The potential of the world beneath our feet

One quarter of terrestrial biodiversity exists underground. In spite of these riches, the world beneath the soil has long been neglected by ecologists and agronomists. And yet, it could well prove to be a priceless source of effective alternatives to intensive agriculture.

Giant Madagascan earthworm: *Kynotus giganteus*.

Soil ecology was long considered a sort of poor relation in the ecology family, for reasons both methodological and historical. Almost all subterranean organisms are microscopic, living in dense, opaque and highly heterogeneous milieus. Their lifestyles and interactions are thus notoriously difficult to study. Furthermore, ecological theories are primarily constructed with reference to life "above ground," without taking much account of the specificities of the world "down below." Nevertheless, we largely have this thriving subterranean fauna to thank for imbuing the soils with the properties we know and value, performing a variety of essential functions (e.g. breaking down organic matter, maintaining soil structures, perpetuating the nutrient cycles).

In today's world, the narrow, productivist vision of agriculture has reached its environmental limits (soil deterioration, erosion, pollution etc.). As such, scientists are beginning to devote much more attention to the life beneath the surface, home to over 25% of total biodiversity. In order to preserve and restore this biodiversity, under threat from practices such as intensive ploughing and the use of chemical products, we first need to correctly identify the ecosystemic functions and services which it provides. But these functions are often the fruit of interactions between different components of the fauna, interactions which elude simple taxonomic classification. Measuring the biological health of soils thus requires us to develop a more holistic approach which takes this level into account.

··· Researchers are attempting to understand how subterranean fauna allows the soils to function ···

Earthworm study, Vietnam.

For researchers, the long-term objective is to develop more functional approaches to soil biodiversity in order to better understand the connection between biological interactions and/or combinations and the broader functions of the soil. This would enable us to propose solutions which might improve soil health while also maintaining productivity, stimulating this biodiversity indirectly (with a "cocktail" of organic material designed to modify the biological make-up of the soil) or directly (biological reseeding). In Madagascar, for example, a three-year project to introduce earthworms to certain rain-fed rice paddies succeeded in boosting harvests by 44 %. This improvement was primarily a result of an increase in the release of nutrients (particularly phosphorous, a common problem in these soils) available to the plants.

Although this approach is still in its infancy, it offers a first glimpse at the vast complexity of the world's subterranean systems. The challenge now is to preserve that biodiversity while harnessing its functions to make the agriculture of the future both sustainable and productive.

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Research
for a sustainable world

IRD Éditions
INSTITUT DE RECHERCHE POUR LE DÉVELOPPEMENT
FRENCH RESEARCH INSTITUTE FOR SUSTAINABLE DEVELOPMENT

Marseille, 2020

Written by
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Design and page layout
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The photos in this publication come from the Indigo image bank (IRD), unless otherwise specified

Cover photo
Swim At The Lake - Henri Robert Brésil
By courtesy of www.naderhaitianart.com

ISBN print : 978-2-7099-2874-8
ISBN PDF : 978-2-7099-2875-5

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