Assessing the impact of lumbricid earthworms (keystone species) on greenhouse gasses and ecosystem multifunctionality

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Abstract

One of the aims of the Paris Climate Agreement is to reduce the emissions of greenhouse gases (GHG) in a manner that does not threaten the food production. In an agricultural context, lumbricid earthworms (family Lumbricidae) have always been considered indicators of soil fertility and productivity. In contrast to this view, a couple of recent meta-analyses suggested that earthworms enhance the emissions of soil GHG (CO2 and N2O) and can reduce soil carbon storage. However, there is accumulating evidence that the difficulty of setting up realistic experiments manipulating earthworm treatments is responsible for numerous idiosyncratic findings in natural and agro-ecosystems. Also, there is increasing realization that there is an urgent need of earthworm studies assessing simultaneously the multitude of ecosystem functions present in nature - ecosystem multifunctionality – such as primary productivity, nutrient cycling and carbon storage and water fluxes.
To address these knowledge gaps we started a large experiment using the 12 Macrocosms with lysimeters (5m2, 1.5 m deep and weighting 13 tonnes each) of the CNRS Ecotron facility (www.ecotron.cnrs.fr), and established treatments with and without different earthworm functional groups (none, anecic and endogeic). Our overarching hypotheses are that: i) in contrast to the methodologically biased meta-analyses using predominantly data from unrealistic microcosm experiments, in realistic field conditions including plants, earthworms reduce greenhouse gas emissions and increase soil carbon stabilization and sequestration and ii) in a multifunctional context earthworms will have an overwhelming positive effect on multiple ecosystem functions.
In this presentation we will discuss the experimental design, hypotheses, preliminary results and opportunities for collaborations.

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