Deltas in Depth scientific sessions		
Deltas in Depth Theme 6. Rural development and food security		
DD 6.1 Opportunities for socio-ecological landscape development		
Chair	Prof.dr. Frank Berendse, Wageningen UR, the Netherlands	
Presentations	•	Dr. Ruud Bartholomeus, KWR Watercycle Research Institute, the Netherlands
	•	PhD Martha Bakker, Wageningen UR, the Netherlands
	•	PhD Helen Adams, University of Exeter, United Kingdom Dilruba Begum, ICDDR, Bangladesh
	•	Dr. Nico Polman, Wageningen UR, the Netherlands
	•	Prof.dr. Boris Braun, University of Cologne, Institute of Geography, Germany PhD Amelie Bernzen, University of Cologne, Institute of Geography, Germany

In this session on opportunities for socio-ecological landscape development, five studies are presented and discussed. Three of the presentations deal with nature development under changing climatic conditions in the Netherlands. Both on the European as on the national level laws and regulations on nature conservation are in place, e.g. the European Habitat Directive and the National Ecological Network (NEN). How effective are these under the influence of climate change? Are targeted nature areas still suitable in the future? Ruud Bartholomeus shows how the probability of vegetation types can be predicted by using an eco-hydrological model, PROBE, which focusses on atmosphere-soil-plant processes. It models habitat factors in the root zone, such as oxygen, nutrient and water availability and acidity, which directly influence plant life. Water management and climate change scenarios are included as input. Output of the model are vegetation maps showing the probability of occurrence of a certain vegetation type. The model helps policy makers and nature managers to analyse the feasibility of nature targets, to define adaptation measures and to select hotspot areas of biodiversity. The model works very fast and at the moment work is in progress to build a user friendly interface.

To safeguard and promote biodiversity, the Netherlands is dedicated to the implementation of the NEN. Most of the land that is to become part of the NEN is currently agricultural land. To evaluate the effects of climate change and socio-economic development on the acquisition of land for the NEN, a spatial explicit Agent based Model (ABM) has been developed. Martha Bakker explains how this model works and shows the outcomes of a case study (Baakse Beek area). The ABM uses actual farmers' characteristics and census data as input. The model simulates land exchange between farmers and with nature organisations. The model shows which parcels farmers want to sell and at what price and estimates how much nature organisations are willing to pay. Some farmers want to expand and compete with nature organisations. The highest bidder will get the land. The wet parcels are least suitable for farming and are most desired by nature organisations. Under drier climate conditions, land prices will be higher. The model shows that in the case study area the NEN targets are not feasible. The land mobility is not enough to buy the necessary parcels. Nature organisations are picky in the parcels they buy. Preferably the wet parcels close to existing nature areas. Nature

organisations have a limited budget and lose the competition over land with farmers. Under wetter conditions this competition gets somewhat less.

Nico Polman applies a similar type of model, a spatial explicit ABM, to explore green agricultural water policy scenarios. The land market is also central in this model. In the Common Agricultural Policy (CAP) 2014-2020 of the European Commission, collective implementation of Ecological Focus Areas (EFA) are included as a means to improve environment, climate and biodiversity on farms. The model gives insight in the spatial, ecological and economic impact of farmers' cooperative decision making under different scenarios. An example shows the effectiveness of water conservation measures taken by farmers individually in comparison to a collective conservation scheme. The presented model is a promising approach to explore the impact of environmental cooperative decision making in rural areas. It is still work in progress and more factors can be included in the model.

Two presentations discuss studies about coastal environments of Bangladesh. Helen Adams and Dilruba Begum share their preliminary results of a study on the drivers, constraints and dynamics of wellbeing from ecosystem services (ESS) in the region of the Ganges-Meghna-Brahmaputra delta. The study addresses the question why delta areas – that are highly productive environments – harbour some of the poorest populations. A framework was developed that shows mechanisms that link ESS and wellbeing. In the framework, five dynamic factors determine the wellbeing outcome of the ecosystem service use in a socio-ecological system: climate variability and seasonality, mobility, social relations, nature and strength of property rights and productivity. Seven socio-ecological systems were identified in the study area. The dependency on ESS in all seven socio-ecological systems is high. All five dynamic factors in the framework are important in relation to wellbeing. However, the importance of each factor varies across the socio-ecological systems. An important preliminary finding is that to reduce poverty one should not focus on the ESS themselves but on improving the access to as well as decreasing the dependency on ESS.

Boris Braun and Amelie Bernzen show the findings of a preliminary fieldwork in six coastal districts in Bangladesh about the social and economic processes leading to land use change, land degradation and salinisation. The study takes an economic geography perspective. The study shows that changes in the land use pattern are visible, both in terms of the intensity of land use (multiple harvests a year) and the type of crops. The pressure on the land and the demand on water resources is growing. In other areas the land is less intensely used due to salinisation. Local land use change is connected to national and global developments. For instance the increase of salt water shrimp farming in some areas. There is an economic driver: a growing market for shrimps. However, it is not known what is the driving factor for this change. Are farmers making this shift because of the salinisation of the land, or because of the growing market for shrimps? Will this economic driver lead to the displacement of traditional farmers? The research is to be continued.