Amelioration of Hypoxic Coastal Shorelines Using the Physiological Adaptations of Spartina Grasses, Elucidated by Pick’s Theorem

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Coastal erosion, subsidence, and hypoxia are forces that impact Louisiana and beyond. The objective of this research was to determine the extent of land loss due to erosion and establish the most effective Spartina (S.) species stabilize land. Using graph theory in the Geometer's Sketch Pad program, progressive land loss from Isles Dernieres was calculated from 1853 through 2005. This was accomplished using Pick's Theorem (A=I+B/2-1), where A= total land area, I= interior intersections, and B= boundary intersections. Analysis indicated that there has been greater than eighty percent land loss from 1853 through 2005. Additionally, four plants from each species (S. alterniflora, patens, spartinae) were planted and flooded in three-gallon containers filled with potting soil,and a non-vegetated control was included in this same manner. Over a six month period, dissolved oxygen was measured every other day under three different temperature regimes, twenty-two, thirty, and ten degrees, respectively. Temperature control was established through growth chambers. This resulted in the control groups diffusing the most oxygen at twenty-two degrees Celsius and all the species diffusing statistically similar oxygen levels at thirty degrees Celsius and ten degrees Celsius. After six months of flooding conditions, penetration and subsidence were measured. The vegetated soils required the greatest penetration force and subsided the least. Additionally, nutrient analysis indicated that fertilizer pollutants were commonly found in the Gulf of Mexico and can be assimilated by the S. species. Oxygen diffusion is dependent on plant species and temperature. The penetration and subsidence results also support the conclusion that plants can reduce land loss and preserve the coastline.

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