UNIL | Université de Lausanne
Faculté des géosciences et de l'environnement
Secrétariat du master en biogéosciences
bâtiment Géopolis
CH-1015 Lausanne

A poor man's enzyme: Abiotic drivers of decomposition in forest soils

Motivation:

Soil organic matter represent the largest and most dynamic terrestrial reservoir of carbon (C) on earth. The rate at which microbes can decompose soil organic matter determines the proportion that is either stored in soils or emitted to the atmosphere as CO_2. Even a small increase in decomposition rates may increase atmospheric CO_2 concentrations and adversely impact global climate. Understanding the mechanisms that control the decomposition is thus critical to predicting how soils respond and drive climate change, and remains one of the most important scientific challenges of the 21st century.

Aim of the study:

Manganese (Mn) is one of the most abundant and potent oxidants in the environment, but the impact of its cycling on soil organic matter decomposition remains elusive. This project aims to quantify the abiotic contribution of Mn to long-term decomposition in temperate forest soils. The candidate will collect samples from a long-term experiment examining the impact of Mn additions on decomposition rates at the Harvard Forest long-term ecological research (LTER) site in the Northeastern United States. Samples from several seasons will be subjected to a series of cutting-edge (micro)biological and chemical analyses. The results will inform how seasonal variations in Mn availability influence rates of decomposition in temperate forest soils.

Requested skills:

Field work will include transatlantic travel as well as 5-km hikes and long field days in an old-growth deciduous forest. Basic knowledge of soil science, microbiology, and chemistry is recommended. Prior experience in the laboratory, including sample processing and analysis, is beneficial. Availability for in Aug and Oct 2022 for field work.

Collaboration:

Field work in collaboration with the Harvard Forest LTER and the University of Massachusetts, in Amherst, Unites States (Ashley Keiser). Chemical analyses in collaboration with Old Dominion University, United States (Jingdong Mao).

Keywords: climate change, soil organic matter, decomposition, microbial activity, nutrient cycling

Working place: field work at Harvard Forest long-term ecological research (LTER) site, Massachusetts, United States, and soil science and biogeochemistry laboratories in IDYST (UNIL)

References:

Schmidt, M.W.I., Torn, M.S., Abiven, S., Dittmar, T., Guggenberger, G., Janssens, I.A., Kleber, M., Kögel-Knabner, I., Lehmann, J., Manning, D.A.C., Nannipieri, P., Rasse, D.P., Weiner, S., Trumbore, S.E., 2011. Persistence of soil organic matter as an ecosystem property. Nature 478, 49–56. https://doi.org/10.1038/nature10386

Jones, M.E., LaCroix, R.E., Zeigler, J., Ying, S.C., Nico, P.S., Keiluweit, M., 2020. Enzymes, Manganese, or Iron? Drivers of Oxidative Organic Matter Decomposition in Soils. Environ. Sci. Technol. 54, 14114–14123. https://doi.org/10.1021/acs.est.0c04212

Keiluweit, M., Nico, P., Harmon, M.E., Mao, J., Pett-Ridge, J., Kleber, M., 2015. Long-term litter decomposition controlled by manganese redox cycling. PNAS 112, E5253–E5260. https://doi.org/10.1073/pnas.1508945112

Contact:

Marco Keiluweit, Université de Lausanne, IDYST, keiluweit@umass.edu