PHYSICAL FACTORS AND COMPETITIVE INTERACTIONS AFFECTING SALT MARSH VEGETATION

A Thesis

Presented to the

Faculty of

San Diego State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

in

Biology

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by

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Spring 1988

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Project Number - R/CZ-73

California Sea Grant College Program

ABSTRACT

Field and controlled experimentation suggest that competition influences the relative distributions of Salicornia virginica and Spartina foliosa in the salt marsh, and that the competitive outcome is variable and largely affected by local physical conditions. Related experiments demonstrated Salicornia's resistance to drought stress, and that Spartina responds to prolonged salinity depressions during the summer months (and not during winter months) by increasing stem height and stem density.

Salicornia canopy surrounding isolated stems of Spartina was removed from twelve sites at Tijuana Estuary. The growth of these stems and neighboring stems (that remained in the canopy) was followed for 10 months. Mean stem density increased more than sevenfold where Salicornia was removed and less than twofold when grown with Salicornia, demonstrating a significant competitive release by Spartina when Salicornia is removed.

Miniature salt marshes (27) with compressed salinity and moisture gradients were planted with Spartina and Salicornia in monoculture and in mixture to compare relative competitive advantages of each species at simulated tidal heights ranging from standing water to dry and hypersaline. After one year, Salicornia grew best at the upper elevations and Spartina grew best at the lower elevations in both monoculture and mixed plantings. At environmental extremes for either plant (dry and hypersaline for Spartina, inundated and anaerobic for Salicornia), the

competitive outcome was more predictable as the competitive advantage of one species increases and the other becomes stressed. Under moderate environmental conditions (middle elevations) the competitive outcome was both spatially and temporally unpredictable.

Root profile experiments for both species simulated water table depths of 20, 45, and 75cm below the soil surface. Spartina was only able to obtain moisture at 20cm, and died in all other treatments. Salicornia remained productive in all treatments, concentrating its belowground biomass at the saturation zone.regardless of water table depth.

The salinity depression experiment had Spartina receiving either no salinity depression (control), a short depression in the winter months, or a prolonged depression during the summer months. The prolonged salinity depression increased both stem density and stem height of Spartina relative to the other treatments.

These findings underscore the importance of relative tidal height if a wetland is to be managed or restored as habitat for one species over the other. In addition, they demonstrate that computer modelling of the system must include a competition function that changes with changing physical parameters and provide a new emphasis on the timing of freshwater release into southern California estuaries.