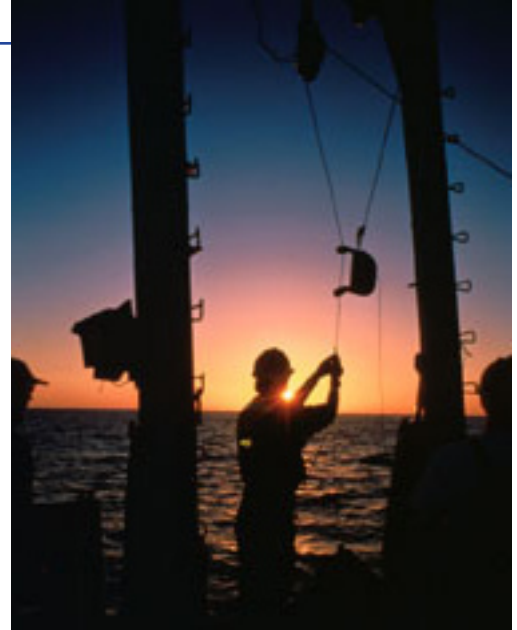


Land & Resource Use Overview

Issue

Land use impacts to estuarine and coastal areas include pollutant loading from urban and agricultural runoff; waste discharge; dam construction; dredging; withdrawal of water for agricultural and human consumption; logging and urban development. The effects of these impacts varies, but often include increases in nutrient concentrations and associated eutrophication, loss of native plant and animal habitat and diversity, and decreases in commercial and recreational finfish and shellfish stocks.

Although the impacts of human land use activities on coastal waters are diverse, one of the most dramatic impacts is the increased quantity, distribution, and movement of nutrients (e.g., nitrogen, phosphorus, silica) entering coastal environments. This has negatively affected human health and the environment. Enriched nutrient levels in coastal waters have led to increased algal levels which has increased the frequency of harmful algal blooms; the loss of both commercially important fisheries and overall aquatic biodiversity; loss of natural submerged aquatic vegetation habitats (which are vital to fish and other biota); and hypoxia or anoxia leading to fish kills and/or degraded benthic habitats that affect shellfish and other biota.



Approach

CSCOR research on the effects of land and resource use on coastal ecosystems is helping coastal managers make more informed choices among coastal development options and helping them choose the most cost-effective measures for protection and restoration. CSCOR supports long-term (2-5 years), integrated, multi-investigator, multi disciplinary process studies, monitoring, modeling, assessment, and environmental valuation with the overall goal to predict impacts of multiple stressors on coastal resources, particularly in the context of integrated resource management. These integrative studies lead to effective management of coastal resources by developing indicators of stress in coastal systems; predicting impacts of multiple land use stressors on living coastal resources; evaluating natural resources in ecological and economic terms; and predicting the outcomes of specific management strategies.

Ecological Forecasting

CSCOR promotes sound research for the development of land use ecological forecasts for decision makers. [Ecological forecasting](#) applies research results to management problems, allowing coastal managers to better predict future environmental conditions using current conditions and various management scenarios. Timely forecasts can provide coastal managers with practical information for better ecosystem management.

Research to Applications

CSCOR is committed to providing decision makers with high quality scientific information and predictive tools in formats appropriate to promoting improvements in coastal ecosystem management. CSCOR supported efforts are striving towards developing a understanding of the processes by which ecosystem change occurs as a function of anthropogenic change/stress (e.g. , pollution, habitat destruction, human population shifts, land use change). The methods developed and information provided are essential for management decisions relating to fostering sustainable use of coastal resources and for understanding and predicting the effects of multiple stressors on the natural system, living resources, and associated economies. New models and techniques are also being developed for applied coastal zone management that incorporate land-use patterns and practices, integrated toxicological and risk assessment modeling, and Geographic Information System analysis approaches.

Current Programs

A number of CSCOR research projects involve understanding impacts of land use on coastal ecosystems. These include a multiple stressor study in the Louisiana Barataria River watershed, South Florida (i.e., Everglades) restoration effects on Florida Bay, hypoxia research in the northern Gulf of Mexico and other U.S. coastal areas and fish to model animal exposure to hazardous environmental contaminants.

Accomplishments

In the theme area of environmental quality and cumulative coastal impacts CSCOR conducted major studies regarding toxic chemical contaminants, estuarine habitats and multiple stressors. For example, CSCOR initiated a series of multi-year field studies through the mid-1990s of [toxic contaminant coastal studies](#) around the country with work on the bioeffects and bioaccumulation of toxic chemicals in selected organisms and the development of physiological biomarkers of contaminant exposure. These studies complemented and expanded the existing NOAA Status and Trends Program for toxic contaminants and also provided opportunities to field test new bioeffects indicators.

In response to emerging concern of coastal wetland loss, in 1990 CSCOR initiated the [Estuarine Habitat Program \(EHP\)](#). The EHP (1990-1996) combined remote sensing to map the extent and rates of change coastal seagrasses, wetlands, and adjacent uplands, determined the function interaction and dynamics of natural and restored habitats and developed new in vitro propagation and genetic techniques to improve the restoration of restored wetlands. Included in the EHP suite of research projects was the [Coastal Change Analysis Program \(C-CAP\)](#) which addressed the need to develop a national protocol for mapping watersheds and habitats and detecting change through satellite and aircraft remote sensing. C-CAP is now an operational national program managed by the NOAA Coastal Services Center in Charleston, South Carolina.

Beginning in 1996 and 1997 a large number of 5-year projects related to the [cumulative effects of multiple stressors](#) in coastal environments were initiated. All projects emphasized the linkage of adjacent watersheds to the health of the adjoining coastal waters. Multiple stressor/cumulative effects projects were conducted in the Great Lakes, coastal South Atlantic Bight, Florida Keys, Chesapeake Bay, the Pacific Northwest and Florida Bay. The coastal South Atlantic Bight and Florida Bay projects continue to this day due to Congressional interest in these important coastal areas. Coral reef research and assessment studies were initiated in 1999 in Puerto Rico and the Hawaiian Islands as part of the [U.S. Coral Reef Initiative](#). Coral reef research funding continues to the present. New multiple stressor projects were initiated in 2002 to focus on developing indicators of stress, predicting impacts of multiple stressors, valuing natural resources in ecological and economical terms, and predicting the outcomes of management strategies. Initial funding under this new multiple stressor initiative is focused on cumulative coastal stressors in the northern Gulf of Mexico.

In the area of harmful algal blooms and eutrophication, the first major field project undertaken by CSCOR was the Nutrient Enhanced Coastal Ocean Productivity (NECOP) project (1990-1996) that dealt with the effects of the Mississippi River nutrient plume in the northern Gulf of Mexico. The relationship between excessive nutrients flowing from the Mississippi River and the occurrence of hypoxic conditions in the Northern Gulf of Mexico was investigated. Research on this important national issue has continued to the present with the [NGOMEX](#) project emphasizing continued yearly hypoxia mapping and the effects on hypoxia on higher trophic levels in the northern Gulf of Mexico. Important early studies on the importance of atmospheric nutrient deposition were highlighted with the [Atmospheric Nutrient Inputs to Coastal Areas \(ANICA\)](#) from 1991-1996. Early CSCOR nutrient studies regarding eutrophication and hypoxia provided the scientific foundation for the National Science and Technology Council's Committee on Environment and Natural Resources [Integrated Assessment on Hypoxia in the Northern Gulf of Mexico](#). CSCOR headed the scientific assessment that resulted in the publication of six interrelated hypoxia reports in 1999. This integrated assessment on hypoxia provided the scientific base for the Mississippi River/Gulf of Mexico Watershed Nutrient Task Force to produce an Action Plan describing a national strategy to reduce the frequency, duration, size and degree of hypoxia in the Northern Gulf of Mexico in 1991.

[Additional CSCOR accomplishments can be found at: http://www.cop.noaa.gov/aboutus/accomplishments.html](http://www.cop.noaa.gov/aboutus/accomplishments.html)

For more information on ARC, contact:
Carol Auer
e-mail: Carol.Auer@noaa.gov

For more information on CERP or South Florida, contact:
Larry Pugh
e-mail: Larry.Pugh@noaa.gov

For more information on CRES, contact:
Dr. Felix Martinez
e-mail: Felix.Martinez@noaa.gov

For more information on Multi-stress, contact:
Dr. Elizabeth Turner
e-mail: Elizabeth.Turner@noaa.gov

Center for Sponsored Coastal Ocean Research Web site: <http://www.cop.noaa.gov/welcome.html>