Deltas in Depth scientific sessions		
Deltas in Depth Theme 4. Coastal systems and wetlands		
DD 4.6 Ecosystem values and the coupling of human and natural dynamics		
Chair	Prof.dr. Peter Herman, Netherlands Institute of Ecology / Royal Academy of Sciences, the Netherlands	
Presentations	•	PhD Nina Lam, Louisiana State University, USA
	•	PhD Christian Ferrarin, CNR-ISMAR, Italy
	•	PhD Carles Ibanez, IRTA, Aquatic Ecosystems Program, Spain
	•	Prof. Mashfiqus Salehin, Bangladesh University of Engineering and Technology (BUET), Bangladesh
	•	PhD Igino Emmer, Silvestrum, the Netherlands

This scientific session focused on the use of modelling practices to understand the relationship between natural processes and human actions when managing coastal systems and wetlands. We enjoyed five presentations and subsequent discussion. The research settings included the United States, Italy, Spain, Bangladesh, and the Netherlands.

Coupled Natural-Human Dynamics in the Mississippi Delta, PhD Nina Lam, Louisiana State University, USA

First up was American researcher Nina Lam, with the aim of answering the question of how should we plan and maintain sustainability in Delta regions, areas which are threatened by global warming? Her research involves conducting resilience and sustainability assessments that combine natural and human dynamics, to understand the processes that drive threats to the Mississippi Delta, in particular Louisiana. Louisiana is a very important region economically but it is increasingly vulnerable. Nina models land change processes and delineates rules that explain the change from one land use to another. Then model simulations can answer questions like: is there significant migration from the south to the north?

Towards homogenization of Mediterranean lagoons under climate change, PhD Christian Ferrarin, CNR-ISMAR, Italy

Next stop- Italy, with Christian Ferrarin, who presented findings on how climate change will impact Mediterranean lagoons. Lagoons are bodies of water separated from the sea by a reef or other barrier, and they are interesting because they are responding acutely to environmental fluctuations, are highly productive, and have fundamental economic, ecological, and cultural relevance. They have different characteristics: size, number of inlets, depth, ecosystems, and presence of tidal flats. Using models and experiments, Christian examined nine lagoons from all over the Mediterranean, assessing them for changes in sea water temperature, level, and salinity, and explains the reduction of intra- and inter lagoon variability. The conclusions are that these systems are on their way to “marinisation”- taking on more of an ocean state, losing “hydro-diversity” (diversity in hydrographic conditions). Like the canary in a cage, lagoons are most sensitive to changes in sea level rise and temperature and enlighten us about the impending effects of climate change.

Management options to adapt to high-end scenarios of sea-level rise: implications for deltaic coastal wetlands, PhD Carles Ibanez, IRTA, Aquatic Ecosystems Program, Spain

Our third speaker was Carles Ibáñez, from Spain, presenting research looking at management options for scenarios of high-end sea level rise. High-end scenarios are those that assume warming higher than 2^0C and a sea level rise of around 1 m by the end of the century. In particular, Carles models the impacts of sea level rise on rice fields and wetlands in the Ebro Delta, Spain, with and without adaptation measures. He makes the point that Deltas naturally respond to sea level rise with feedback mechanisms, but how do Deltas with human interference respond? One feedback mechanism is sediment trapping using salt marshes. Modelling this shows a rise in trapping as sea level rises. Another strategy to cope with sea level rise is the protection strategy- building dikes to keep the water out, as currently employed in the Netherlands. Based on the modelling, dikes can keep out a rise of 5-6m (which is a high-end level) as long as the economy can afford to keep building dikes. In conclusion, the research suggests allowing a Delta to naturally accrete sediment; for instance, with a sediment bypass system that works around dam structures.

Spatial variation in soil salinity in relation to hydro-climatic factors in southwest coastal Bangladesh, prof. Mashfiqus Salehin, Bangladesh University of Engineering and Technology (BUET), Bangladesh

Mashfiqus Salehin comes to us from Bangladesh, to present results of a study that looks at how ecosystems and poverty interact under different scenarios, focusing particularly on what hydro-climatic factors affect soil salinity in coastal Bangladesh. Soil salinity limits cultivation and thus lowers agricultural productivity compared to the national average, causing poverty. Soil salinity is increased by a reduction in freshwater from the River Ganges, and sea level rise will exacerbate the situation. Another factor causing a rise in salinity is shrimp farming, with farmers diverting seawater inland through canals (although this trend appears to be abating with farmers wanting to return to agriculture). Scenario modelling shows that soil salinity is correlated with river salinity, with rivers on the east side of the Delta flushing out salt more than in the west side. Projected future salinity shows no significant trends for groundwater level, so the main factor will be sea level rise.

New carbon market procedures recognizing the value of delta wetland, PhD Igino Emmer, Silvestrum, the Netherlands

The final speaker was Igino Emmer, bringing us back to the Netherlands to discuss new carbon market procedures that encourage carbon sequestration. Coastal wetlands are highly organic carbon soils that when converted to another use, lose 450 million tonnes of CO_2 per year. That's a lot of carbon. As a mitigation response we can assign value to the services that wetlands provide, thus bringing them into the carbon markets. Wetland restoration can be seen as an adaptation response, performing a coastal protection function. Igino presented some guidance on how to calculate for a project how much carbon is sequestered; considering spatial and temporal dimensions, direct measurements, and proxy measurements (e.g. water level, salinity) as well as a baseline analysis. Modelling scenarios are used to

understand the fate of carbon in inundated and eroding wetlands- this is not the same as forest sequestration, here you must consider impermanence and sea level rise.