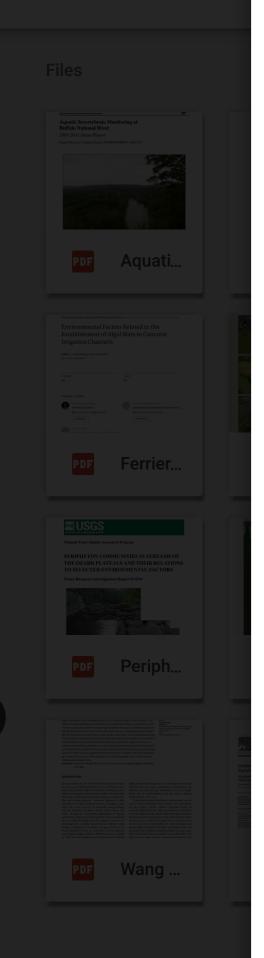
## **Buffalo National River w**







# Periphyton as a potential phosphorus sink in the Everglades Nutrient Removal Project

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### ABSTRACT

Phosphorus uptake and release by periphyton mats were quantified in the Everglades Nutrient Removal Project (ENRP) to evaluate the potential for periphyton P removal. Short-term P uptake rates were determined by incubating cyanobacteria (Oscillatoria princeps and Shizothrix calcicola) and Chlorophycean (primarily Rhizoclonium spp.) algal mat samples for 0.5-2 h under ambient conditions in BOD bottles spiked with soluble reactive P (SRP). Cyanobacterial mats removed P more than twice as fast (80–164  $\mu$ g P h<sup>-1</sup> g<sup>-1</sup> AFDM) as Chlorophycean mats (33–61 $\mu$ gPh<sup>-1</sup>g<sup>-1</sup>AFDM) during these incubations. In a longer term study, fiberglass cylinders were used to enclose 1.8 m<sup>2</sup> plots within the wetland and were dosed weekly for 7 weeks with: (1) no nutrients; (2) SRP ( $0.25 g P m^{-2} week^{-1}$ ); or (3) SRP plus nitrate  $(0.42 \text{ gN m}^{-2} \text{ week}^{-1})$  and ammonium  $(0.83 \text{ gN m}^{-2} \text{ week}^{-1})$ . Phosphorus uptake rates by this periphyton assemblage, which was dominated by the chloro Stigeoclonium spp. and Oedogonium spp., were measured weekly and were similar among nutrient treatments on most dates, indicating that the algal storage compartment for P was not saturated despite repeated P additions. Decomposition rates and P loss by cyanobacteria and Chlorophycean mats were determined by measuring biomass loss and SRP release in darkened BOD bottles over 28-42 day periods under anaerobic and aerobic conditions. First-order aerobic and anaerobic decomposition rates for cyanobacterial mats (k = 0.1095and 0.1408 day<sup>-1</sup>, respectively) were 4–20-fold higher than rates for Chlorophycean mats  $(k=0.0066 \text{ and } 0.0250 \text{ day}^{-1}, \text{ respectively})$  and cyanobacteria released considerably more P back to the water column. Our findings suggest that periphyton can be an important short-term sink for P in treatment wetlands and that retention is strongly affected by the taxonomic composition of the periphyton assemblage.

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#### 1. Introduction

the accretion of macrophyte detritus in anoxic sediments with low mineralization rates (Richardson and Craft, 1993; Kadlec and Knight, 1996). While algal and microbial biomass has been acknowledged as a potentially important shortterm sink for P in wetlands, the working assumption is that these biological compartments play a minor role in longterm P retention due to high turnover (e.g., decomposition)

Nutrient retention in freshwater wetlands is attributed to sediment accretion and chemical sorption processes (Nichols, 1983; Reed et al., 1995; Richardson et al., 1997; Reddy et al., 1999; Verhoeven and Meuleman, 1999). The principal biological mechanism for long-term phosphorus (P) removal is

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low chlorophyll a and soluble reactive P [SRP] concentrations (median values = 10 and  $4 \mu g L^{-1}$ , respectively) and a history 1: 1 1:

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