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UNIVERSITÉ DE LYON

ENTPE
L'école de l'aménagement durable des territoires

Position:

PhD fellowship

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Ecole nationale des travaux publics de l'Etat

(ENTPE)

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Job title:	Importance of plant-fungi interactions in vertical-flow Nature-based Solutions for stormwater treatment (Importance des interactions plantes-champignons dans les Solutions fondées sur la Nature pour le traitement des eaux pluviales en écoulement vertical)
Host laboratory:	LEHNA-IAPHY
Location:	Vaulx-en-Velin (69), France
Duration:	36 months (start date April 2025)
Type of contract:	PhD scholarship, fully funded
Contact:	Katharina Tondera, professor at LEHNA-IAPHY, katharina.tondera@entpe.fr

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1-Context and challenges

The IAPHY team (Impact of Developments and Pollutants on Hydrosystems), located on the ENTPE campus in Vaulx-en-Velin (69), is one of the six research teams within the Mixed Research Unit (UMR) 5023, LEHNA (Laboratory of Ecology of Natural and Anthropized Hydrosystems). It comprises a total of 70 permanent staff based on the Doua campus and the ENTPE campus. Its main research focus is the analysis and understanding of the influence of global changes on ecosystem services in hydrosystems. The three overarching transversal axes mobilized are (i) biotic interactions and global changes, (ii) stress and adaptations to global changes, and (iii) eco-hydrology at interfaces, from ecological processes to ecosystem services. Research is organized into themes corresponding to the research scopes of its six teams: (i) BAH (Biodiversity and Plasticity in Hydrosystems), which identifies the ecological and evolutionary mechanisms governing the biodiversity and functioning of river hydrosystems; (ii) EVZH (Plant Ecology and Wetland Zones), which studies adaptive and functional responses of plant communities in wetland areas to environmental constraints; (iii) E3S (Ecology, Evolution, Underground Ecosystems), which focuses on identifying factors and connections shaping the evolution, dynamics, and role of biodiversity in underground ecosystems; (iv) E2C (Ecophysiology, Behavior, Conservation), which investigates how natural and anthropogenic changes in the environment influence ecological, behavioral, and physiological processes contributing to biodiversity conservation; (v) IAPHY, and finally, (vi) BMPT (Biogeography and Macroecology in Deep Time) to characterize the patterns, rhythms, and modalities of biodiversity variations at different spatiotemporal scales.

The scientific field of the IAPHY team falls within the broader scope of Environmental Sciences and focuses on assessing the impact of developments, in a broad sense, and chemical pollutants on continental aquatic environments and ecosystems. The research and teaching activities of the IAPHY team intersect the concerns of the INEE (National Institute for Ecological and Environmental Sciences) of CNRS and the land development and management missions under the Ministry of Ecological Transition (MTE). The team's work is centered on understanding the role of developments, pollutants, and other stresses resulting from human activities on biotic and abiotic processes within continental hydrosystems. This aims to identify high-risk situations and characterize the resilience of these ecosystems. The scientific project aligns with the broader study of the effects of anthropogenic pressures (developments and pollutant emissions) on fluxes (water, sediments, nutrients, and pollutants) and their impacts on hydrosystems and their ecological functions.

In this context, ENTPE is recruiting a postdoctoral research fellow, hosted at IAPHY, in collaboration with the Urban Water Engineering research group of Luleå University of Technology (LTU), Sweden. For more information on the host institution in Sweden, LTU, see www.ltu.se/water.

2-Objectives

The primary objective of the PhD project is to explore how microbial communities associated with plant roots impact the effectiveness and longevity of vertical-flow Nature-based Solutions (NbS) for the treatment of stormwater. Symbiotic interactions with microbial communities are known to support plant growth under conditions of environmental stress. These interactions could improve infiltration conditions and prevent clogging in NbS for stormwater treatment. In addition, biologically very active biofilms increase pollutant removal, transfer and bio-degradation. While some studies exist on bacterial communities, the role of the overall plant-microbe associations including fungi in NbS remains poorly known, which also extends to the limited knowledge on pollutant transformation due to these associations, e.g. speciation and isotope fractionation for heavy metals in the “substrate-to-plant continuum”.

To investigate the potential links between the chemistry of substrate, organic and inorganic pollutants, the structure of the microbial communities and the services provided by the plants, microcosm experiments with several target plant species will be coupled with long-term data sets and supplementary investigations on plant biodiversity and water quality in situ at urban infrastructure sites for stormwater management.

The PhD student will be located in the Metropolitan area of Lyon, France. Research visits in Sweden for a period of three to six months will allow investigating the impact of colder climates. The costs of travel and stay are funded by the project.

3-Expected profile

We are seeking a highly motivated candidate who holds a master's degree in a relevant field, such as biology, environmental engineering or environmental science, with a solid background in microbiology (molecular analysis) and knowledge of multivariate statistical tools. An interdisciplinary mindset is crucial, as we encourage collaboration across various disciplines (Prof. Katharina Tondera, ENTPE, Prof. Godecke Blecken, LTU, Prof. Anne-Kristel Bittebiere, University Lyon 1). Strong English communication skills and the ability to work effectively in interdisciplinary teams are essential qualities we are looking for. A driver’s license equivalent to type B for reaching the field sites is very beneficial.

4-Application procedure

If you require further information on the position please contact Prof. Katharina Tondera. Applications must be sent to Prof. Katharina Tondera by February 1st, 2025, and should include an application letter describing your interests and their relevance to this position, a CV, and the names and contact information for two references. The anticipated starting date for the position is April 2025.