University of Antwerp
Faculty of Science

ECOSPHERE

The ECOSPHERE research group aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2023

Impact of tidal marsh submergence by sea level rise on soil organic carbon stocks

Research group: ECOSPHERE

Hosting laboratory: CDE – building C

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Figure 1: Pictures showing the pond formation in the Blackwater marsh in Maryland, USA.

- **This topic mostly contains ☒ literature study, ☐ lab work, ☐ field work, ☐ experimental work, ☒ GIS, ☐ numerical modelling, ☐ other: ……**
- **Possession of driver's license B is ☐ needed, ☐ recommended, ☒ not needed**
- **Possession of certificates needed: ☐ FELASA C, ☐ other: ……**

Summary

Vegetated coastal systems are among the most effective ecosystems to capture and sequester atmospheric CO_2 into soil organic carbon (SOC) and as such are important for climate change mitigation. Through a combination of high primary productivity, high efficiency in sediment trapping and high carbon preservation in wet soil conditions, these systems account for almost 30% of the global carbon buried in ocean sediments. One of the main knowledge gaps regarding the carbon stocks in coastal marshes is how they will react in response to sea level rise (SLR) that is driven by the climate warming. We know that SLR can lead to a gradient in vegetation die-off, as the marsh vegetation gets more and more stressed by increased tidal inundations associated with SLR. This vegetation die off results in the formation of ponds, which grow bigger and deeper over time. What happens to the carbon when these ponds deepen? How can we use this information to estimate the future carbon budget of marshes in the face of sea level rise?

In this thesis you will perform a spatial analysis to determine the rate at which ponds have been developing for the Blackwater marshes in Maryland, USA, a marsh system where historic marsh conversion to ponds can be well documented. This spatial analysis will be based on an analysis of remote sensing images (aerial photographs) dating back to previous years and decades, allowing to reconstructed the spatio-temporal development of marsh conversion to ever more and larger ponds. This analyses will be done using GIS techniques. The resulting data will be combined with estimates of soil organic carbon density in these ponds versus remaining marshes, to quantify the change in total stock of soil organic carbon in a drowning marsh system.

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