Everglade project - Cattail Habitat Improvement Project

Project Overview and Background: While Everglades restoration as related to phosphorus (P) has focused on reducing concentrations and loads to the region via the implementation of the stormwater treatment areas (STA), a significant portion of the Everglades ecosystem remains impacted with high levels of P, readily evidenced by over 11,000 ha of monotypic Typha stands. In 2003, the Everglades Forever Act was amended by The Long Term Plan for Achieving Water Quality Goals in the Everglades Protection Area and Tributary Basins (LTP). In addition to further best management practices for agriculture (BMP's) and STA enhancements, the LTP acknowledged that reduced surface water P concentrations and loads may not be sufficient to successfully restore highly enriched areas for decades. Consequently, the LTP required the SFWMD to undertake large-scale research into possible restoration options that may accelerate recovery.

Nutrient enrichment in the Everglades imposes constraints on ridge and slough communities through two pathways, food webs and vegetative structure. Nutrients have affected Everglades food webs directly by increasing plant nutrient content and productivity and by changing the species composition and biomass of periphyton, macrophyte, invertebrate, fish and bird communities (Rader and Richardson 1992, McCormick and O'Dell 1996, Miao and Sklar 1998, Turner et al. 1999, Crozier and Gawlik 2002). The community is also affected indirectly by the change in physical structure of the habitat brought about by the encroachment of uninterrupted stands of dense cattail. The dense structure affords relatively little incident solar radiation to the aquatic community thereby moderating photosynthesis and primary production (Grimshaw et al. 1993). Little is known about how cattail structure affects the aquatic community but at minimum it likely precludes populations of larger predatory fish species. Wading bird populations are also much reduced in cattail regions because foraging is constrained by dense vegetation (Bancroft et al. 2002, Hoffman et al. 1994, Crozier and Gawlik 2002).

The Cattail Habitat Improvement Project (CHIP) was conceived in recognition that the recovery of key Everglades's characteristics may be accelerated through the creation of open-water patches embedded within the cattail matrix**.** Although removal of cattail will likely result in improved ecosystem structure, equally critical to environmental restoration is the return of some level of ecosystem function. CHIP will evaluate the utility of creating openings for improved ecosystem function by examining potential changes in trophic structure. A preliminary study using small-scale 10×10 m open-water plots created in densely vegetated cattail stands demonstrated that the creation of open-water habitat results in increased dissolved oxygen (DO) levels, which in turn may cascade up trophic levels (Newman et al. unpublished data). CHIP is building upon this earlier study by establishing plots of sufficient size, such that all key ecosystem functional and structural components can be assessed. CHIP was peer reviewed and is currently in its second year of implementation. More specific details can be found in (Newman et al., 2006).

Management and Restoration Objectives: The LTP required evaluation of approaches to accelerate the recovery of P enriched areas of the Everglades. This resulted in considerable attention on removing cattail as a restoration method, despite the recognition that cattail removal is addressing the symptom as opposed to solving the problem. Large scale intensive restoration efforts (e.g., peat removal or adding chemical amendments) will likely be more disruptive and harmful to the Everglades ecosystem than allowing the ecosystem to recover naturally. Additionally, large-scale cattail removal may be detrimental because the dense cattail areas adjacent to inflow points currently serve an important ecosystem function; protecting downstream pristine areas through their rapid growth and P removal. However, ecosystem function could be enhanced by recognizing the constraints inherent in a monotypic cattail community. That is, there may be some active management strategies that can be implemented in conjunction with a 'natural recovery strategy' that may improve ecological function, and thereby contribute to the overall intent of Everglades restoration. A key restraint is the density of the vegetation resulting in net heterotrophic production and limited access by wildlife. CHIP evaluates whether we can use active management, i.e., a combination of fire followed by herbicide application, to maintain open water sites within densely vegetated areas such that we can restore more desirable ecological function while external loads are addressed via STA and BMP implementation. The restoration objective is to create openings in the cattail landscape to bring about a critical change in ecosystem function such that the open system is dominated by algae or submersed aquatic vegetation and supports greater wildlife abundance and diversity.

Methodological Approach: CHIP will evaluate ecosystem function of the openings in two stages. The first objective is to assess whether creating openings within densely vegetated areas will sufficiently alter trophic dynamics such that wildlife diversity and abundance is increased. The experiment will consist of creating replicated 6.25 ha openings in a highly P enriched landscape dominated by cattail and a less impacted transitional region comprising an equal mixture of cattail and sawgrass. Each created opening will be proximate to a paired control plot (untreated) and will be created using proven vegetation removal techniques. The experimental design is a 2×2 factorial with two treatments (created openings versus dense cattails/controls) and two locations (enriched and transitional), replicated three times. The second objective is to compare the opened plots with natural sloughs in WCA 2A, not affected by nutrient intrusion, to examine changes in trophic structure compared to the natural Everglades. Ecological change will be measured using a relatively new approach, stoichiometry. This will result in a coupling of traditional methods of assessing the food web (e.g., species composition and abundance) with the nutrient status and elemental composition of various components of the ecosystem

Objective 1 Hypothesis—Treatments plots (openings) will experience greater nutrient fluxes and be comprised of more nutritional plants (i.e., algae) and, therefore, lose higher percentages of production to herbivores (invertebrates and cyprinodontoid fish), channel lower percentages of primary production as detritus, experience faster decomposition rates, and, as a result store less carbon and nutrients, and support higher wading bird foraging.

Objective 2 Hypothesis—Relative to the P limited Everglades, openings in P enriched areas will experience greater nutrient fluxes and be comprised of more nutritional plants (i.e., algae) and, therefore, lose higher percentages of production to herbivores (invertebrates and cyprinodontoid fish), channel lower percentages of primary production as detritus, experience faster decomposition rates, and, as a result store less carbon and nutrients, and support higher wading bird foraging.

Preliminary results confirm that vegetation burning results in a change in P species in the soil and increased P in the overlying water column. In addition, areas in which openings are maintained are readily used by wading birds.