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 2026

How vegetation shapes the microbial communities in tidal wetlands

Research group: ECOSPHERE

Hosting laboratory: CDE – building C

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Tidal wetland vegetation along the Scheldt estuary at the depoldered area of Groot Schoor (2022), © Yves Adams.

- **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

Tidal wetlands are coastal ecosystems at the boundary between land and sea. They are typically found along the banks of estuaries, which are the downstream reaches of rivers subject to tides and mixing of salt sea water and fresh river water. They provide important ecosystem services, including carbon storage, water quality regulation, flood protection and support for biodiversity. Tidal wetlands are globally recognized as crucial *blue carbon* ecosystems because of their capacity to capture and store large amounts of organic carbon into their soils and as such to contribute to climate change mitigation. For this reason, there is a high demand for tidal wetland restoration and management. Yet, the biological mechanisms governing soil organic carbon storage remain complex. Microbial communities are central to these processes, regulating carbon turnover and stabilization in wetland soils. However, the extent to which the salinity gradient in estuaries, and the associated different plant species, shape the composition and function of bacterial communities remains to be determined.

This thesis aims to investigate how salinity and associated wetland vegetation influences bacterial communities along the salinity gradient of the Scheldt estuary (SW Netherlands & N Belgium). Specifically, it will address the following questions:

1. How does the different environment of freshwater, brackish and saltwater tidal wetlands shape the composition of bacterial communities in the rhizosphere of the wetland plants?
2. How are these microbial assemblages related to the quality of plant-derived carbon, particularly the abundance of recalcitrant compounds such as lignin and cellulose?
3. Can specific microbial taxa or functional groups be linked to key vegetation types across the salinity gradient?

These objectives will be addressed through an integrated field and laboratory approach, combining ecological sampling in challenging environments (muddy wetlands) with advanced molecular and analytical techniques.

Fieldwork will be conducted at selected sites along the Scheldt estuary, covering a salinity gradient from freshwater to salt marshes. The first field campaign is scheduled to begin in February 2026. At each site, dominant plant species will be sampled. Root systems and rhizosphere soil will be collected for microbial analysis, while plant material will be characterized for recalcitrant compounds such as lignin and cellulose. Environmental variables including salinity, tidal regime, and sediment properties will be recorded. Microbial communities will be analyzed through 16S rRNA gene sequencing. You will gain hands-on experience with DNA extraction, PCR amplification, and bioinformatic analysis. Multivariate statistics will be applied to identify relationships between environmental variables, vegetation, and microbial community structure.

To conclude, this study will clarify how salinity and vegetation contributes to the structuring of microbial communities along environmental gradients and how this interaction could affect carbon cycling in blue carbon wetlands. By identifying plant–microbe associations of specific marsh types, the results will support better predictions of carbon dynamics in restored and natural wetlands.

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