



STAGE DE RECHERCHE M2 ECOLOGIE EVOLUTION GENOMIQUE

Rentrée 2020

A trait-based approach to study the effect of earthworms (megascolecidae and lumbricidae species) on the stabilization of soil organic carbon

- **Context and objectives**

In the context of climate change and increasing atmospheric CO₂ concentrations, ecological processes associated with soil organic carbon (SOC) dynamics have received attention. Earthworms are known to play a key role in SOC from decomposition to greenhouse gas emissions, notably CO₂ and N₂O (Lavelle et al., 2020; Lubbers et al., 2013). Earthworms ingest a large amount of soil that they mix with organic matter in their digestive tract and excrete dejections as organo-mineral aggregates, called earthworm casts, which contain organic matter. The current earthworm ecological studies are mostly based on the three main ecological categories defined by Bouché (1977). Epigeic, anecic and endogeic species process soil organic matter (SOM) differently depending on their specific living space in the soil profile and their sources of food. The amount, nature and stability of the SOC included in casts is variable between and within ecological categories (Van Groenigen et al., 2019). This approach is simplistic and give only a rough estimation of the effect of earthworms on SOM. In this project it is hypothesized that more than three categories might better reveal OM quantity and quality in casts. In fact, Bouché (1977) identified four more categories (epi-anecic, epi-endogeic, endo-anecic and intermediate) that now can be easily assign with 13 morphological and anatomical traits (Bottinelli et al. 2020).

The objectives of this internship project are (i) to determine the quantity and quality of the OM incorporated in the casts produced by different temperate and tropical earthworm species, (ii) to assess greenhouse gases potentials of these casts and (iii) to relate the findings to the seven earthworm ecological categories.

- **Methodology**

The Master 2 student will analyze earthworm cast collection from 15 lumbricidae species in France and 15 Megascolecidae species in Vietnam. The quantity and quality of the organic matter in casts will be determined by elemental, isotopic and spectroscopic analyses. The student will carry out a laboratory incubation to determine the stability of OC within the casts by monitoring CO₂ emissions. He/she will assess nitrification, gross and net N₂O emission potential.

- **Conditions of completion**

The internship will contribute to the U2 worm and PRECIOUS projects funded by ANR. The experimental work will be supervised by Alessandro Florio, Nicolas Bottinelli and Yvan Capowiez. The laboratory analyses including elemental, isotopic and spectroscopic analysis will be carried out in Paris (site of Bondy with technical staff from the iEES laboratory). Nitrification and gas analyses will be carried out in Lyon, LEM laboratory. The duration of the internship is set between 5 to 6 months from February 2021. The student will benefit an internship allowance (≈ 550 euros / month). Possibility of accommodation at the site of Bondy.

- **Possible follow-on for the student after the Master**

A PhD project will be submitted at the doctoral school (ED129)

- **Bibliography**

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Lavelle, P., Spain, A., Fonte, S., Bedano, J. C., Blanchart, E., Galindo, V., ... & Zangerlé, A. (2020). Soil aggregation, ecosystem engineers and the C cycle. *Acta Oecologica*, 105, 103561.

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- **Contact**

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