Decomposition of *Cladium jamaicense, Eleocharis* spp., and *Juncus roemerianus* in the ecotone regions of Taylor Slough and Shark River Slough

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Abstract

An ecotone region is a habitat at the juxtaposition of two or more distinctly different habitats, or a zone of transition between habitat types (Ricklefs and Miller, 1999). This transition region is best exemplified in the estuarine oligohaline zone where fresh water draining phosphorus-limited Everglades marshes mixes with water from the more nitrogen-limited coastal ocean. Since wetlands are detrital ecosystems, the dynamics of the decomposition process in this region will be unique. This project is set to estimate the decomposition of three key macrophyte species that occur in the Everglades ecotones, *Cladium jamaicense, Eleocharis* spp., and *Juncus roemerianus*. The project will take place in the ecotone region of Shark River Slough and Taylor Slough. Litter bags will be used to study the decomposition process. Litter bags will experience three different treatments 1) open air, 2) soil surface, and 3) macroinvertebrates. These treatments have been chosen to examine the decomposition that leaves experience before they are shed by the plant, after they have fallen off the plant, and the influence that macroinvertebrates have on the decomposition process.

Introduction

Water is the most important factor responsible for the formation of the existing plant communities in the Everglades (Steward and Ornes, 1983). Since the water in the ecotone region of Taylor Slough is P limited, due to the sequestering of P from the coastal waters by Florida Bay (Fourqueran et al., 1993), and the water of the Shark River Slough ecotone region is relatively P enriched, the effects of these waters in their respective ecotone region will vary significantly. The purpose of this project is to measure the ecosystem process of decomposition for three predominant macrophyte species *Cladium jamaicense, Eleocharis* spp., and *Juncus roemerianus*. This project is to take place in the ecotone regions of Taylor Slough and Shark River Slough located in the Everglades National Park. Given that *Cladium jamaicense, Eleocharis* spp., and *Juncus roemerianus* are low nutrient status species (Daoust and Childers, 1999; Richarson et al., 1999), makes them good indicators to represent the effects of increasing water P on decomposition in the ecotone region of Shark River Slough when compared to the decomposition in the P limited ecotone region of Taylor Slough.

Hypotheses

Hypothesis 1: Decomposition rates for all species will be faster in areas of highest nutrient availability. If nutrient availability is higher in the Shark River Slough ecotone region, then litter in the Shark River Slough ecotone region will decompose faster than litter in the Taylor Slough ecotone region.

Hypothesis 2: Macroinvertebrate activity enhances litter decomposition by shredding the litter, thus increasing the surface area of litter for microbial activity. If litter was exposed to macroinvertebrates activity, then this litter will decompose faster than litter that is not exposed to macroinvertebrate activity.

Hypotheses 3: Moisture is an important environmental variable that drives decomposition. Decomposition rates will be higher when more moisture is present and lower when there is less moisture. If litter was exposed to a moisture environment and a dry environment, then litter exposed to the moist environment will decompose faster than litter exposed to the dry environment.

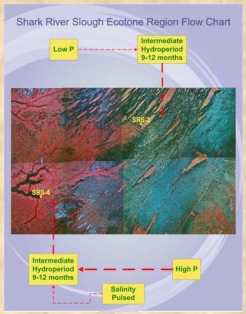


Figure 2: Shark River Slough ecotone flow chart.

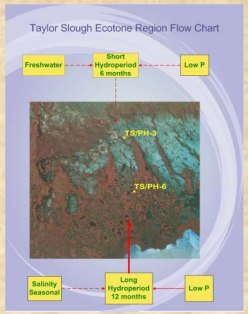


Figure 3: Taylor Slough ecotone flow chart.

Study Area

The area of study will focus on the oligohaline ecotone regions of Taylor Slough and Shark River Slough (Figure 1). These areas show a mixing between freshwater and saltwater. Salinity in the Shark River Slough ecotone region is pulsed by tides and seasonal (Figure 2), and in the Taylor Slough ecotone region salinity is seasonal following wind patterns (Figure 3). The hydroperiod for the Shark River Slough ecotone region is intermediate with inundation time varying between 9-12 months (Figure 2). The hydroperiod for the Taylor Slough ecotone region varies with a low hydroperiod of ~6 months for the northern site (TS/PH3) to a long hydroperiod ~12 months for the southern site (TS/PH6) (Figure 3).

Figure 4: Represents the 1mm mesh fiberglass screening bags used for both the open air and soil surface treatment (small mesh).

Figure 5: Represents the 6.35mm white nylon mesh bags used for the macroinvertebrate treatment (large mesh).

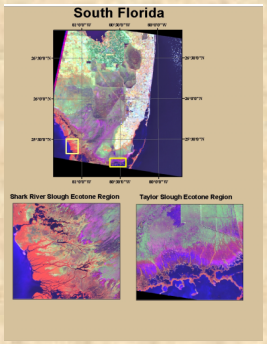


Figure 1: Landsat image of South Florida, and the ecotone regions for Shark River Slough and Taylor Slough.

Figure 6: Mesocosm for dry treatment

Statistical Analysis

- Single Exponential Model
- Analysis of Variance
- Stepwise Regression

Methods

Senesced *Cladium jamaicense, Eleocharis* spp., and *Juncus roemerianus* leaves that hadn't been shed by the plant were collected between the months of December 2001 and January 2002. *Cladium jamaicense* was collected at all sites, *Eleocharis* spp. was collected at all sites except SRS4, and *Juncus roemerianus* was only collected at SRS4. *Eleocharis* spp. wasn't collected at SRS4 because this species is replaced by *Juncus roemerianus* in the ecotone region of Shark River Slough (the inverse is true for TS/PH6). All leaves were air dried for more than two weeks, and 5g of leaf material was placed into a 15cm by 15cm litter bag. The two types of litter bags used were small mesh (Figure 4) and large mesh (Figure 5). The small mesh litter bags will be used for the open air and soil surface treatment, and the large mesh litter bags will be used for the macroinvertebrate treatment. Each litter bag contains a unique ID. Table 1 shows the distribution of plant species litterbags that will be placed at each site. There are 36 litter bags per species, 18 litter bags per treatment, that are going to be placed at each site. Since there is going to be a litter transplant study at both TS/PH6 and SRS4, each site will contain 18 extra bags of *Juncus roemerianus* and *Eleocharis* spp. respectively. The litter transplant bags were made of the small mesh and they will be set to resemble the soil treatment. Three random bags are going to be collected from each treatment at 1, 2, 4, 6, 12, and 18 months. The experiment will be set out in February 2002.

There will be three litter bag treatments. The first treatment will be the open air treatment, and bags will be attached to the outer edge of a chicken wire mesocosm to manipulate the decomposition that litter experiences when they haven't been shed by the plant (Figure 6). The second and third treatment consists of the soil surface, and macroinvertebrate treatment. The bags for both treatments will be placed at the soils surface (Figure 7). The soil surface treatment will resemble decomposition that litter experiences after it has been shed from the plant, and the macroinvertebrate treatment will take into consideration the influence that macroinvertebrates have on the decomposition process.

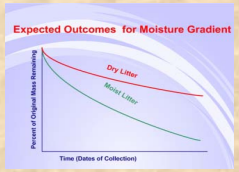
After the litter for each site had been homogenized, a subset of leaves from each species was collected. This subset of leaves will be grinded, and analyzed for TN, TP, and TC. This will determine litter quality, and allow calculating the rate of nutrient loss due to the decomposition process. After a litter bag collection, every bag will be oven dried, and weighed again to estimated % biomass loss. Litter TN, TP, and TC will be analyzed for each bag after collection. The environmental variables that will be collected are water level, salinity, TN and TP, and soil pH, Eh, bulk density, organic matter, TN and TP.

SITE	*Cladium jamaicense*	*Eleocharis spp.*	*Juncus roemerianus*
TS/PH3	X	X	
TS/PH6	X	X	X*
SRS3	X	X	
SRS4	X	X*	X

Table 1: Shows the distribution of plant species litterbags placed at each site. Note that X* corresponds to a litter transplant of *Juncus roemerianus* and *Eleocharis* spp. placed at TS/PH6 and SRS4 respectively. *Juncus roemerianus* litter from SRS4 was placed at TS/PH6, and *Eleocharis* spp. from TS/PH6 was placed at SRS4.

Figure 7: Placement of bags for macroinvertebrate treatment.

Expected Results



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