Vital Signs(2): Nutrient Dynamics *and* Water Chemistry

[shortened names: Nutrients; Water_Chem]

Parks Where Vital Sign will be implemented:
BICY, BISC, DRTO, EVER, VIIS – SFCN will analyze data collected by existing programs
BUIS, SARI - deferred

Justification/Issues being addressed: Nutrient Dynamics ranked 4th among the 44 SFCN vital signs. Nutrients and physical characteristics within freshwater and marine water bodies drive primary production and when unbalanced can have deleterious effects. Understanding their distribution allows more complete interpretation of other indicators. Nutrients can change due to numerous reasons, for example; upstream/upland development, agricultural inputs, malfunctioning septic systems, boat discharges, atmospheric deposition, as well as internal nutrient cycling. Many parks have had monthly sampling for nutrients at permanent sites for a number of years and understanding the pattern and input fluxes can help explain patterns observed. Nutrient enrichment in freshwater and brackish areas has occurred primarily due to agricultural inputs (South Florida, SARI) with some impacts due to malfunctioning septic systems (USVI). Rain events can create pulses of nutrients. CERP/MOD Waters Everglades restoration is expected to reduce nutrient inputs to the Greater Everglades system.

General Monitoring Questions to be addressed by the Vital Signs:

- What are the status and trends in the spatial and temporal distributions of nutrients at specific sites in the wet prairies and marshes, near shore areas, and marine water bodies?
- What are the status and trends in nutrient loading to the estuaries from all sources and in sediment loading to guts and standing ephemeral pools at VIIS?
- What are the status and trends in the spatial and temporal distributions of physical water chemistry (e.g. conductivity, DO, temperature, pH, etc.) in the wet prairies and marshes, near shore areas, and marine water bodies?

Measures:
Discharge of freshwater to specific estuaries need to calculate nutrient and sediment load, plus flux measurements of nutrients at specific locations, Nitrogen, Phosphorous, Dissolved oxygen, Chlorophyll a, organic carbon, and other currently collected parameters.

Basic Approach:
The basic approach for “Nutrient Dynamics” and “Water Chemistry” involves much of the same data collection at the same sites so these two vital signs are described together. Please note that the “Water Chemistry” vital sign overlaps with “Estuarine salinity patterns” which covers changes in salinity patterns and other water chemistry parameters in bays.

1) *Freshwater marshes*

At BICY, the NPS takes six grab samples (only during the summer months) at 16 marsh stations (funded by South Florida Water Management District - SFWMD). This data is stored in SFWMD DBHydro database and is summarized into annual reports by the park staff. This report will be posted on the SFCN website.

At EVER, the NPS takes water quality grab samples 12 times a year (monthly) at 15 sites and this data is stored in SFWMD DBHydro database. These sites are located in the Shark River and Taylor River Slough and downstream of the water control structures in freshwater and marsh locations. Ground water nutrient grab samples are done quarterly at wells around the park at 12 sites. Summarizing this data and coordinating with other users of this data set will be done annually.

For EVER, summarize the Florida Coastal Everglades Long Term Ecological Research (FCE LTER) automated nutrient samples to generate annual reports at specific sites.

2) *Marine water bodies*

At BISC, DRTO, EVER, and VIIS SFCN will work with PIs to summarize existing marine nutrient grab samples (sampling varies from quarterly or biannual).

For BISC, we can combine 25 Florida International University Southeast Environmental Research Center (FIU SERC) water quality monthly grab sample stations and Miami-Dade County Department of Environmental Research (DERM) 13 water quality monthly grab sample stations to look at regional patterns.

For DRTO water quality is monitored by the Southeast Environmental Research Center (SERC) Water Quality Monitoring Network for 15 sites. This information will be summarized annually.

For EVER, summarize the FIU SERC water quality monthly grab samples and the Florida Coastal Everglades Long Term Ecological Research (FCE LTER) automated nutrient samples to generate annual reports at specific sites.

For VIIS, SFCN will assist in establishing analysis and reporting procedures for the existing 16 sites where biannual nutrient grab samples are being collected by the NPS.

3) *Nutrient and sediment loading*
Calculations of nutrient loads may be accomplished at some sites due to preexisting instrumentation and site specific knowledge (BISC, EVER). For EVER, using the FCE LTER automated nutrient samples and continuous hydrology data generate nutrient fluxes into estuary. At BISC, there are some discharge curves being generated by FIU Joe Boyer (to be published shortly) for canal discharge into BISC. Need to see if there is consistent nutrient data to go along with this canal discharge data. Calculation of sediment loads for VIIS is only feasible when surface water runoff is known. Modeling of the sediment loading will draw upon some modeling work from NOAA (http://ccmaserver.nos.noaa.gov/ecosystems/coralreef/summit_sea2.html)

Sediment loading will also be investigated by the use of Sediment Elevation Tables (SETs) see Coastal Geomorphology indicator.

This task will be split by the community ecologist for marshes (objective 1 sediment in guts part of objective 3) and the marine ecologist for marine nutrient dynamics (objective 2 and 3).

4) *Reef water temperature*
Reef water temperature is being monitored at selected reef sites using continuous water temperature data loggers. The methods will be included in the "Marine Benthic Communities" protocol.

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Development Schedule, Budget, and Expected Interim Products:
SFCN will be gathering existing protocols from the implementing agencies and developing SOPs for how SFCN will analyze and report the data. The Standard Operating Procedures (SOPs) involved are expected to take about 2 years of SFCN staff time to draft and test. The marine post-doc and a community ecologist post-doc will be developing the SOPs and gathering the existing protocols from the implementing agencies. SOP development will be completed by 2009 with implementation in 2011. Table indicates proposed SFCN workload upon full monitoring implementation.

Expected SFCN staff time requirements once program is fully implemented in 5 years:

SFCN Staff	Full Time Equivalent (FTE)
Coordinator	
Marine Ecologist	0.02
Fisheries Biologist	0.02
Marine Biologist Technician (So FL)	
Marine Biologist Technician (VI)	
Community Ecologist	
Wildlife Technician (Wildlife)	
Wildlife Technician (Vegetation)	0.02
Quantatitive Ecologist	0.06
Data Manager	0.04

GIS/Data Tech	0.04
Interns	
SFCN Total	0.2