



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 2026-2027

Microclimates beyond forests

Research group: ECOSPHERE

Hosting laboratory: CDE, building C

Promotor(s): prof. Tobias Ceulemans – tobias.ceulemans@uantwerpen.be

Daily supervision:



Boreo-Montane species *Sphagnum quinquefarium* at a heathland of the north-facing slope of Beninksberg (Rotselaar), The only known Flemish locality of this species that is even rare in the high Ardennes.

- 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

Forest canopies buffer temperature extremes, creating microclimates that differ from the surrounding atmosphere. This has drawn attention to forests as natural “air conditioners”. However, local cooling alone does not establish that all open habitats are less climate-resilient or that forest openings should be eliminated. Topography and hydrology also shape microclimates: north-facing slopes receive less direct solar radiation, while groundwater discharge may influence temperatures through cool water inflow, soil wetness and evaporation. Their relative importance and interactions with vegetation cover require targeted comparisons. This thesis will investigate how forests, heathlands and grasslands differ in microclimatic buffering under comparable topographic and hydrological conditions.

The student will review the literature and establish a replicated, paired observational study. Forest and heathland sites on north-facing slopes will be compared, alongside forest and grassland sites receiving groundwater discharge. A combined factorial sampling design will be considered where sufficient independent sites represent the relevant combinations of vegetation cover, aspect and groundwater influence. During spring and summer, calibrated data loggers will record near-ground air temperature and relative humidity simultaneously, using radiation shields and consistent sensor heights. Soil temperature and moisture will complement these measurements. The student will characterise canopy cover, vegetation structure, slope and aspect, and assess groundwater levels and temperature together with evidence of groundwater discharge. Regional weather data will provide a common climatic reference. Analyses will compare temperature maxima and minima, daily variability, humidity and responses to hot and dry periods. Mixed-effects models will account for the paired design, independent site replication and repeated measurements, and assess interactions among vegetation, topography and hydrology.

The goal is to evaluate the relative contributions of canopy cover, topography and groundwater influence to local thermal buffering, and identify conditions under which open habitats may provide cool microclimates. The results will inform conservation and restoration decisions concerning habitat mosaics, forest openings and hydrological restoration, without equating local temperature buffering with overall climate resilience. This topic is intended for MSc Biology students specialising in Biodiversity, Conservation and Restoration. A category B driving licence is required.

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