

PhD project in Hydrology and Hydrogeology

Quantifying how nature-based solutions reduce hydrological hazards and contribute to climate change adaptation

Rural watersheds are experiencing water quantity and quality stress which will be magnified by climate change which is expected to cause more frequent droughts and extreme storm events that will influence how water is stored and flows. These changes can modify water availability and impact how nutrients are transported. Nature based solutions (NBS), including wetlands, river corridors, and forests, are increasingly considered to mitigate the impacts of hydrometeorological hazards and increase watershed resilience to climate, but they are still not well understood, and they are seldom implemented in agricultural watersheds.

The aim of this PhD project is to better understand how NBS can reduce hydrological hazards and contribute to climate change adaptation in agricultural areas. The specific objectives of this research are 1) to document the role of existing NBS in agricultural areas of southern Canada, 2) to quantify how NBS affect surface and groundwater flows and quality, and 3) to determine which NBS have the best potential to reduce hydrological hazards and improve water quality in agricultural watersheds.

The project will include i) reconstruct past and current NBS maps and document long-term changes in their presence, ii) pursuing the development of a SWAT-MODFLOW-RT3D hydrological model for an agricultural region of southern Ontario (near Guelph, Ontario, Canada) to quantify the role of current NBS, iii) develop a range of plausible NBS and climate change scenarios for the next decades, iv) quantify how these scenarios can promote climate change adaptation, v) developing recommendations that include NBS to increase watershed resilience. The project is part of a larger research initiative led by a team of researchers from University of Guelph and UQAM. The Ontario ministry of Environment and the Grand River Conservation Authority are partners in the project.

Prerequisites: MSc in Earth sciences, Civil Engineering, Environmental Engineering or a related field, and *demonstrated French speaking abilities*

Scholarship: 25 000\$/yr for four years (additional funding opportunities available)

Start: January 2025

Supervisors: *Marie Larocque*, groundwater specialist and professor at the Department of Earth and atmospheric sciences UQAM (Montreal, Canada) (larocque.marie@uqam.ca) and *Jana Levison*, groundwater specialist and associate professor in Water Resources Engineering, School of Engineering, University of Guelph (Guelph, Ontario, Canada) (jlevison@uoguelph.ca).

Application by email including:

- Motivation letter
- Full CV
- BSc and MSc transcripts
- Contact details for two references