college vehicle charges)	Cost: $150	$150
2:	Cost:	
3:	Cost:	
		$
TOTAL EXPENSES		$1313
AMOUNT REQUESTED (not to exceed $1500 + stipend commensurate with rank)		$2113

Have you applied for, or received funding from, another source to help support this project? <u>Yes</u>
Funding Source: <u>My student researcher is funded by the Environmental Studies program</u>
Amount: <u>$3200 + on campus housing</u>
Please explain how the RSC will be used in addition to the other funding.
<u>The RSC funding would be used as described in this budget. The student's summer stipend and housing is paid by the Environmental Studies funds, and I did not include that in this budget.</u>