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Hidden Heros

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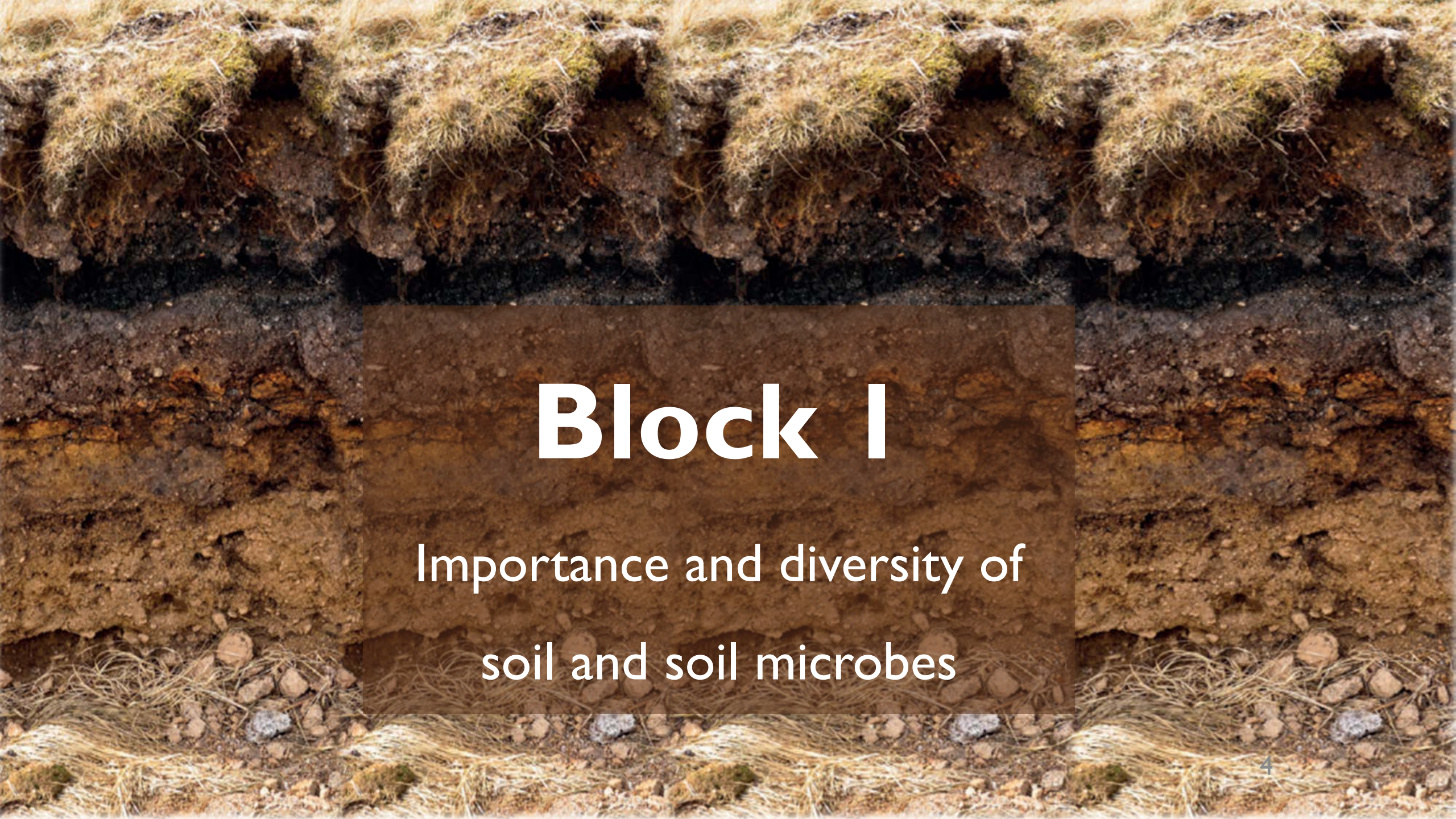
Organics Europe Youth Event: Workshop "Hidden Heroes" 01.09.2022

Program

- Block 1: Importance and diversity of soil and soil microbes
  - Group work Think-pair-share: what are microbes doing in the soil?
  - Soil functions, structure, soil biodiversity
- Block 2: Taking a closer look
  - Spotlight on plant symbionts
  - How to study soil microbes – case study the BIOFAIR project
- Break

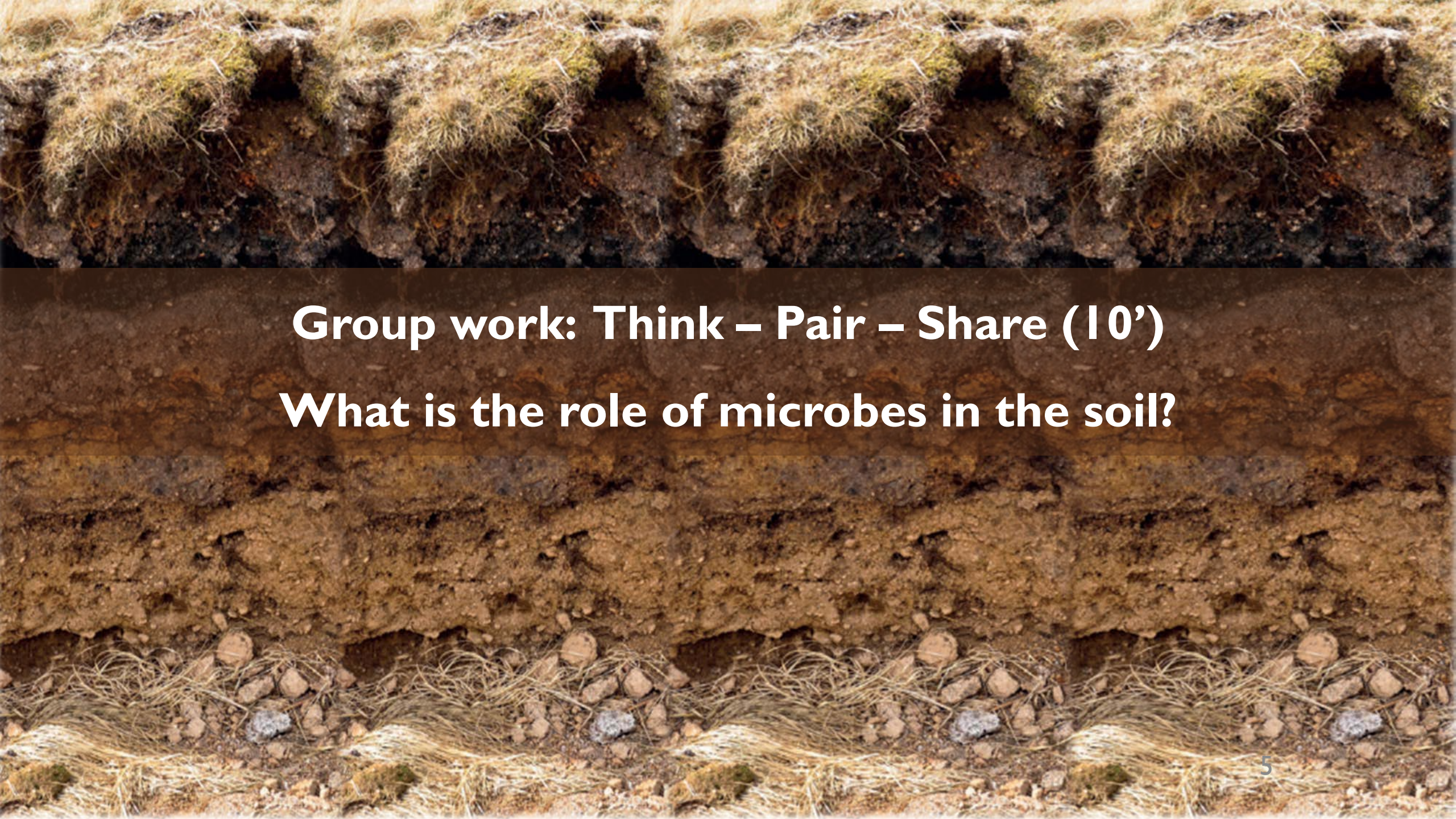
Program

- Block 3: Managing soil microbes
  - Discussion round: how are soil microbes affected by agricultural management?
  - How to promote soil microbes
  - Reduced tillage with Frick trial as case study
- Block 4: Using soil microbes
  - 15' Biofertilizers: How to produce, benefits and drawbacks
  - 15' the compost microbiome
- Block 5: Final discussion



Block 1

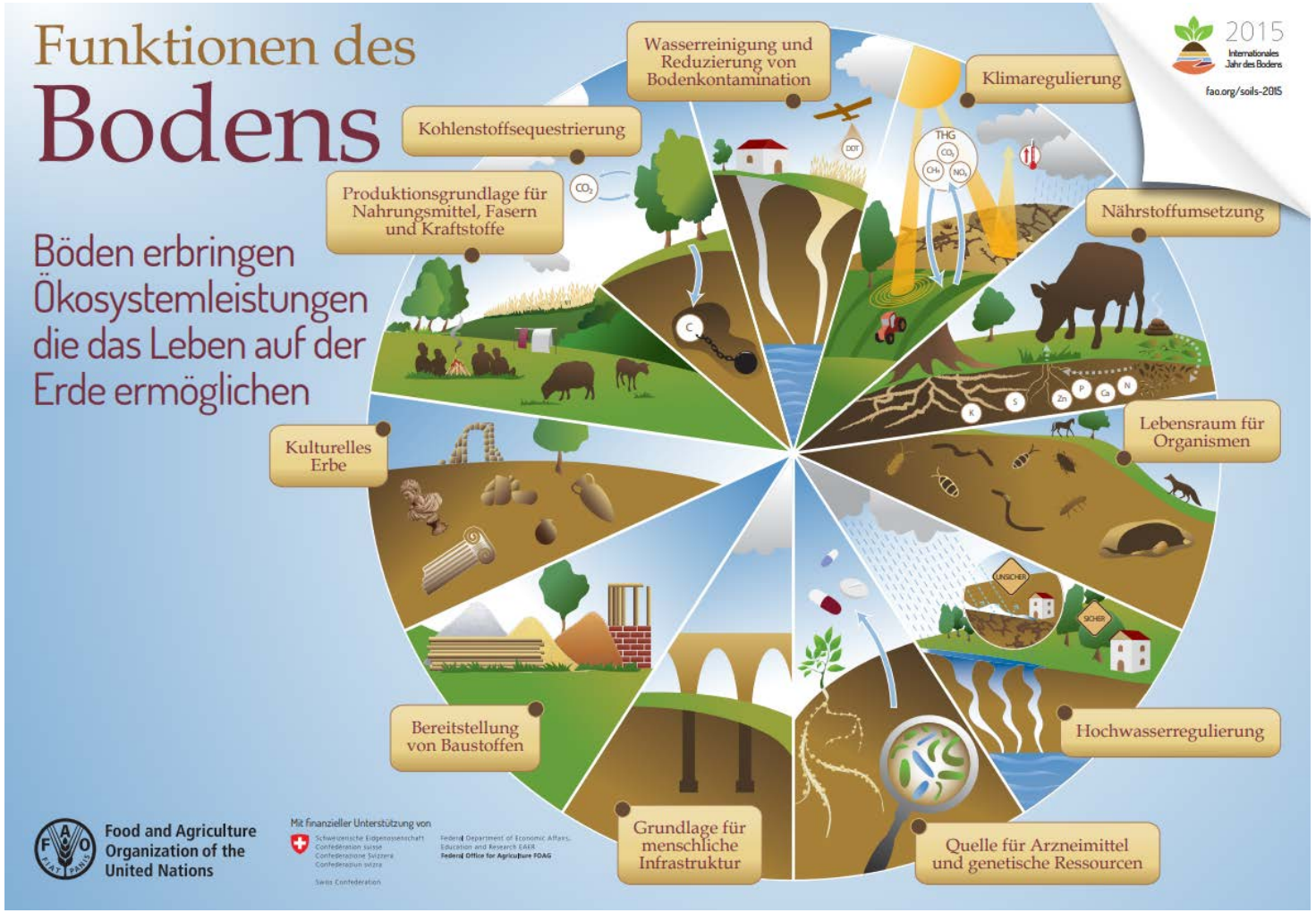
Importance and diversity of soil and soil microbes



Group work: Think – Pair – Share (10')

What is the role of microbes in the soil?

Importance of the soil



- Soils fulfil multiple functions and people are influenced by and depend on soils in many ways.
- The concept of ecosystem services shows how soil functions are linked to human well-being.

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http://www.fao.org/fileadmin/user_upload/GSP/WSD2017/temporary_material_PWS/NRL_Your_silent_ally_DE_Web.pdf

Ecosystem services

- Ecosystem services are "Gifts from nature"
- Soil scientists divide these into 4 areas (MEA, 2005; Baer and Birgé, 2018)

- Provision of food, water, building materials (wood), fibres
- Raw materials for medicines

- Degradation of pollutants
- Climate regulation
- Drainage of surface water
- Pest control
- Water quality

https://soilsmatter.wordpress.com/2016/12/15/the-soil-provides-services-to-me/
Art: P Scullion

- Soil formation
- Nutrient cycle
- Preservation of genetic diversity
- Promotion of plant growth

- Recreation
- Nature tourism
- aesthetic enjoyment
- spiritual fulfilment

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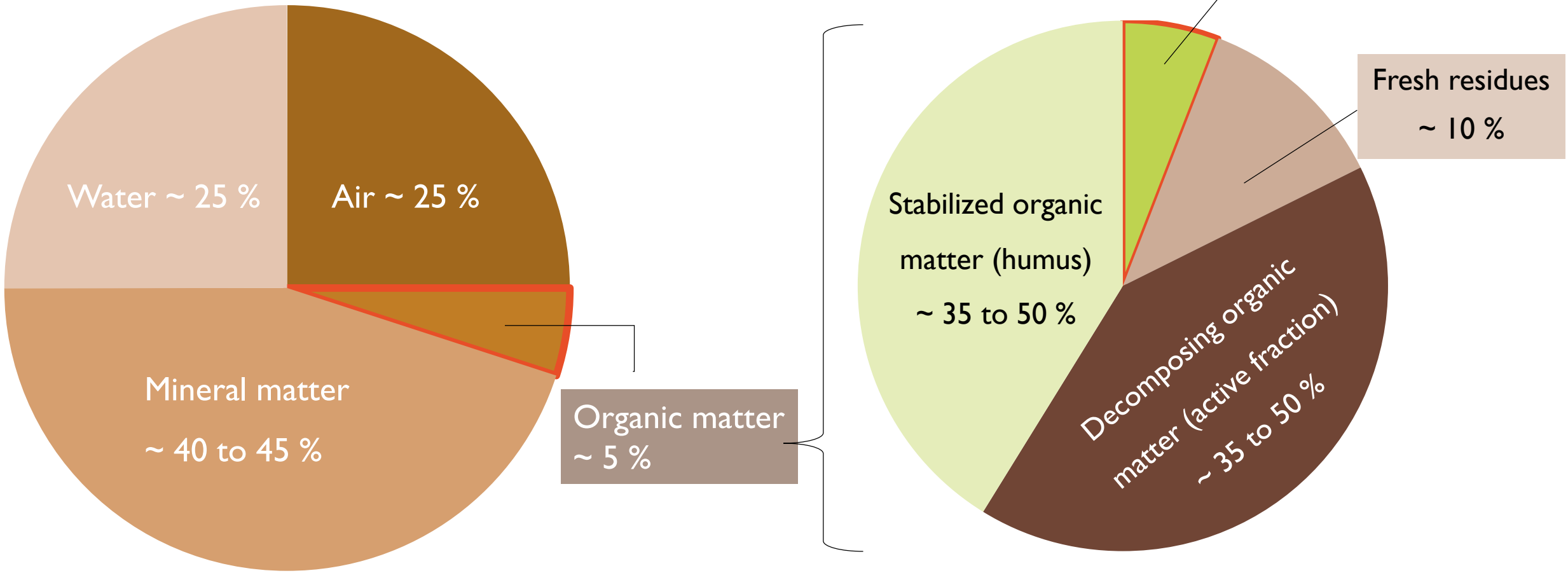
General composition of soils



→ **5% of the soil organic fraction (=0.25% of total soil) consists of living organisms**

→ **healthy soils are alive and harbour around 25% of the biodiversity on our planet**

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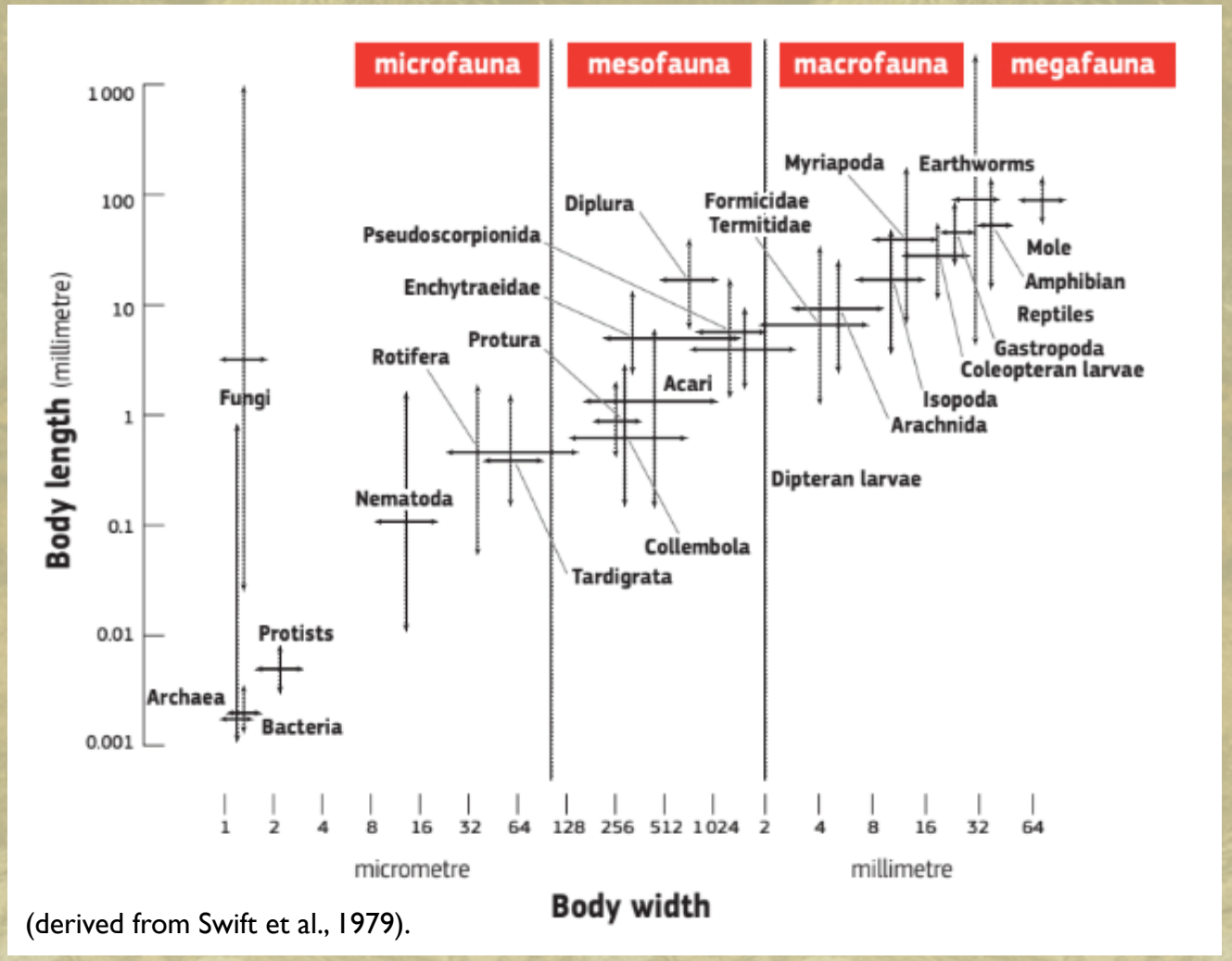
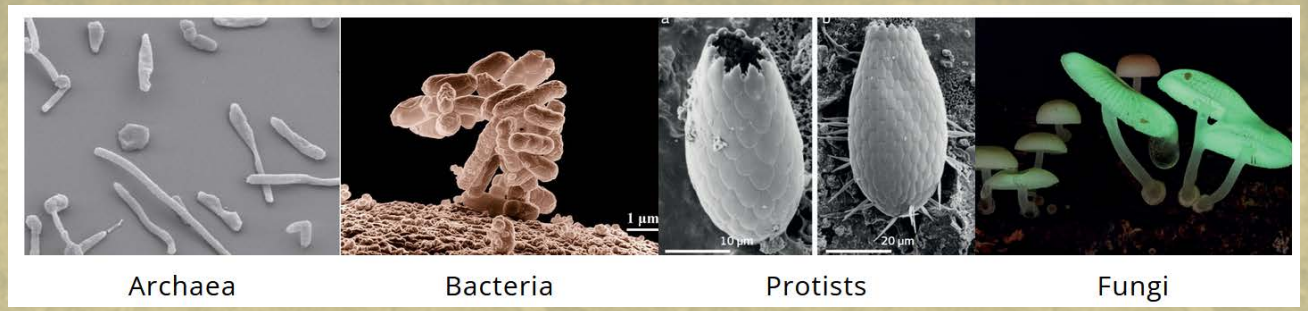
Soil biodiversity



(derived from Swift et al., 1979).

Soil biodiversity

- **Mikroorganisms** [1, 2] (only 1% of species are described!)
  - Bacteria
  - Archae
  - Fungi/Mycorrhizal fungi
  - Aktinomycetes
  - Algae
  - Protozoa



https://www.globalsoilbiodiversity.org/atlas-chapter-2

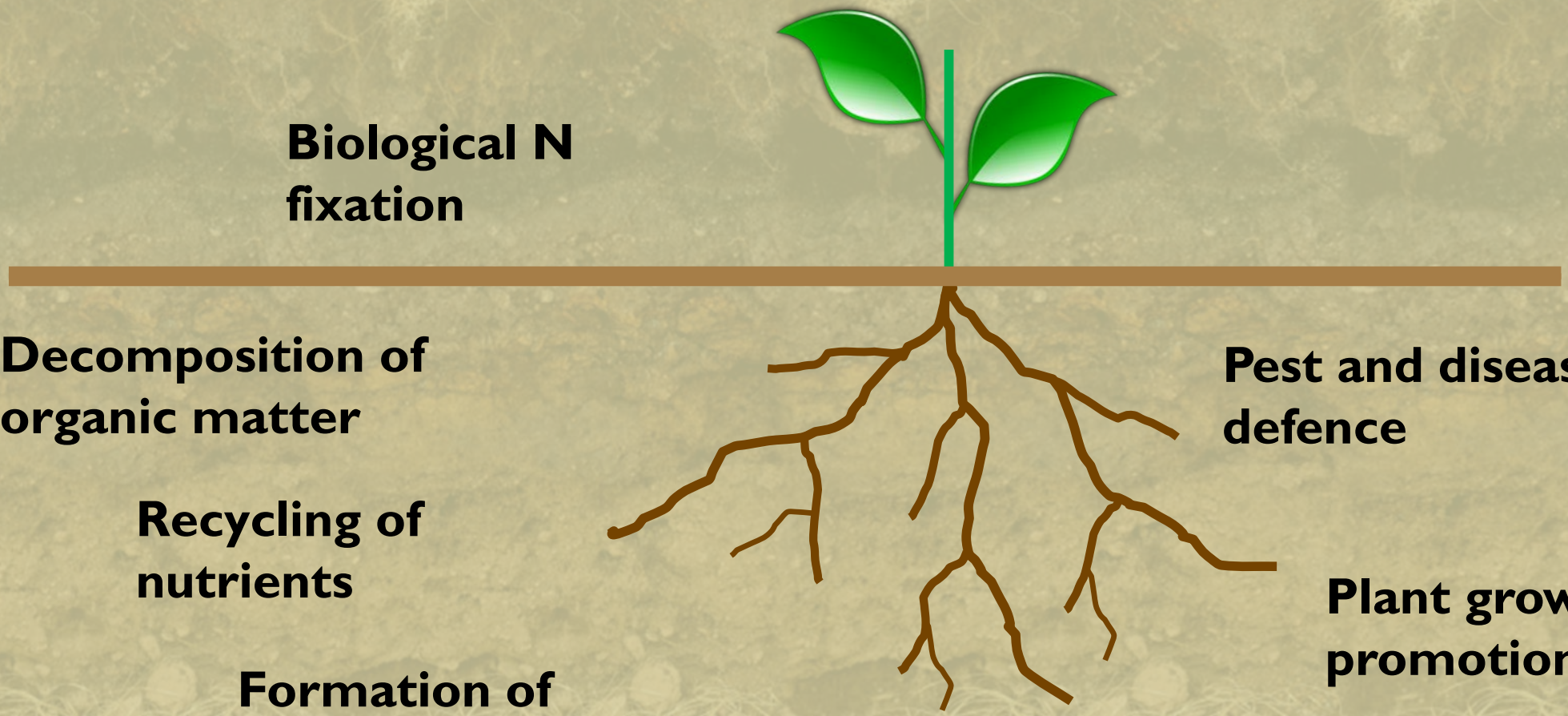
[1] Swift et al. (1979). Blackwell Scientific, Oxford; [2] MEA. (2005). Millennium Ecosystem Assessment., Island Press.

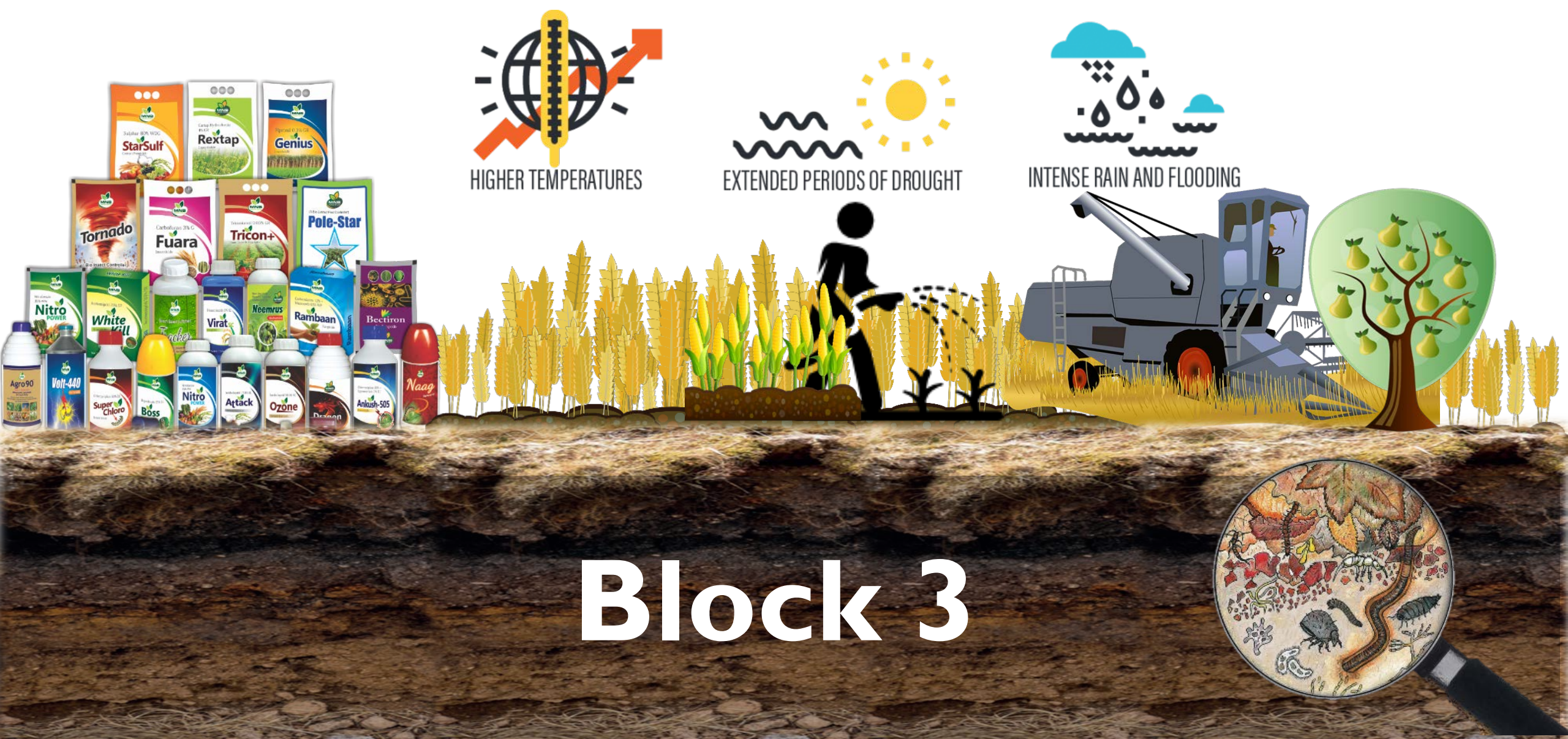
Group	Number/g soil	Biomass (g/m^2)
Bakteria	10^8–10^9	40–500
Aktinomycetes	10^7–10^8	40–500
Fungi	10^5–10^6	100–1500
Alga	10^4–10^5	1–50
Protoza	10^3–10^4	varying

Hoorman and Islam (2010) Understanding Soil Microbes and Nutrient Recycling

→ **You can find more microorganisms in a teaspoon of soil than people on this earth**

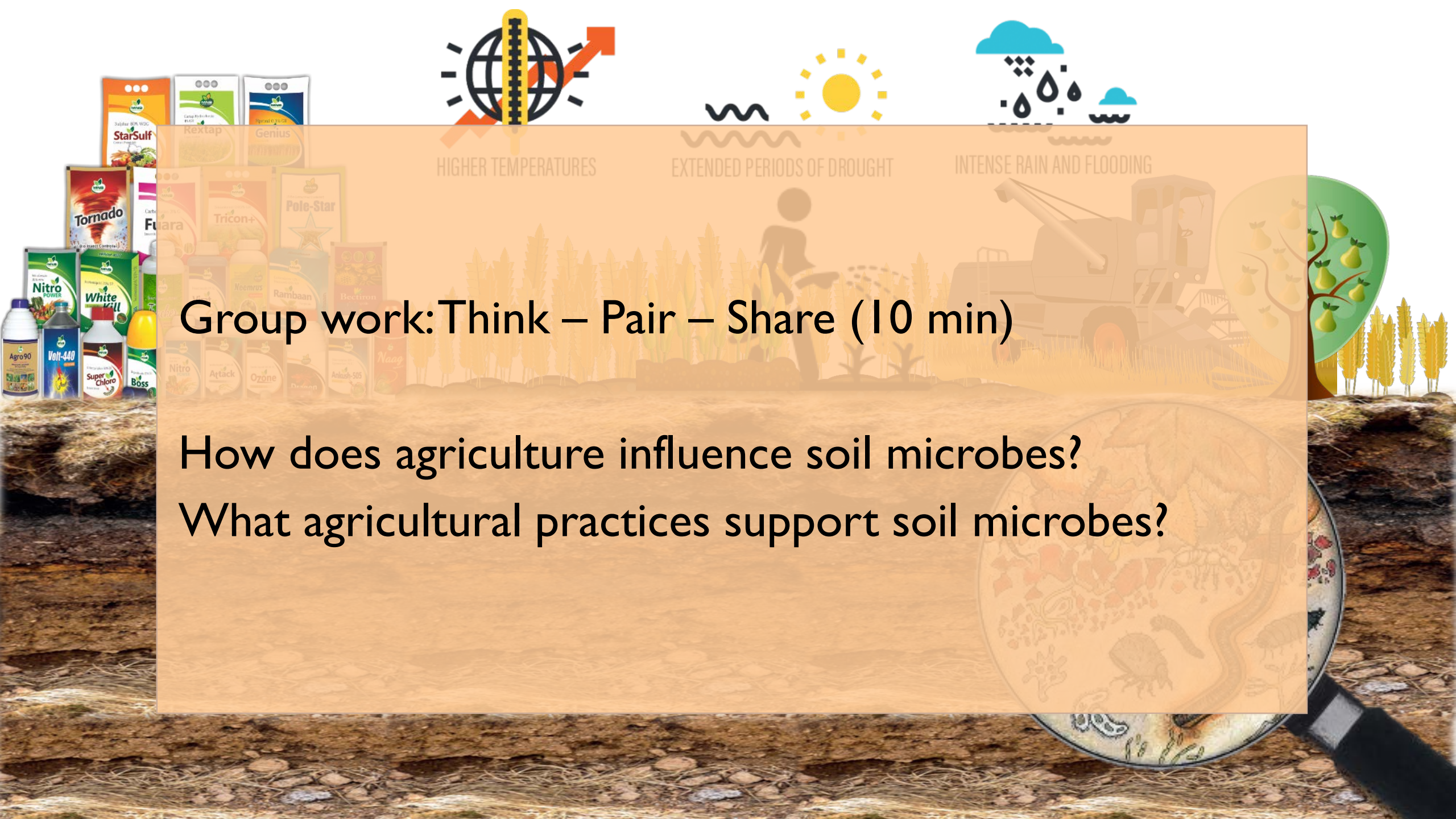
Soil microbes in action





Block 3

Einfluss der Landwirtschaft auf Bodenmikroben

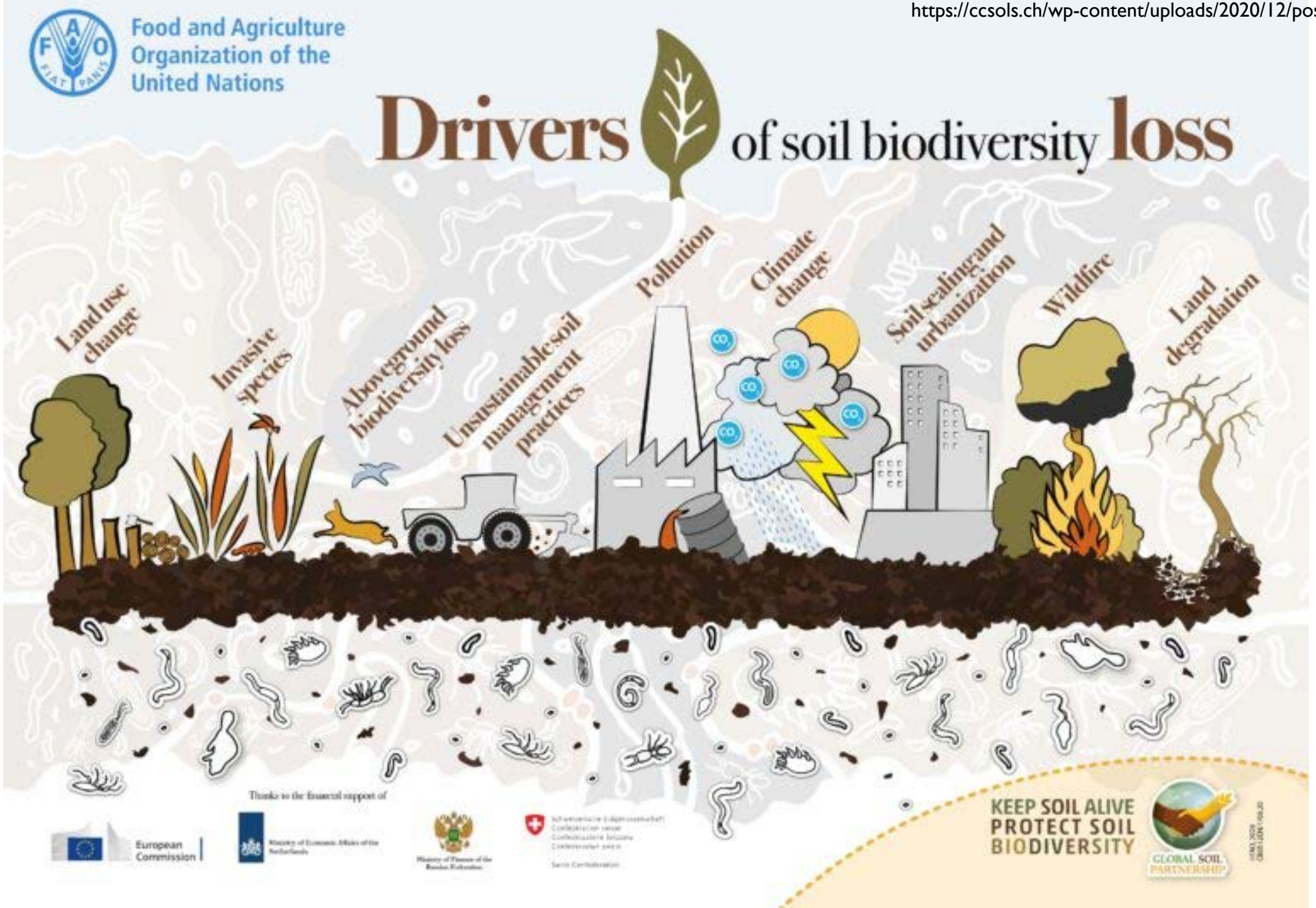


Group work: Think – Pair – Share (10 min)

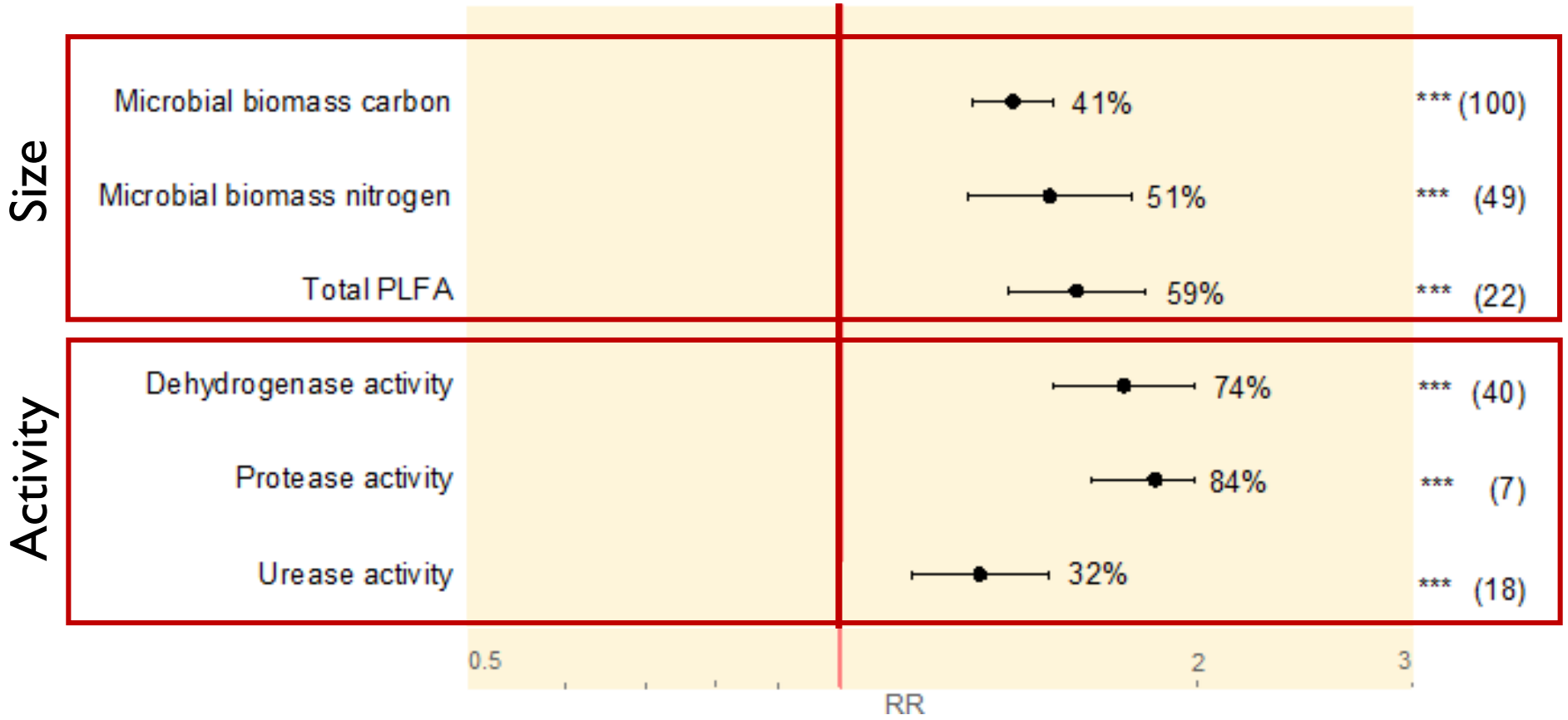
How does agriculture influence soil microbes?

What agricultural practices support soil microbes?

https://ccsols.ch/wp-content/uploads/2020/12/poster3_en-1-768x543.jpg



Impact of different farming systems on soil microorganisms: Meta-Analyse von Lori et al. 2017



Conventional farming vs organic farming

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Lori et al. (2017) Organic farming enhances soil microbial abundance and activity—A meta-analysis and meta-regression. PloS one 12 (7), e0180442

Impact of different farming systems

Positive effects on soil microbes through:

- Diverse crop rotations (with legumes)
- Organic fertilisers
- High organic carbon content

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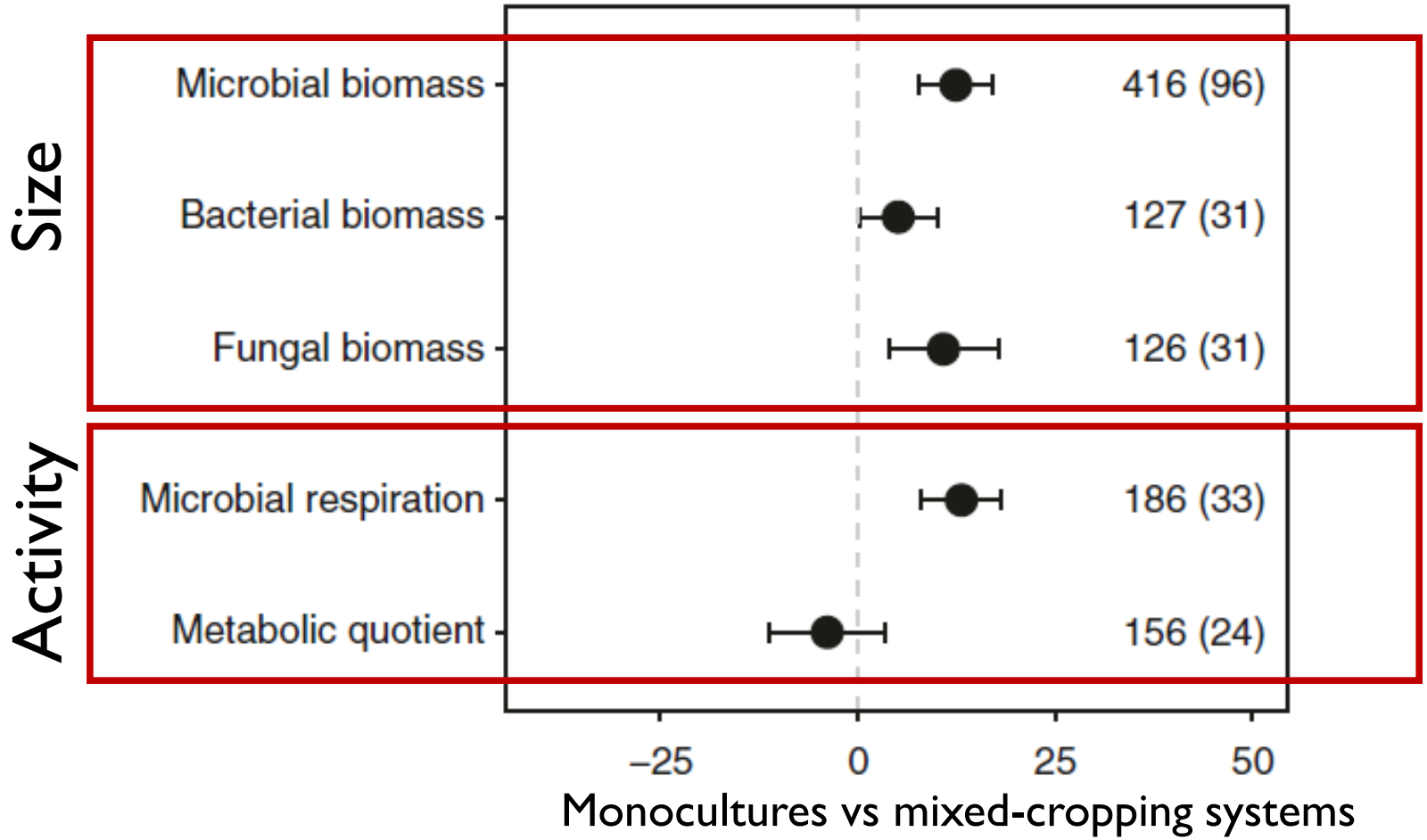
Lori et al. (2017) Organic farming enhances soil microbial abundance and activity—A meta-analysis and meta-regression. PloS one 12 (7), e0180442

Influence of above-ground diversity on soil microorganisms: meta-analysis by Chen et al. 2019



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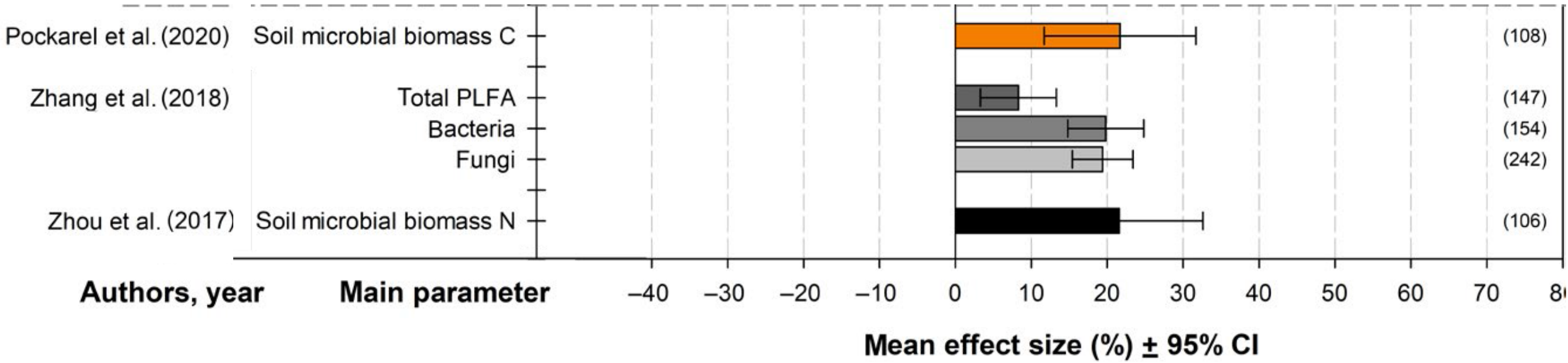
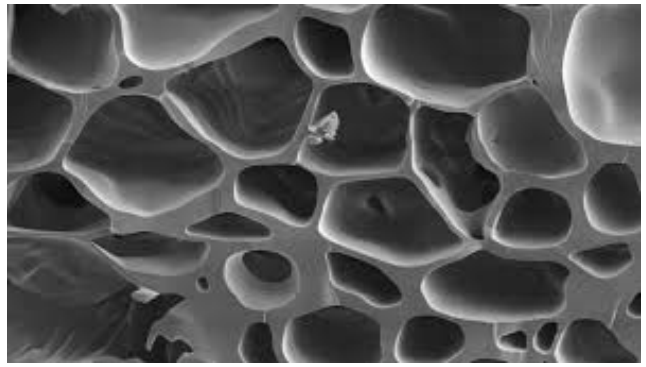
Chen, C., Chen, H.Y.H., Chen, X. et al. Meta-analysis shows positive effects of plant diversity on microbial biomass and respiration. Nat Commun 10, 1332 (2019). https://doi.org/10.1038/s41467-019-09258-y

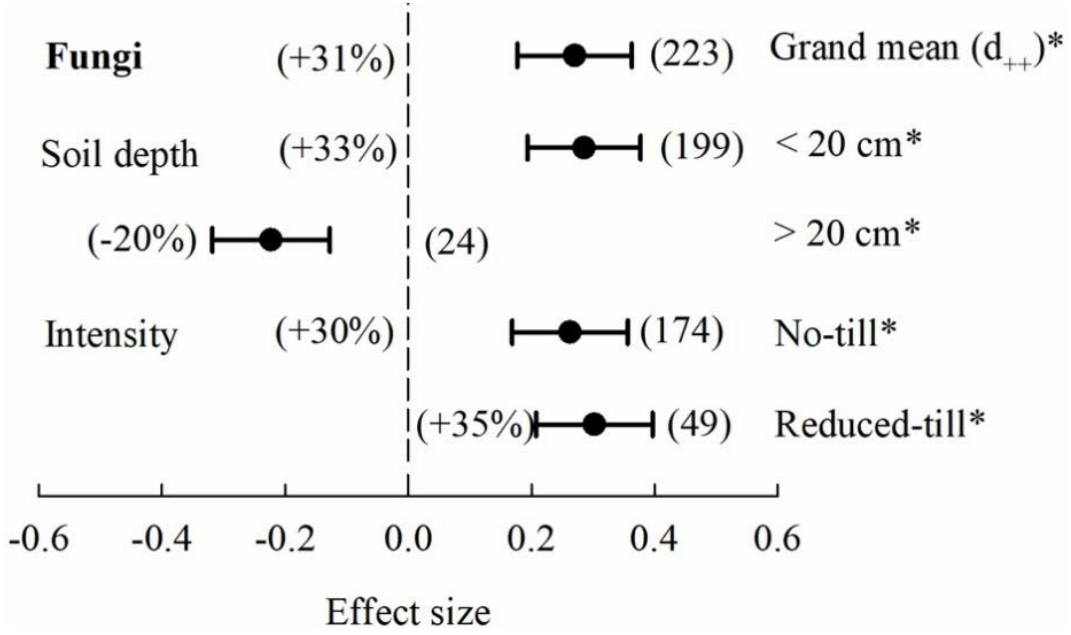
Review of meta-analysis on the influence of plant charcoal on soil microorganisms

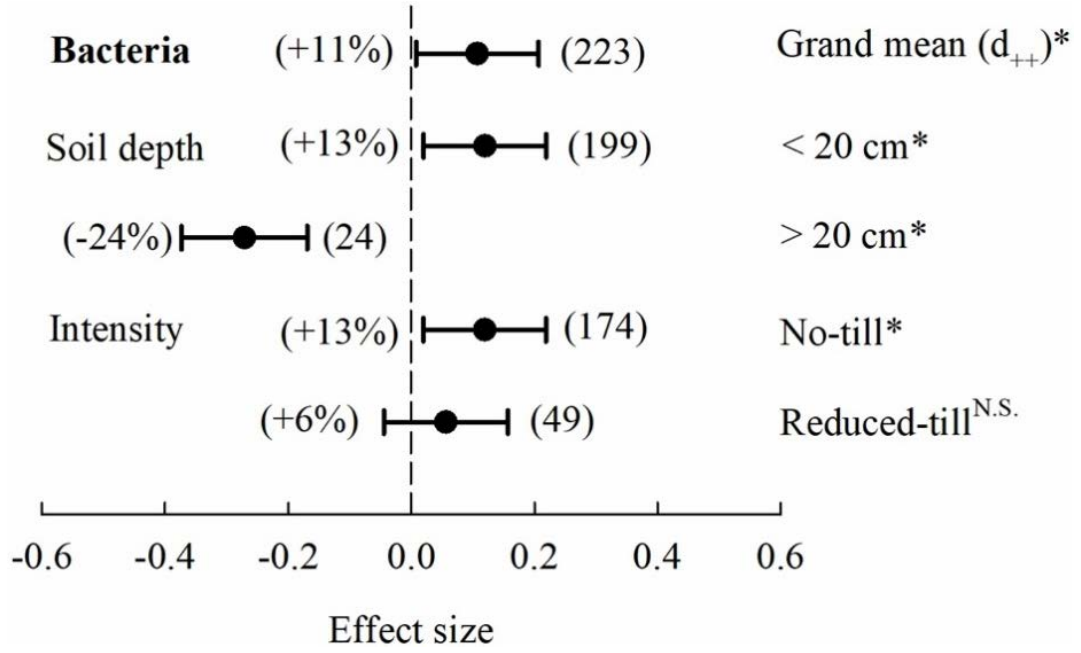




Modified from Schmidt et al. (2021). Biochar in agriculture – A systematic review of 26 global meta-analyses. *GCB Bioenergy*, 00, 1– 23.

Influence of tillage on soil microorganisms: meta-analysis by Chen et al. 2019





Chen *et al.* Global meta-analyses show that conservation tillage practices promote soil fungal and bacterial biomass. *Agriculture, Ecosystems & Environment* **293** (2020)