United States Environmental Protection Agency
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EPA Coastal Communications

REMOTE SENSING OF COASTAL AND ESTUARINE WATERS AND HABITATS

Background

Remote sensing is the science of acquiring information about the Earth's surface by sensing and recording reflected or emitted energy. The U.S. EPA's Office of Research and Development's National Health and Environmental Effects Research Laboratory (NHEERL) is conducting research in the use of aerial and satellite imagery to remotely collect information on the environmental condition of coastal and estuarine habitats. Conventional sea or ground-level sampling will be augmented by this remotely-sensed data to provide synoptic information on water quality indicators [e.g., chlorophyll a and total suspended solids (TSS)] and habitat characteristics at smaller spatial scales and shorter time intervals. Incorporating these data into environmental assessments will assist the States and Tribes in developing a better understanding of the effects of natural and anthropogenic stressors on coastal and estuarine habitats across a variety of temporal and spatial scales.

Approaches

Two of NHEERL's Ecology Divisions, the Atlantic Ecology Division (AED), and the Western Ecology Division (WED) have developed remote sensing research programs. The AED is utilizing two approaches to understand stressor effects in coastal areas. Global scale, multi-year satellite (AVHRR) images were reprocessed using visualization software, and subsequently integrated with data from the Texas Water Development Board to create data sets at weekly to monthly time scales. These data sets related changes in coastal vegetation greenness with regional scale climate conditions and watershed water management practices (see Fig. 1). In a second approach, bio-optical models are being developed in partnership with EPA Region I, the University of Rhode Island, Brown University, and NOAA. These models accurately simulate the distribution of chlorophyll a concentrations in New England estuaries from ocean color viewed from aircraft or satellite sensors.

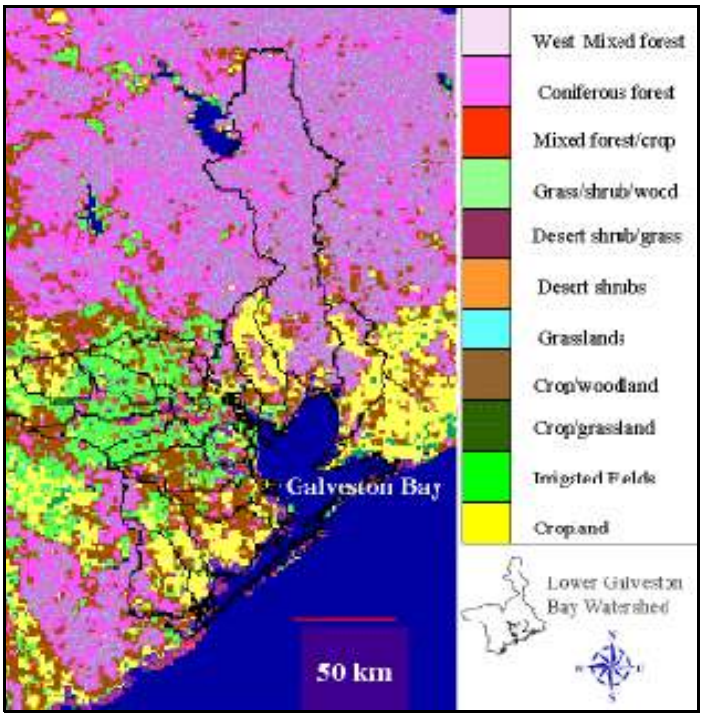

Fig. 1. Reprocessed Advanced Very High Resolution Radiometer (AVHRR) sensor image of the Texas Upper Coast and Lower Galveston Bay.

(Over)

The WED is comparing side-scan and sediment-penetrating sonars, underwater video imagery and aerial photography for mapping benthic invertebrate habitats (Fig. 2). These mapping tools are designed to assist States and Tribes in establishing criteria that will be protective of these important resources. They also support EPA's research on determining the effects anthropogenic stressors may have on estuarine habitats and food webs. Geographic image analysis applications of color infrared (CIR) aerial imagery are being developed to interpret, classify and map intertidal submerged aquatic vegetation (SAV; e.g., Zostera spp., eelgrass) (Fig. 3).

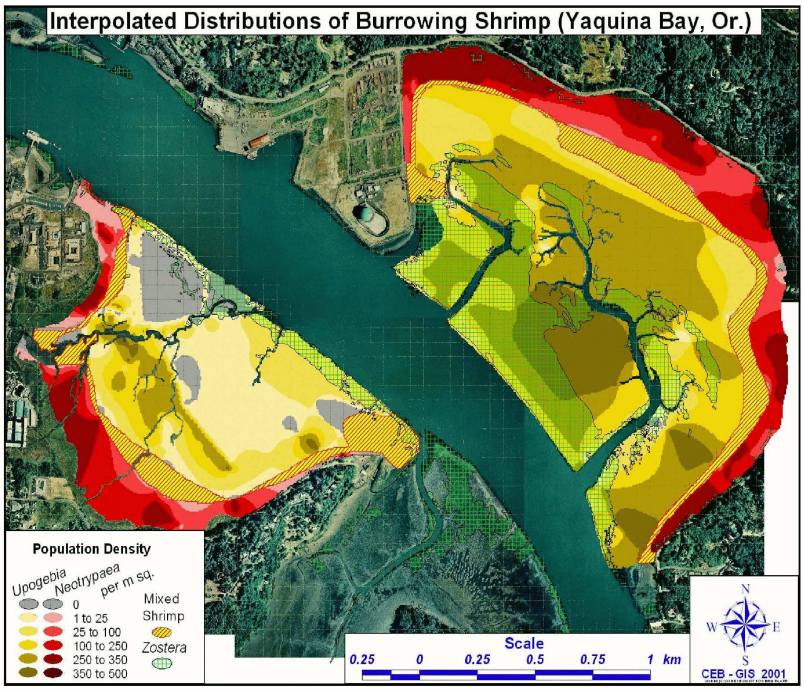

Fig. 2. Map of Yaquina Bay, OR showing distribution and density of two burrowing shrimp genera & two species of the seagrass *Zostera*.

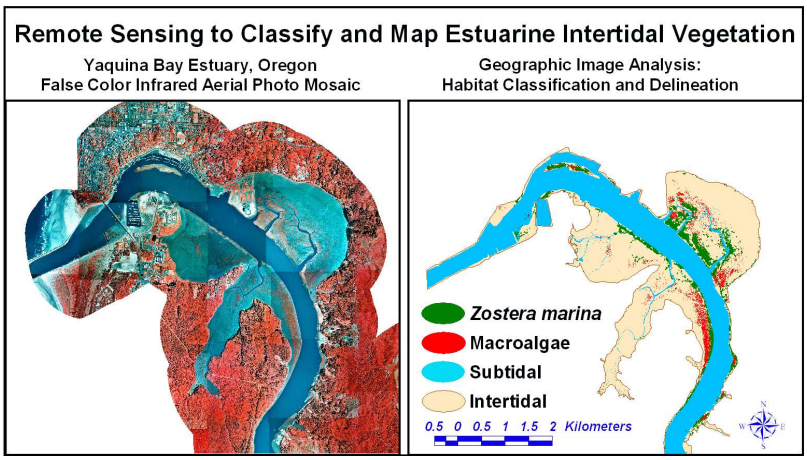

Fig. 3. Digital image classification algorithms are used to classify SAV in the Yaquina Bay Estuary, OR.

Because eelgrass has been identified as critical habitat for many estuarine species, concerns have been raised in the Pacific Northwest (PNW) regarding possible negative impacts of increasing nutrient levels to eelgrass habitat via the stimulus of macro algae growth. The goal of this research is to develop techniques to monitor changes in estuarine habitats at a very high resolution (~ 0.2 m).

Further Information

For further information on the data analysis and algorithm development of the bio-optical models or watershed analyses, contact Darryl Keith keith.darryl@epa.gov, at (401) 782-3135 at the EPA's NHEERL Atlantic Ecology Division. The NHEERL Western Ecology Division's contacts for estuarine habitat mapping are Ted DeWitt, dewitt.ted@epa.gov, (541) 867-4029, and David Young, young.david@epa.gov, (541) 867-4038 at the Pacific Coastal Ecology Branch in Newport, OR. Visit the Coastal Communications Web Site at http://www.epa.gov/ged/crc.htm.