



## WATER RESOURCES RESEARCH GRANT PROPOSAL

**Project ID:** NY1081

**Title:** Microbial indicators: new tools for assessing phosphorus eutrophication

**Focus Categories:** Nutrients, None

**Keywords:** Microbiology, Nutrient management, Phosphatase, Wetlands, Phosphorus

**Start Date:** 03/01/2001

**End Date:** 02/28/2002

**Federal Funds:** \$11,870

**Non-Federal Matching Funds:** \$14,840

**Congressional District:** 26

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**Abstract**

**Problem:** An urgent need exists to establish water-quality indicators that are cost effective, simple to perform, and appropriate in both early assessment and long-term monitoring programs of freshwater phosphorus (P) eutrophication. Proper management and conservation of wetland ecosystems depends on the ability to discriminate between the inherent natural ecosystem variability of soil and water P and the increase from anthropogenic inputs. The protection and management of wetland habitat in particular has been impeded significantly by a lack of understanding of complex ecological dynamics and an absence of simple methods with which to evaluate threats and appropriate conservation strategies.

**Objectives:** Measurement of wetland microbial processes and pool sizes may serve to alert management agencies of changes in natural nutrient cycles. The microbial community is largely responsible for ecosystem processes such as the decomposition of organic matter, nutrient cycling and energy flow. Enzyme activity in particular may be a key indicator of P dynamics within a wetland.

**Methods - Water Chemistry and Soil Nutrient Pools.** We have been monitoring water chemistry and the soil environment using several methods of nutrient determination to better understand how the different pools are affected by nutrient loads. At each site, we have installed two transects of five well clusters oriented perpendicular and parallel to the presumed direction of groundwater flow. We will continue to collect hydrometric data and water samples bi-weekly to calculate ground water fluxes and inputs of mineral ions (Ca<sup>2+</sup>, Mg<sup>2+</sup>, Na<sup>+</sup>, Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, and HCO<sub>3</sub><sup>-</sup>), dissolved inorganic carbon, and potentially limiting plant nutrients (NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, and soluble reactive phosphorus). Conductivity and pH are measured in the field with hand meters.

Labile soil nutrients are measured with ion-exchange resin bags. We are using a Hedley fractionation technique modified for wetland soils to estimate pools of mineral and organic P (Qualls and Richardson 1995, Reddy et al. 1995, Reddy et al. 1998).

**Methods - Plant Tissue Nutrients and Community Responses.** Dominant plant species from each site have been collected and analyzed for tissue concentrations. Early results demonstrate that even after one year of

P enrichment, the plant community is responding significantly by increasing tissue P concentration and biomass. We propose to expand this portion of the study by collection and analysis of several species of sub-dominants in each of the plots. Additionally, we have been using and will continue annual vegetation surveys in each of the plots to help chart changes in plant species composition due to treatment.

Methods - Microbial Pools and Processes. While the measurement of microbial biomass in wetland systems is not new, use of the microbial community as a tool to monitor phosphorus loads to wetlands represents a significant contribution to our assessment of an ecosystem as a whole. We propose to measure microbial biomass C, N, and P within each plot after the second addition of fertilizer has been made in late June. As we are also interested in the C:N:P ratio of the microbial pool, additional extracts will be used for determination of microbial C and N (Carter 1993). In addition to the measurement of microbial pool sizes, we will incorporate measurement of microbial processes affected by P loading. We will use methods outlined in Tabatabai (1982) to determine levels of alkaline phosphatase activity within soil samples from each plot at the time of microbial biomass measurements.