ABSTRACT BOOK

CERF2013
SAN DIEGO CALIFORNIA

TOWARD RESILIENT COASTS AND ESTUARIES, SCIENCE FOR SUSTAINABLE SOLUTIONS

3-7 NOVEMBER 2013 • SAN DIEGO, CALIFORNIA, USA

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Please note: This book includes all of the CERF 2013 abstracts as of September 25, 2013. Program changes after that date are not reflected in this book. Abstracts are listed in alphabetical order by the first author's last name. The index in the back of the book provides an alphabetical listing of all authors and the page number of their respective abstracts.

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APPLYING FRESH AND MARINE WATER MODELING RESULTS TO SUPPORT DECISIONS FOR LOCAL GOVERNMENT MANAGERS: SNOW CAPS TO WHITE CAPS

Local government water resource managers are faced with the twin challenges of climate change and increasing development in coastal watersheds, and are driven by the necessity to provide critical habitat for endangered fish in the estuary and watershed, and the requirement to protect human infrastructure from flooding. Numerical models of waters resources have been developed for the Snohomish Basin in north central Puget Sound, linking the flow of freshwater from the upper watershed (Snow Caps) through the floodplain, into the marine waters of the Snohomish River estuary and into Puget Sound (White Caps). The linked models were used to generate scenarios of fresh and marine water flow and interaction, run under conditions of future climate change, and changes in land use/land cover (to simulate development in the watershed). Scenarios were informed by the model output in order to understand effects of climate change and development on seasonal flooding, transport of contaminants from land into the estuary, changes in salt wedge intrusion into salmon habitat, and changes in the exposure of mud flats in the estuary. The scenarios are based on specific questions posed by local government staff; scenario storyboards have been shared with local and state water managers through interactive workshops and online tools. Feedback from the participants helped guide the outcome of the scenarios. The effectiveness of providing model-driven simulations and forecasts to local water managers is assessed and best practices for developing communication vehicles and disseminating the results are analyzed.

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FLOWERING AND BIOMASS ALLOCATION IN THE SALT MARSH FOUNDATION SPECIES *SPARTINA ALTERNIFLORA*

Salt marshes must maintain elevation relative to sea level in order to resist drowning and conversion to open water habitat. Given the importance of belowground plant production in maintaining marsh elevation, understanding the biomass allocation of plant species is critical. Along the U.S. Atlantic coast, smooth cordgrass (*Spartina alterniflora*) plays a dominant role in salt marsh establishment and persistence. In particular, belowground biomass production by cordgrass is an important driver of marsh accretion and elevation maintenance. We sought to understand a potential link between belowground biomass allocation and flowering in cordgrass because climate change may affect flowering phenology. It is not clear what drives the timing of cordgrass flowering on multiple spatial scales or how allocation of biomass into above and belowground structures progresses during the growing season. In this study we asked (1) what spatial and temporal patterns exist in cordgrass flowering, and (2) does the timing of flowering determine the onset of belowground biomass allocation (and thus alter marsh accretion)? We conducted field surveys and a common garden experiment on flowering phenology, and quantified the timing of biomass allocation using field sampling and a non destructive re-sampling technique (Computer-aided Tomography (CaT) scans of cores). Latitudinal-scale surveys revealed that northern marshes flowered earlier than southern; this flowering order was retained in the common garden. On local scales, the timing of flowering and density of flowering stems varied between marsh sub-habitats and across marshes. Intensive temporal sampling suggested a link between flowering time and allocation to above and belowground production. We followed up on these intriguing results with non-destructive methods, tracking biomass of individual plants through time. Our results will help inform how marsh elevation will be impacted with climate-driven shifts in phenology.

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RESOURCE MANAGEMENT INFORMED THROUGH MODELING IN THE FIRTH OF THAMES, NEW ZEALAND

Regional jurisdictional boundaries in New Zealand are arranged according to catchments and extend 12 nm offshore. This presents the ideal spatial domain from which to develop resource management and monitoring frameworks that take into account land-sea connections and cumulative effects in the marine environment. New Zealand is undergoing rapid land use changes (e.g. increases in dairy farming) while also developing shellfish and finfish aquaculture in downstream coastal waters. Sustainable development at regional scales requires the use of models to assist in spatial planning, setting limits, and adaptively managing resources. Waikato Regional Council (WRC) has commenced the development of a Marine Management Model (MMM) for the eastern Waikato coastal marine area (covering the Firth of Thames, Hauraki Gulf and Coromandel east coast) that will assist in addressing a range of resource management issues such as aquaculture development, biosecurity risks, and oil spill response. Stage one of the MMM has included the construction and validation of an underlying 3D hydrodynamic model using open-source SELFE code and models for assessing effects of aquaculture. Hindcast datasets from the hydrodynamic model provide predictions of mixing and transport processes, which in turn were used to estimate gradients of dissolved and solid wastes from existing and proposed aquaculture farms. Benthic and water column results for possible finfish developments under varying tide and wind conditions highlight potential enrichment gradients at local to regional scales. A key to success for the MMM is making outputs widely accessible, which in turn maximises their usefulness in guiding decision making and developing resource management and monitoring frameworks.

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INFLUENCES OF BENTHIC MICROALGAL PHOTOSYNTHESIS AND INVASIVE BIVALVES ON BENTHIC NUTRIENT FLUXES AND DENITRIFICATION IN NORTHERN SAN FRANCISCO BAY AND THE SACRAMENTO/SAN JOAQUIN DELTA

In the Sacramento-San Joaquin Delta region, strong salinity gradients, shallow water depths and variable amounts of primary production/algal biomass have an important effect on nutrient recycling. While concern for nutrients has been low relative to other stressors such as invasive bivalves, the role of nutrients in the ecology of this ecosystem is understudied. We are examining key processes that may regulate sediment nutrient exchange, such as changes in abiotic factors including salinity and pH, and biotic factors including benthic community composition and benthic microalgal photosynthesis. Overall rates of sediment respiration were low to moderate, reflecting overall low rates of algal production. Estimated benthic microalgal productivity was variable and surprisingly high in Delta sediments and may represent an important source of labile carbon. Denitrification rates, based on the N_2:Ar ratio approach, were between 0.6 and 1.0 mmol m^{-2} d^{-1}, similar to other mesotrophic estuarine sediments. We will present experimental and observational data on the role of invasive bivalves (*Corbicula fluminea, Corbula amurensis*) on N and P exchange and examine controls of denitrification and DNRA by benthic photosynthesis, salinity and pH.

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THE EFFECT OF EPIPHYTES ON LIGHT HARVESTING AND ANTIOXIDANT RESPONSES IN THE SEAGRASS POSIDONIA OCEANICA

Posidonia oceanica (L.) Delile is a subtidal seagrass whose leaves are commonly colonized by epiphytes. Epiphytes pose physical barriers to light penetration within the leaves, with possible significant impacts on photosynthesis. Furthermore, epiphytes can indirectly be responsible for leaf chlorosis, necrosis and senescence which are known to be related with the increase of oxygen reactive species (ROS) levels, potentially leading to oxidative stress. The aim of this work was to investigate in situ (i) the effect of epiphytes on the composition and balance of light harvesting pigments in leaves of the naturally growing

seagrass P. oceanica, and (ii) evaluate differences in antioxidant responses. Epiphytized and non-epiphytized plants were analyzed to establish potential photosynthetic pigment role-shift between light harvesting and photoprotection functions. The experiments were carried out in Cabo de Gata Natural Park, southern Spain, where epiphytized and non-epiphytized plants can be found at identical depths and light exposure. The results showed that both O2 evolution rate along the day and chlorophyll a/b ratio were higher in non-epiphytized plants, indicating a negative effect of epiphytes on photosynthesis and light harvesting. Although under high irradiance (at solar noon) the xanthophyll cycle was activated in both epiphytized and non-epiphytized leaves, the de-epoxidation-ratio (AZ/VAZ) was lower in epiphytized leaves, due to light attenuation by epiphytes. The antioxidant capacity (TEAC and ORAC essays) and the activity of the antioxidant enzymes ascorbate peroxidase and dehydroascorbate were higher in epiphytized plants, showing that epiphytes can also be a potential source of oxidative stress to P. oceanica. Our results show that despite the light attenuation effect, leaf colonization by epiphytes can also be potentially stressful and reduces plant productivity.

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ABC IS NO LONGER AS EASY AS 123. ADVANCES IN SCHOOL REPORT CARDS THAT ARE APPLICABLE TO ECOLOGICAL HEALTH REPORT CARDS

In a world overflowing with information, report cards have remained central to tracking the progress of a students academic abilities. Their ability to synthesize and communicate information quickly and easily to a wide range of people have seen report cards expand outside the school domain, and into a range of other public, private and government sectors. It is not uncommon now to see report cards that assess and track e.g. health departments, retirement funds, insurance companies and more recently the ecology of natural environments. Ecological health report cards have become an important tool for integrating diverse physico-chemical and biological data types into simple scores that can be communicated to decision-makers and the general public on a routine basis. This approach was pioneered by the Integration and Application Network at the University of Maryland Center for Environmental Science. Report card popularity and influence on natural resource management decisions have to date been the only (indirect) measures of their success and effectiveness. There has been a push recently to develop more direct measures of the effectiveness of ecological health report cards. The commonality and universal acceptance of school report cards has resulted in much of the research into the effectiveness and continued development of report cards, to have come from the schooling sector. This presentation/paper outlines recent advances in school report card design, function and research and how these findings can be applied to improve the delivery, reception and effectiveness of ecological health report cards as tools for environmental management.

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EXAMINING OCEAN ACIDIFICATION IN ESTUARINE WATERS USING THE NARRAGANSETT BAY FIXED SITE MONITORING NETWORK

Twelve Narragansett Bay stations were analyzed on a summer seasonal basis June-September and three year round stations were also examined for changes in pH levels. A number of agencies worked together to establish the Narragansett Bay Fixed-Site Monitoring Network (NBFSMN) to assess water quality in Narragansett Bay. The stations are strategically located to transect the north-south axis of Narragansett Bay and serve as sentinels of changing conditions. These stations measure near surface and near bottom temperature, salinity, oxygen, pH and depth, and near surface chlorophyll at 15-minute intervals. PH changes may be in response to increased acidity due to higher concentrations of CO_2 as well as metabolism and salinity changes due to the nutrient and salinity gradients in Narragansett Bay. Several large freshwater rivers enter upper Narragansett Bay delivering increased nutrient loads from wastewater treatment plants and storm runoff. As a result, phytoplankton bloom concentrations and salinity tend have a north to south gradient in Narragansett Bay. PH follows this gradient with pH ranges of 9.18-6.78 in the Providence River/upper bay compared to ranges of 8.35-7.48 in the lower bay. Salinity is the main driver of pH change at the furthest north station in the Providence River as well as the furthest south station in the bay, the GSO pier, which typically has no net metabolism. The upper and mid bay stations likely have both factors affecting pH. Quantifying how much pH change is attributed to each is a goal of our investigation. Over the 15-year annual record at the GSO dock, no change in pH due to enhanced acidity has been documented in the time series record.

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THE CANADIAN WATERSHED RESEARCH CONSORTIUM: DEVELOPING MONITORING FRAMEWORKS IN SUPPORT OF CUMULATIVE EFFECTS ASSESSMENT

A 2006 review of cumulative effects assessment (CEA) in Canada concluded that it was not contributing to the sustainability of valued ecosystem components and should be replaced by regional environmental assessments and effects frameworks. To encourage the development of monitoring frameworks in support of CEA at the watershed level the Canadian Water Network is supporting end-user driven research in six places across Canada. Two of these areas are estuarine: the harbour of Saint John New Brunswick and the estuaries of the Northumberland Strait region. This talk will outline the development of these projects and what they hope to deliver in April 2015 at the end of their three years of funding.

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HYPERTEMPORAL LAND AREA CHANGE ANALYSIS IN COASTAL LOUISIANA

Coastal Louisiana wetlands currently experience the highest rate of wetland loss in the contiguous United States. Recent trend analyses show that if this loss were to have occurred at a constant rate, it would equate to Louisiana having lost an area the size of one football field per hour during the 1984-2010 observation period. Documenting and understanding these rates and how they change through time is necessary for effective planning and design of protection and restoration projects. Previous analyses have been limited in their ability to dissect rates of wetland loss into finer temporal increments due to insufficient dates of imagery for analysis. The analyses of landscape change presented here used between 66 and 133 dates of classified Landsat MSS, TM, and OLI data to track wetland change rates through time. Summary data are presented for the 1973–2013 time period. The number of datasets used in this study provides opportunities to better understand the timing and causal mechanisms of wetland loss, which are critical for forecasting landscape changes in the future.

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RISK COMMUNICATION AND SEA LEVEL RISE ADAPTATION IN NORTH CAROLINA: PERCEPTION AND POLICY

One of the most significant challenges in addressing sea level rise (SLR) in many coastal communities is understanding and engaging with the variety of risk perceptions that exist among stakeholders. Many people involved in planning and decision-making do not have scientific backgrounds, yet scientists, planners and managers need to communicate complex information, such as projected rates of change and the potential for impacts to natural and human-built infrastructure that involve significant uncertainty. For effective risk communication, scientific information must be appropriately framed, visually compelling and take into account prevailing risk perceptions and diverse viewpoints. Results of a study conducted in two small, low lying communities in coastal North Carolina identified problems that residents had in interpreting SLR information. A document-based evaluation approach was used to assess issue awareness, reaction to texts and images, and possible adaptation responses; and was supplemented by semi-structured interviews with community leaders. Most people (88%) reported that they learned new information from documents, but they expressed substantial difficulty understanding information about SLR. The inability to decipher and understand information in sample documents was exacerbated by attitudes and beliefs about environmental change including fear, skepticism, fatalism, and loss. Perspectives among local officials also varied, suggesting that people serving communities in different capacities may have conflicting views on economic and infrastructure issues related to SLR adaptation. Such diverse perspectives have led to an on-going policy conflict between scientists and managers anticipating SLR and coastal development interests worried about the economic impact of adaptation policies. An empathetic, audience-driven communication strategy is more effective in promoting understanding and may make discussions of adaptation strategies more productive.

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MODELLING BIOTA-SEDIMENT INTERACTIONS IN ESTUARINE ENVIRONMENTS

Future choices about the realization of hydrodynamic infrastructures in estuaries should be based on solid forecast about the changes they will generate in the environment. While