LAKE OKEECHOBEE IN-LAKE TILLING/DISKING PROJECT

Project Overview:

Lake Okeechobee has vast near-shore littoral regions dominated by wetlands vegetation that have been exposed and dried down as a result of recent low lake stages. Some of these areas have thick deposits of organic sediments resulting from the long-term accumulation of wetland and aquatic plant detrital materials, and experienced drought conditions for a period of two years (2007-2009). With a rise in lake levels with the return of normal rainfall periods, these near-shore littoral zones flood, raising the possibility of an initial flush of phosphorus (P) and other nutrients stored in these organic sediments into the water column. An alternative to prevent these nutrient releases into the water column from these areas is to excavate and haul these organic materials out of these areas. However, this procedure is extremely expensive to implement on a large scale. A proprietary methodology was initiated using a tilling (burial) technique for sequestering nutrients associated with wetland plant biomass and detritus during the drought of 2008.

Project Objectives:

Test different tilling/disking techniques:

1. To reduce the total P levels of the surface horizon.
2. To reduce the internal P loading of sediment/soils to the water column.
3. Replace the undesirable organic sediments from the surface with less contaminated subsoil that will still have desirable chemical and/or physical properties for supporting desirable aquatic vegetation once the area is reflooded.
4. Evaluate the success of this technique as a cost effective alternative to the scraping/excavation technique.

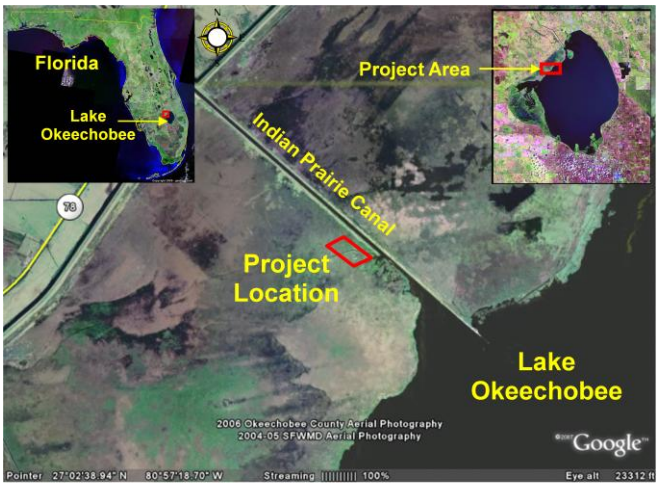

Figure 1. Site Location.

Project Description/Features:

This study was conducted on a 40-acre area adjacent to the Indian Prairie Canal in the northwest littoral zone of Lake Okeechobee (Figure 1). The purpose of this study was to evaluate the effectiveness of tilling the subsurface organic layer into the underlying sand substrate as a mechanism for (1) reducing the surficial total and extractable P levels, and (2) reducing the internal P loading.

The site was divided into eight five-acre plots to allow for two replicate plots to be treated using two plow techniques. The vegetation was first mowed followed by a light disking to break-up the thick mat of mowed vegetation to facilitate the tilling process. Two plow types (Baker-disk and Moldboard plow) were used to either blend or flip the surface organic layer into the underlying sand substrate (Figure 2).

Figure 2. Plow types used in the study.

Composite sediment samples were collected at three different depths (0-15, 15-30, and 30-60 cm) from each plot before and after plow treatments to evaluate the effect of tilling on the reduction of total P, Mehlich-I extractable P and metals on surface sediments. Sediment samples were also collected from an adjacent untreated site (Control) and a second adjacent site where the organic layer had been removed by scraping the previous year. Intact sediment cores for P-flux studies were also collected from all experimental plots before and after plow treatments (Figure 3).

Project Status:

Vegetation for the experimental site was first mowed on May 13 and 14, 2008. On May 15, 2008, a Moldboard and a Baker plow were used to till the surface organic layer to an optimal plow depth of 45 cm (18 inches). Both tilling techniques were effective in reducing surface total P and Mehlich-I P by about 80 and 70%, respectively. Total P concentrations from the undisturbed adjacent plot were in the same range as those measured in the pre-treatment plots, with concentrations considerable decreasing with depth. However, total P from the scraped plot were low across the entire profile. Results from the lower sediment depths indicate that most of the organic layer from both plow treatments was buried within the 15-30 cm layer. The final report from the tilling project was submitted in March 2009.

Figure 3. Phosphorus flux laboratory set-up.

The P-flux study showed that dissolved reactive P (DRP) concentrations in the water column from post-treatment cores were considerably lower as compared to those measured in all pre-treatment cores. Potential P flux rates from pre-treatment cores averaged >3.5 mg m^{-2} day^{-1}, indicating the effect that that these organic sediments have on internal P loading to the Lake. Both tilling techniques were effective in reducing DRP fluxes to the water column, with flux rates from the first flood cycle of both treatments averaging 0.081 mg m^{-2} day^{-1}. Results from the post-treatment sediment cores showed a favorably alternative with the more traditional method of scraping and removal of the organic layer. However, caution must be taken when comparing both techniques because of the uncertainty of future P fluxes from the buried organic layer over time. The effect of tilling on wetland seed bank and the vegetation that was established after tilling was investigated separately (Figure 4). The final report from the P-flux study was completed May, 2009.

Figure 4. Aerial photo of the tilled site in July 2008, during the initial vegetation colonization period.