Coastal Vulnerability Initiative Launch:
Initial Plans and Directions

Breakout Session March 25, 2013. Participants: Brad Murray, Gary Clow, Helena Mitasova, Ad Reniers, Jaap Nienhuis, Don Potts, France Floc'H (IUAM), Celso Ferreira, Chris Thomas (BGS), Jorge Lorenzo Trueba, Joep Storms, Barry Eakins, Liz Olhsson, Fei Xing, Jun Cheng, and Irina Overeem,

Scope

We discussed the definition of 'coastal vulnerability', and agreed that for us, this term refers to both the vulnerability of human coastal infrastructure and habitation to coastal processes that can impact them, and to the vulnerability of coastal ecosystems, which provide critical ecosystem services to society.

We discussed the relationship between the Coastal Working Group and the Coastal Vulnerability Initiative. Clearly, because the discussions in the Coastal WG included substantial and enthusiastic suggestions for WG goals that address human and ecosystem vulnerability in coastal environments, a subset of the current Coastal WG goals apply to the new Coastal Vulnerability Initiative—those involving the impacts of coastal processes on human infrastructure and activities, as well as the reverse. (Below we include the main goals articulated by the Coastal WG, with highlights showing which aspects apply to the Coastal Vulnerability Initiative.)

Discussion in the initial break out session focused on how the CSDMS community can most effectively contribute to addressing issues of coastal vulnerability and sustainability. Clearly, through modeling of storm impact using detailed hydrodynamic and sediment-dynamic models, we can contribute to the ability to forecast the effectiveness of alternative coastal-management policies, and associated engineering efforts, in protecting coastal infrastructure. Coupling state of the art models in the CSDMS toolbox will facilitate such assessments.

However, this group can also offer unique contributions to our understanding of how the long-term evolution of coastal environments depends on human actions, from land-use changes to coastal policy decisions. Typically, engineering interventions to protect or enhance human use of coastal environments is undertaken and evaluated in the context of impacts on scales up to kilometers and years. The relatively small scale engineering interventions, however, alter the landscape-forming processes, and therefore the long-term, large-scale trajectories of landscape evolution (including ecological and human-development states).

Human decisions regarding coastal management and defense of coastal infrastructure, in turn, depend on how coastal environments change—ranging from rates of coastline erosion to flooding frequencies and the severity of storm impacts. Therefore, human dynamics and coastal dynamics are intimately intertwined. The CSDMS modeling community is uniquely capable of evaluating the long-term (decades to centuries), large-scale consequences of alternative engineering and coastal management approaches.

Given this thorough coupling between the long-term evolution of human actions and coastal morphology and ecology, the Coastal Vulnerability Initiative is also clearly linked with the Anthropocene Focused Research Group.

Geographical Scope

We agreed that this initiative should clearly focus on studies of delta environments, as well as sandy coastlines, and possibly rocky coasts as well. In each case, human decisions help shape the future of coastal environments and the future set of hazards human coastal habitation faces.

We agreed that the idea of concentrating community efforts on the study of a small number of case-study regions, raised initially in Coastal WG Breakout sessions, makes especially good sense in the Coastal Vulnerability context. For example, the Gambia Delta, already the focus of World Bank attention, could provide a highly relevant case study to test coupled-model studies of delta and human dynamics against. In addition, the Netherlands coast offers the combination of intensive coastal defense efforts (specifically beach nourishment) and intensive monitoring of the results. The New Jersey coast, in the wake of superstorm Sandy, offers clear advantages for studying how coastal development density and style affects storm impacts, and in in the longer term barrier island morphological evolution—and therefore future human habitation. As the shape of the Coastal Vulnerability Initiative emerges, we should discuss the most appropriate case-study regions.

Partners Scope

How the Coastal Vulnerability Initiative will evolve in the coming months will depend on the fate of several pending proposals, including multiple Belmont Forum consortia (multi-national, interdisciplinary efforts involving physical and social scientist as well as a strong component of end-user involvement), Coastal SEES (NSF Science, Engineering and Education for Sustainability call for proposals), and FESD (NSF Frontiers of Earth Surface Dynamics call for proposals). The currently funded Delta Dynamics Collaboratory FESD project should certainly be involved in this initiative. In addition, we several USGS personnel should be asked to join this Initiative.

We clearly need to engage a growing number of social scientists (e.g. economists and anthropologists) in the studies of couplings between landscape/ecosystem changes and human dynamics. Along with helping us investigate coupled human/landscape evolution, social scientists can help evaluate the costs/benefits associated with alternative management strategies.

Intended Stakeholder/Decision-Maker Audience Scope

We disused what level of government entity would be most likely to make use of the information we could help provide, and agreed that community level planners were less likely to be interested in longer-term, larger-scale consequences of local actions than are than region-scale entities (governmental, NGOs, and corporate—including insurance and re-insurance). On the other hand, reaching out to stake holders at the household level, for example with interactive games showing the long-run consequences of alternative management policies, could help create a better informed constituency. In any case, effectively reaching out to stakeholders likely requires the involvement of social scientists and/or specialists in science communication, which we will lobby for the Education and Knowledge Transfer Working Group to focus more directly on, in collaboration with those involved in this initiative.

Appendix: selected Coastal Working Group goals (5 years +), with Coastal Vulnerability overlap highlighted

Overarching Goals

1. **Improve the understanding of, and ability to forecast, how a broad range of coastal environments evolve, including the effects of: the dynamic feedbacks among physical, biological, and human processes; interactions between different environments along coastlines; and interactions among coastal, terrestrial, and marine environments--all under a range of climate and human management scenarios. (Initial goals for the next five years listed as 'specific science goals' below.)**
2. **Address societally relevant science questions, and assemble a set of model tools facilitating investigation of coastal impacts and vulnerability, and their variability--and to enhance the ability of coastal managers and policy makers to use and interpret the modeling tools and results (in collaboration with the Education and Knowledge Transfer Working Group, key stakeholders, and decision makers).**

Specific Science Goals (SSG's) Under these Umbrellas, and Steps Toward Them

SSG1 To improve understanding of and ability to hindcast/forecast past and possible future *delta evolution on decadal to millennial time scales, as affected by couplings between terrestrial, fluvial, coastal, wetland, floodplain, subsidence, ecological and human processes*, ultimately including coupling between 1) long-term changes in delta morphology/ecology and 2) storm-event impacts to morphology, vegetation, and human dynamics and infrastructure.

SSG2 To improve our understanding of and ability to forecast how the *morphology, ecology, and human components of sandy coastal environments co-evolve under different scenarios of changing storm climate, sea level rise, and human manipulation*--including coastal environments ranging from urban to undeveloped.

SSG3 To improve our understanding of and ability to forecast how *rocky and soft-cliffed coastlines change over time, as human manipulations (e.g. river damming and coastal armoring) and changes in climate affect interactions between cliff erosion, sediment production, and sediment redistribution*--and how these interactions affect coastal communities.