

PROJECT SUMMARY

Integrative assessments of ecological resources and ecosystem stressors at NERRS

Rationale: Under the National Centers for Coastal Ocean Science (NCCOS) FY05-09 Strategic Plan, NCCOS is directed to produce baseline assessments of ecological resources and to quantify impacts of ecosystem stressors in all NOAA protected areas, including among others National Estuarine Research Reserve System (NERRS) sites. It follows that an associated performance measure is the number of NERRS sites that have key resources and stressors adequately characterized for meeting coastal-management needs. In addressing such goals and performance measures, it is also critical for NCCOS to work directly with the NERRS to ensure that their specific programmatic needs are being met and that the partnering efforts complement ongoing NERRS research activities.

Objectives:

The two primary objectives of this study are to:

- 1) Determine impact of land use on tidal creeks in the NERRS;
- 2) Assess the ecological status of individual NERR sites.

The long term plan is to implement these assessment strategies NERRS-wide. This pilot project will be conducted in the NC and GA NERRS.

Approach:

Objective #1 will be addressed by evaluating the applicability of the preliminary hierarchical creek classification framework that was developed and tested in 2005 by HML for grouping the various types of coastal ecosystems that occur along the tidal creek estuarine gradients into classes of similar environmental attributes including: different location (e.g., distance from headwaters), geomorphic attributes (e.g., width, depth), watershed attributes (e.g., size, land and impervious surface cover, freshwater inflow), environmental conditions (e.g., dissolved oxygen and salinity regimes), pollution exposure gradients (e.g., chemical and microbial contaminants), food webs (e.g., kinds and abundances of benthic prey and predators), and vulnerability to human activities (e.g.,

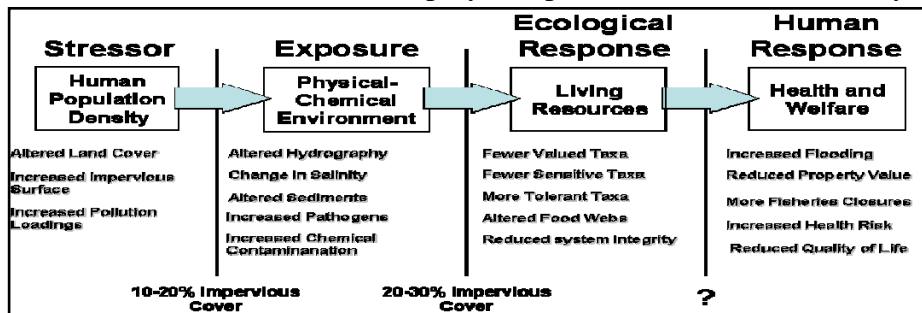


Figure 1. Conceptual model of linkages between altered land

risk to human health). As part of this task, we also will incorporate appropriate aspects of the newly developed NERRS Habitat Classification System (NERRS/ERD 2005) into the tidal-creek classification system.

This study will also evaluate and refine the stressor-exposure-response model (Fig. 1) to provide a conceptual basis for addressing NERRS coastal management needs. These include: (1) defining linkages between land use and ecological and human-use resources at risk; (2) characterization of ecosystem changes that

occur along key environmental gradients, such as from creek headwaters to open ocean; and (3) identification of human and natural causes of observed changes including land cover and watershed attributes.

For each reserve site (NC and GA) three creek networks will be sampled, including ones located within non-perturbed and nearby perturbed watersheds. Creek networks will be selected in collaboration with the NERR Site Managers based on land-use patterns to ensure that forested, suburban, and urban/industrial watersheds are included in the sample frame. Three creek orders (classes) will be randomly sampled within each network. The following parameters will be measured in each creek order: (1) water quality, including dissolved oxygen, salinity, water temperature, pH, and depth for at least a 25-hour semi-continuous record; (2) sediment chemical contamination including trace metals, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, pesticides, Poly Brominated Diphenyl Ethers (PBDEs), and other new emerging chemicals of concern when appropriate; (3) diversity and abundances of macrobenthic and nekton communities; (4) chemical contaminants in tissues of targeted benthic/fish species; (5) sediment toxicity; (6) water-column nutrients; and (7) human pathogens including fecal coliform bacteria and viral indicators. Replicate samples will be collected within each creek order for the analysis of benthic and nektonic communities, nutrients/chlorophyll, and water quality and one sample per creek order will be collected for the remaining indicators.

Objective #2 will be addressed with a stratified random sampling design, consisting of synoptic measurement of multiple ecological indicators, including stressor levels (e.g., eutrophication symptoms, microbial indicators, chemical contaminants) and measures of biological condition (benthic and demersal fauna), at a series of random probabilistic sampling stations within subtidal portions of each NERRS site. Incorporating a probabilistic sampling framework will also provide the ability to make unbiased statistical estimates of the spatial extent of degraded vs. non-degraded condition with respect to the various measured environmental indicators. Including measures of eutrophication, microbial/pathogenic indicators, and chemical contamination provides a basis for evaluating relative contributions of such multiple stressor sources to potential biological risks and identifying which may be the most problematic for a given reserve. Thirty stations will be sampled at each reserve, with stations stratified by major habitat type within subtidal creek locations. Information from prior NERRS studies should be used to help identify the best stratification schemes. Due to funding limitations the probabilistic sampling approach will only be conducted in the NC NERRS during this pilot study, but as this effort expands System-wide, indicators and protocols will be standardized across all reserves to maximize data comparability for regional and national comparisons.

Products:

1. A formalized partnership with the NERRS program aimed at producing a system-wide strategy for integrative assessments of ecological resources and stressor impacts across NERRS sites.
2. Completion of an integrative assessment (both probabilistic and fixed site tidal creek methods) at the NC NERRS site, plus an additional tidal creek assessment for the GA NERRS.
3. An implementation plan for completion of assessments at remaining NERRS sites.

Timeline:

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| April 2006: | Site visits to NC and GA NERRS for site selection |
| July-August 2006: | Field sampling in GA NERS |
| September 2006: | Field sampling in NC NERRS |
| September 2006-February 2006: | Sample analyses |

February 2007 – September 2007: Data analysis
July 2008: Findings published in report format

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