European Commission

GLOBAL SOIL BIODIVERSITY ATLAS

176 PAGES
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AVAILABLE MARCH 2016

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GLOBAL SOIL BIODIVERSITY INITIATIVE

European Commission

GLOBAL SOIL BIODIVERSITY ATLAS

Supporting the Global Soil Biodiversity Initiative: preserving soil organisms through sustainable land management practices and environmental policies for the protection and enhancement of ecosystem services.

GLOBAL
SOIL BIODIVERSITY
INITIATIVE

2015
International
Year of Soils

Joint Research Centre

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Scope of the atlas

'Essentially, all life depends upon the soil ... There can be no life without soil and no soil without life; they have evolved together.'

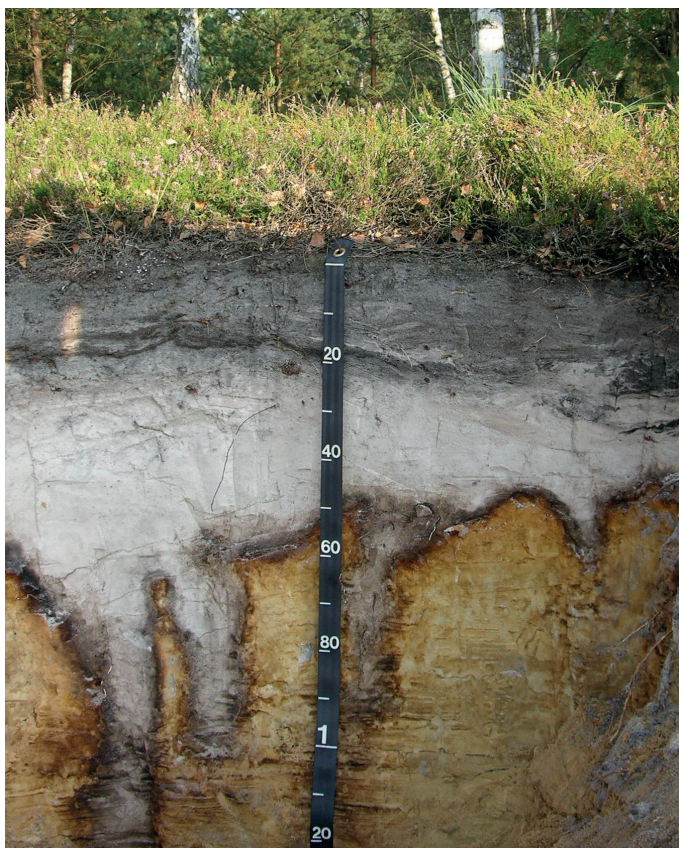
Charles E. Kellogg, USDA Yearbook of Agriculture, 1938.

Soil is composed of living organisms, minerals, organic matter, air and water and performs a number of key environmental, social and economic services that are vital to life. Supplying water and nutrients to plants, at the same time soil protects water supplies by storing, buffering and transforming pollutants. Soil is also an incredible habitat and it provides raw materials, preserves our history and reduces the risk of floods. Without soil, the planet as we know it would not function.

However, the importance of soil and the multitude of environmental services that depend on soil properties are not well understood by society at large. Part of the problem is that with an increasingly urban society, many people have lost contact with the processes that lead to food production. Most people expect to find food on the shelves of supermarkets and have limited or even no appreciation of the roles played by soil. Concepts such as nutrient cycling and organic matter management, that are critical to soil fertility and food production, are a mystery to most of us.

There is very little dialogue between the soil science community and the general public. The majority of soil-related information is geared towards university level or scientific journals – normally beyond the reach and understanding of the general public. This results in a lack of material to help interested stakeholders appreciate the value of soil and to guide them in preserving this precious resource.

As a consequence, soil tends not to feature in the minds of the public or politicians. However, soil experts are becoming increasingly aware of a greater need to inform and educate the general public, policy makers, land managers and other scientists of the importance and global significance of soil. This is particularly true for soil biology and biodiversity.



To many people soil appears as solid ground. However, all soils contain space for life, from pores and cracks to burrows and root systems. (EM)

Life within the soil is hidden and, therefore, often suffers from being 'out of sight, out of mind'. However, this atlas aims to raise awareness of the important roles that the soil biota plays in driving life on Earth and demonstrating that soil is a vital habitat that needs to be managed in a sustainable way or, in some cases, protected from misuse and degradational processes.

A key goal of this atlas is to provide non-specialists with access to information about this unseen world through a comprehensive guide to the belowground environment, the organisms that live there and the functions carried out by soil biota in general.

In order to better explain the complex interactions that occur among organisms in the soil, this atlas is divided into six main sections.

Organism size	Group	Known species	Estimated total species	% Described
	Vascular plants	270 000	300 000	90 %
	Soil macrofauna			
	Earthworms	7 000	30 000	23 %
	Ants	8 800	15 000	59 %
	Termites	1 600	3 000	53 %
	Mesofauna			
	Mites	20 000 - 30 000	900 000	2 - 3 %
	Collembolans	6 500	24 000	27 %
	Microfauna ad microorganisms			
	Nematodes	5 000	400 000	1 %
	Protists	1 500	200 000	7.5 %
	Fungi	18 000 - 35 000	1 500 000	1 - 2 %
	Bacteria	13 000	1 000 000	1 %

Estimated number of species of soil organisms and vascular plants organised according to body size (derived from Barrios, Ecological Economics, 2007). [1,2]

The first section aims to provide an overview of the factors that determine the main characteristics of the habitat by describing the key soil forming factors and how soils vary on a global scale, while the second section presents a visual introduction to, and description of, the main groups of soil organisms. Given the astonishing levels of variation of life present in soils, it is impossible to present a complete overview of all soil biodiversity in this publication (just listing all of the known species of bacteria found in soils could take up many hundreds of pages). Starting with the smallest organisms, namely bacteria, and working up through the taxonomic groups, from fungi and nematodes to insects and mammals that we are more familiar with, this section gives a taste of the breadth of different types of organisms which live, usually unnoticed, beneath our feet.

The third section describes the patterns of soil biodiversity from micro to global scales, both geographically by specific ecosystems and in time. The fourth, fifth and sixth sections are linked in explaining how soil biota drive ecosystem services; how ecosystem services are under threat from a range of pressures, such as land use and climate change, and what measures may be taken to protect soil organisms and the benefits they provide to society.

The final section outlines a series of policy, education and outreach initiatives to support soil biodiversity management and conservation. The atlas also contains a supporting glossary and suggestions for further reading.

The atlas is an activity of the Global Soil Biodiversity Initiative, which was launched in September 2011 to develop a coherent platform for promoting the translation of expert knowledge of soil biodiversity into environmental policy and sustainable land management for the protection and enhancement of ecosystem services (see Chapter IV).

A fungus emerges from the soil. The soil that lies beneath our feet is teeming with life. Much of it unknown and beyond the comprehension of most. Soil is the living shell of planet Earth. (WJ)

The Global Soil Biodiversity Atlas has been completed in time for the International Year of Soils 2015 and is a follow up to the highly acclaimed European Atlas of Soil Biodiversity, which was published by the European Commission as a contribution to the 2010 International Year of Biodiversity. By providing a global perspective on soil biodiversity and related issues, the atlas discusses the steps being taken to increase our appreciation of soil biodiversity and the development of measures to protect this vital resource.

Stable, healthy and productive landscapes reflect underpinning soil characteristics (Ngorongoro Conservation Area in Tanzania, East Africa). (VL)

Soil is alive!

- According to the United Nations Convention on Biological Diversity (CBD), biodiversity is defined as the variation of life from genes to species, communities, ecosystems and landscapes.
- While there is no formal unit of biodiversity, the expression is used to represent the totality of life through taxonomic, ecological, morphological and molecular diversity.
- Soil biodiversity reflects the mix of living organisms in the soil. These organisms interact with one another and with plants and small animals, thus forming a web of biological activity.
- Soil biodiversity varies greatly across the globe as the species numbers, composition and diversity of a given soil depend on factors, such as air, temperature, acidity, moisture, nutrient content and organic matter.
- Soils are conditioned by climate, altitude, soil parent material, land use and the presence of living organisms (especially humans).
- Soils provide an amazing habitat and may contain more than 10 000 species per square metre.
- A single gramme of soil may contain millions of individual cells and thousands of species of bacteria. Bacterial biomass can amount to 1 - 2 tonnes per hectare in temperate grasslands.
- Soil organisms maintain critical processes, such as carbon storage, nutrient cycling and plant species diversity, and play a key role in maintaining soil fertility.
- Earthworms, termites and other soil organisms enhance soil productivity by mixing the upper soil layers, which redistributes nutrients, aerates the soil and increases surface water infiltration. Earthworms increase crop yields by 25 %, on average.