

# OPTIMIZING SOIL & PLANT HEALTH IN AGRI-FOOD PRODUCTION

Regenerative Agriculture - its  
benefits and innovations

Module 10



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# MODULES

- 1 ➡ INTRODUCTION TO SOIL HEALTH
- 2 ➡ SOIL TESTING & ANALYSIS
- 3 ➡ BUILDING HEALTHY SOIL WITH COMPOSTING
- 4 ➡ PREVENTING MOLD & FUNGAL DISEASES
- 5 ➡ NUTRIENT MANAGEMENT & FERTILIZATION
- 6 ➡ ORGANIC SOIL AMENDMENTS & ALTERNATIVES
- 7 ➡ CROP ROTATION & PLANT PAIRING
- 8 ➡ WATER MANAGEMENT & IRRIGATION PRACTICES
- 9 ➡ INTEGRATED PEST MANAGEMENT (IPM)
- 10 ➡ SOIL CONSERVATION & SUSTAINABLE PRACTICES





# MODULE 10: **CONSERVATION & SUSTAINABLE PRACTICES FOR SOIL HEALTH**

- Soil Health & Soil Conservation
- Regenerative Agriculture
- The Soil Food Web
- The Role of Fungi



There are only  
**60 harvests left**  
with  
the earth's **natural topsoil.**

## FAO warns 90 per cent of Earth's topsoil at risk by 2050



© FAO | Farmers at work in Guatemala.

27 July 2022 | **Climate and Environment**

A full 90 per cent of the Earth's precious topsoil is likely to be at risk by 2050, according to the UN Food and Agriculture Organization, [FAO](#).

In a bid to protect soil globally *and* help farmers, the [FAO](#) warned on Wednesday that the equivalent of one soccer pitch of earth erodes, every five seconds.



# 1. SOIL HEALTH

Soil health plays a crucial role in regenerative agriculture, significantly impacting **crop yield**, **ecosystem stability**, and the **long-term success of farms**.

Rich, healthy soil is packed with **vital nutrients**, **organic matter**, and a diverse array of **microbial life** that fosters plant growth and enhances resilience.



## NUTRIENT MANAGEMENT

Nourishing soils are rich in vital nutrients, which play a key role in the growth of crops.

## WATER RETENTION

High-quality soil retains water effectively, minimizing the need for irrigation and enabling crops to better endure drought conditions.

## MICROBIAL DIVERSITY

The vibrant microbial community in the soil promotes nutrient cycling and enhances plant health, resulting in improved resilience for crops.





# SOIL CONSERVATION

Soil conservation **prevents** and **reduces** soil **erosion** and **degradation** through protective measures against agents like wind and water.

It includes **various land management practices** to sustain agricultural production, aiming to enhance soil fertility and maintain soil health.

PREVENTS SOIL  
EROSION &  
DEGRADATION

PROTECTIVE  
MEASURES

VARIOUS LAND  
MANAGEMENT  
PRACTICES



# 2. REGENERATIVE AGRICULTURE

**Interconnectedness** is crucial because, in nature, everything influences everything else.

In regenerative agriculture, we **move beyond mere preservation** or sustainable practices. Instead, we must embrace a more **dynamic understanding of ecology**, where **air quality, water management, soil health, pest control**, and the myriad **organisms** that dwell within the soil all play vital roles.

To address the challenges we face in agriculture, we cannot rely on pinpoint solutions that target symptoms without considering the broader context. Nature operates on **principles of time and balance**; it thrives when **all elements work together synergistically**.

*In summary, regenerative agriculture requires a **paradigm shift toward systems thinking**, recognizing that **true ecological regeneration is achieved through the integration of diverse components**.*





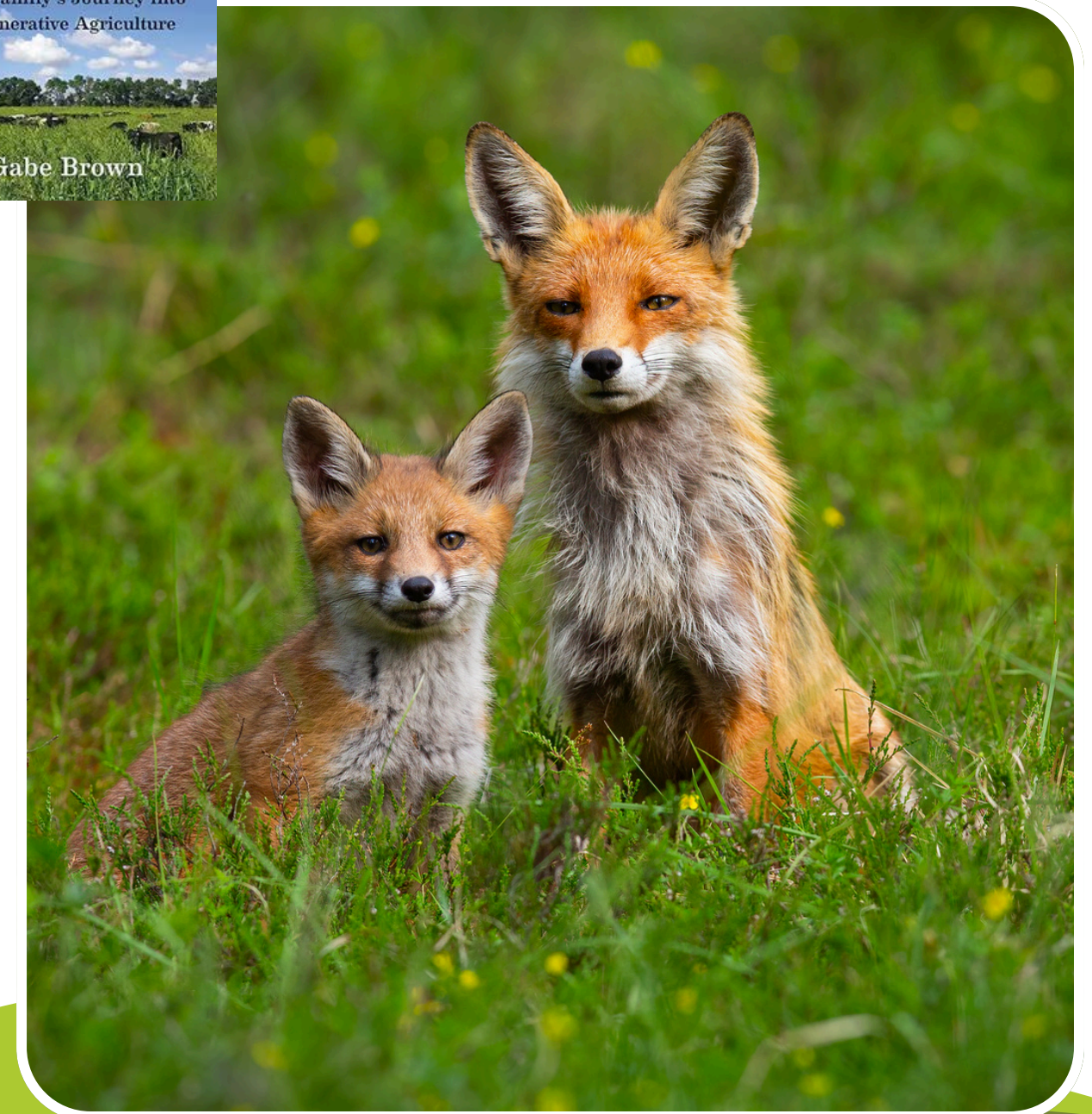
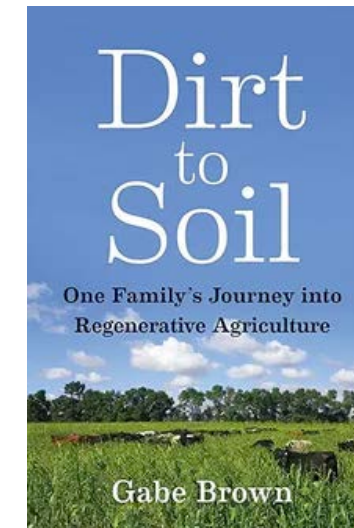
# REGENERATIVE AGRICULTURE

## The 5 Principals of Soil Health

- Limit Disturbance 'no-till' > improve soil structure, protects beneficial microorganisms, weed suppression, stress reduction, nutrient availability
- Armor the Soil Surface > Keep soil covered with plant residues
- Build Diversity > Crop Rotation, Cover crops, Soil organisms
- Keep Living Roots in the Soil > Cover crops, C-transfer into soil, soil structure improvement, erosion control, disease suppression
- Integrate animals > Attract predatory birds/animals help pest control, apply organic fertilizer, weed management

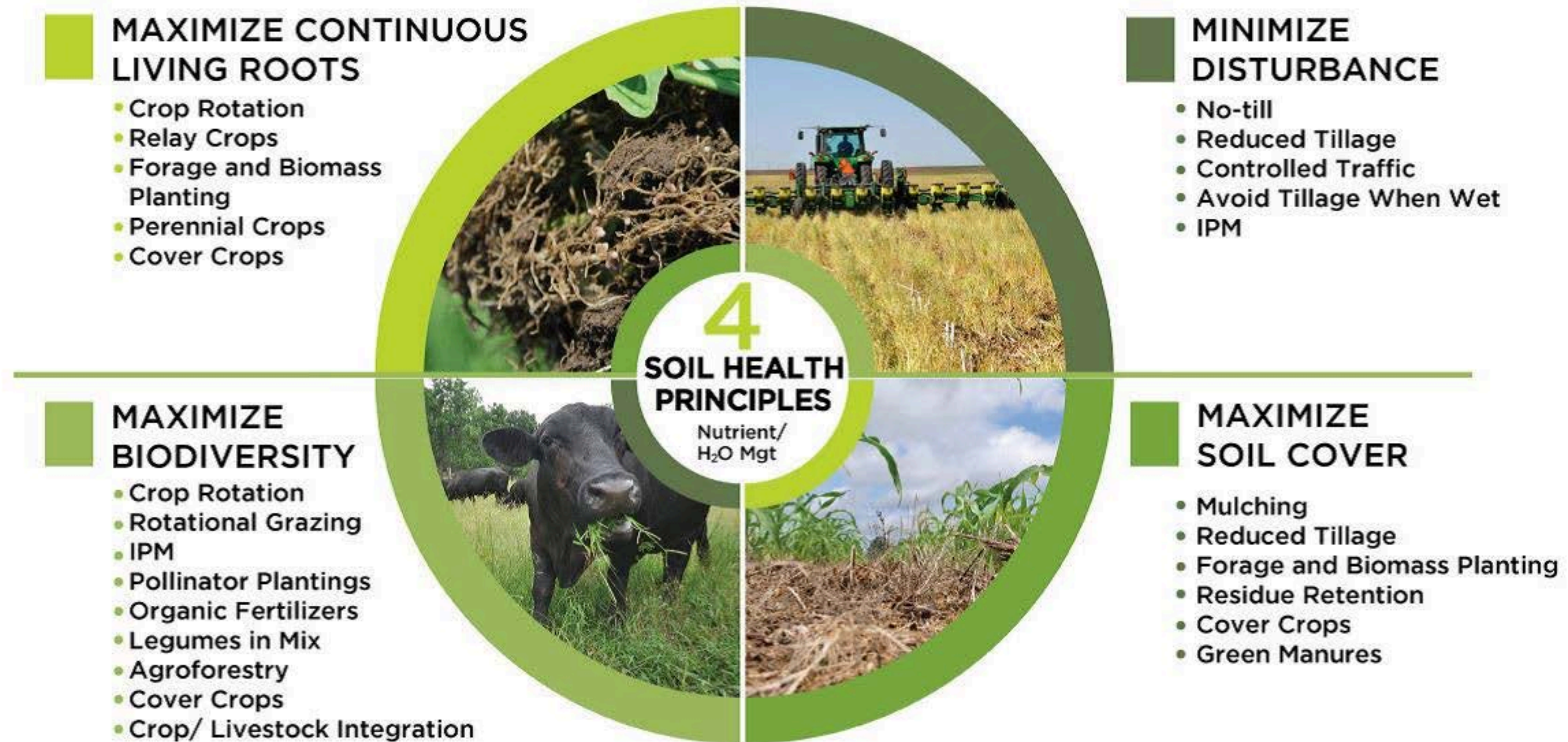
>wild meadows/forests as the model

See: Module 5: **Nutrient Management & Fertilization**





# KEY PRINCIPLES



Source: USDA, [www.climatehubs.usda.gov/hubs/northwest/topic/soil-health-management-reduce-climate-and-weather-risks-northwest](http://www.climatehubs.usda.gov/hubs/northwest/topic/soil-health-management-reduce-climate-and-weather-risks-northwest)

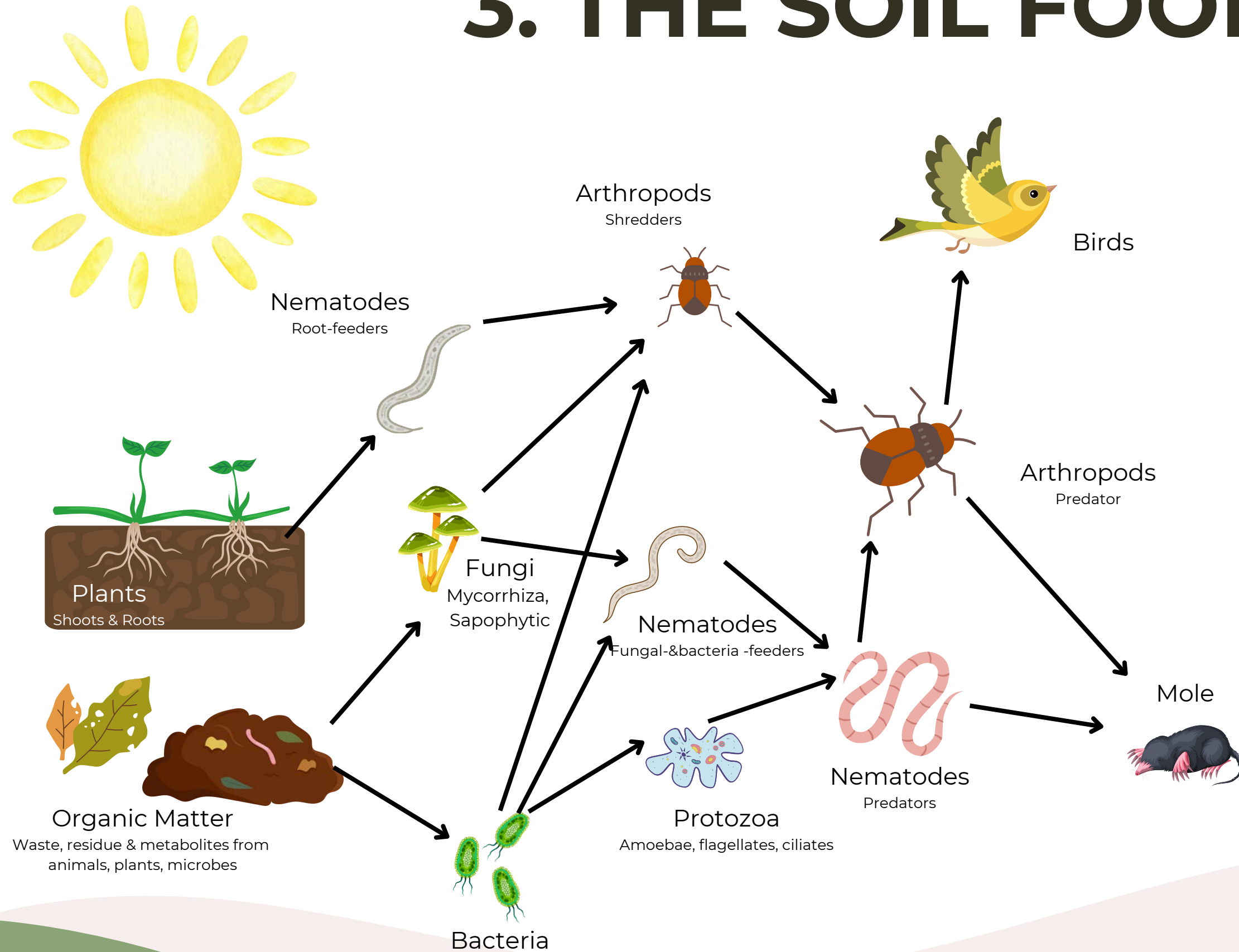




Source: CA4SH - Coalition of Action for Soil Health,  
[www.coalitionforsoilhealth.com](http://www.coalitionforsoilhealth.com)



# 3. THE SOIL FOOD WEB



- = community of organisms living in the soil
  - diagram represents energy & nutrient flow > one organism eats another
  - organic matter gets decomposed & organisms get eaten > nutrients are transformed & made available to plants & other soil organisms
  - huge variety of organisms of various sizes interact, grow, eat, get eaten, die
  - primary producer: plants > main energy flow starts there
  - soil is not a growing medium - it is living & provides life
- > **Minimal Soil Disturbance!**

Diagram based on: USDA Soil Biology Primer



# 4. THE ROLE OF FUNGI

- The Neural Underground Network of Soil
- mycorrhizae connect plants with each other
- sharing chemical signals between trees/plants
- sharing nutrients and disease defense between plants ('mother tree')

## Soil Builder:

- hyphae excrete enzymes > breaking down substances in their way
- enzymes work like glues > connect soil particles, aggregate forming, improve soil structure > more water & air movement possible > work as sponge to buffer extreme weather

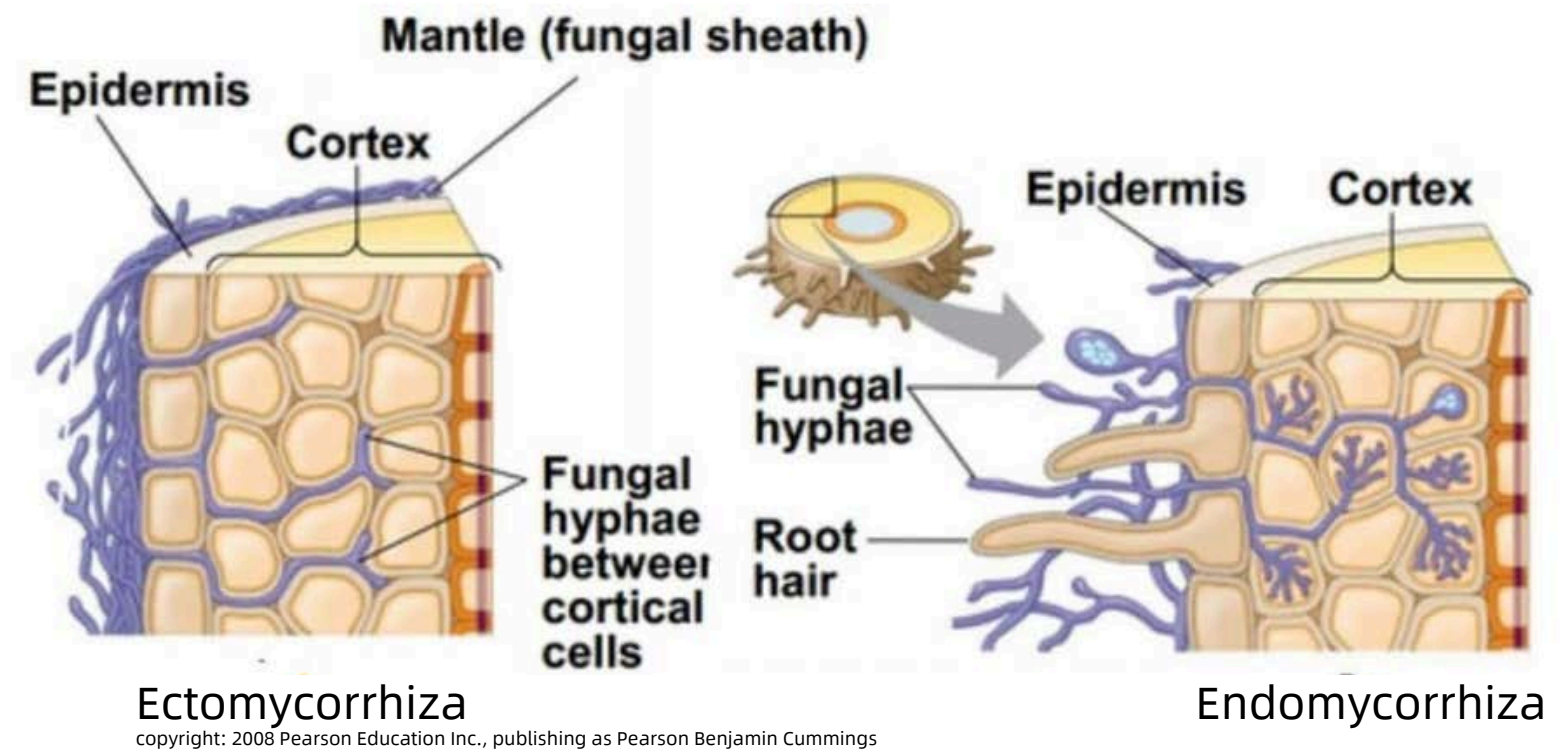


**'Wood Wide Web'**



# THE ROLE OF FUNGI

- Mycorrhizae: specialized roots that form mutualistic relationships between fungi and plant roots; *mycor-rhizae* means *fungus-root*  
> *symbiotic relationship between plant & fungus*
- *Benefits for the Fungus*: supply of sugar from host plant
- *Benefits for the Plant*: increased surface > increased water uptake, mineral absorptions; disease protection; communication; soil builder







## SOIL HEALTH IS THE FOUNDATION

Healthy soil is crucial for sustainable agriculture and ensuring **global food security**. It promotes **plant growth**, **retains water**, **cycles essential nutrients**, and serves as a **carbon sink**, helping to alleviate climate change.

## SOIL CONSERVATION IS KEY

Erosion, degradation, and a decline in organic matter pose significant risks to the sustainability of agricultural productivity. Regenerative practices prioritize **reducing disturbances**, preserving **cover crops**, and **preventing soil erosion** to safeguard this essential resource.

## EMPHASIS ON NATURAL PROCESSES

Regenerative practices, including **crop rotation**, **agroforestry**, **composting**, and **cover cropping**, emulate and enrich natural ecosystems. These methods boost biodiversity, rejuvenate soil fertility, and decrease reliance on synthetic materials.

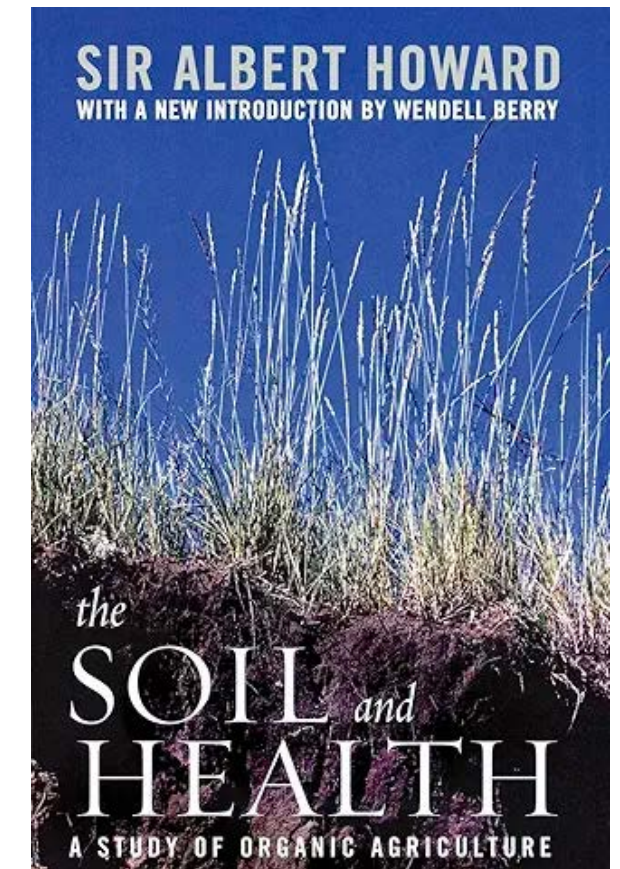
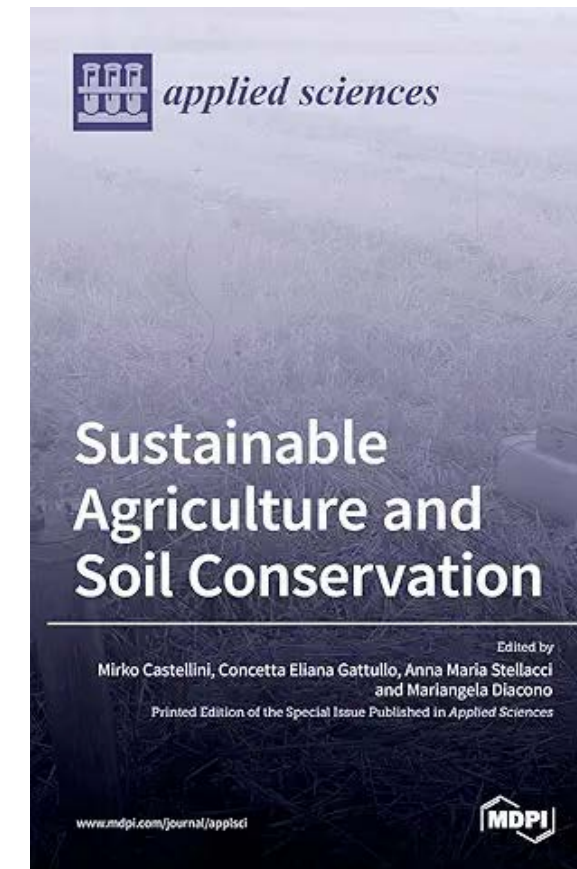
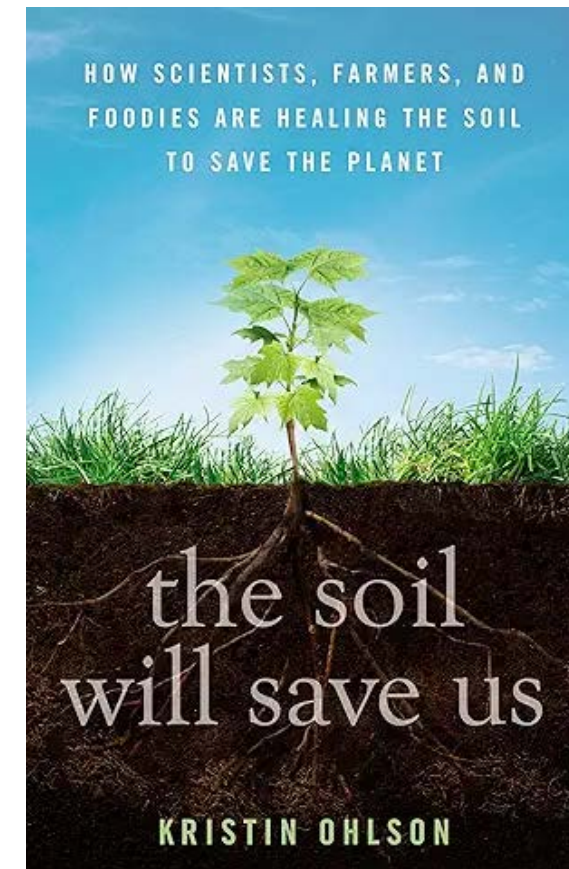
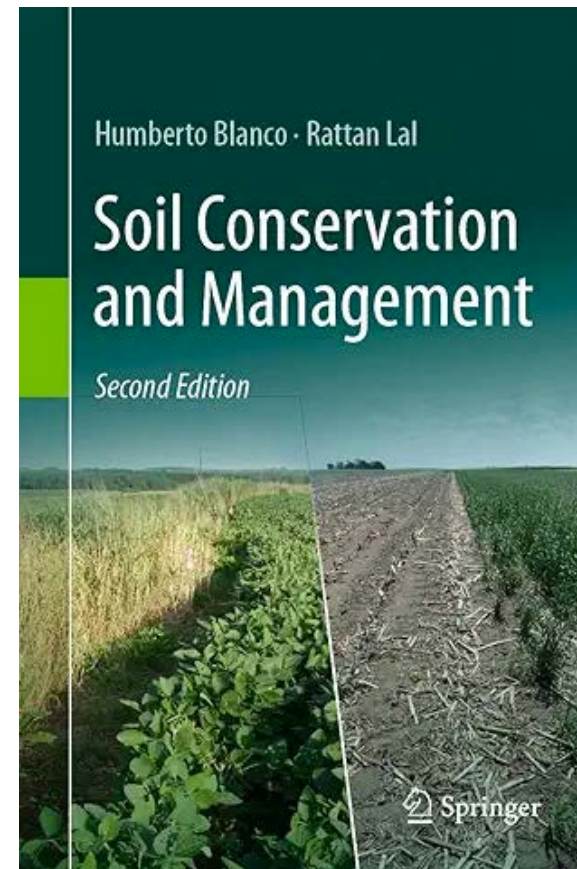
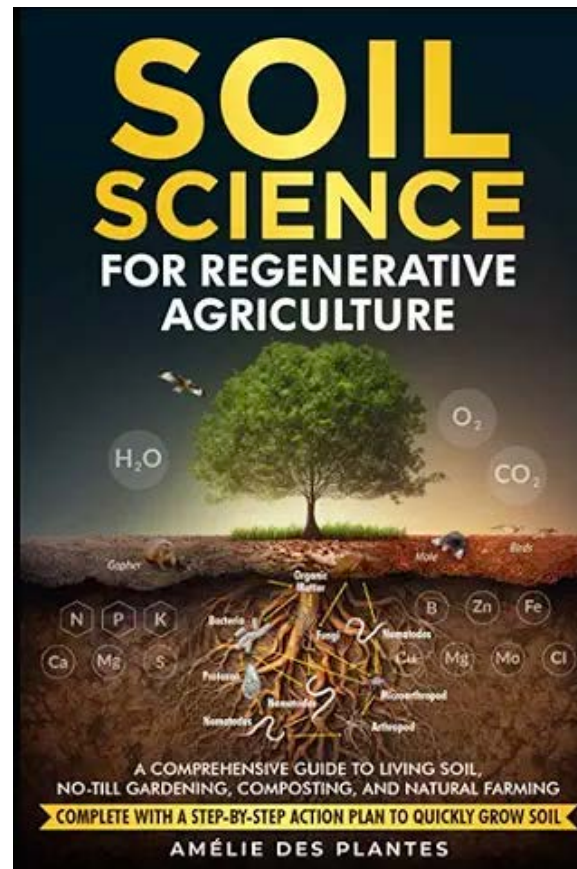
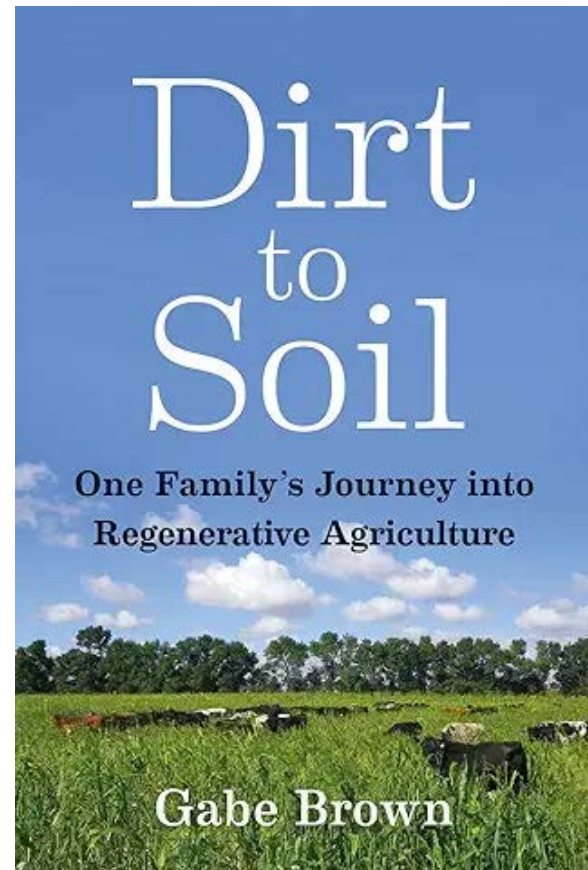
## A PATH TO RESILIENCE

By focusing on regenerative practices, farmers can develop **resilient systems** that adjust to climate challenges, enhance sustainable yields, and ensure the future of agrifood production.

# CONCLUSION



# RESOURCES



**FAO - Food & Agriculture Organization of the United Nations**

[www.fao.org/soils-portal/en/](http://www.fao.org/soils-portal/en/)

**Dr. Elaine's Soil Food Web School**

[www.soilfoodweb.com](http://www.soilfoodweb.com)

**Coalition of Action for Soil Health**

[www.coalitionforsoilhealth.com](http://www.coalitionforsoilhealth.com)

**USDA - National Resources Program, Soil Health**

[www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health](http://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soils/soil-health)

[www.climatehubs.usda.gov/hubs/northwest/topic/soil-health-management-reduce-climate-and-weather-risks-northwest](http://www.climatehubs.usda.gov/hubs/northwest/topic/soil-health-management-reduce-climate-and-weather-risks-northwest)



THANK  
YOU

