Nitrogen and Phosphorus Mass Balance Models and Nutrient Biogeochemistry in Florida Bay

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Nutrient cycling in Florida Bay is controlled by 1) rates of external input from groundwater, surface water and atmospheric precipitation and 2) rates of "internal" cycling processes such as uptake and recycling by algae in the water column and in the sediments, uptake and recycling by seagrasses, water column transformation of organic nitrogen and phosphorus, nitrogen fixation, sediment denitrification, sediment remineralization processes and solid phase phosphorus geochemistry. This project will provide 1) a well-constrained nutrient mass balance model that includes both external and internal loading/cycling terms and 2) new rate measurements that are critical for development of process-based models of nutrient cycling.

A robust biogeochemical model will be developed for computing annual mean values of net fluxes and transformations of nutrients and carbon in Florida Bay and its major regions for use as an index of Bay ecosystem function and responses to variations in climatic and hydrologic forcings. In addition, a mechanistic knowledge of factors regulating key processes of benthic nutrient cycling will be developed to deepen understanding and for calibration of numerical models of water quality and ecology of Florida Bay.

Methods employed will included lab-based and in situ measurements of nutrient exchange in seagrass chambers/microcosms, measurements of nitrogen fixation and denitrification, production/respiration measurements derived from continuous oxygen measurements, measurements of nutrient remineralization, and measurements of dissolved nitrogen, phosphorus and carbon exchange. Spatial coverage will include stations in four distinct hydrologic regimes (as defined by existing physical exchange models) with sampling three times per year for two years.

These studies are consistent with the stated program goal of "developing a capability to predict changes in coastal ecosystems resulting from restoration activities". The mass balance model and the contribution of rates and model coefficients to other modeling efforts will increase understanding of nutrient cycling, water quality, and seagrass habitats.