December 2014 Volume 2, Issue 4

Sentinel Site Quarterly

North Carolina Sentinel Site Cooperative

Happy Holidays from the N.C. Sentinel Site Cooperative!

The North Carolina Sentinel Site Cooperative (NCSSC) Coordinator and Core Management Team have been busy this Quarter. We reached out within the research community to encourage submissions to the 2015 Ecological Effects of Sea Level Rise RFP, participated in the 2014 Southeastern Estuarine Research Society (SEERS) Conference, and worked with partners to highlight their research within the NCSSC Quarterly.

For more information about the NCSSC, contact Jennifer Dorton. Happy Holidays!

Be Part of the Quarterly!

The Quarterly is a way to communicate and collaborate among NCSSC partners. Our goal is to keep you informed about the research, upcoming events, and opportunities within the NCSSC. The Winter Quarterly is full of great information that we are excited to share. If

In This Issue

Quick Links

you have an interesting project or event related to the Cooperative, Let us know!

Anna Hilting - On Assignment with NOAA CO-OPS

In October 2015, Anna Hilting, Oceanographer with NOAA's Center for Coastal Fisheries and Habitat Research in Beaufort, began a 4-6 month assignment with NOAA CO-OPS to coordinate the water level requirements of their stakeholders within identified gaps in the National Water Level Observation Network (NWLON). Approximately 30 stakeholders (e.g. National Weather Service, Army Corps of Engineers) provided CO-OPS with a list of over 500 desired locations for water level stations based on their desired usages (e.g. navigation, storm surge, sea level rise).

Anna will be organizing these data to produce a map of stakeholder needs that can be overlain with a map of the NWLON gaps and used to make strategic decisions for infrastructure siting. Identified gaps include areas within the NCSSC boundary, making this effort relevant to the NCSSC Water Level Sub-Committee's assessment of existing water level assets. Additionally, the NCSSC will benefit from the CO-OPS NWLON improvements to the resolution for the VDATUM grids in the Pamlico Sound since CO-OPS determined that some of the upriver sites, previously considered nontidal, are actually tidal. Another upcoming improvement in VDATUM is "point source conversion error" which allows the estimation of uncertainty of points within grids.

Contact Anna for more information on her temporary assignment with CO-OPS: anna.hilting@noaa.gov.

Alternative Classification Approach Improves Estimates of Seagrass Acreage

The NCSSC boundary includes extensive areas of seagrass ranging from continuous meadows (extending tens of kilometers) to groups of patchy mounds (less than a meter across; Figure 1). To date, the most widely adopted approach to seagrass classification is through visual interpretation whereby an analyst manually delineates polygons of seagrass habitat on-screen (Figure 2). A known flaw of this method is the frequent inclusion of areas lacking vegetation within the mapped polygons (Figure 3a) leading to overestimates of actual seagrass acreage and ignoring seagrass spatial patterns.

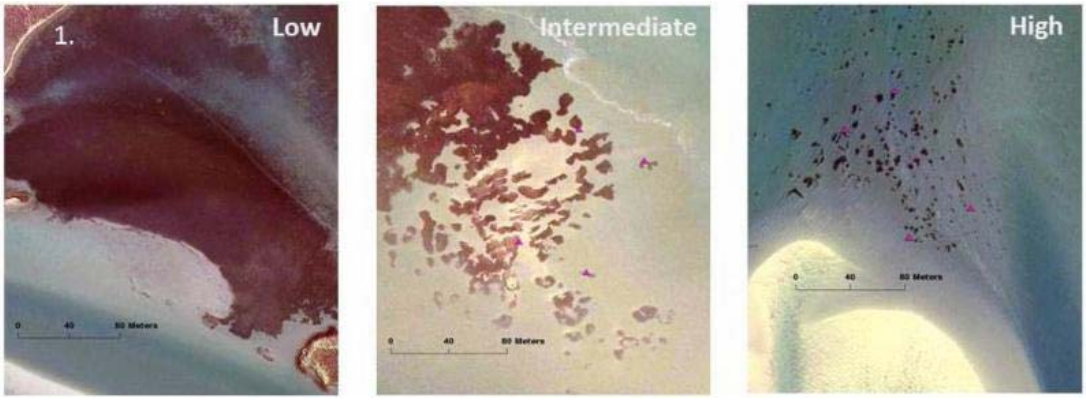

Figure 1. Seagrass habitat in NC ranges from continuous beds, extending hundreds of kilometers (far left) to aggregations of patchy mounds, often less than one meter in diameter (far right). In NC, the spatial configuration of seagrass seascapes is largely driven by the level of hydrodynamic stress experienced at a site in the form of tidal currents and exposure to wind-waves. As these stressors increase, either individually or in concert, seagrass seascapes become patchier.

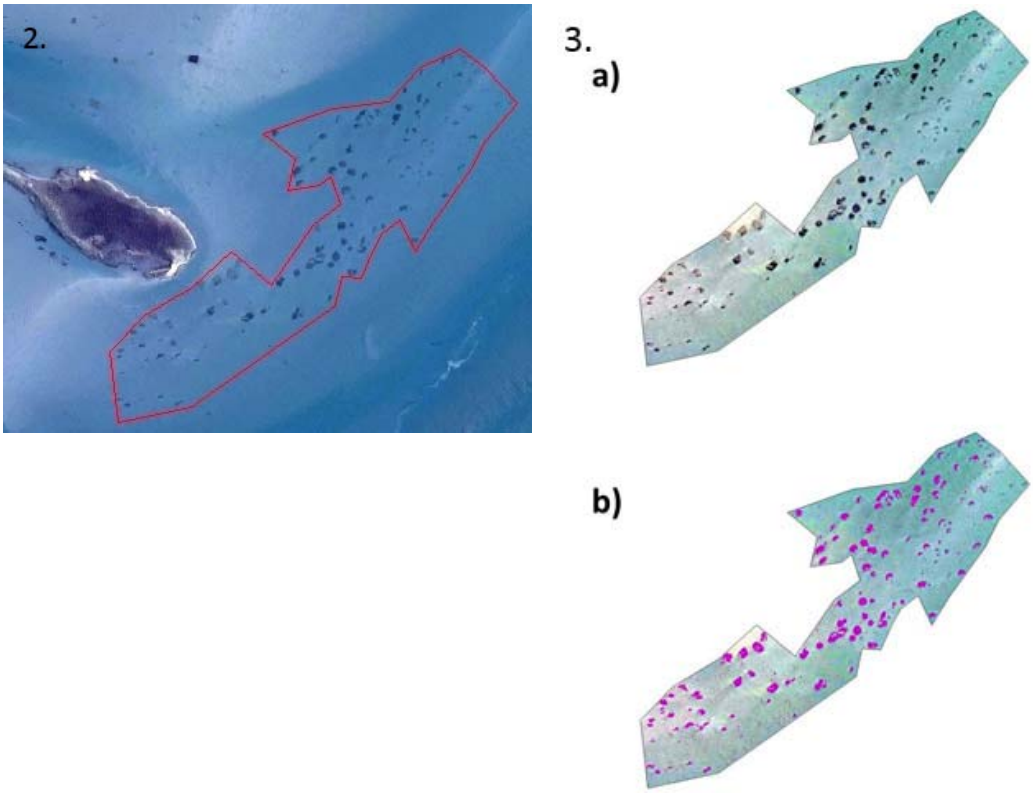

Figure 2. A manually-delineated seagrass polygon (outlined in red) interpreted from 30cm resolution imagery captured in May 2013. **Figure 3**. The mapped polygon from Figure 2 is clipped out of the original image, revealing extensive unvegetated areas between discrete patches of seagrass (a) and the ability of linear spectral unmixing to identify individual pixels of seagrass (b) indicated by magenta-colored pixels. At this particular site, the actual

amount of seagrass classified via unmixing represents only 6.6% of the original manually-delineated polygon (b).

In a recent study conducted at the NOAA Center for Coastal Fisheries and Habitat Research in Beaufort, NC, in collaboration with the University of Wisconsin Madison, researchers evaluated an alternative method to improve classifying and calculating the extent of shallow seagrass ecosystems using digital aerial photographs. The technique, linear spectral unmixing, utilizes the spectral information contained in images as well as a set of representative habitat training data (pixels selected directly from an image by the analyst) to report the proportion of each habitat type found in each pixel of the image. This classification technique has been successful in classifying other shallow coastal habitats, namely coral reefs, using multispectral imagery from satellites. However, the current study utilized digital aerial photos rather than multispectral images, demonstrating that traditional remote sensing techniques involving spectral signatures can be applied to aerial photos having only three bands of spectral information.

The unmixing technique was applied to six historically studied seagrass sites located in the Albemarle-Pamlico Estuary System (Back Sound) representing a gradient of seagrass cover ranging from continuous to patchy (Figure 1). Performance of the unmixing technique was site-dependent with high overall accuracy (range: 86.3- 99.0%). At continuous cover sites, the percentage of the polygon that was actually classified as seagrass via the unmixing technique was high (i.e., 97.9%). With increasing patchiness, the percentage of the polygon that was actually classified as seagrass via the unmixing technique decreased, reaching a low of 6.6% in one case (Figure 3b).

Having a more accurate assessment of seagrass acreage will help fisheries managers to better estimate the extent available to commercially important species and will support the development of aquaculture suitability indices. Additionally, classification techniques that better capture seagrass 'patchiness' help address seagrass resilience in future climate change scenarios and altered hurricane regimes, as patchy seagrass areas are known to be more susceptible to storms than continuous meadows.

Understanding the conditions that may produce both quantitative and qualitative shifts in seagrass and identifying areas of greatest vulnerability is increasingly important from both an ecological and economic perspective. The unmixing technique will be used in a larger study in the Albemarle-Pamlico Estuary System that seeks to quantify differences in seagrass spatial patterns across hydrodynamic gradients, identify thresholds in hydrodynamic drivers of seagrass spatial pattern, and examine how seagrass spatial pattern

influences ecological resilience in the face of climate change, namely increasing severity and frequency of hurricanes.

For more information please visit:
http://coastalscience.noaa.gov/projects/detail?key=174

CISA Studies Drought Impacts in Coastal NC and SC

The Carolinas Integrated Sciences & Assessments (CISA), in partnership with NOAA's National Integrated Drought Information System (NIDIS), is focused on efforts to improve understanding of coastal drought impacts and how improved monitoring might be incorporated into drought planning and preparedness. During the summer and fall of 2013, CISA team members conducted a series of interviews with fishermen, outdoor recreationalists, and land managers in Carteret County, NC, and Beaufort County, SC, in order to document and assess local impacts and experiences with drought. Interviewees were specifically asked about: their experiences with drought and drought impacts; how they cope with or adapt to drought; their needs for drought information or resources; and, other stressors that interact with drought to exacerbate impacts, create other resource pressures, or otherwise affect their ability to cope with drought. This project serves as a first step in understanding the information and/or actions that are necessary to better integrate coastal-environmental needs into drought monitoring, planning, and response by identifying gaps in existing knowledge and primary stakeholder concerns. Key themes which emerged from the interviews are summarized below.

- It is not a shortage of rainfall that contributes to coastal ecological drought, but multiple factors including variable precipitation patterns, freshwater inflows from upstream, and tidal regimes. Key concerns focused on water quality conditions, particularly salinity levels and fluctuations, and the availability of freshwater at certain times of the year to meet the needs of animals, vegetation, and habitats.
- Drought can directly and adversely affect shrimpers and crabbers because of the inherent salinity sensitivity of these fisheries. Other interviewees highlighted more indirect impacts such as ways in which drought can amplify stressors related to broader economic conditions, government regulation, and land use change.
- Interviewees working in managed lands or refuges indicated concerns about the effects of drought on managed ecological areas (e.g. waterfowl impoundments), vegetation (e.g. submerged aquatic vegetation for impoundments and fire fuel), and soil conditions.

Drought conditions can increase fire risks as well as make impoundments unsuitable for waterfowl or fish (thereby limiting recreational use of these areas).

- In general, interviewees did not report using formal sources of drought information on a regular basis. Individuals involved in fishing or recreation consider information related to weather, tides, salinity, fishing conditions, financial costs, and regulations, as well as their personal observations and local knowledge about coastal resources. Likewise, land and refuge managers also use a range of locale-specific hydrological, salinity, and other environmental information to make management decisions.

Ongoing projects in the Carolinas Coastal Drought Early Warning System Pilot Program will address information needs identified by interviewees:

- *Salinity*: The movement of saltwater in and out of coastal estuaries and river systems, and the impacts of increased salinity on individual species and habitats, is a cross-cutting concern for all groups.
- *Extremes*: One of the most consistent findings of this study is that participants consider drought events within a continuum of precipitation-related threats. Data collection and monitoring processes that include all extreme precipitation events and impacts, rather than focusing only on drought, may have greater utility for coastal decision makers. As they are interested in the full-range of hydroclimate extremes, i.e. too little or too much rainfall, drought information will need to be integrated into a larger network of resources and tools.
- *Drought duration and timing*: Both intense, seasonal and extended, multi-year droughts have impacts on coastal ecological resources. The timing (which season) of droughts is particularly important for some species (e.g. shrimp, blue crabs) and management decisions (e.g. impoundment management for migratory birds).
- *Uncertainties about drought impacts*: While most participants indicated having observed or experienced impacts that they attributed, in part, to drought over the past 10-15 years, there was also considerable uncertainty regarding drought as the exact cause or the degree of such effects. Consequently, information about how specific species or ecosystems respond to extreme hydroclimate events (drought and flooding) and the thresholds at which severe impacts occur is needed. This is especially the case for several species of anadromous fish, crabs, shrimp, and types of vegetation (e.g. marsh grasses, tree species). Improved understanding of both the immediate and long-term

impacts on populations and communities, and how extreme events influence various life stages of species of concern (e.g. class years, larval vs. adult), would aid in management processes seeking to monitor and mitigate those impacts.

- *Integration with local information*: Although the coastal environments of the Carolinas are similar with regards to general climate, soil composition, and species composition and diversity, the local geography greatly influences the direct and indirect (ecological) impacts in a given area. Most interviewees use and rely on local information and their personal expertise in making decisions. New tools and information would need to mesh with or complement the information currently used.

About CISA: Based at the University of South Carolina, CISA is one of eleven NOAA-funded Regional Integrated Sciences & Assessments teams. CISA supports research and activities to incorporate climate into water, public health, and coastal management and decision making.

The NOAA Sentinel Site Program leverages existing research and monitoring resources to ensure resilient coastal communities and ecosystems in the face of changing conditions. The program's place-based approach focuses on issues of local, regional, and national significance that impact habitats and species managed by NOAA as well as surrounding coastal communities.