Abstract

Climate changes are expected to result in rising sea levels, with flooding of low-lying areas as an inevitable consequence. Managed realignment (MR) is an adaptation to that threat. But what happens on the ecological site when agricultural soil is flooded by seawater? How fast will life return and for how long would the area be affected by its agricultural history? The aim of this project was to gain understanding of the ecological consequences that accompany the permanent flooding of agricultural land. All work was conducted in relation to Gyldensteen Coastal Lagoon, a newly created habitat on agricultural soil flooded with seawater by MR. Investigations focused on the ecological succession with emphasis on macroalgae, but also included early benthic fauna colonization.

Manuscript 1: Key factors controlling Macroalgal succession after managed realignment on agricultural land followed development of the macroalgal community during first five years after flooding agricultural land with seawater. Effective reduction of N resulted in rapidly decreasing cover of opportunistic macroalgae and gradually increased perennial macroalgae within 5 years. However, persistence of high P levels resulted in benthic cyanobacteria blooms. The state of the macroalgae community was determined by nutrient availability, and it was suggested that an unstable DIN:DIP-dependent tipping point will promote either opportunistic macroalgae or cyanobacteria in the future. The agricultural origin of nitrogen was investigated in **Manuscript 2: Fertilizer-derived N in opportunistic macroalgae after flooding of agricultural land**, where an analysis of stable nitrogen isotopes δ15N in green algae tissue strongly indicated that the bloom was mainly driven by fertilizerderived N from synthetic inorganic sources. After the first year that light nutrient source was no longer detected in algal tissue and cover by opportunistic green algae was low. **Manuscript 3: Benthic macrofauna bioturbation and early colonization in newly flooded coastal habitats** showed rapid colonization by pioneering benthic fauna and detected a negative impact of macroalgal blooms on colonization, however it was concluded that the pioneer fauna community colonized successfully in homogeneous agricultural soil in newly flooded habitats.

This thesis provides important knowledge about the progression of ecological succession when flooding agricultural land. It highlights the importance of effective water exchange to reduce nutrient accumulation and macroalgal blooms. It is recommended to focus on reduction both nitrogen and phosphor to avoid cyanobacteria blooms. Knowledge of eutrophication degree and water residence time of surrounding recipient waters are important when performing managed realignment on nutrient-rich soil.