



Food and Agriculture
Organization of the
United Nations

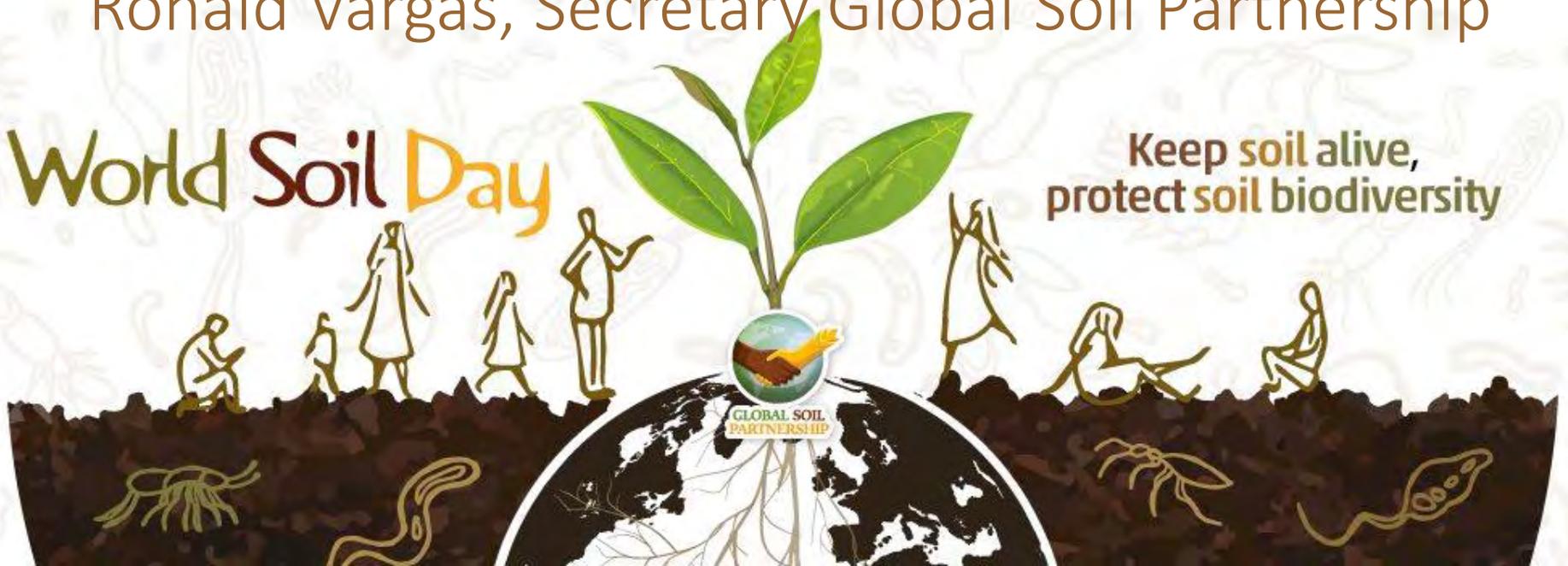
5 DECEMBER 2020

STATE of KNOWLEDGE of SOIL BIODIVERSITY- Status, Challenges and Potentialities

Ronald Vargas, Secretary Global Soil Partnership

World Soil Day

Keep soil alive,
protect soil biodiversity

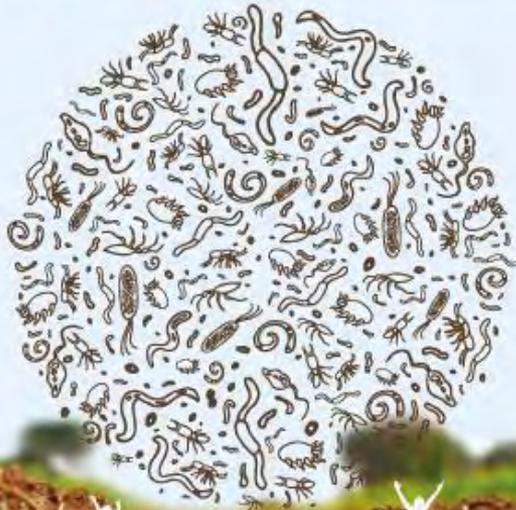




Food and Agriculture
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United Nations

Report
2020

STATE of KNOWLEDGE of SOIL BIODIVERSITY



Status, challenges and potentialities



Convention on
Biological Diversity



GLOBAL
SOIL BIODIVERSITY
INITIATIVE



The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

Thanks to the financial support of



Ministry of Environment and
Climate Change



European
Commission



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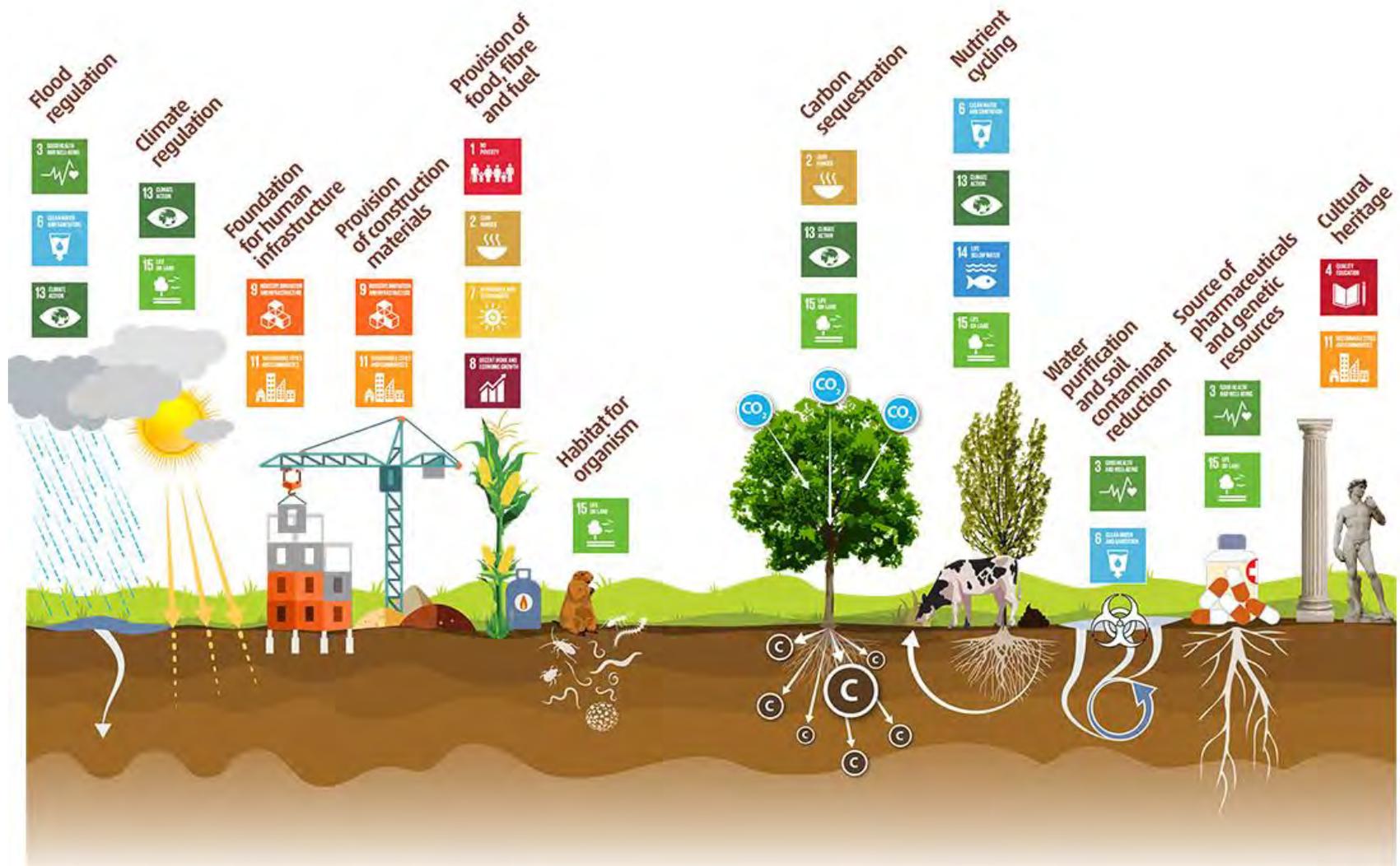
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A healthy soil is capable of providing most terrestrial ecosystem services, therefore contributing to achieve the SDGs and human well-being



What is soil biodiversity?

We define soil biodiversity as the variety of life belowground, from genes and species to the communities they form, as well as the ecological complexes to which they contribute and to which they belong, from soil micro-habitats to landscapes.



What is soil biodiversity?



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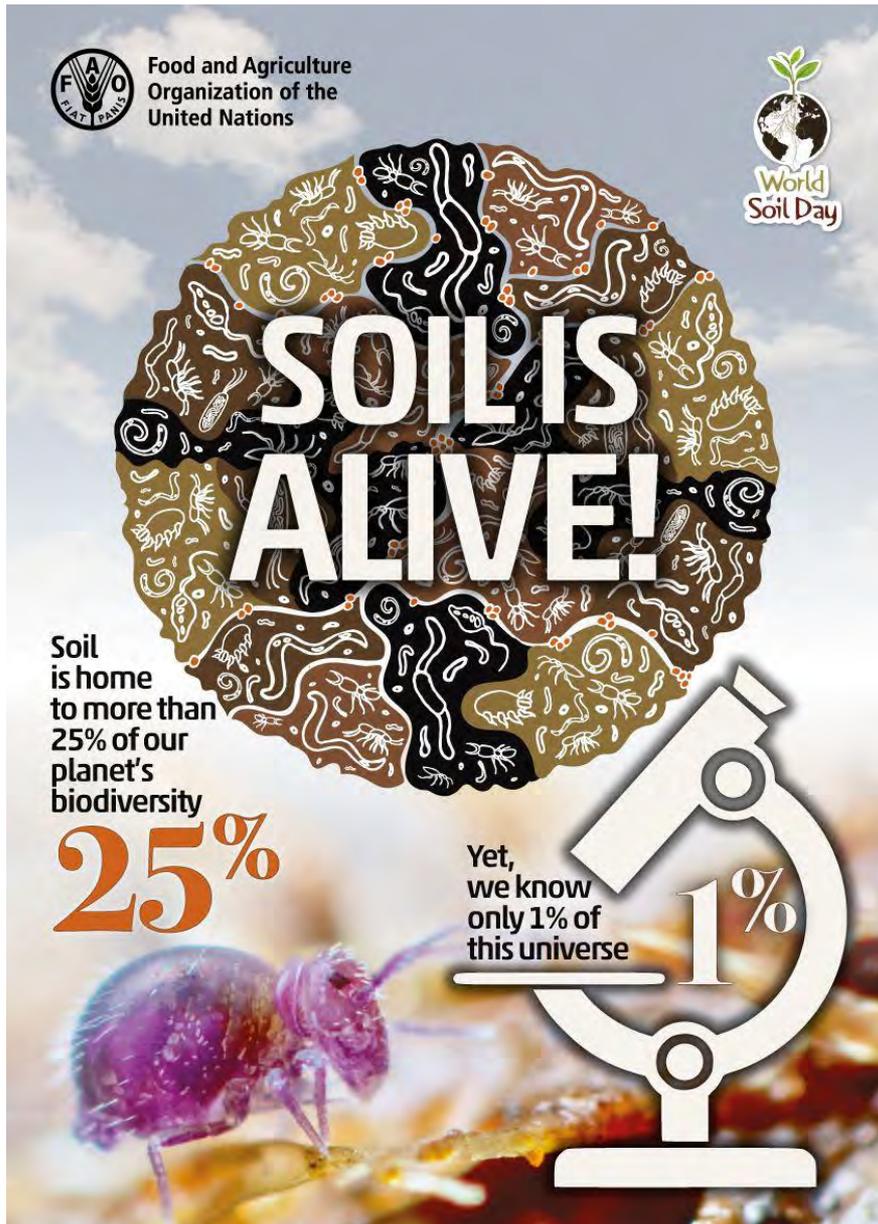
What do we know about soil biodiversity?

Soil diversity



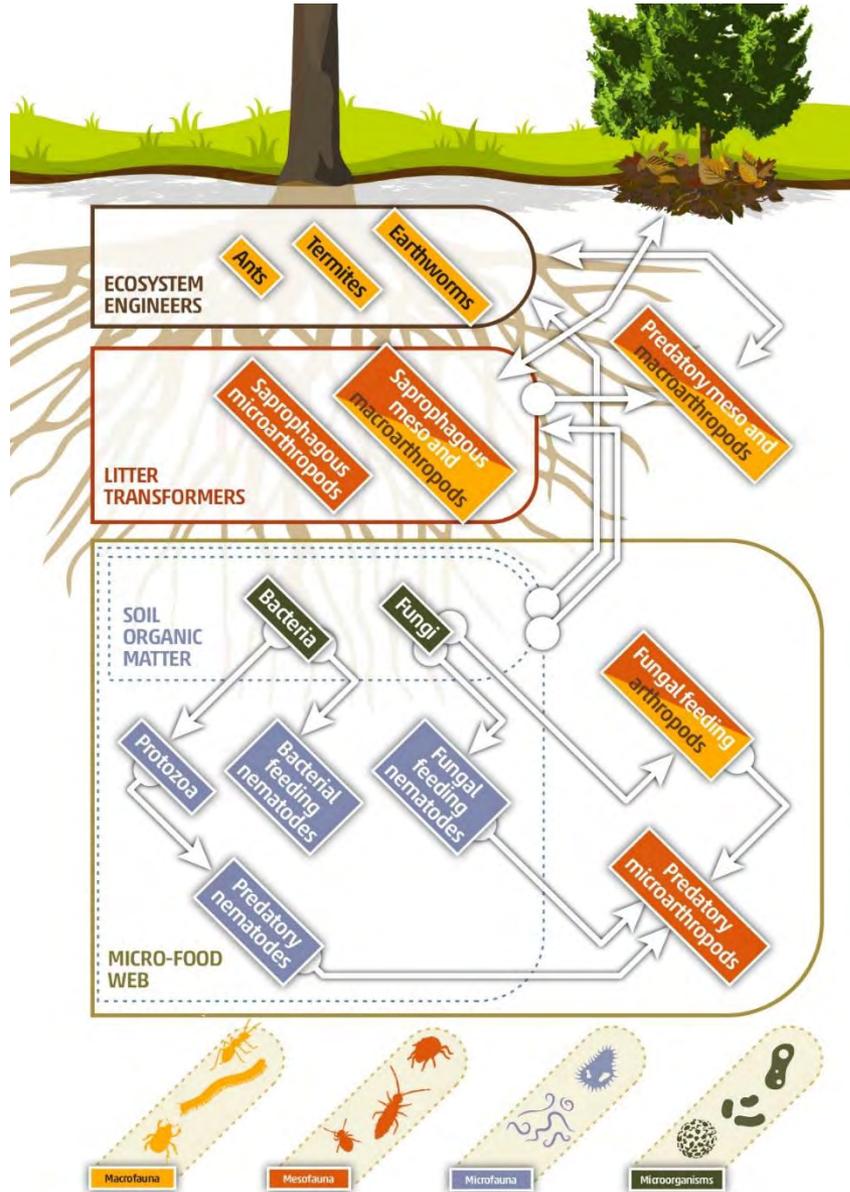
- **Bacteria and Archaea:** 2.5×10^{30} cells.
- **Fungi:** 0.8-3.8 million species.
- **Nematodes:** 4×10^{20} individuals in soils alone.
- **Mites:** 20 000 described, 80 000 undescribed species.
- **Collembola:** 8 000 described species worldwide.
- **Earthworms:** 6 000 species, from 20 families
- **Termites:** 2 934 species in 282 genera.
- **Ants:** 20 000 species.

What do we know about soil biodiversity?



- More than 40% of living organisms in terrestrial ecosystems are associated during their life-cycle directly with soils.
- Soils contains arguably the most diverse terrestrial communities on the planet.
- It supports most life above ground by means of increasingly well-understood above and belowground linkages.

Why is soil biodiversity important?



- These organisms are part of a vast food web that cycles energy and nutrients from microscopic forms through the soil's megafauna to organisms that live on top of the soil.
- Soil biodiversity is essential for most of the ecosystem services soils provides, which benefit the species that inhabit and use them, and their environment.

Aboveground and belowground biodiversity

An inseparable interaction

Above-ground food web

Pollinators



Herbivores



Energy and matter



Litter transformers

Saprophagus macrofauna

Ecosystems engineers

Symbiotic beneficial associations

Pathogenic bacteria

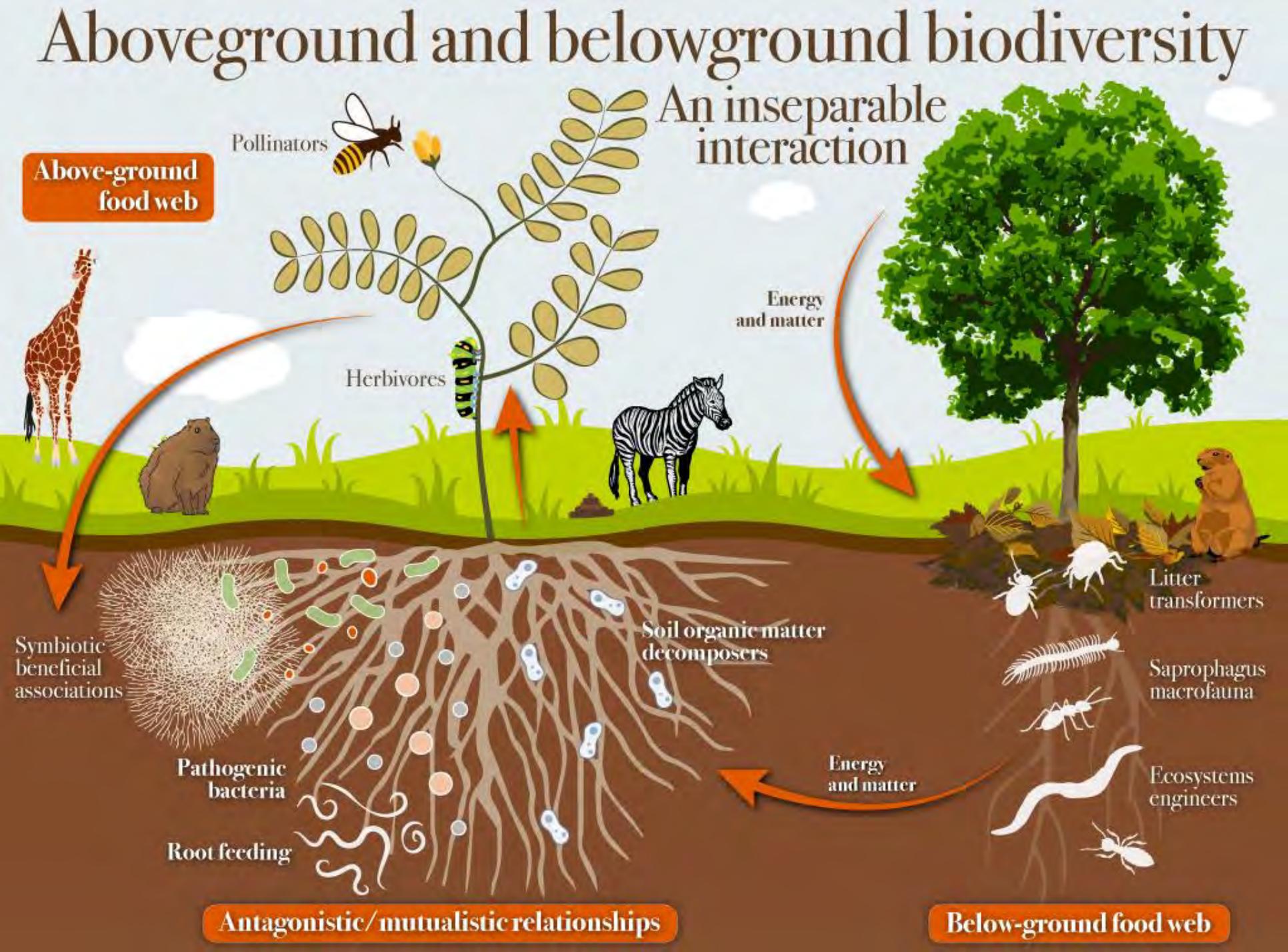
Root feeding

Soil organic matter decomposers

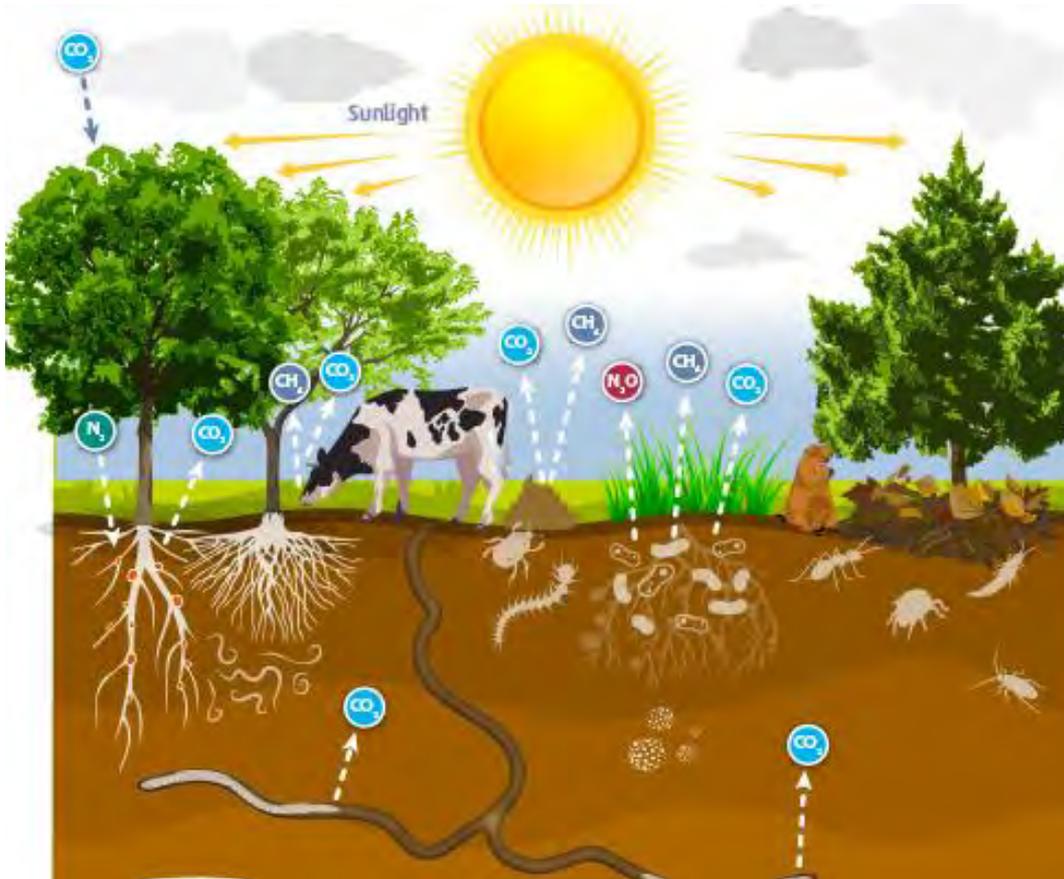
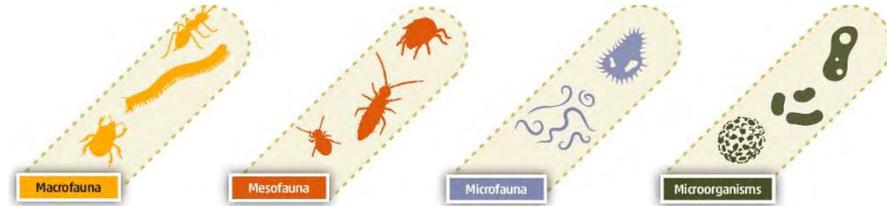
Energy and matter

Antagonistic/mutualistic relationships

Below-ground food web



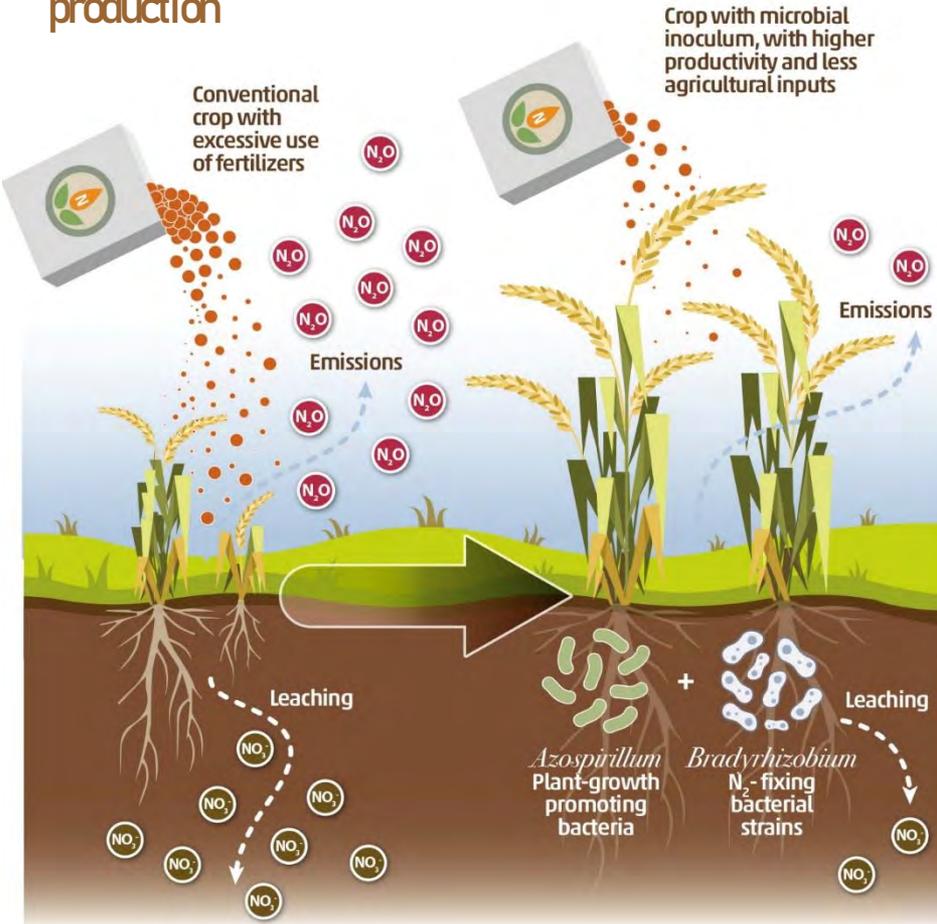
Why is soil biodiversity important?



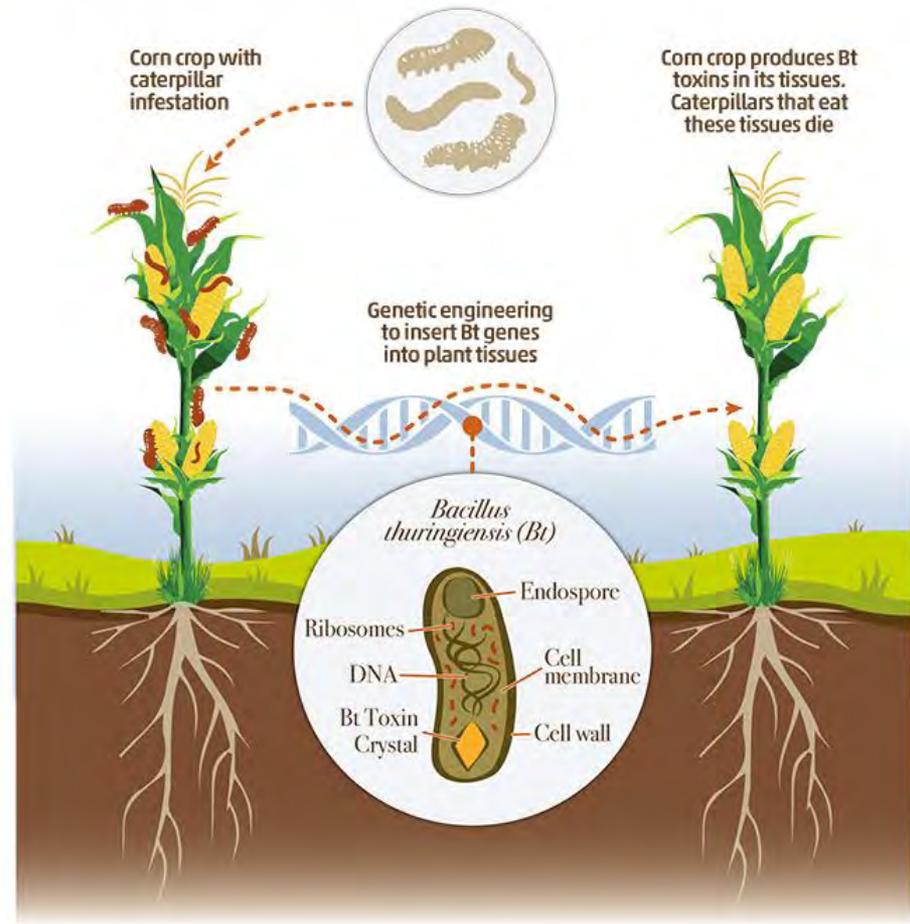
- Soil formation/soil structure.
- Carbon transformations.
- Nutrient cycling.
- Biological regulation.
- Provision of ecosystem services.
- Food security and food safety.
- Bioremediation.
- Human health.
- Links with above-ground biodiversity.

Why is soil biodiversity important?

Clean biotechnology in agricultural production



Biological control



Why is soil biodiversity important?



- The discovery of antibiotics has had a major impact on increasing human life expectancy.
- The early exposure to a diverse collection of soil microorganisms might help prevent chronic inflammatory diseases, including allergy, asthma, autoimmune diseases, inflammatory bowel disease and depression.

YET SOIL BIODIVERSITY IS IN GREAT DANGER FROM

Unsustainable soil
management practices



MONOCULTURES LIMIT THE PRESENCE OF BENEFICIAL BACTERIA, FUNGI AND INSECTS, AND CONTRIBUTE TO ECOSYSTEM DEGRADATION

Pollution

POLLUTION CAUSES A CASCADE OF SOIL DEGRADATION PROCESSES AND AFFECTS SOIL ORGANISMS BY REDUCING BIOMASS AND SPECIES RICHNESS



Surface sealing and
urbanization

IN EUROPE,
11 HECTARES OF SOIL
ARE SEALED UNDER
EXPANDING CITIES
EVERY
HOUR



75bn t

Erosion

EACH YEAR, 75 BILLION TONS OF SOILS AND THEIR ORGANISMS ARE STRIPPED FROM THE LAND BY WIND AND WATER EROSION

SOIL BIODIVERSITY IS A NATURE BASED SOLUTION



COST OF INACTION:
50 BILLION €
PER YEAR AND COULD REACH
14 000 BILLION €
IN 2050



What are the challenges and gaps?



Lack of data/information on soil biodiversity at local, national, regional and global levels (not included in soil surveys).

Few countries that maintain a national soil information system/monitoring that includes soil biodiversity.

Unavailable global harmonized sampling, measurements and analysis protocols.

Strengthen all groups (i.e., microbes and micro, meso, macro and mega soil fauna) with data and information.

Recognition of Soil biodiversity in the 2030 and Post 2020 Biodiversity Agenda. Weak capacity development in the adoption of molecular tools and emerging novel technologies to contribute to human, plant and soil health.

Ecosystem restoration does not include soil health and soil biodiversity considerations.

Microbiome investigations for environmental management are still novel and highly experimental, yet they underline the need for conservation of entire soil biotic communities.

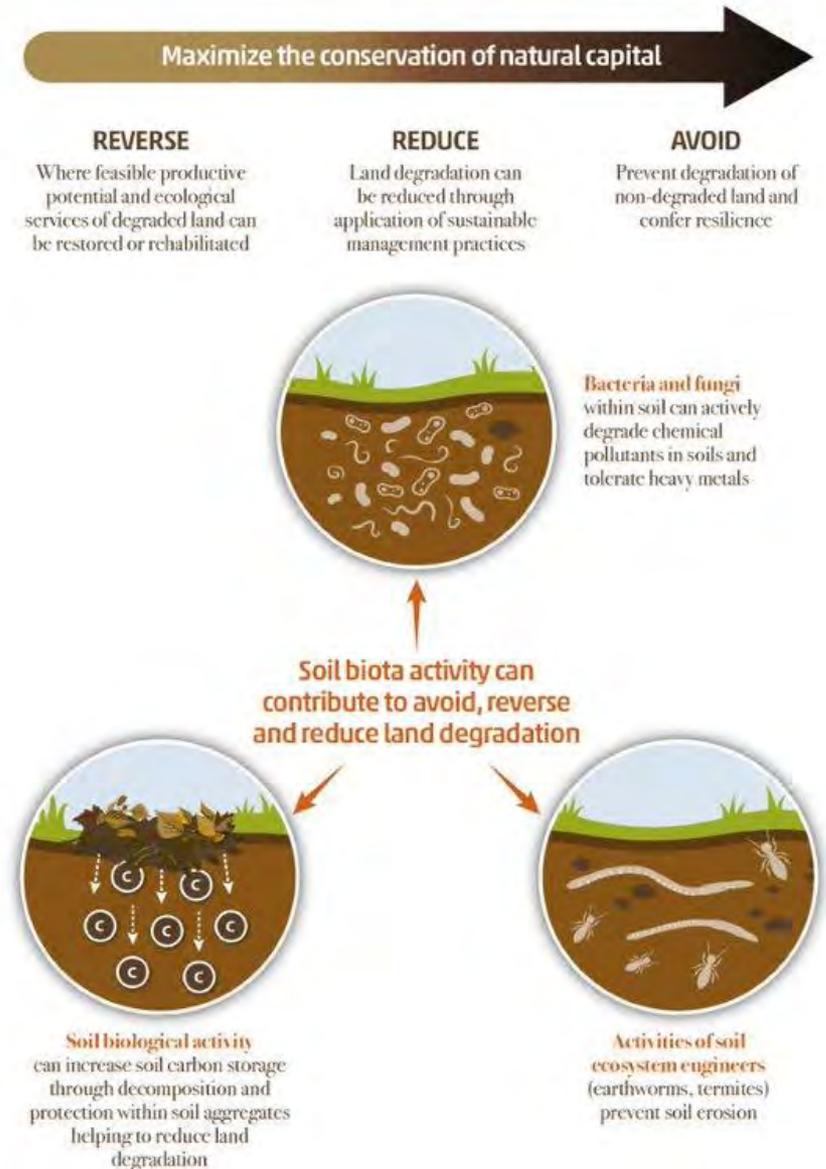
Need to invest on research for soil borne diseases and scale up soil biodiversity responses for the Agricultural sector.

Need to scale up bioremediation to address soil pollution.

Further work is needed in terms of soil biodiversity and human health.

What are the potentialities?

- **Food security and food safety:** improvement of agricultural production (biofertilizers, nitrogen fixation, pathogen control).
- **Biological control:** pests, diseases.
- **Environmental remediation (bioremediation):** bioaugmentation, phytoremediation, vermiremediation.
- **Climate change mitigation/adaptation:** carbon sequestration, GHG.
- **Nature-based solutions:** stimulate the growth and activities of soil fauna for ecosystem restoration.
- **Nutrition and human health:** vaccines, medicines, traditional medicine, microbiome.



The way forward

5 DECEMBER 2020

1. **Advocate for mainstreaming Soil Biodiversity** into the sustainable development agenda, the **Post-2020 biodiversity framework**, the **UN decade on ecosystem restoration**, and all areas where SB can contribute;
2. **Develop standard protocols and procedures for assessing SB** at different scales;
3. Promote the **establishment of soil information and monitoring systems that include SB as a key indicator of soil health**;
4. **Improve knowledge** (including **local or traditional knowledge**) of the **soil microbiome**;
5. Strengthen the **knowledge on the different soil groups forming SB** (i.e., microbes, micro, meso, macro and megafauna);
6. Establish a global capacity building programme for the use and management of soil biodiversity and the **Global Soil Biodiversity Observatory**.
7. Execute the **Implementation Plan** of the International Initiative for sustainable management of Soil Biodiversity initiative.

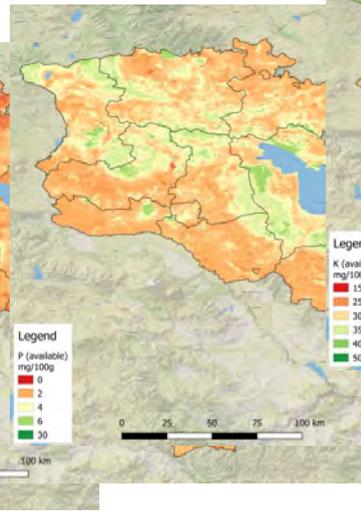
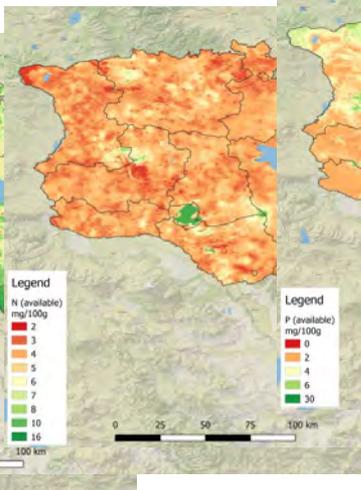
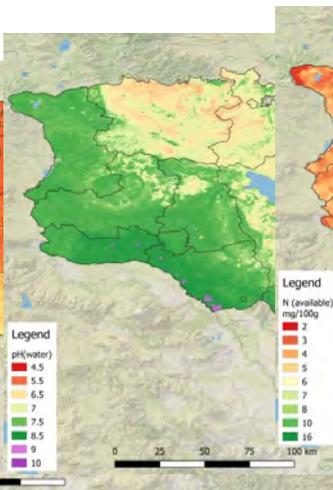
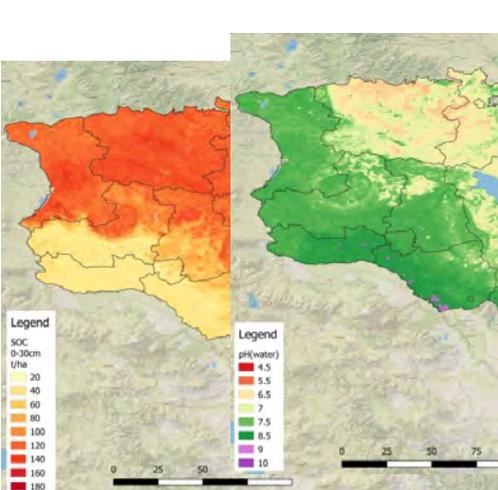
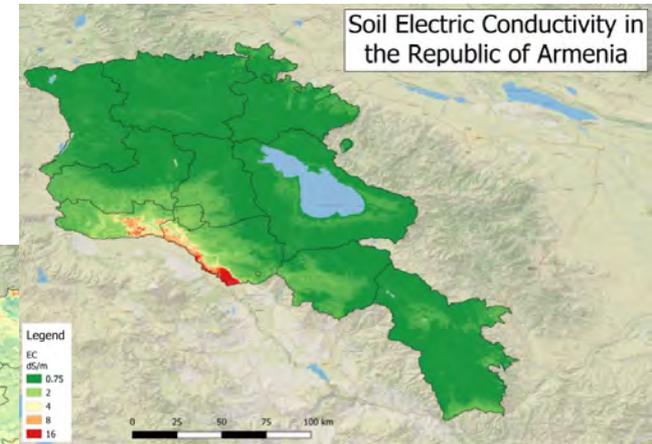
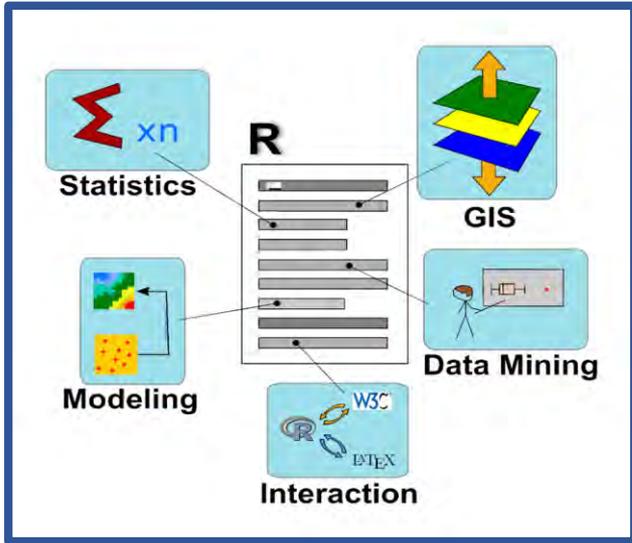
World Soil Day



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Armenian Soil Information System



Thanks to the financial support of
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Thanks for your attention!

