Deltas in Depth scientific sessions Deltas in Depth Theme 4. Coastal systems and wetlands		
DD 4.2 Climate change and delta ecosystem functioning		
Chair	Prof.dr. Peter Herman, Netherlands Institute of Ecology / Royal Academy of Sciences, the Netherlands	
Presentations	•	Dr. Hans Paerl, University of North Carolina at Chapel Hill, USA
	•	Md Golam Rabbani, Bangladesh Centre for Advanced Studies, Bangladesh
	•	Dr. Jose A. Fernandes, Plymouth Marine Laboratory, United Kingdom
	•	MSc Karlijn Brouns, Utrecht University, the Netherlands
	•	PhD Francesc Montserrat, Netherlands Institute for Sea Research (NIOZ), the Netherlands

Dr. Hans Paerl, University of North Carolina at Chapel Hill, USA, Coastal eutrophication dynamics and controls in a culturally and climatically stressed world

Humans have been over-enriching the coastal waterways and deltas with nutrients for a long time. People think that the primary production is controlled by P availability in freshwaters and by N in marine ecosystems. However, by accelerating anthropogenic N and P loading, nutrient limitation and eutrophication dynamics were altered. This caused human-impacted systems to reveal a complex picture and a challenge to nutrient management. Estuarine and coastal systems show us that the Nixon paradigm is still correct: a higher DIN input causes an increase in primary production. However, both an enrichment in N and P sre often more stimulatory. So excessive anthropogenic N loading has led to conditions in spring where P is limiting and this controls the spring bloom. N limitation still persists in summer. A management option to control eutrophication and hypoxia is to reduce both N and P input. This was done in a fjord in Sweden, where they tried to manage the nutrient load and phytoplankton growth by developing a N loading-bloom threshold. In China, they researched the contemporaneous effects of damming and nutrient enrichment. The nutrient ratios change by damming and cause an increase in N loading and a lowering of the sedimentation rate which causes eutrophication. The diatom dominated area changes to one that is dominated by toxic blue-green algae. In the Neuse river estuary the importance of tropical cyclones is clearly visible: immediately after a major hurricane or tropical storm, the chlorophyll a peaks. And freshwater discharge affects the location of algal production and blooms.

Md Golam Rabbani, Bangladesh Centre for Advanced Studies, Bangladesh, Cyclone induced salinity intrusion causes loss and damage in rice fields in the coast of Bangladesh

The objective of this study is to gain a better understanding of the interactions of salinity intrusion and rice production in the study area and how the salinity intrusion might change in the coming decades as the impacts of climatic variability and climate change are changing. In this way, loss and damage by the impacts of climate change may be decreased in Bangladesh. Several factors are related to climate change and affect the rice production: increase in temperature (especially in early spring), salinity in the agricultural field and water, shifting of the rainfall pattern, cyclones and storm surges, drought and water logging. Salinity intrusion has increased in soil and water, which causes a reduction of rice production in the study areas. However, in some areas this was not the case, due to improved farming technology. The changes in rice production caused food crises in the villages in the study area. The most extreme one was between 2009 and 2011 after cyclone Aila which had an influence on the salinity. Salinity intrusion as well as the lack of rainfall in the critical months for rice growth, were identified as the major reasons for the declining rice production. There are some field and non-field based adaptation measures, including temporary migration for work, switching to non-agricultural activities, taking loans etcetera. A minority, 39%, adopted the saline tolerant varieties. The loss of rice production accounted for almost two million dollars and still some major questions need to be answered.

Dr. Jose A. Fernandes, Plymouth Marine Laboratory, United Kingdom, Projecting fish production in Bangladesh under climate change

The aim of the project was to provide Bangladesh policy makers with the knowledge and tools that enable them to evaluate the effects of policy decisions on peoples' livelihoods. The project is strongly based on modeling and collaboration. All models project decreases on potential catches, when present and future are compared. Warming and OAE are not encountered in the models. The two main species decrease between 27 to 48% and the total productivity decreases 3.5 to 5%. However, in a more sustainable scenario, catches will be higher on average in species up to 50%, and total productivity up to almost 5%. Thus, it can be concluded that climate change has a negative impact on the Bangladesh fisheries, but good management can mitigate potential catches lost due to climate change. This does not imply that there cannot be additional side effects of climate change.

MSc Karlijn Brouns, Utrecht University, the Netherlands, Peatlands in a changing climate, summer droughts and salinization

Peatlands cover a few percent of the earth's land surface and act as a sink of carbon when they are undisturbed. However, this is a labile sink and is sensitive to disturbances. Dutch peat areas are subsiding and cause damage to buildings and infrastructure and are in this way very expensive. Peat decomposition occurs in two ways, aerobic and anaerobic. The first one is faster and consumes O2, the second one uses NO3, Fe3+ and SO4. The hydrolytic and oxidative enzymes that are used in peat decomposition are produced by soil microorganisms. More oxygen in the soil increases the decomposition rate. However, because upwelling is local, when salinity increases in oxygenated peat, there is less decomposition visible and so decomposition can play a more important role in anoxic conditions. Deeper parts of the peat are mostly anoxic and thus play a role in subsidence. Dry summers have both a direct and long-term stimulating effect on the decomposition of normally anoxic peat.

PhD Francesc Montserrat, Netherlands Institute for Sea Research (NIOZ), the Netherlands, Enhanced olivine dissolution: creating a coastal CO_2 sink?

First let's assume that in the climate and carbon management the goals will not be met. There have to be negative emissions to meet those goals. Geo-engineering might give new ideas and possible solutions to this problem. For example: we can try to reverse the carbon imbalance of the planet by creating peninsulas which takes up CO_2 just by the use of natural resources. There can be made use of enhanced weathering, which causes mineral dissolution by CO_2 and are a natural global climate control. Olivine can be used as such a mineral, which is a fast-weathering silicate mineral and widely abundant. For the idea illustrated in the picture, there is however no experimental evidence. There has to be taken into account a lot of variables. The first steps have been made but there is still much to do. Olivine dissolution in seawater indicated that nickel is a better proxy than silicate. Mg is controlling the alkalinity in seawater, so increased weathering increases alkalinity. Also the stoichiometry is affected by Ca/Mg carbonate precipitation. The bioturbators show a strong dissolution effect, but the pattern of the grain surface may also be local weathering. Finally, the ecosystem effects are still unclear and thus many more questions need to be answered.