

REQUEST FOR PROPOSALS FOR A PROJECT TO BE INITIATED THROUGH THE COOPERATIVE ECOSYSTEM STUDIES UNITS (CESU) NETWORK

PROJECT TITLE: CESU - Differentiating phosphorus sources using phosphate oxygen isotopes to identify contributing watersheds.

DEADLINE: 5:00 pm, Friday, May 20, 2023

Everglades National Park (ENP) and Biscayne National Park (BNP) are actively involved in Comprehensive Everglades Restoration Plan (CERP) projects to improve quantity, quality, timing, and distribution of water moving through south Florida and specifically addressing the system's water quality challenges. The ability to meet water quality changes is lacking information on phosphorus (P) sources from regional landscape, especially the immediate watersheds of ENP and BNP.

The National Park Service (NPS), South Florida Natural Resources Center (SFNRC), a division of Everglades National Park, seeks proposals to identify potential collaborators to assist the park in identifying a diverse set of P sources in south Florida such as agricultural (fertilizers), residential (septic systems), as well as natural sources (erosion and local biological activity) through application of $\delta^{18}\text{O}$ isotope method. The collection of water samples and monitoring upstream in the watershed will aid our identification of source contributions from the sub-watersheds to help operational decisions to conserve the natural resources of ENP and BNP from P pollution.

BACKGROUND

Comprehensive Everglades Restoration Plan (CERP) seeks to 'get the water right' in the broadest sense, by improving the quantity, quality, timing, and distribution of water moving through south Florida. CERP's primary tool for addressing the system's water quality challenges are Stormwater Treatment Areas (STAs) with the ambitious goal of approximately 90% reductions in total phosphorus (TP) levels in water entering the Everglades Protection Area. The ability of the STAs to meet these targets will become clear as construction efforts are completed in coming years. Even with successful phosphorus (P) removal at the northern boundary of the Everglades ecosystem, expanding urban development and agricultural activity in adjacent lands pose persistent water quality challenges for downstream ecosystems in ENP, Florida Bay, Biscayne Bay, and BNP. Addressing these water quality challenges is complicated by the diversity of potential sources, including agricultural fertilizer, septic systems, and localized biological activity in canals.

Resolving water quality problems is premised on accurate identification of pollutant sources. Current approaches to source attribution rely on correlated analytes, for example, using sodium:calcium ratios as indicators of agricultural water (Surratt and Aumen, 2014). These approaches have demonstrated utility, but quantitative attribution requires assumptions about the relationship between source correlates and P, and may be prohibitively costly or not available for all sources. The project proposed here will support implementation of an emerging attribution

technique that uses stable isotope ratios of oxygen to quantitatively and directly link orthophosphate ions (PO_4^{3-}) to their proximate source.

This approach is based on the relative non-reactivity of O-P bonds in PO_4^{3-} , which preserves the isotopic signal of a PO_4^{3-} source (Davies et al. 2014). We propose to use this approach to identify sources of P entering Upper Taylor Slough and differentiate more complex sources contributing to Biscayne Bay, which may pollute ENP and BNP, respectively. This stable isotope approach is relatively novel but has been applied successfully in the Everglades in a two-end-member application (Li et al. 2011). The proposed work will expand the application of $\delta^{18}\text{O}$ and attempt to differentiate a more diverse set of P sources in south Florida: such as agricultural fertilizer, septic systems, as well as natural sources such as erosion and local biological activity. Expanding the number of sources identified will be made possible by incorporating additional analytes and using multi-parameter mixing models. This project will generate new information about the importance of different sources of P entering Biscayne Bay and Taylor Slough. By sampling over time this effort will also document seasonality in P sources, testing hypotheses that P contributions from agricultural and biological activity are highly seasonal, while septic contributions are temporally uniform. Understanding the timing and magnitude of P sources enables targeted, effective management responses to water quality concerns.

OBJECTIVES

The National Park Service, South Florida Natural Resources Center, a division of Everglades National Park, seeks collaborators to: 1. identify a diverse set of P sources in south Florida such as agricultural (fertilizers), residential (septic systems), as well as natural sources (erosion and local biological activity) through application of $\delta^{18}\text{O}$ isotope method; 2. help develop tools to enhance ongoing restoration efforts; 3. bring new information or perspectives on water resource management and protection practices in ENP and BNP through formal presentations, informal discussions, and or training sessions, including remote training mechanisms such as webinars.

BRIEF DESCRIPTION OF ANTICIPATED WORK

The success of this project will depend on the collaboration between the cooperator and the NPS. NPS staff will have significant involvement with the project to ensure the study and resultant products meet the NPS needs. SFNRC staff will provide any background references, documents, research, or other guidance.

The Principal Investigator's (PI) team shall develop a course of study to explore P loading, identifying the sources and effects of external P input in South Florida watersheds. Project performance may require the following activities:

- a. Conduct field sampling and monitoring in south Florida region in upper Taylor Slough inside ENP, BNP, and immediate watersheds of Taylor Slough and BNP in 'Homestead' and 'Florida City' of Florida,
- b. Conduct laboratory analysis through application of $\delta^{18}\text{O}$ isotope methods as defined by the PI,
- c. Provide written progress reports, according to a specified schedule,
- d. Participate and provide oral reports at progress meetings,
- e. Submit draft and final technical report with management recommendation for Park Managers' review and approval.

Upon selection, the PI's team may be asked to update their proposal and collaborate with SFNRC staff to develop a Statement of Work for the cooperative agreement process. Once underway, project status updates will be required at a minimum, each year of the agreement to demonstrate progress toward meeting project goals and objectives.

SCOPE

Timelines: The project is designed as a 3-year study with an estimated start date of Sept. 15, 2023; it will extend through Dec 15, 2026. Proposals are welcome to adjust the duration and start date, although the start date must begin before Oct 1, 2023.

Budget: NPS will provide funding in an amount not to exceed \$300,000.00 for the work described in accordance with the approved budget for this project. Partial funding in an amount not to exceed \$97,734 is available for Fiscal Year (FY) 2023; the remainder of the funding, should be available in FY 2024 - 2025. All awards are subject to the availability of funds per the Anti-Deficiency Act, satisfactory performance, and compliance with the terms and conditions of the Federal award.

This project will be implemented under a Cooperative Ecosystem Studies Unit (CESU) agreement already in place with your institution, which sets the indirect cost rate at 17.5%.

ELIGIBILITY

This opportunity is open to non-federal members of the CESU National Network. Information on the CESU National Network can be accessed at <http://www.cesu.psu.edu/>.

HOW TO APPLY

Interested Principal Investigators are invited to submit an application package of no more than six (6) pages. The package should cover the following areas, which will be used to evaluate the applications received:

1. *Research Team Experience/Qualifications:* Outline your qualifications (a) as a Principal Investigator(s), (b) relevant to stable isotope technology ($\delta^{18}\text{O}$ isotope method specifically), (c) work on the hydrology and/or biogeochemistry of watersheds, and (d) relevant to large land management agency operations (NPS and/or federal-level experience preferred). Briefly, outline your institution's research capacity (e.g., special facilities, equipment, centers, or institutes related to this study) and CESU affiliation. Please include information for key collaborators, who will also work on the project.
2. *Methodology:* Describe how you would approach the project, including staffing, methodology, and timelines. Describe your vision for the project. Are there any objectives that are particularly exciting? Are there any that feel weak, missing, or odd? How does the applicant define success for the project, and how will they measure project success. The applicant should also include a discussion of how the applicant will transfer results of the project, including resources developed (such as datasets, reports, webinars and/or training materials) to NPS and interested stakeholders.
3. *Logistics:* Detail a thorough and reasonable budget breakdown. A sample template of the budget showing budget categories and details necessary is attached for your reference. Use of this template is not required. There is some flexibility within the itemized list above, but please be specific (e.g., institutional tuition and graduate student costs as well as faculty salary rates and

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schedules). Please also quantify potential institutional match (e.g., finances, equipment, services). NOTE: Institutional match is not required. Please provide a clear statement that you would be able to complete the project with the available funds and 17.5% IDC.

CONTACTS

Questions regarding technical requirements and/or scope of the proposed project should be addressed to Dilip Shinde, Ecologist, SFNRC [Dilip_Shinde@nps.gov; (305) 224-4201].

Submit your application package by no later than 5pm, Friday, May 20, 2023 to Carol Daniels, Senior Science Advisor, South Florida Caribbean-CESU [carol_daniels@nps.gov; 305 323-7542]. Please use the subject line “CESU Proposal: Differentiating phosphorus sources in ENP,” to ensure that the email is properly received and reviewed.