

Climate, crops & contamination: Mapping nitrate leaching risk across Switzerland

Context and objectives

Nitrogen leaching in agricultural systems is a major environmental risk resulting from irrigation-fertilization practices. Global losses of fertilized agricultural systems are estimated to be about 30% of the applied nitrogen fertilizer. Nitrate leaching, the most predominant form of loss, results in groundwater contamination impacting the quality of drinking water.

In the context of climate change, food, and water security, it is imperative to develop strategies that optimization fertilization application (and irrigation) to mitigate adverse environmental effects of nitrogen losses while maximizing grain production. Developing and testing such strategies remains challenging, partly because soil functions strongly depend on pedoclimatic conditions, soil degradation, and crop type; and all these variables may largely differ even for different regions across a same country and for different years.

Methodology

This master project aims at a high-resolution assessment of groundwater contamination risk due to agricultural nitrate leaching under changing climate in Switzerland. This will be conducted by integrating climate projections at 11km resolution from the EURO-CORDEX project and 1km resolution soil GRIDS information into a mechanistic modelling framework of nutrient transport and crop growth in agricultural systems. The student will use this framework to compute the nitrate leaching risk of swiss agricultural soils for (at least) two of the Shared Socioeconomic Pathways. Details such as spatial resolution, climate scenarios, climate change time horizons, pedo-transfer functions will be discussed upon the start of the project. Additional possibilities, depending on the student's interests, include agro-geophysical experiments and analysis of historical groundwater contamination data.

Supervision and collaboration

The project will be supervised by Dr. Landon Halloran and Dr. Alejandro Romero-Ruiz as part of the EU/Switzerland-funded FARMWISE project (20 partners total). The student will be encouraged to collaborate with one or more institutions (funded travel is possible) and participate in the project general assemblies. Given satisfactory results, eventual publication of a journal article, co-authored by the student, is foreseen. Contact : landon.halloran@unine.ch / alejandro.romero@unine.ch

