



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

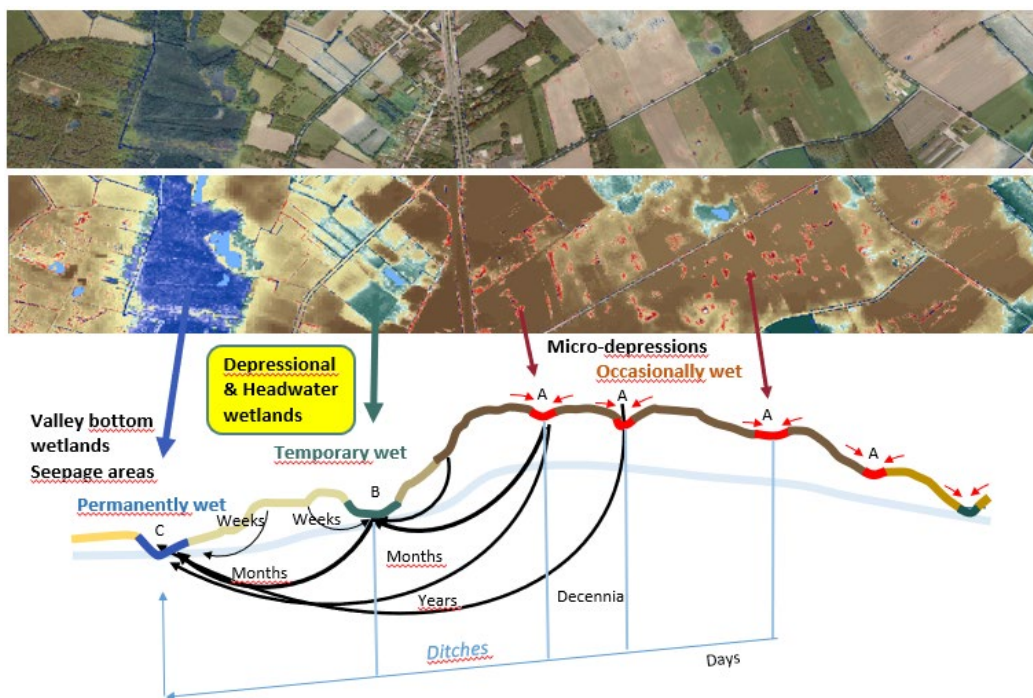
### Modelling the hydrological fluxes of (drained) upstream depressional wetlands (UDWs)

Research group: ECOSPHERE

Hosting laboratory: CDE – Building C

Promotor(s): Jan Staes [jan.staes@uantwerpen.be](mailto:jan.staes@uantwerpen.be)

Daily supervision: Jayson Pinza [jayson.pinza@uantwerpen.be](mailto:jayson.pinza@uantwerpen.be), Annelies Broeckx [annelies.broeckx@uantwerpen.be](mailto:annelies.broeckx@uantwerpen.be)



*Upstream depressional wetlands (yellow box – green on map) within the broader landscape scale. Black arrows indicate the direction of groundwater flow.*

- 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: .....

Groundwater level



Weather parameters (including precipitation)



Drainage discharge



**Example of one of the three monitored UDWs (Kasterlee). Nine piezometers (red dots) are used to measure groundwater level, weather parameters including precipitation values comes from the weather station and a measuring channel (yellow dot) placed at the outlet of the drainage ditch generates drainage discharge data.**

### Summary

There is growing evidence that small scale wetlands have a large potential influence in regulating watershed hydrology. Several recent papers specifically focus on the flow regulating functions of wetlands that are not directly hydrologically connected to a river network by surface-water connections. These local landscape depressions have a hydroperiod that is characterised by a short lag time, high frequency, and low amplitude. This means that UDWs can be only temporarily wet and wetland vegetation may be absent for most of the year. The water storage capacity of UDWs provides the benefits of reduced (peak) streamflow downstream and maintained baseflow and the high water residence time is beneficial for biodiversity and water quality.

Most of the UDWs are currently drained for agricultural purposes, which strongly alters their water balance. The peaks in water level are more attenuated in the case of drainage. A combination of infilling and drainage ditches ensures water level fluctuations to remain below field level.

The impact of UDWs on the catchment scale is largely unknown. Less attention has been given to the understanding the hydrology of drained depressional cropped wetlands, including their hydrological dynamics.

- 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: .....



Three UDWs in the sandy soils of the Campine region in Belgium were continuously monitored for three years (February 2020 till February 2023). Two of the UDWs are located in agricultural areas (Lille and Kasterlee) and the third one is under nature management and consists mainly of grassland (Geel). The three UDWs are drained via drainage ditches. The dataset consists of time series on groundwater level, precipitation and other weather parameters and drainage discharge. Additional soil sampling was performed to have more insight in the geohydrology of the UDWs, so also soil data are available.

In order to have insights on the effect of the drainage ditches, (numerical) modelling is required to simulate what happens when the drainage ditch is blocked (filled up). So the student would model the different hydrological fluxes of an currently monitored UDW by means of HYDRUS 3D to analyse the effect of the drainage ditch on the groundwater level. HYDRUS 3D is a software program for simulating water flow (and solute transport) in three-dimensional variably saturated media.

Research question: what is the impact of the drainage ditch on the groundwater level in an UDW? What is the impact on the groundwater level by closing the drainage ditch (i.e. no drain)?

This study consists of mainly modelling in HYDRUS 3D and interpretation of the results. Fieldwork is not needed, however a field visit to your site can be arranged. Experience in GIS can be useful, but it not necessary. This thesis is suited for someone who is motivated to do numerical modelling.

- 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: .....