

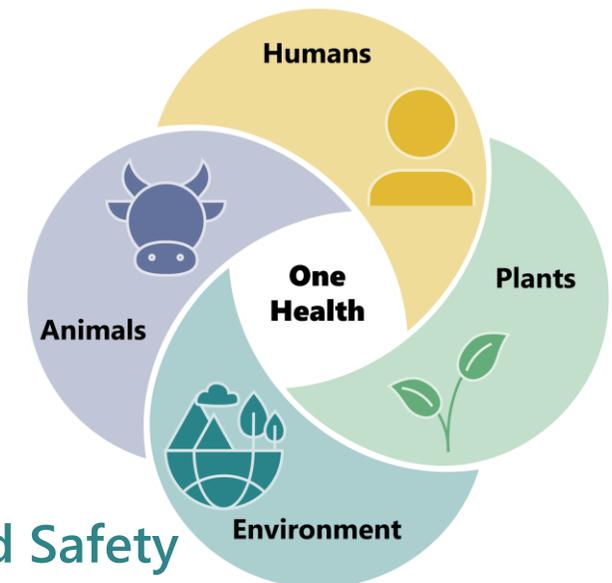


Taru Sandén

**Research Group Leader on Soils and
Agroecology at Austrian Agency for
Health and Food Safety**

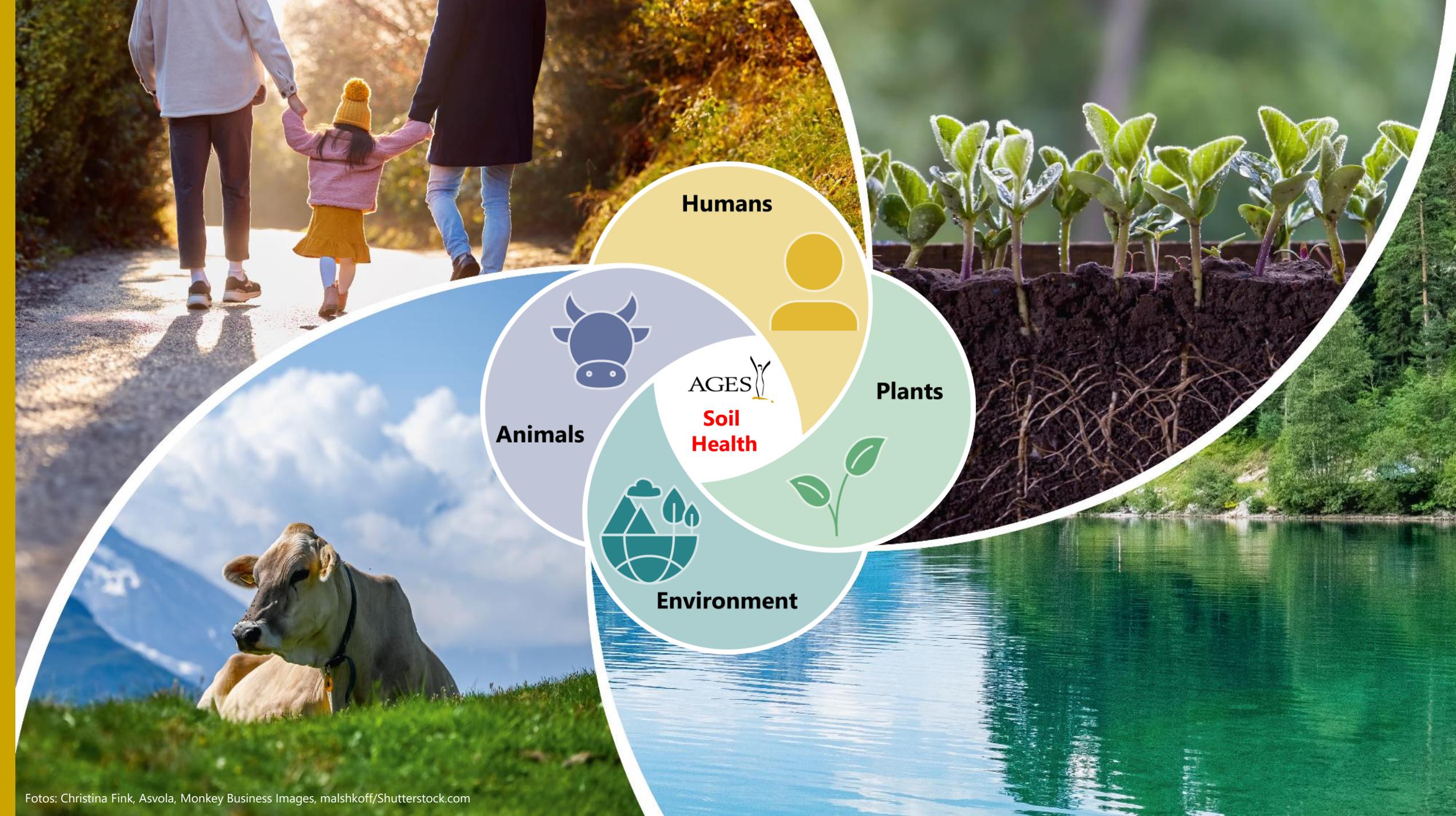
Panel 3

Soil Health – From Field to Data



Dr. Taru Sandén

Research on Soils and Agroecology – Austrian Agency for Health and Food Safety



Humans



Animals

AGES 
**Soil
Health**

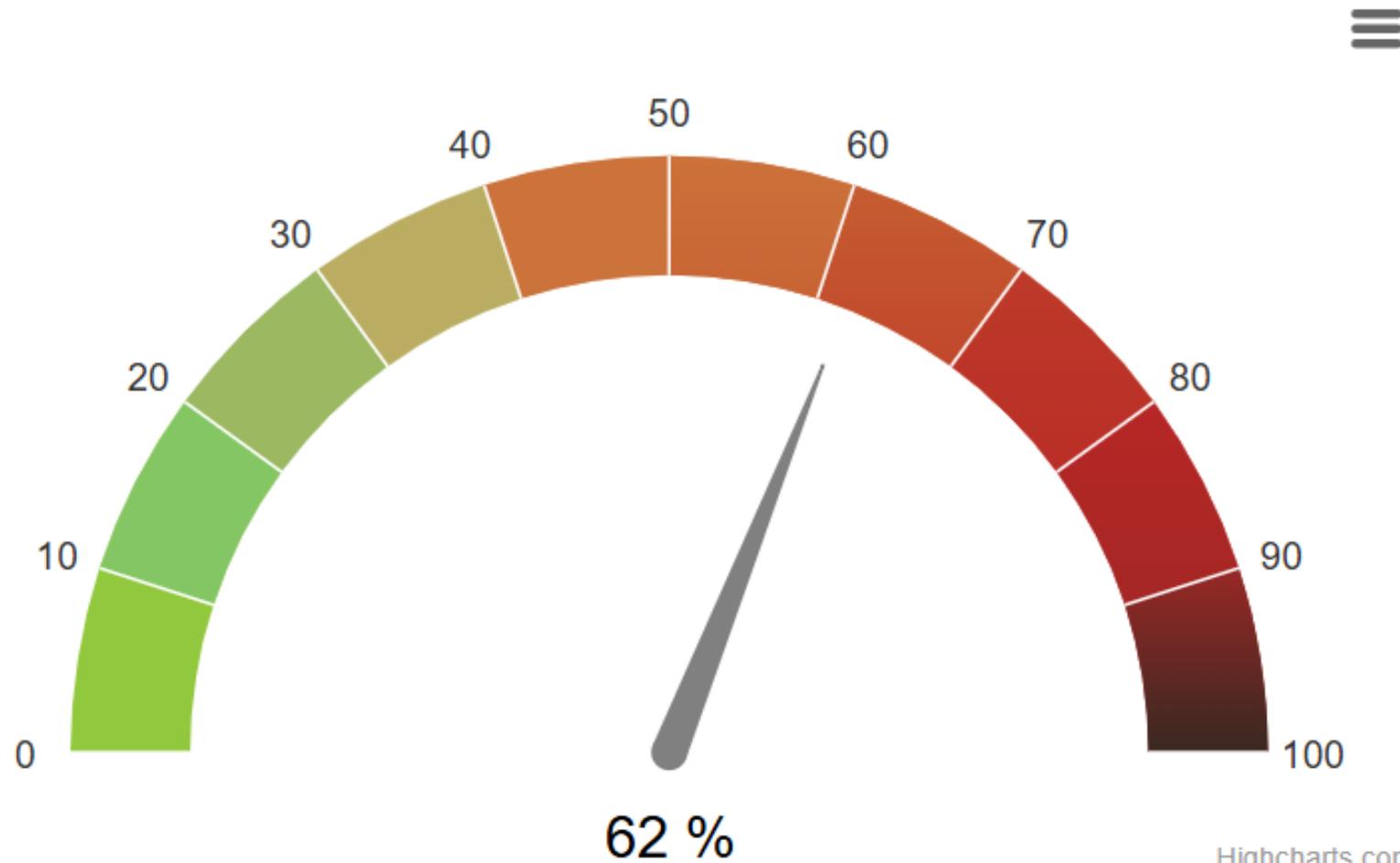
Plants



Environment

SOIL DEGRADATION IN THE EU

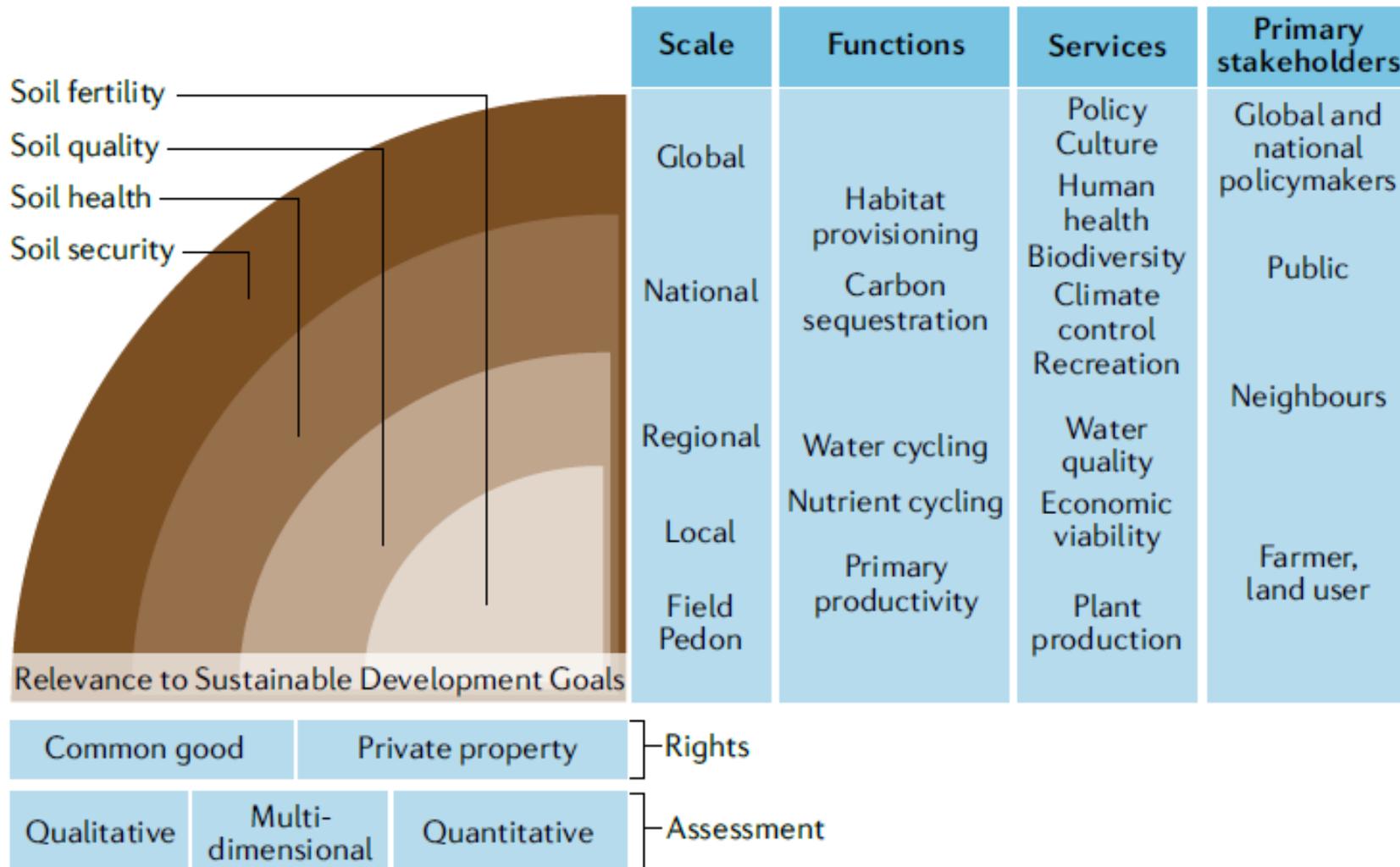
<https://esdac.jrc.ec.europa.eu/esdacviewer/euso-dashboard/>



Highcharts.com

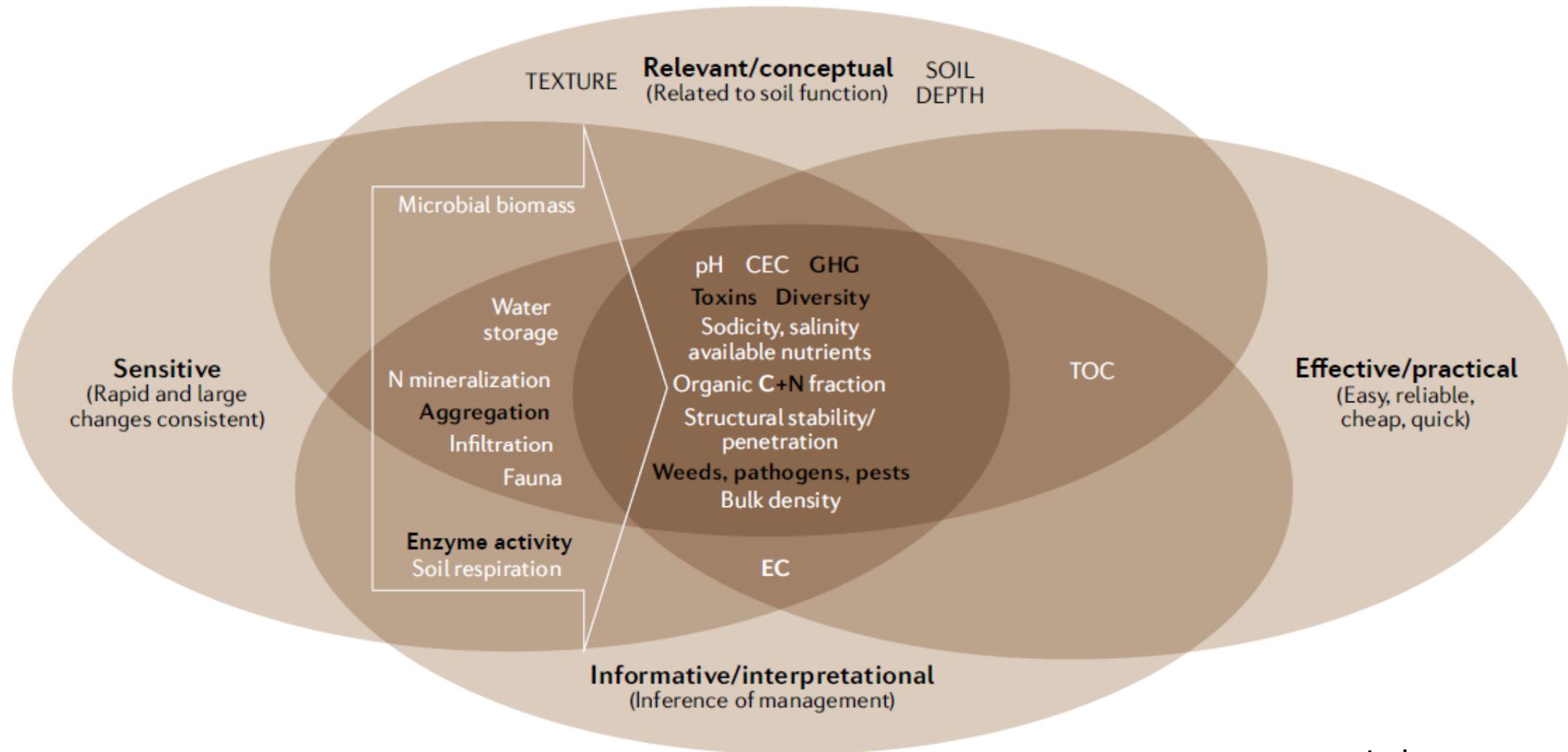
SOIL HEALTH

Definition



SOIL HEALTH

Measurements



BENCHMARKS (01/2023-12/2027)

Project goals

- Identification of soil health indicators
- Development of Soil Health Index
- Development of common soil sampling strategy
- Development of a Soil Health Dashboard
- 28 case studies (agricultural, forest, and urban soils)



HIGHLIGHTS 2024 + 2025 + 2026

Soil sampling

Land use system	Case study type	Sampling depths
Agriculture	Variance sites	0-20 cm
 GRAND FARM <small>INNOVATION • EDUCATION • CONSERVATION</small> 	Replicated carbon amendment sites	0-10 cm, 10-20 cm, 20-30 cm
	Replicated tillage sites	0-10 cm, 10-20 cm, 20-30 cm, 30-50 cm
Forest	Replicated sites	H layer, 0-20 cm, 20-40 cm
	Variance sites	H layer, 0-20 cm
Urban	Fragmentation sites	0-20 cm, 20-40 cm Each horizon of one soil pit

SOIL HEALTH INDICATORS

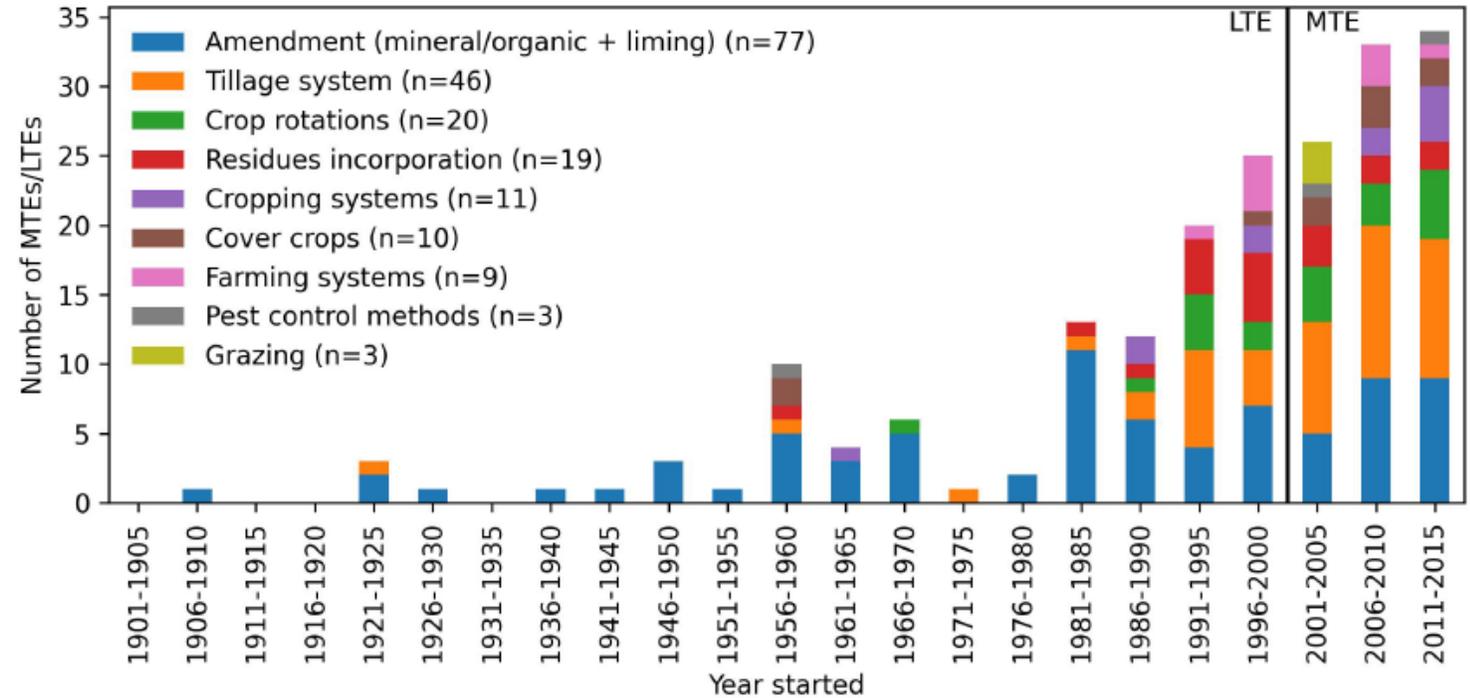
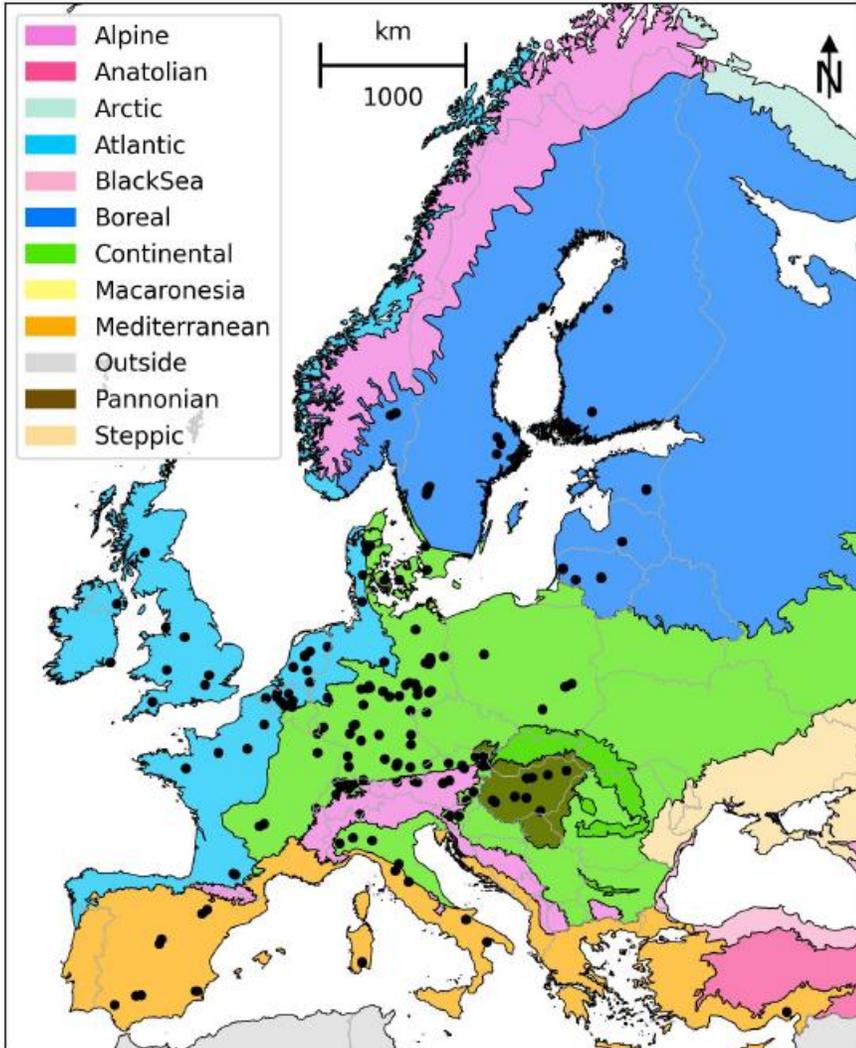
28 case studies

Biodiversity	Nutrients & pH	SOC	Pollutants	Structure	Proxy for various SHI
Potentially mineralisable N	CEC	Soil organic carbon	Metals	Soil texture	Laboratory spectroscopy
Microbial C and N	EC	Carbonates	Pesticides	Aggregate fractions	Handheld scanners
Nematodes_Morpho	pH	Active carbon (Rock-Eval)	POPs	Bulk density	Geophysical sensors
Nematodes_Molec	Total N	POM:MAOM	Plastics	Soil hydraulic properties	UAV imaging
Microbiome composition	Plant available P - Olsen			Penetrometry	
Abundance of bacteria and fungi	Plant available K			Soil profile	
Abundance of N cycling microbes	Boron			Soil erosion	
Earthworms	Chlorine				
Microarthropods_Morpho	Copper				
Microarthropods_Molec	Maganese				
	Zinc				

LONG-TERM FIELD EXPERIMENTS

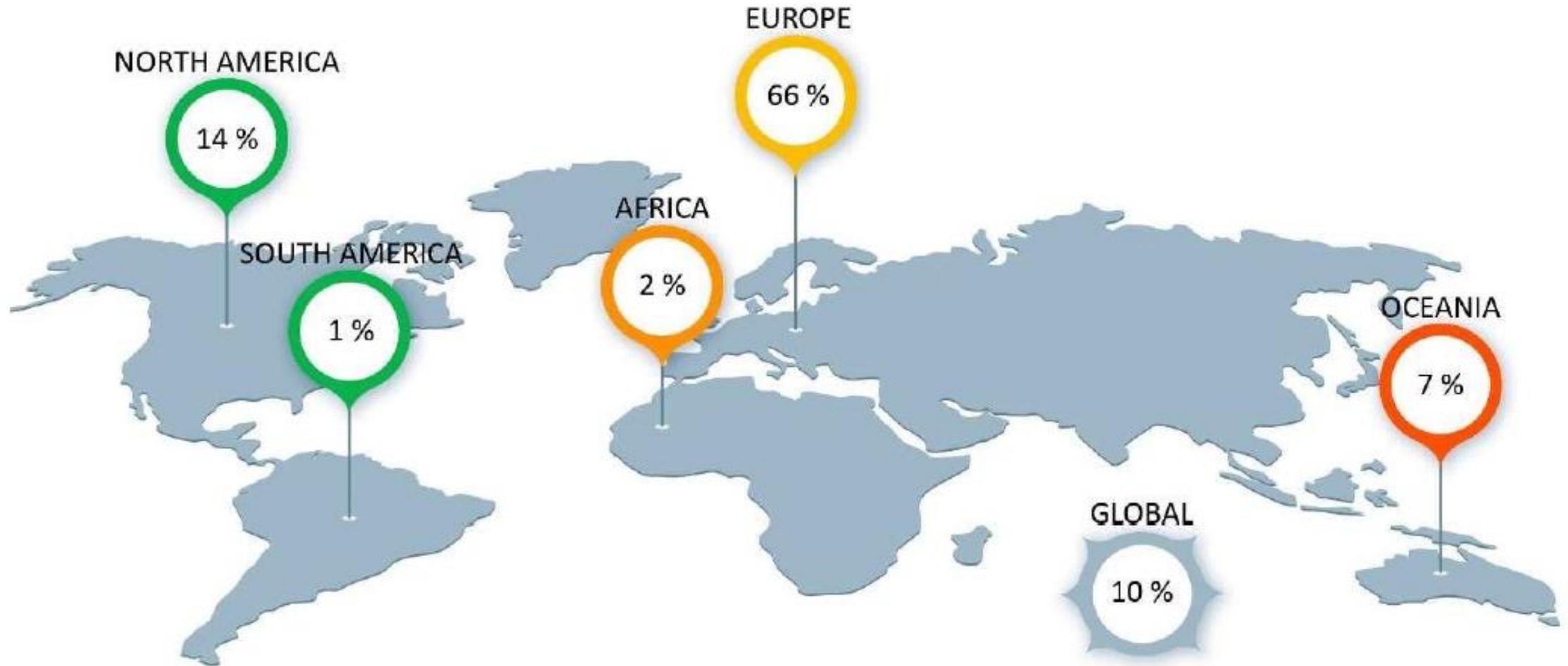
Pedo-climatic-specific effects of soil management practices

Mid- and long-term field experiments (240 MTEs/LTEs)



CITIZEN SCIENCE RESEARCH ON SOIL HEALTH

71 projects

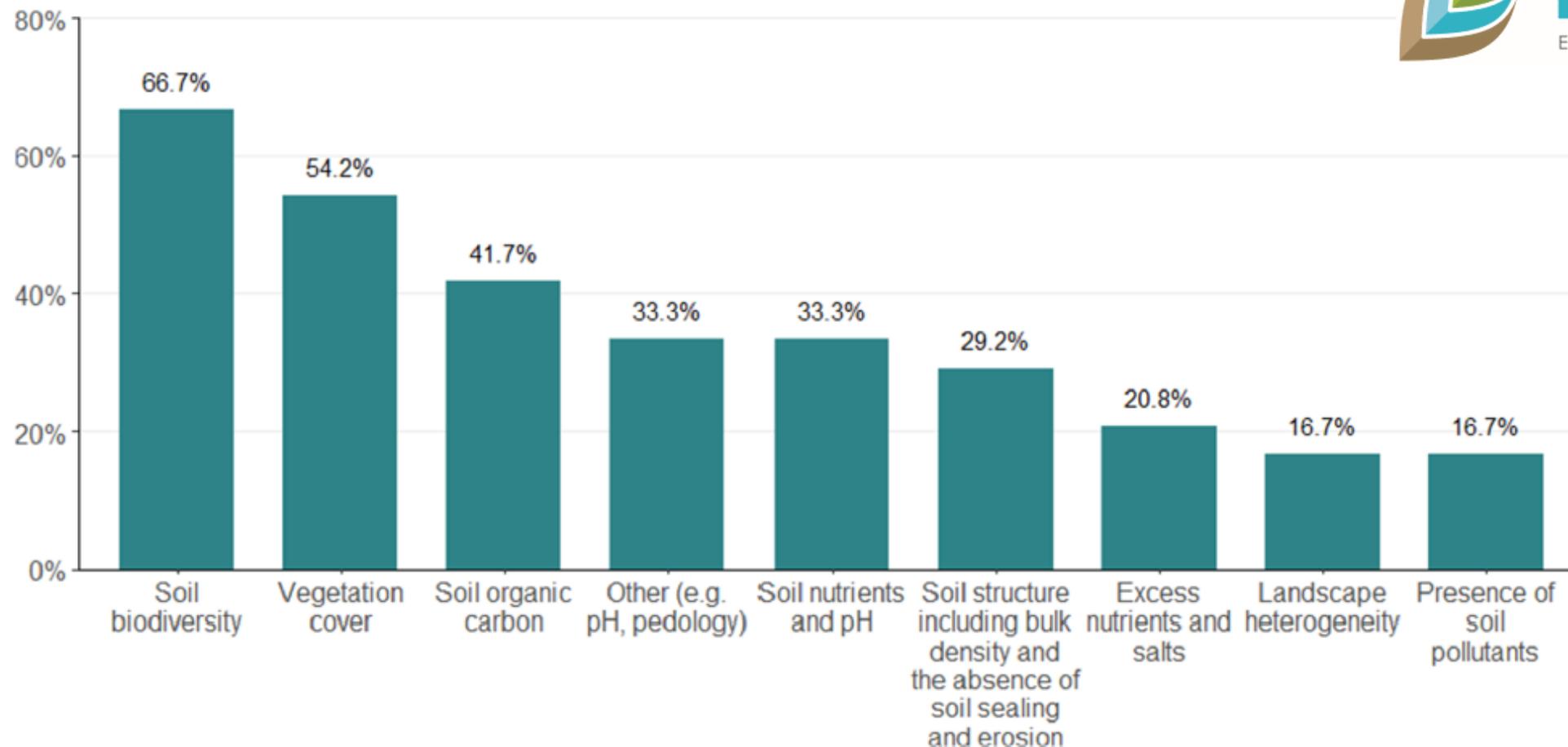


PARTICIPATORY SOIL CITIZEN SCIENCE

An unexploited resource – citizens are already generating new knowledge!



EJP SOIL
European Joint Programme



SOILBLITZ

Citizen Science Award 2025

earthwatch
EUROPE

AGES

Bundesministerium
Bildung, Wissenschaft
und Forschung

oead

Soil Health
BENCHMARKS

- April to July 2025 in Austria
- 406 locations monitored by 25 school classes – 625 students

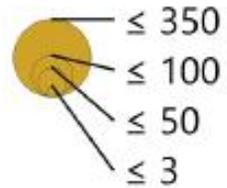


AUSTRIAN NIR SOIL SPECTRAL LIBRARY

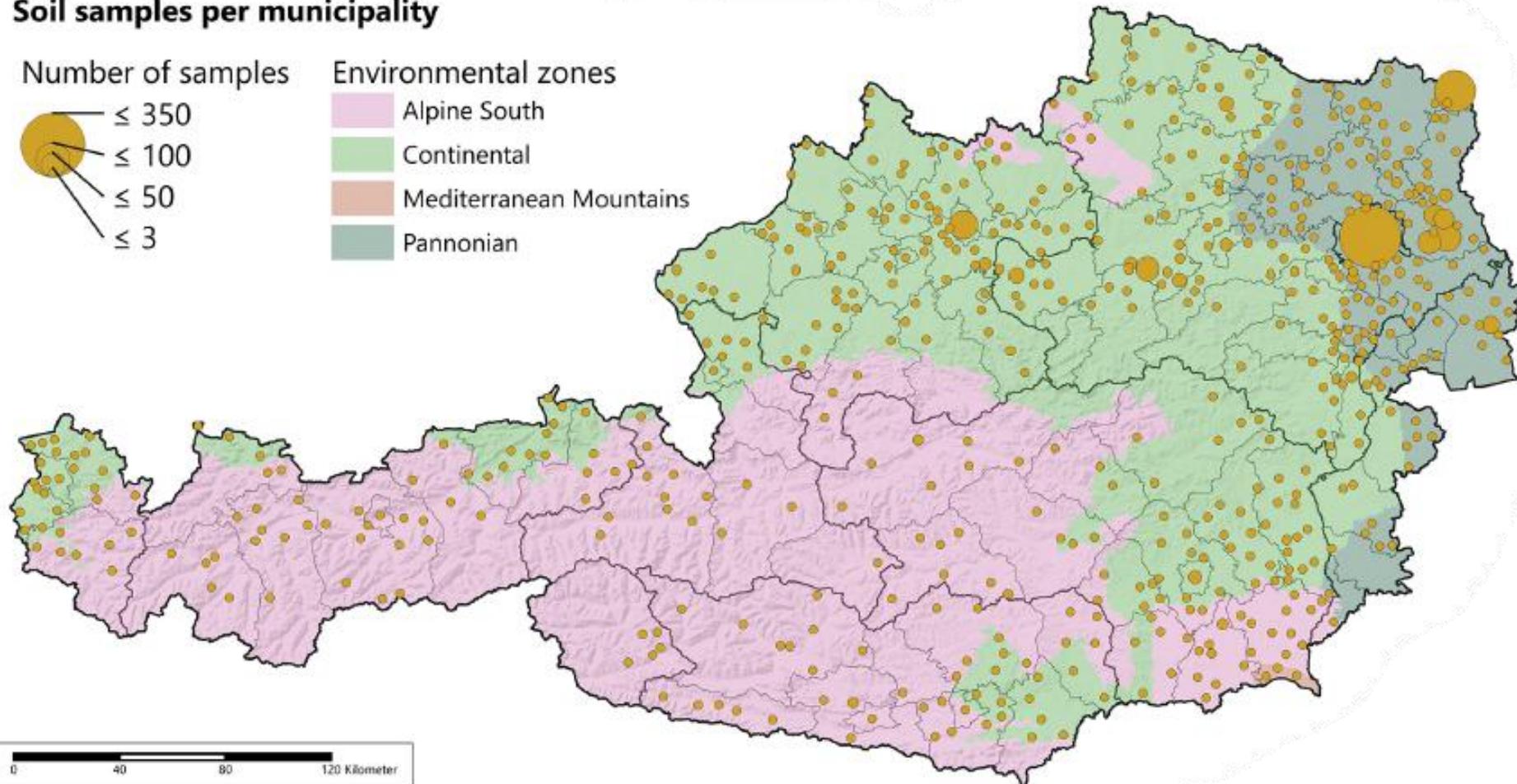
680–2500 nm – 2129 soil samples

Soil samples per municipality

Number of samples



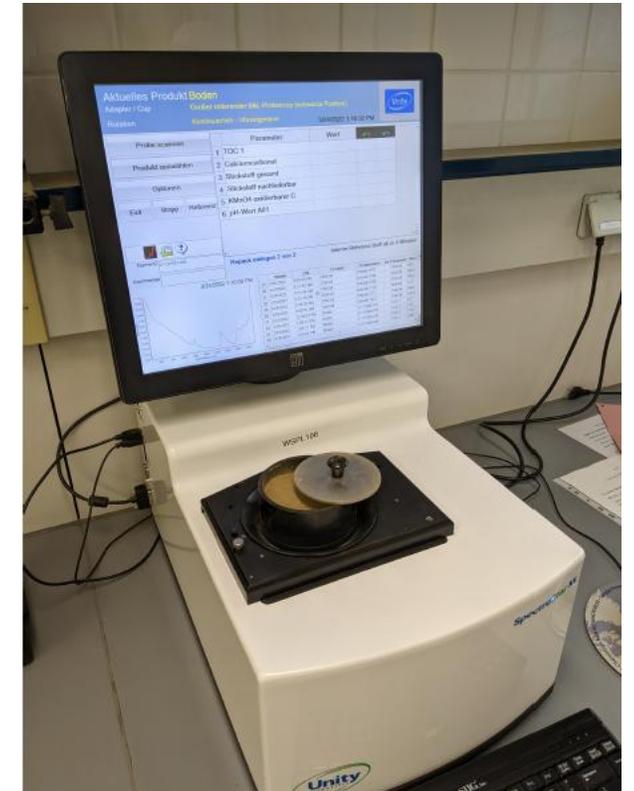
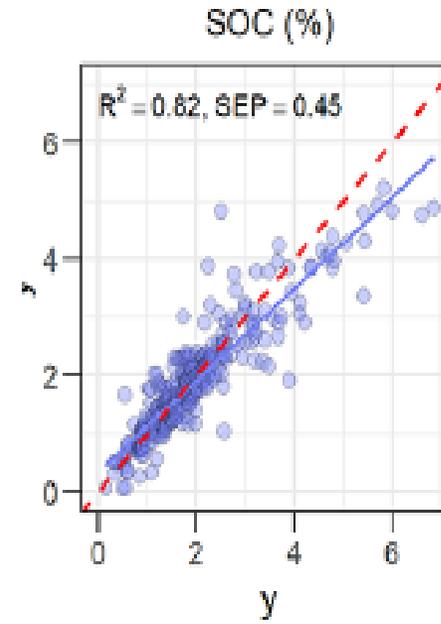
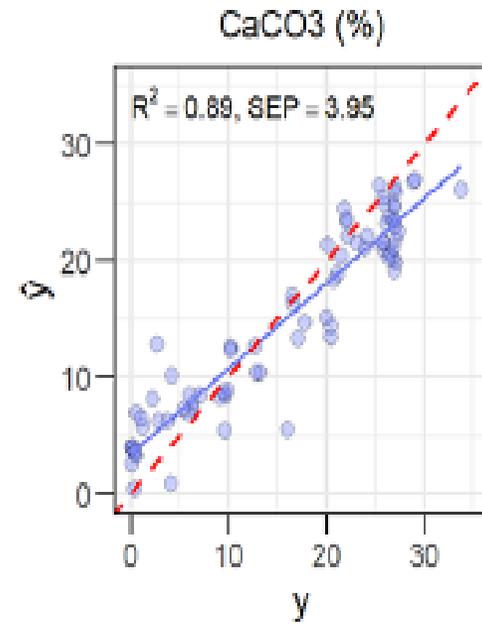
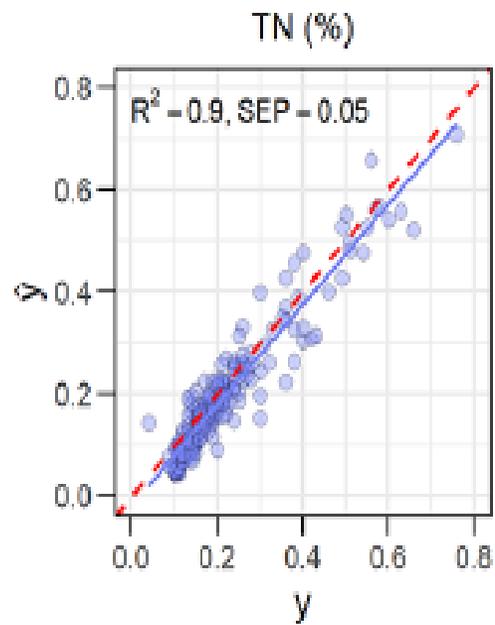
Environmental zones



Data source: Administrative boundaries © BEV; Environmental zones: Metzger, Marc J. 2018
created: 18.06.2025

AUSTRIAN NIR SOIL SPECTRAL LIBRARY

Good enough for soil health assessment?



SpectraStar™ XL NIRS from
Unity Scientific

AGROECOLOGY

Integration of 13 principles can deliver system-level change



TRANSFORMATIONAL

INCREMENTAL

FOOD SYSTEM

AGROECOSYSTEM

LEVEL 5

Build a new global food system based on participation, localness, fairness and justice

LEVEL 4

Reconnect consumers and producers through the development of alternative food networks

LEVEL 3

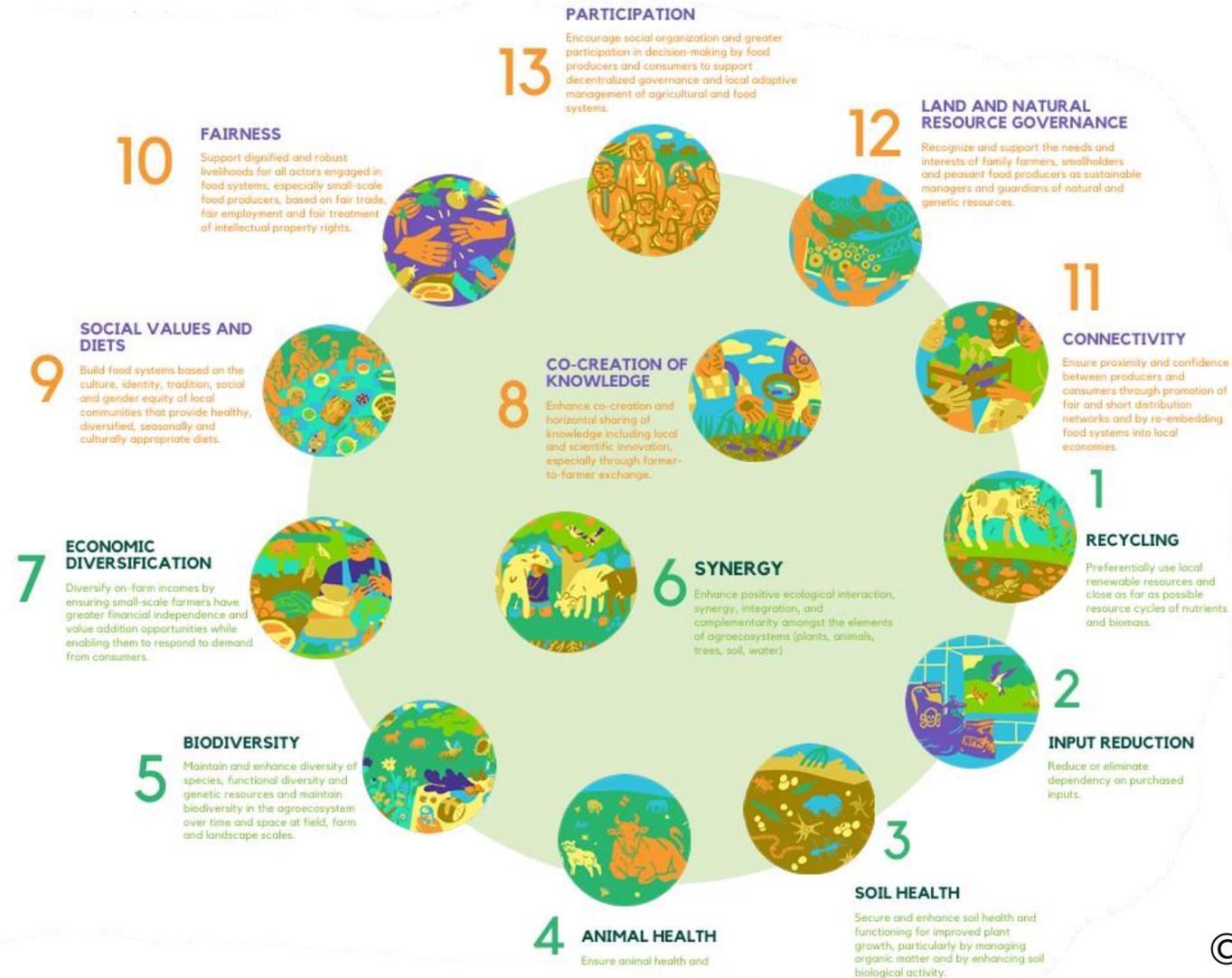
Redesign agroecosystems

LEVEL 2

Substitute conventional inputs and practices with agroecological alternatives

LEVEL 1

Increase efficiency of input use and reduce use of costly, scarce or environmentally damaging inputs



WHAT WORKS ON THE GROUND?

How can we measure it?



- Ask enough questions before measuring
 - What is the goal?
 - For whom?
 - Part of a bigger framework?
 - Relevance – Practicability – Informative – Sensitivity
- Co-creation, knowledge sharing & long-term thinking

Austrian Agency for Health
and Food Safety



Dr. Taru Sandén

Research on Soils and Agroecology

taru.sanden@ages.at



Soil Health
BENCHMARKS



Funded by
the European Union



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