Tropical and Subtropical Agroecosystems

PREFACE

CHARACTERIZATION OF BELOW-GROUND BIODIVERSITY IN SELECTED BENCHMARK AREAS IN KENYA

This special issue of the journal is dedicated to the result of the inventory on below-ground biodiversity conducted in two contrasting benchmark areas in Kenya, both known for the importance in terms of biological diversity. It is part of a project entitled *"Conservation and Sustainable Management of Below-Ground Biodiversity"* that is implemented in 7 countries across Latin-America, Africa and Asia.

It is only in the past one or two decades that soil biota and their roles in soil ecosystem services have emerged as important aspects of soil science research. Soil biota constitutes an important component in the soil ecosystem that performs a wide range of functions considered essential for the sustainable functioning of nearly all ecosystems. The roles of the soil biota relate to decomposition of organic material and regulating the dynamics of soil organic matter; soil carbon sequestration; greenhouse gas emission; modifying soil physical structure and herewith water regimes; nutrient cycling and enhancing the amount and efficiency of nutrient uptake by vegetation through mycorrhizal fungi and nitrogen fixing bacteria; and influencing plant health through the interaction of pathogens and pests with their natural predators and parasites.

Soil organisms provide an important resource for the sustainable management of agricultural productivity in addition to other ecosystem services. Thousands of often undiscovered soil organisms play a role in regulation of chemical and biological processes which have wide applications in agriculture, and many have found their application in pharmaceuticals and other industrial products.

It is this realization of the importance of soil biota that lead to the formulation of this project that aims to improve the knowledge and understanding of below-ground biodiversity importance for sustainable agricultural production through an elaborate inventory of soil organisms, supported processes and their individual functions in agriculture and related ecosystems. The project is co-funded by the Global Environment Facility (GEF) and supported by the United Nations Environmental Programme (UNEP). One of the major objectives of the project is to explore trends in diversity and abundance of soil organisms belonging to different functional groups such as the macro-fauna, mesofauna, nematodes, arbuscular mycorrhizal fungi (AMF), legume nodulating bacteria, phyto-pathogenic fungi and others occurring across land use intensity gradients in selected benchmark areas in Brazil, Cote d'Ivoire, India, Indonesia, Kenya, Mexico and Uganda. The project is unique in that it considered the various functional groups of soil organisms in conjunction rather than to look at specific soil taxa in isolation. The project is to offer means by which below-ground biodiversity (BGBD) may be adequately managed and conserved in tropical agricultural landscapes as the basis for enhancing and sustaining agricultural productivity. The project further aims to build capacity for conservation and sustainable management of BGBD across tropical landscapes in three continents, backed by South to South exchanges and training backed by institutions of international acclaim.

The Kenyan benchmark sites are located in the Embu Region in the central part of the country on the slopes of Mount Kenya and in Taita in south-western part of the country that is part of the Western Arc biodiversity hotspot that stretches between Kenya and Tanzania.

The major land use categories in the areas form the basis for the inventory of the BGBD. The land use types together represent a land use intensity gradient, allowing investigating effects of land use intensity on BGBD, whereby forests are considered to represent the lowest land use intensely and horticulture the highest Standard methods were used for extracting, isolating and characterizing the different soil biota groups across the benchmark sites. What we report in this special issue are the results of the inventory on fungi, ants, termites, earthworms, acari, collembolla and nematodes. Details of the methods for sample collection are described in the book *'A Handbook for Tropical Soil Biology'* by Moreira *et al.,* (2008).

This inventory clearly demonstrated that quantitative and qualitative changes in diversity and density of soil organisms occur when various land use systems are subjected to varying levels of intensification. These changes are associated with management practices such as tillage and use of agrochemicals which affect the soil physical and chemical properties thereby influencing soil organisms' occurrence. Increase in soil disturbance for example resulted in increased plant parasitic nematodes and pathogenic fungi and decreased collembolla population. Phosphorus and acidity stood out as major soil conditions that affected arbuscular mycorrhizae fungi spore abundance and colonization negatively. Macrofauna also showed correlation with soil physical and chemical properties.

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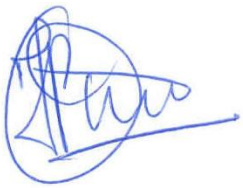

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