Coastal vulnerability has been gaining recognition as a critical issue, especially with the increasing predictions of sea level rise. Susceptibility to extreme events, eutrophication, and shoreline modification has left many coastal regions in a degraded state. Shoreline protection has traditionally taken the form of seawalls and offshore breakwaters which can be detrimental to both the local ecosystems and adjoining shorelines. The objective of this thesis is to analyze the hydrodynamic and bathymetric variation that occurs within Mosquito Lagoon, Florida following living shoreline and oyster reef restorations. The shoreline sites were sampled using a Before-After-Control-Impact (BACI) design and data were analyzed to ascertain the hydrodynamic and bathymetric variations that occurred resulting from plantings of emergent vegetation and deployment of biogenic wave break structures. Turbulent statistics were calculated to determine the effects of nearshore emergent vegetation on the incoming currents and waves. The vegetative growth in conjunction with the wave break structure was shown to reduce the onshore velocities to 46% of those observed at the reference site. Surveys among restored and degraded shorelines and oyster reefs show average crest heights 10–20 cm low in the restored sites. Nearshore slopes at the hard armored TM Seawall site were over 161% steeper than the restored sites comprised of emergent vegetation and wave break structures implying that scour was present at the toe of the structure from potentially reflected wave energies and increased swash velocities. Quantifying the hydrodynamic and geomorphic processes at work within restored shorelines and reefs may aide managers in best practices both in selection of viable restoration sites and with proper implementation of restoration techniques.