Kearney Foundation Fellowship
Final Report Summary

Fellowship Recipient's Name: **James Chang**

Project Title: **Evaluating the Nutrient Cycling Role of Aquatic Plant Communities in a Constructed Wetland**

Mentor Professor's Name: **Anthony O'Geen**

Reporting Period: **Started June 2008 and ongoing**

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The objectives of this study were to assess the role of wetland plant communities in nutrient cycling in a constructed wetland and also to provide data for nutrient budgeting. A diverse plant community dominated the wetland, which included aquatic macrophytes with all the different growth strategies: emergent, creeping, submerged, and floating. These species included early watergrass (*Echinochloa oryzoides*), pale smartweed (*Polygonum lapathifolium*), knotgrass (*Paspalum distichum*), bulrush (*Schoenoplectus californicus*), cattail (*Typha latifolia*), duckweed (*Lemna minor*), and spiral ditchgrass (*Ruppia cirrhosa*). The ecological niches that these plants fill create a potential benefit to maximize nutrient uptake in the wetland, because different growth strategies specialize to obtain nutrients through different pathways. For example, submerged macrophytes acquire more nutrients from the water column than from the soil as opposed to emergent macrophytes. Because the analysis of this investigation is still under progress, the majority of this report will focus on the methods.

The sampling methods were designed to quantify biomass, species composition, and percent cover. First, I used a Trimble GPS unit to create digital polygons that represent each patch of vegetation by area. Each patch of vegetation was assigned a unique identity. Then, I used a quarter square meter quadrate to record species composition and percent cover data. The established rule was to record three random quadrate points in a polygon that was less than 100 m^2. For polygons larger than 100 m^2, I divided the polygon into five even transects and recorded data for three evenly distributed points within each transect. This procedure was adopted to characterize differences in vegetation in narrow and lengthy channels.

Total plant biomass in the wetland was calculated by dry weight data from destructive samples and area data from the GPS. Since I also hope to perform nutrient analysis on these plant samples, I designed a nonbiased sampling scheme. Using the statistical program R (by CRAN), I created four stratified random points in digital polygons from representative plant species. At least two polygons were chosen from each plant species to represent the input and output areas of the wetland to test for possible nutrient gradients. First, in each of these points, I recorded the leaf area index (LAI) under the canopy with a ceptometer. This was used as a nondestructive sampling method, since similarities in the LAI of canopies between patches of the same species

were assumed to have similar biomass values. In a quarter meter squared quadrate, all the above ground vegetation was collected and dried in 60 degree Celsius. Two cores were also collected in the quadrate to collect soil samples and root samples for nutrient analysis, which is still in progress.

From the biomass contribution data from each species, the total nutrients stored by individual plants species can be extrapolated after nutrient analysis. Although this procedure is under progress, it will contribute important information about the fate of nutrients in the wetland. The main nutrient analyses scheduled are Olson's plant available phosphorus, total phosphorus, total nitrogen, and total carbon.

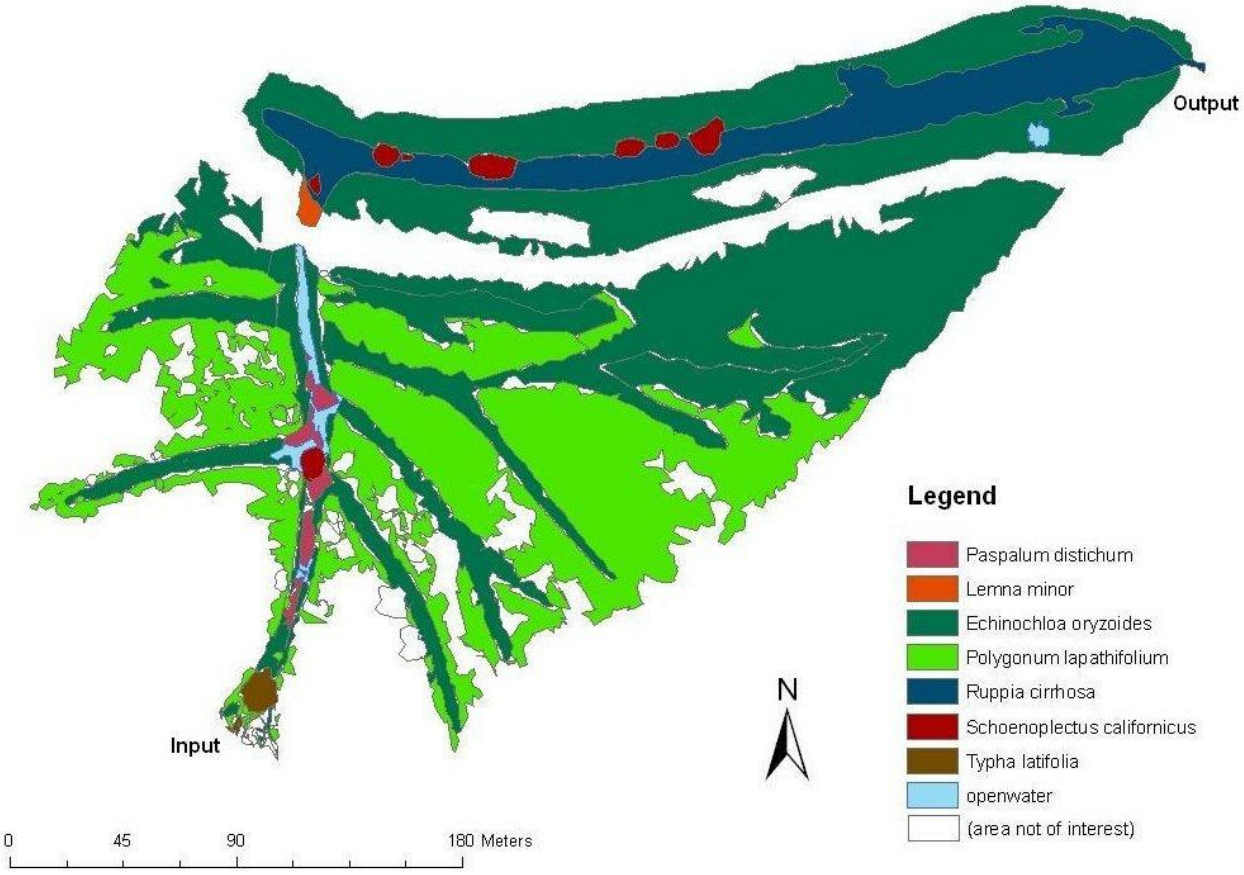

Fig. 1. Dominant plant species distribution. Notice that the low area of open water and the higher biodiversity in the central channel. If compared to Fig. 2, we can see that the presence of species may be controlled by hydrological conditions.

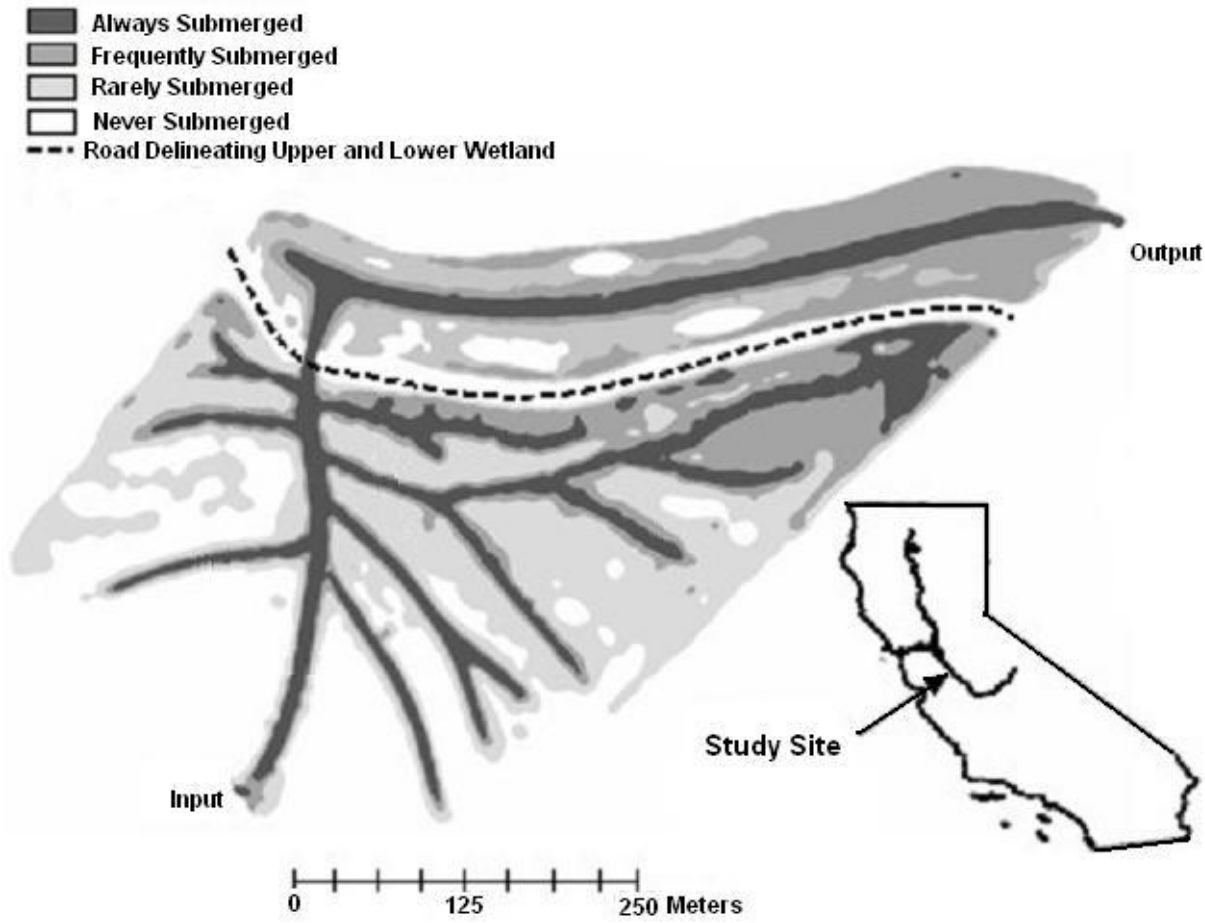

Figure 2. Schematic showing site location, wetland morphology, and areas of submersion. The wetted surface area of the wetland depends on water height and ranged from 1.3 to 5.7 ha in 2007 (Figure 1 from Brauer Unpublished 2007).