QUANTIFYING THE VARIATIONS OF SALT MASH AREA IN THE INTERTIDAL ZONE PRODUCED BY CLIMATE CHANGE

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Project Objectives: Salt marshes are highly sensitive to the effects of long-term climatic change. Their survival is linked to a delicate balance between the rate of sea-level rise, subsidence, and surface accretion. In this project we will focus on the variation of total marsh area in a coastal tidal basin as a function of sea-level rise, subsidence, and storm activity. Our objectives are:
- to determine and quantify the factors responsible for changes in salt marsh area in the intertidal zone
- to build a model able to determine changes in marsh area caused by climate change in different coastal systems.

Specific Hypotheses to be Tested: Our central scientific hypothesis is that shallow intertidal areas are characterized by two landforms, tidal flats and salt marshes, which lie within specific ranges of elevation, whereas intermediate elevations are less frequent in intertidal landscapes. This bimodal distribution of elevations stems from the characteristics of wave induced sediment resuspension and the colonization of intertidal areas by marsh grass.
Our second hypothesis is that external drivers like sea-level rise, subsidence, and storms influence the repartition of intertidal area between salt marshes and tidal flats. These processes are nonlinear, so that slow modifications brought by climate change seldom entail a gradual modification of the landscape.

Location of the Research Activities: The research will be conducted in the coastal bays of the Virginia Coast Reserve Long-Term Ecological Research Site. The results will be applicable to other similar systems along the US coastline.

Methods: The proposed research encompasses a modeling and a field component.
We will develop a 2D numerical model representing the repartition of shallow tidal basins into salt marshes and tidal flats. The model will be divided in three components that will co-evolve in time through exchanges of sediment.
The field component of the project will provide data to parameterize, test, and validate the model. We will establish two transects in the Virginia LTER perpendicular to the marsh/tidal flat boundary and measure deposition rates on the marsh platform, wind velocity, progradation or erosion of the marsh edge, sediment concentration, wave height, and tidal velocity in the tidal flat. The model will be run under different scenarios of sea-level rise, subsidence, and increase of storminess to study the impact of climate change on marsh extension.

Expected Deliverables: - Developed numerical model for marsh extension
- Simulations of marsh evolution under different scenarios of sea-level rise, subsidence, and increase in storminess
- Hydrodynamic and sedimentological data collected in the field
- Vegetation parameters collected in the field