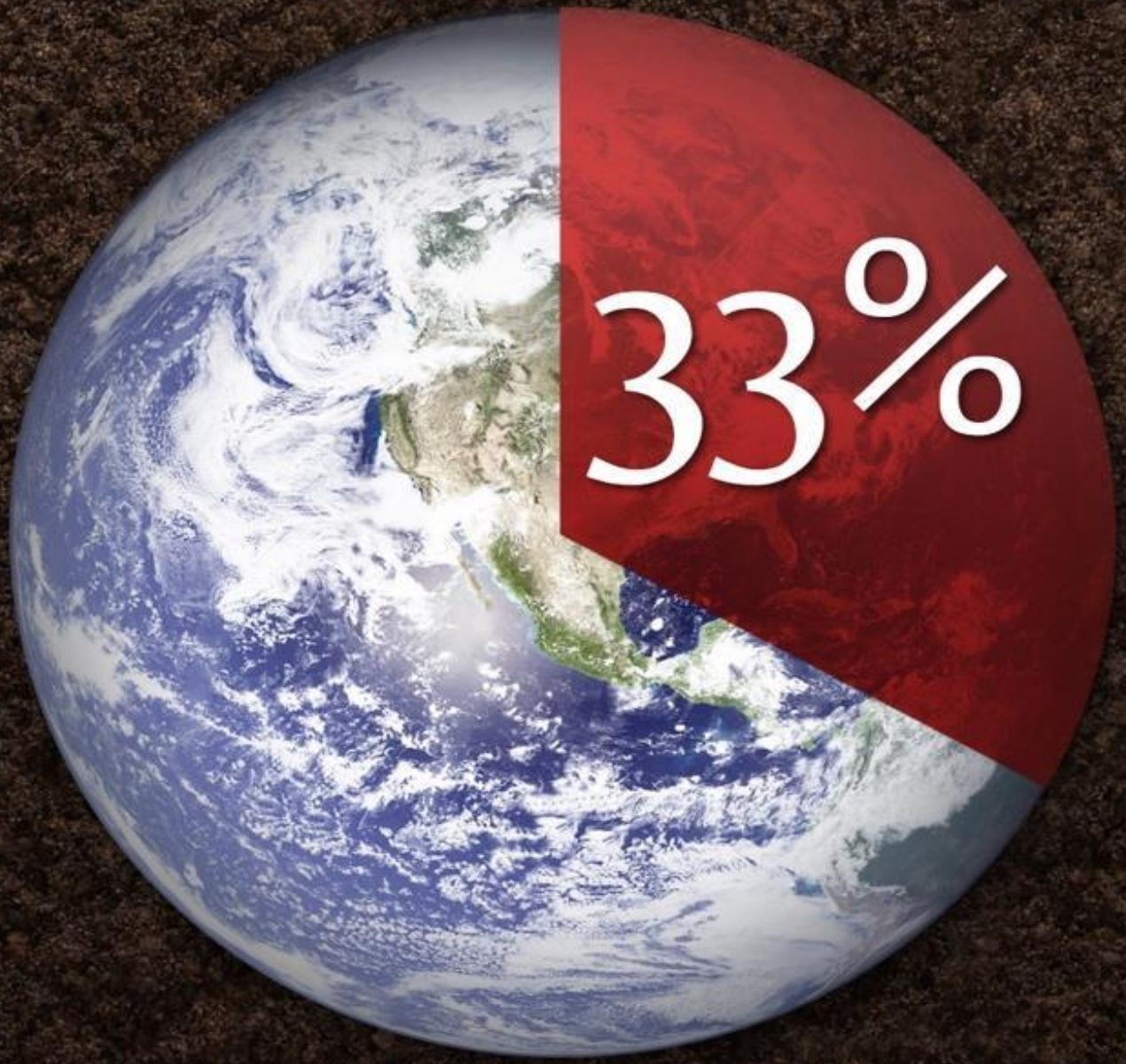
Food and Agriculture Organization of the United Nations

GLOBAL SOIL PARTNERSHIP

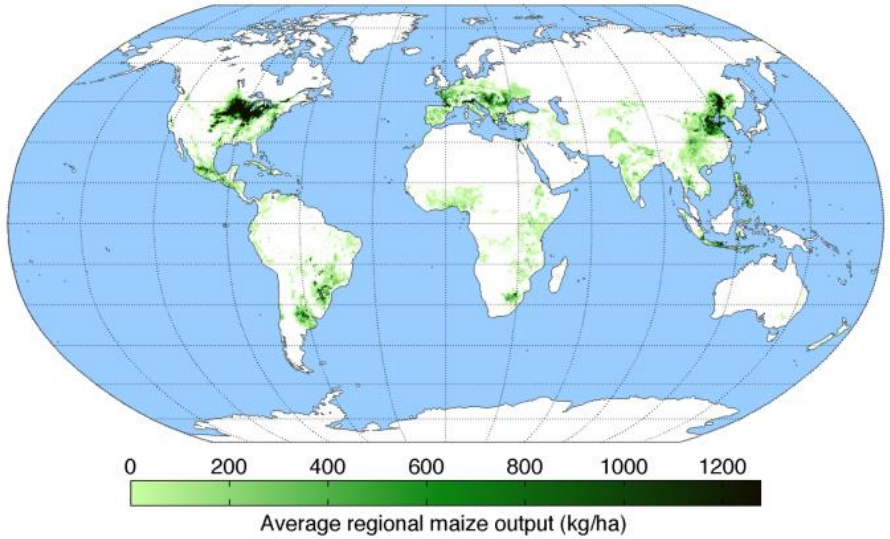
Biodiversity in Soil Health and Carbon Cycling

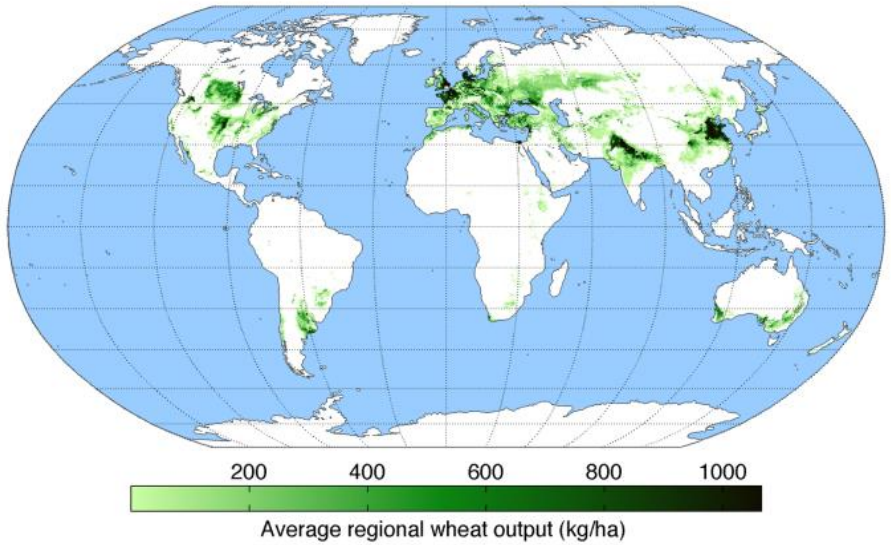
ECOMONDO 2023
J. Jacob Parnell, PhD
Soil Biodiversity Specialist

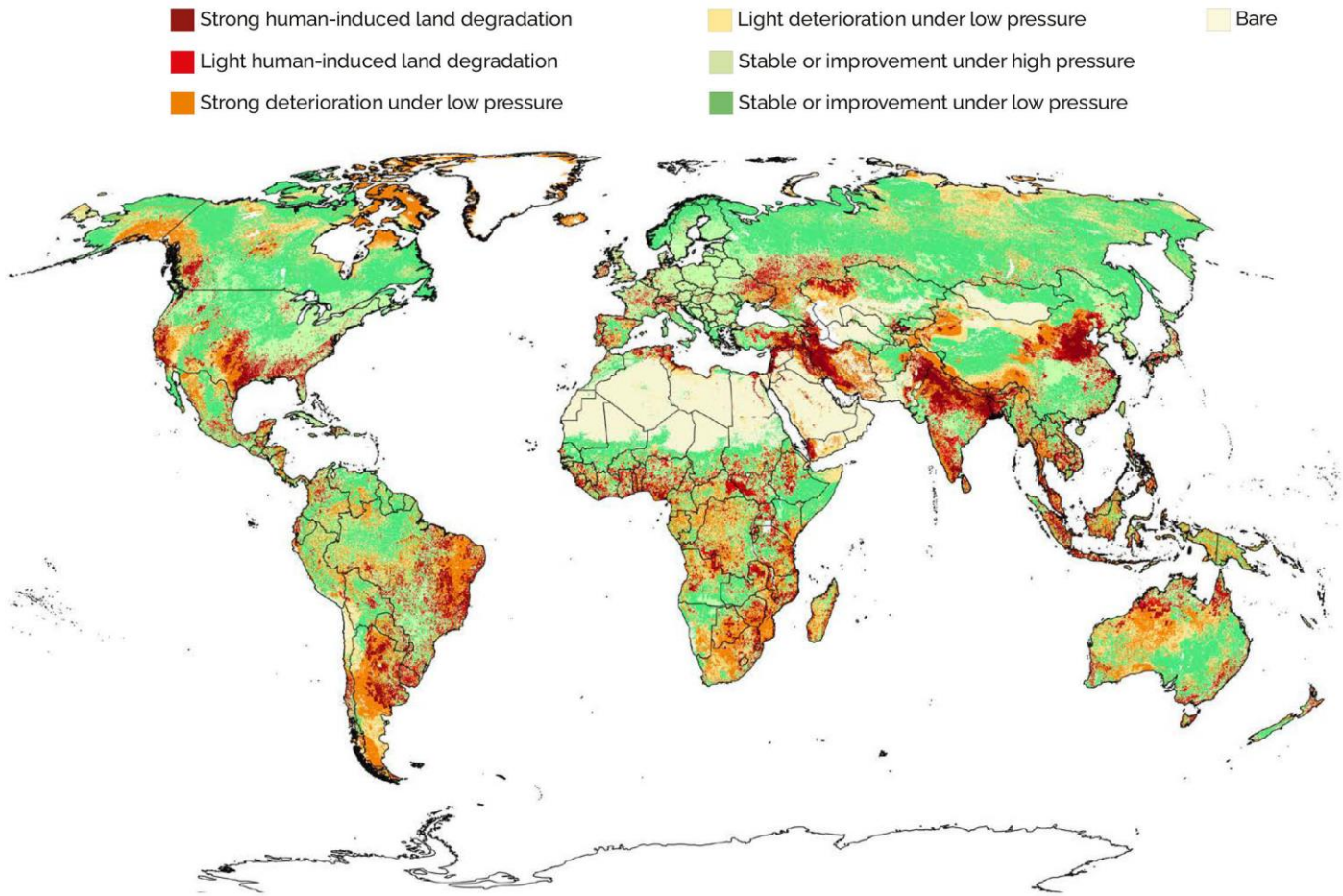
Soils are beautiful and provide multiple ecosystem and productive services



Over 90 percent of soils could become degraded by 2050 if business as usual continues



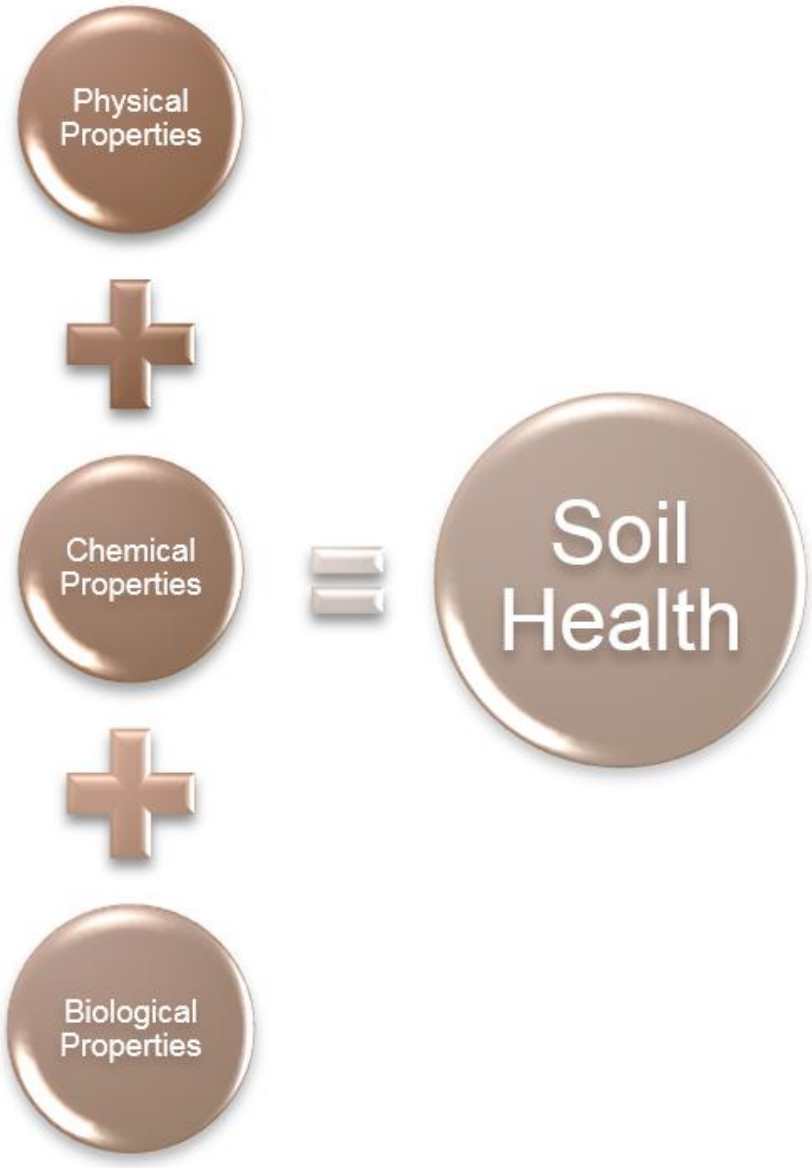




https://www.fao.org/3/cb7654en/online/src/html/chapter-1-2.html

Soils that are responsible for the four major staple crops of the world (sugarcane, maize, rice, and wheat; left) are some of the most degraded (above)

https://decolonialatlas.wordpress.com/2016/10/09/agricultural-maps-of-the-world/



Physical Properties

- bulk density
- wet and dry aggregate stability
- soil texture
- penetration resistance (compaction)

Chemical Properties

- pH
- nutrient availability
- organic matter content

Biological Properties

?

https://www.striptillfarmer.com/articles/2190-case-study-cover-crop-effects-on-soil-properties

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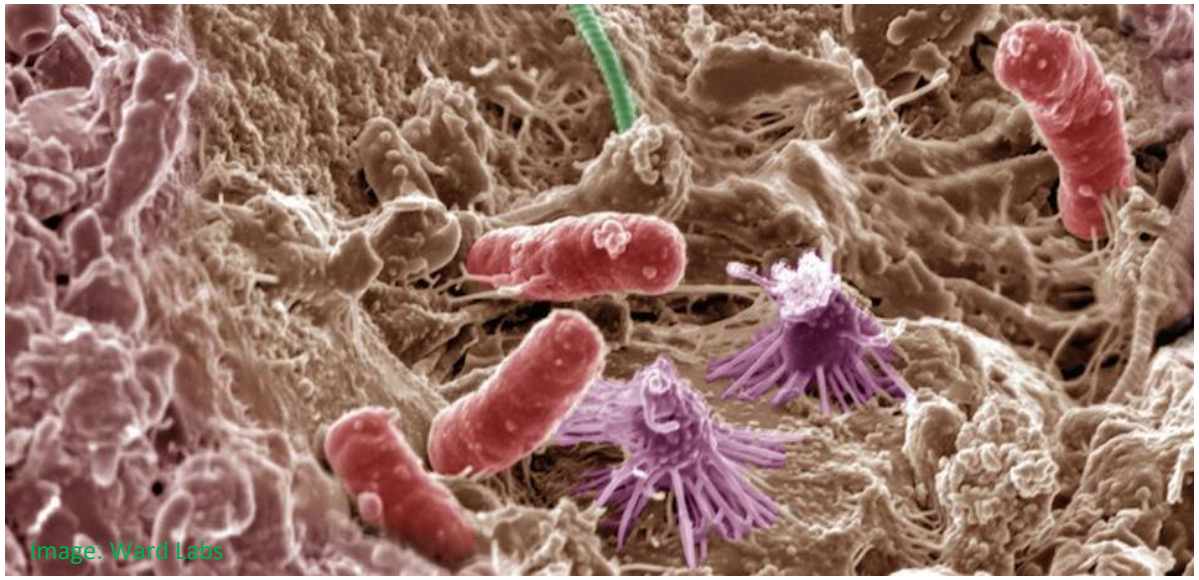
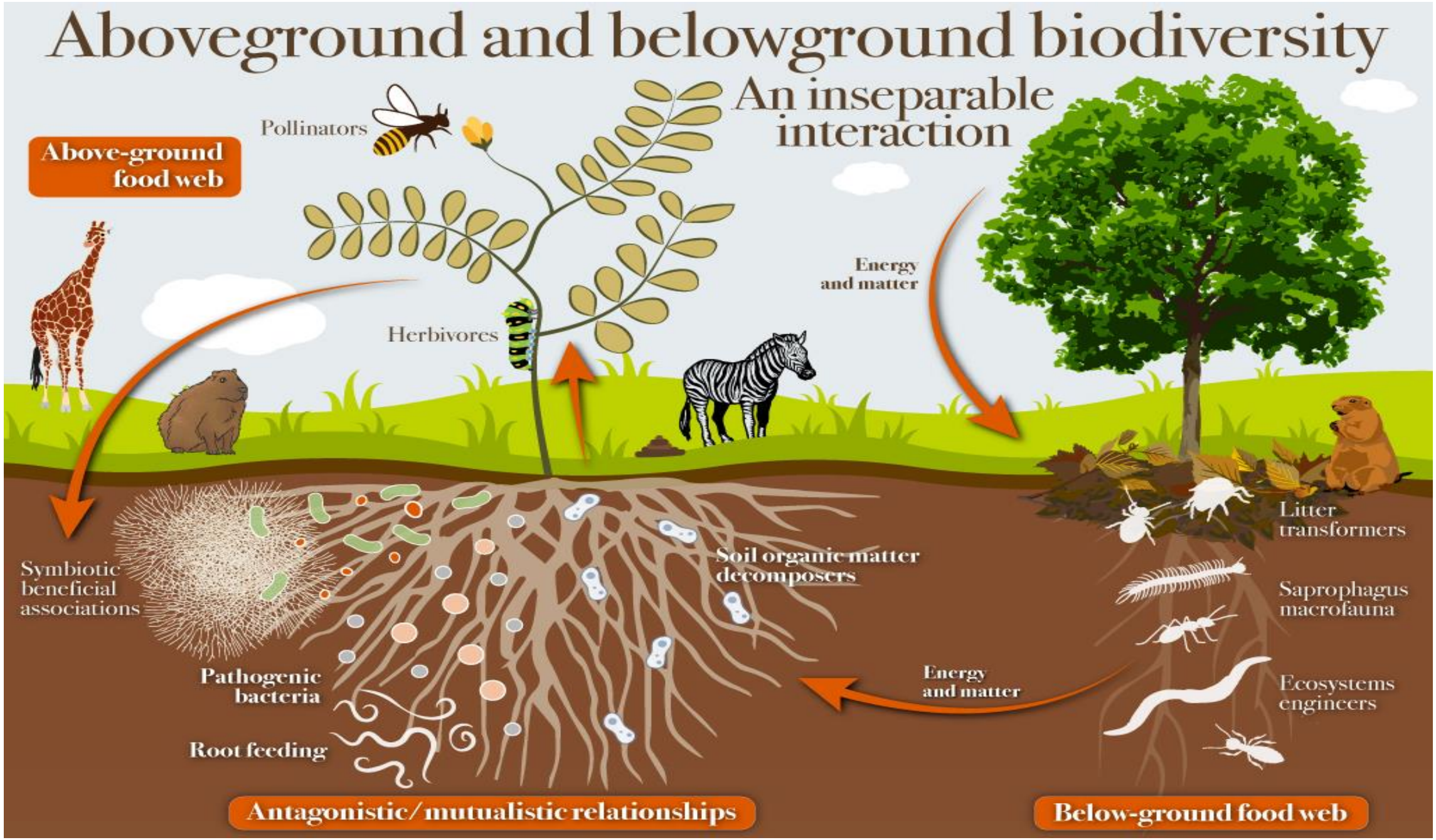
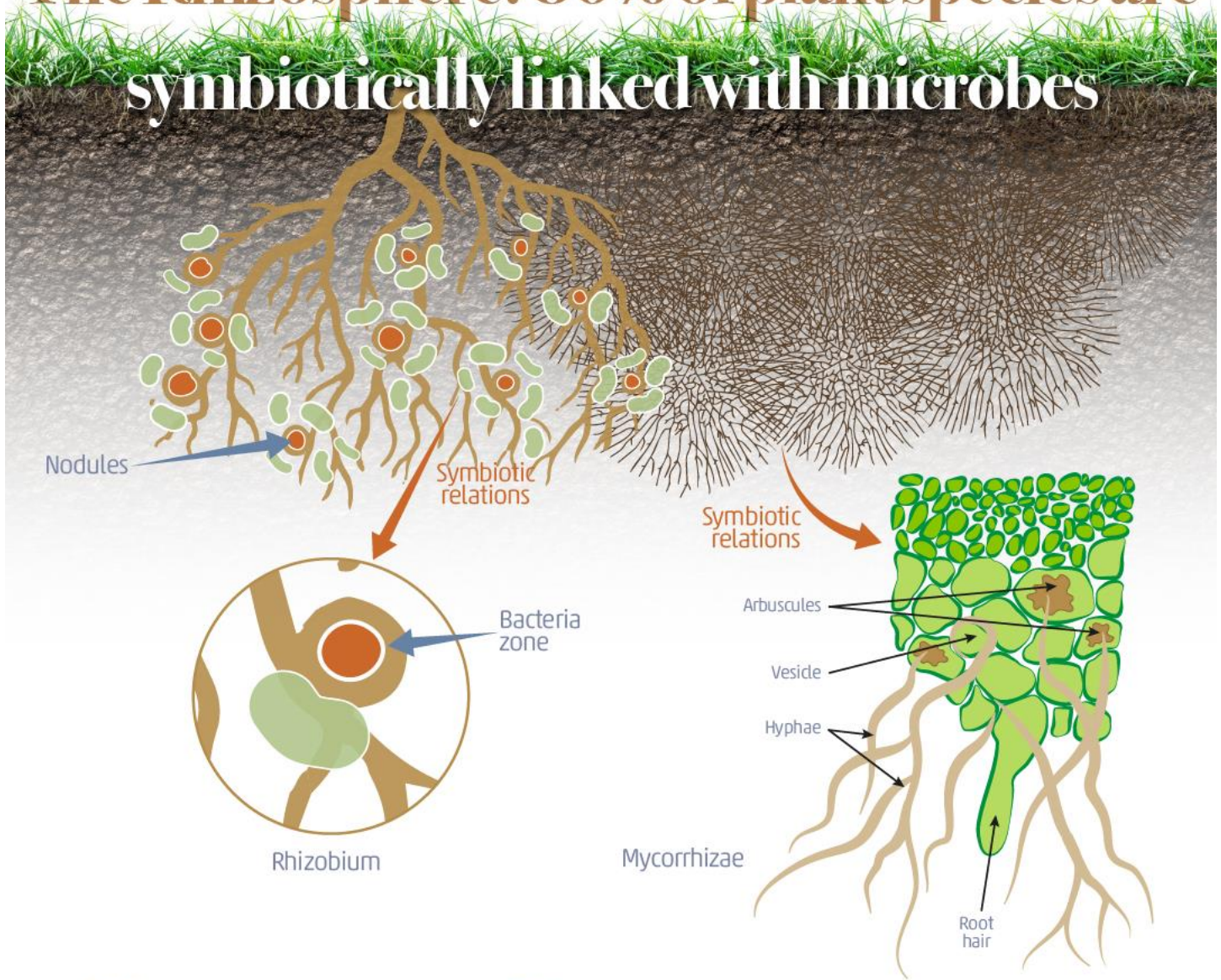
SOIL IS ALIVE!



Anthony, M. A., Bender, S. F., & van der Heijden, M. G. (2023). Enumerating soil biodiversity. Proceedings of the National Academy of Sciences, 120(33), e2304663120.


Aboveground and belowground biodiversity
An inseparable interaction
Pollinators
Above-ground food web
Herbivores
Energy and matter
Symbiotic beneficial associations
Soil organic matter decomposers
Litter transformers
Saprophagus macrofauna
Pathogenic bacteria
Root feeding
Energy and matter
Ecosystems engineers
Antagonistic/mutualistic relationships
Below-ground food web

The Rhizosphere: 80% of plant species are symbiotically linked with microbes



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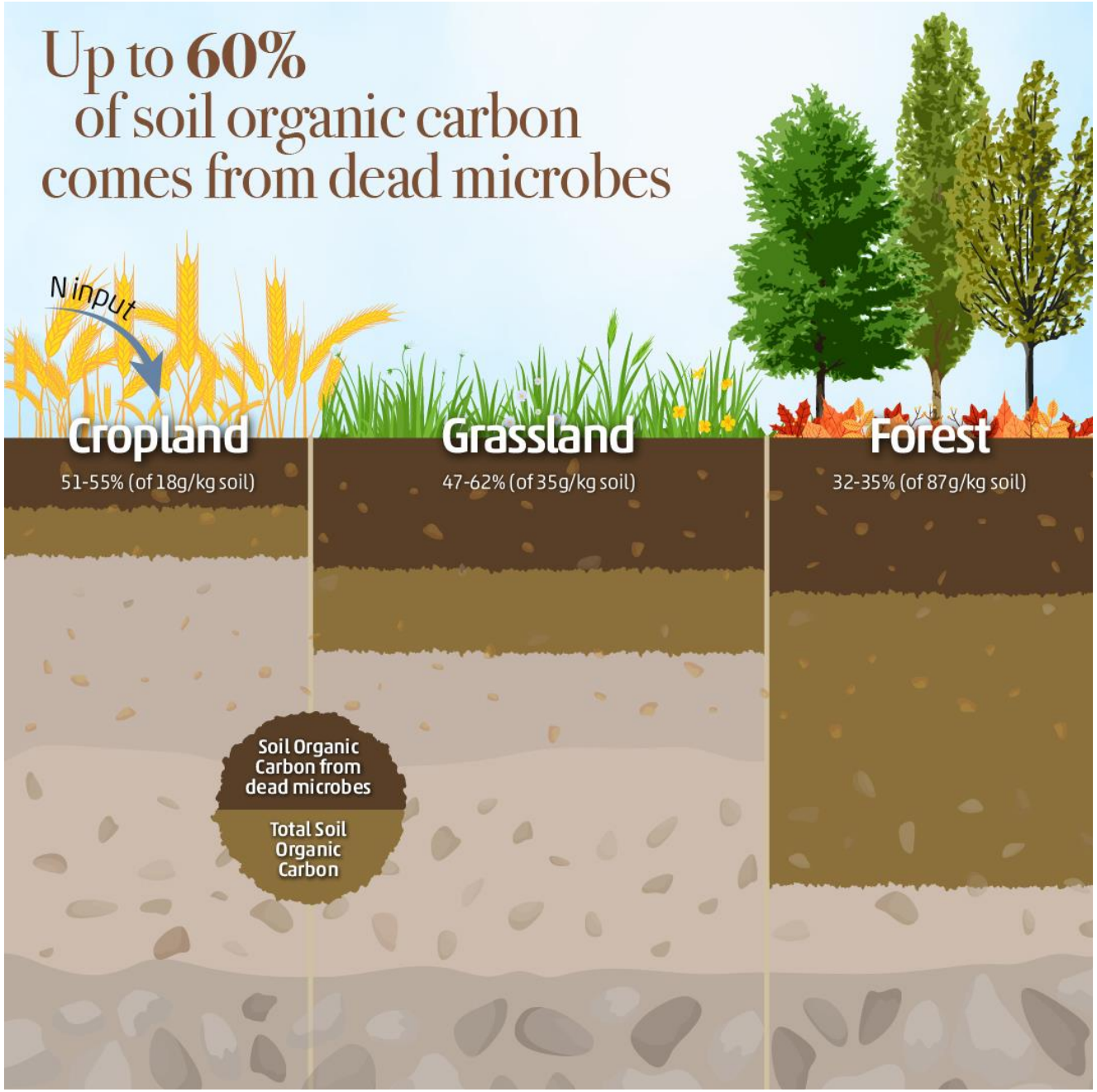
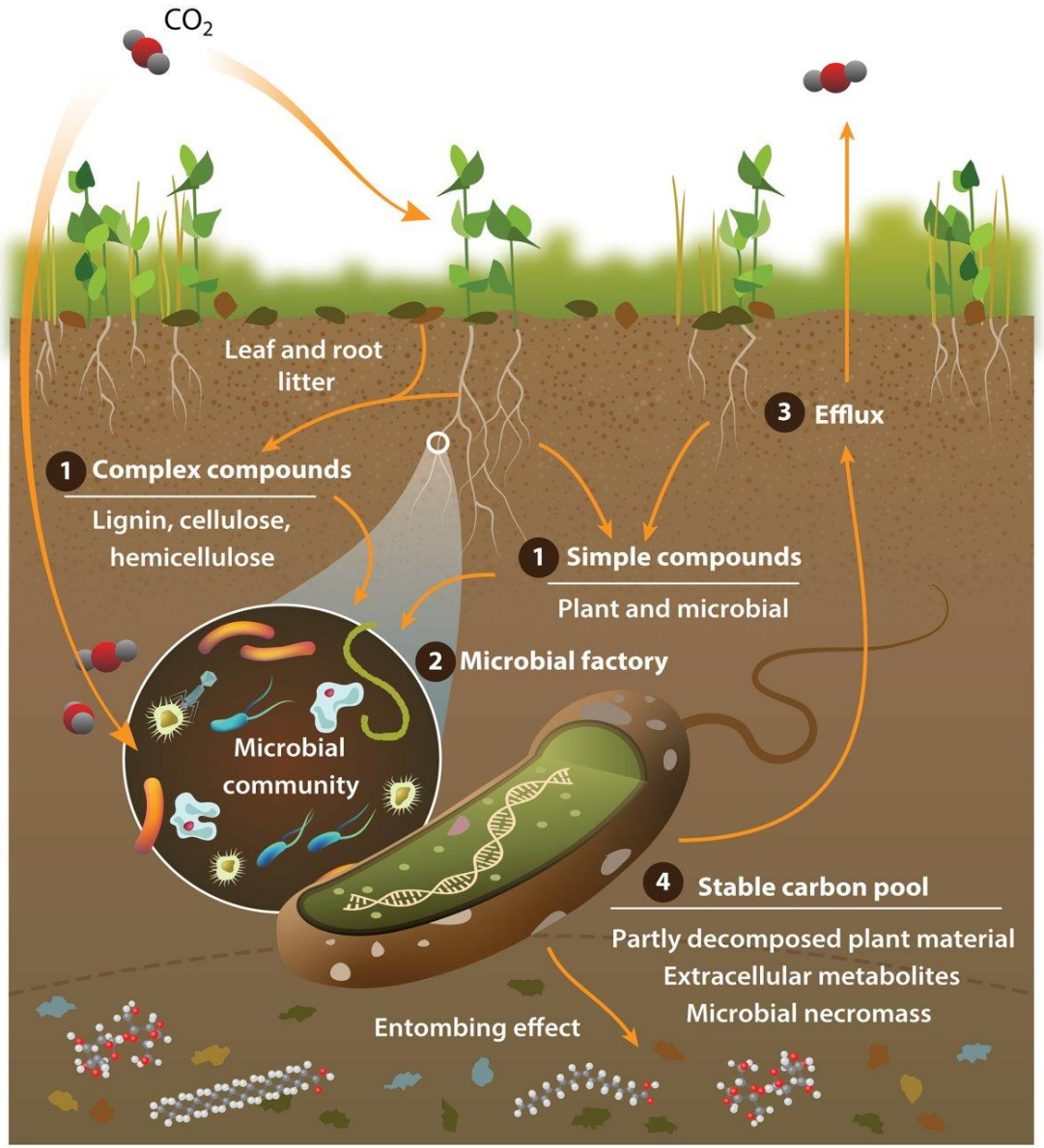
GLOBAL SOIL PARTNERSHIP





Naylor D, et al. 2020.
Annu. Rev. Environ. Resour. 45:29–59

Soil Biodiversity cannot be considered a separate discipline from soil science

Soil biodiversity assessment should be part of Soil Surveys

UN environment programme

CBD

Convention on Biological Diversity

Distr.
LIMITED

CBD/SBSTTA/24/L.7/Rev.1
19 March 2022

ORIGINAL: ENGLISH

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Twenty-fourth meeting
Geneva, Switzerland, 14-29 March 2022
Agenda item 7

REVIEW OF THE INTERNATIONAL INITIATIVE FOR THE CONSERVATION AND SUSTAINABLE USE OF SOIL BIODIVERSITY AND UPDATED PLAN OF ACTION

SCOPE AND PRINCIPLES

19. **FAO is invited to facilitate the implementation of the plan of action**, and it is intended to align activities on soil biodiversity more closely with other FAO-related activities including the **International Network on Soil Biodiversity** and the **Global Soil Biodiversity Observatory**, to monitor and forecast the conditions of soil biodiversity and soil health as well as with regional and country offices in order to create synergies and provide broader support. The full implementation of the plan of action at the national and subnational levels will depend on the availability of resources.

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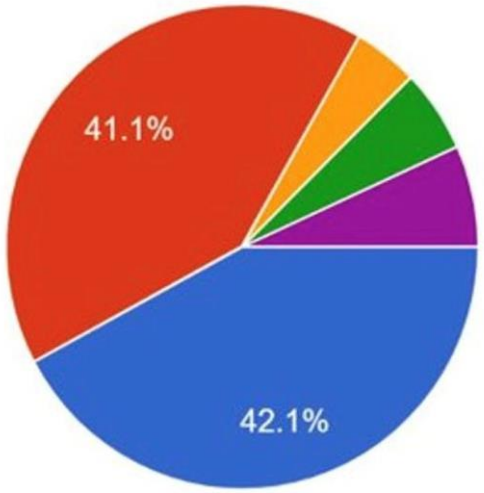
International Network on Soil Biodiversity

- **WG 1:** measurement, assessment and monitoring of soil biodiversity.
- **WG 2:** sustainable use and management, and conservation of soil biodiversity.
- **WG 3:** economics of soil biodiversity.
- **WG 4:** policies and legal instruments related to soil biodiversity.



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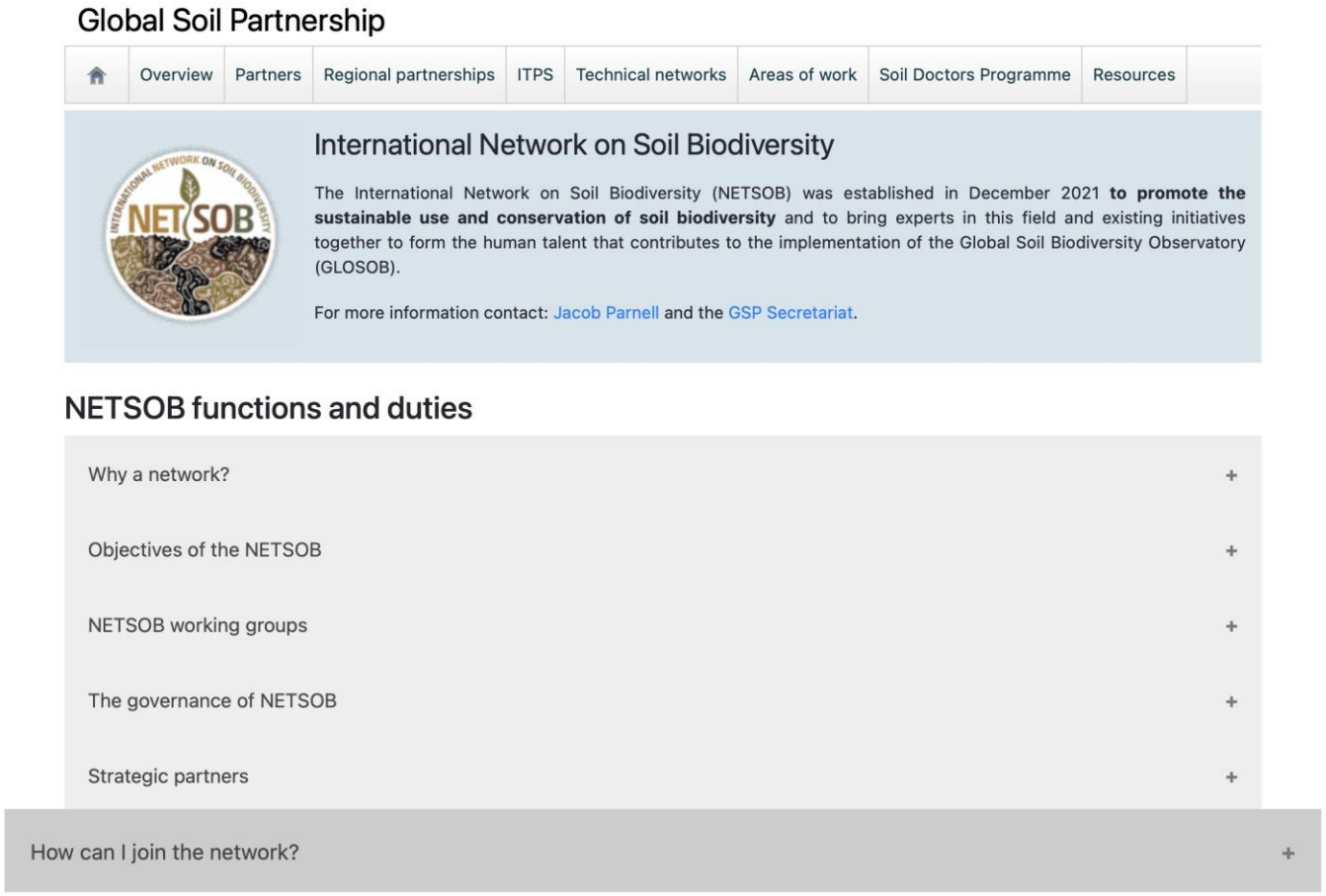
International Network on Soil Biodiversity



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INTERNATIONAL NETWORK ON SOIL BIODIVERSITY
NETSOB

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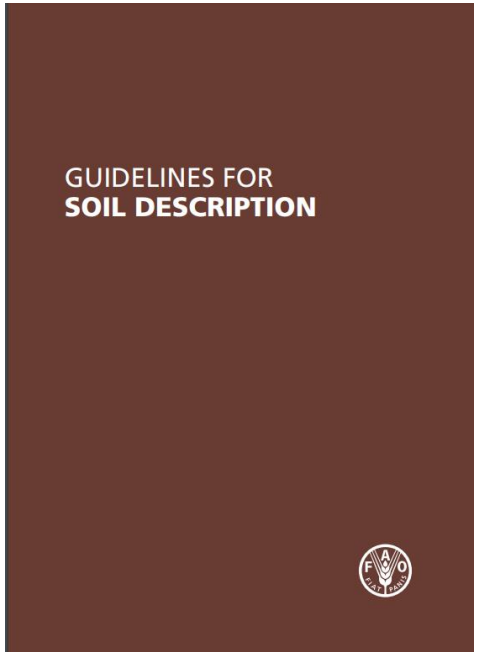
Status of Soil Biodiversity Information



- Soil biodiversity missing from Soil Surveys.
- Few national soil biodiversity surveys, isolated from conventional soil surveys.
- Some global and regional initiatives: SoilBON, EUSO-LUCAS.
- Taxonomic insufficiency & lack of standards.
- Few soil-dwelling species have been evaluated.
- Soil biodiversity cannot be expressed by one single indicator.

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GLOBAL SOIL PARTNERSHIP

- Soil degradation leads to many global problems
- Biology and Biodiversity are key components of soils
- Regular soil testing should include biological measurements
- Soil carbon, health, and biodiversity are all connected
- Sustainable farming improves soil biodiversity

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