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UNIVERSITÀ DI PARMA

GLOBAL SYMPOSIUM ON SOIL BIODIVERSITY | 19-22 April 2021

TRANSFORMING OUR WORLD:
THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT

Biodiversity strategy for 2030 - concrete actions

The EU's biodiversity strategy for 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse the degradation of ecosystems.

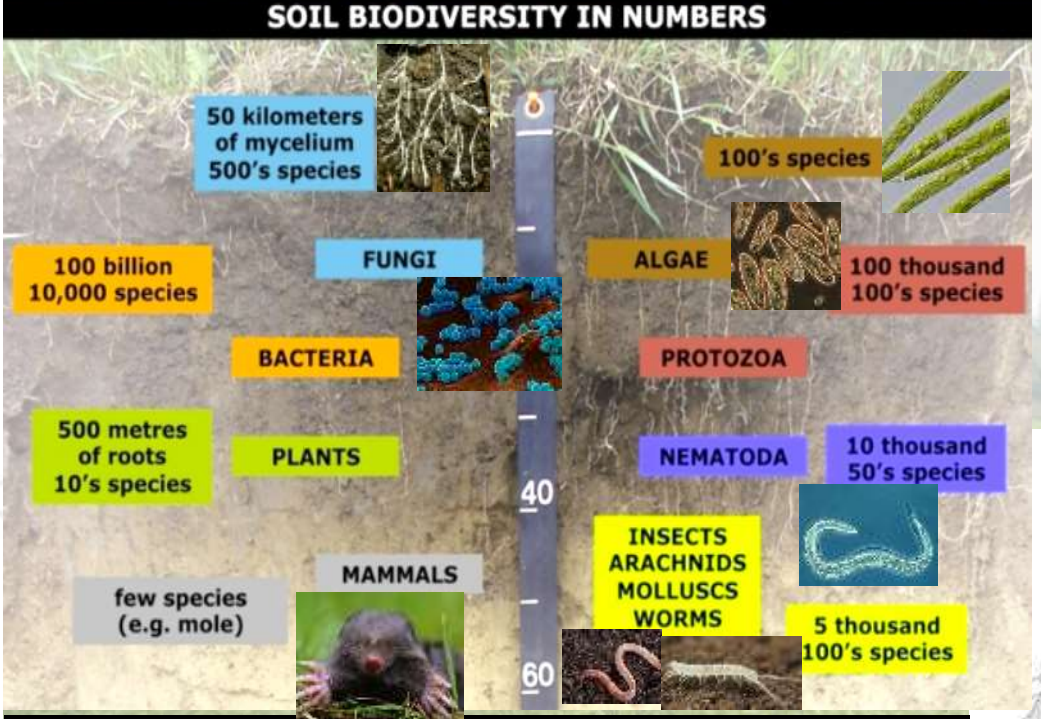
THE GLOBAL GOALS For Sustainable Development

THE 17 GOALS ACTION NEWS RESOURCES BUSINESS SCHOOLS

15 LIFE ON LAND

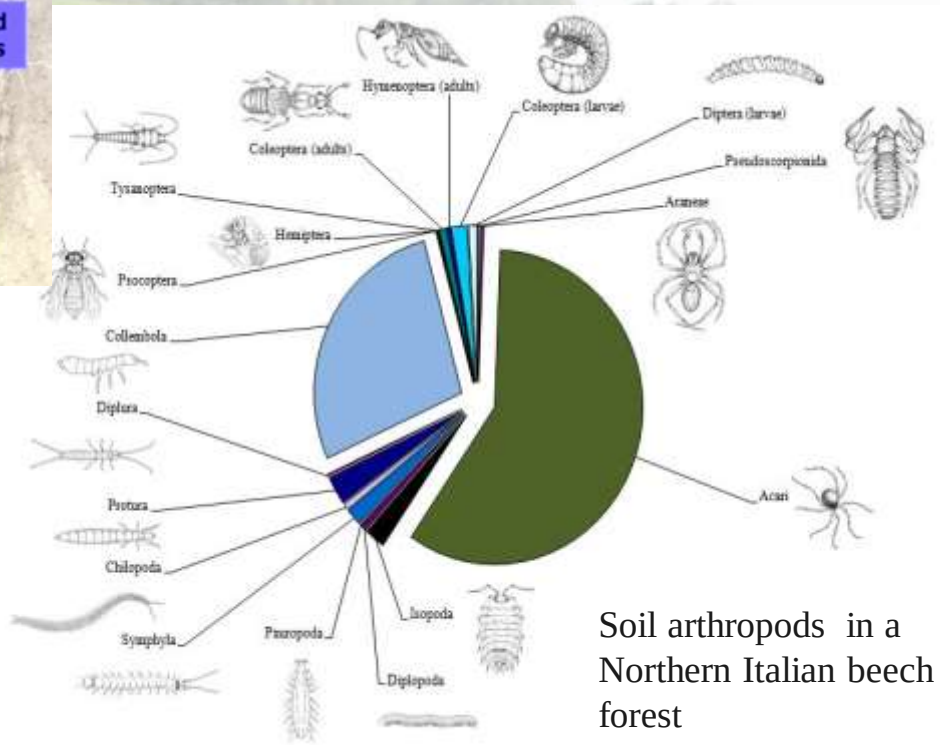
Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

KEEP SOIL ALIVE
PROTECT SOIL
BIODIVERSITY

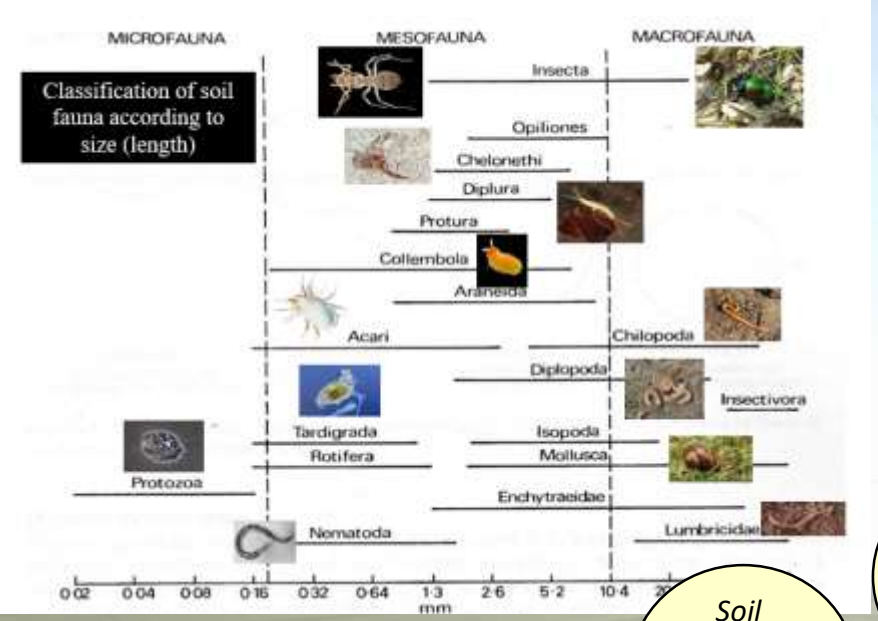


https://esdac.jrc.ec.europa.eu/themes/soil-biodiversity *mod.*

Not only the number of distinct species (richness) and their proportional abundance (evenness) present in a system but may be extended to encompass phenotypic (expressed), functional, structural or trophic diversity.



Soil arthropods in a Northern Italian beech forest

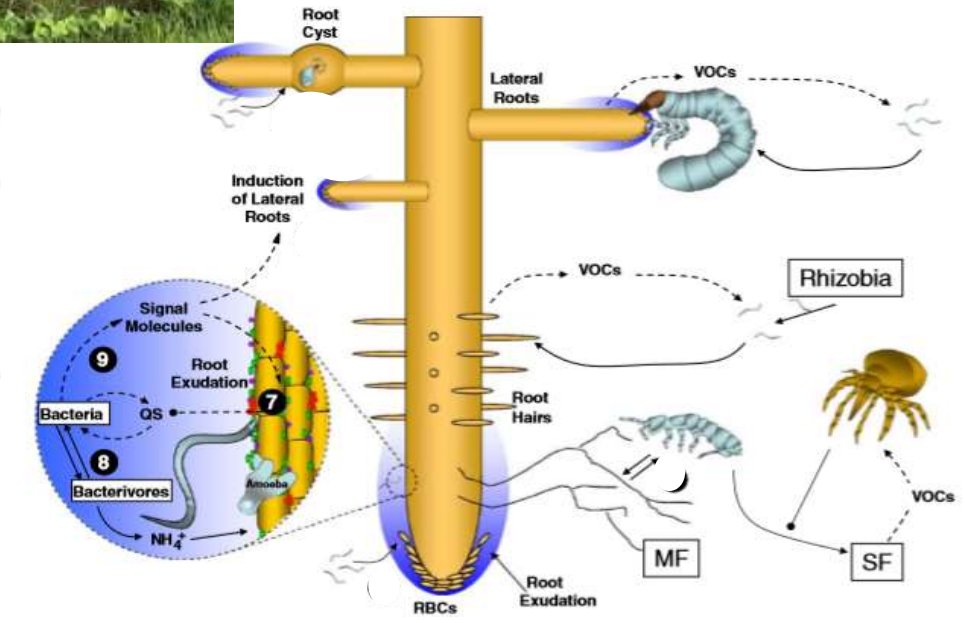


FUNCTIONS of SOIL FAUNA

- *Organic matter decomposition*
- *Carbon and nutrient regulation*
- *Nutrient cycling*
- *Biocontrol of soil-borne phytopathogens*
- *Waste recycling and soil decontaminatio n*
- *Soil pore creation*
- *Water flow regulation*
- *Soil aggregate formation*

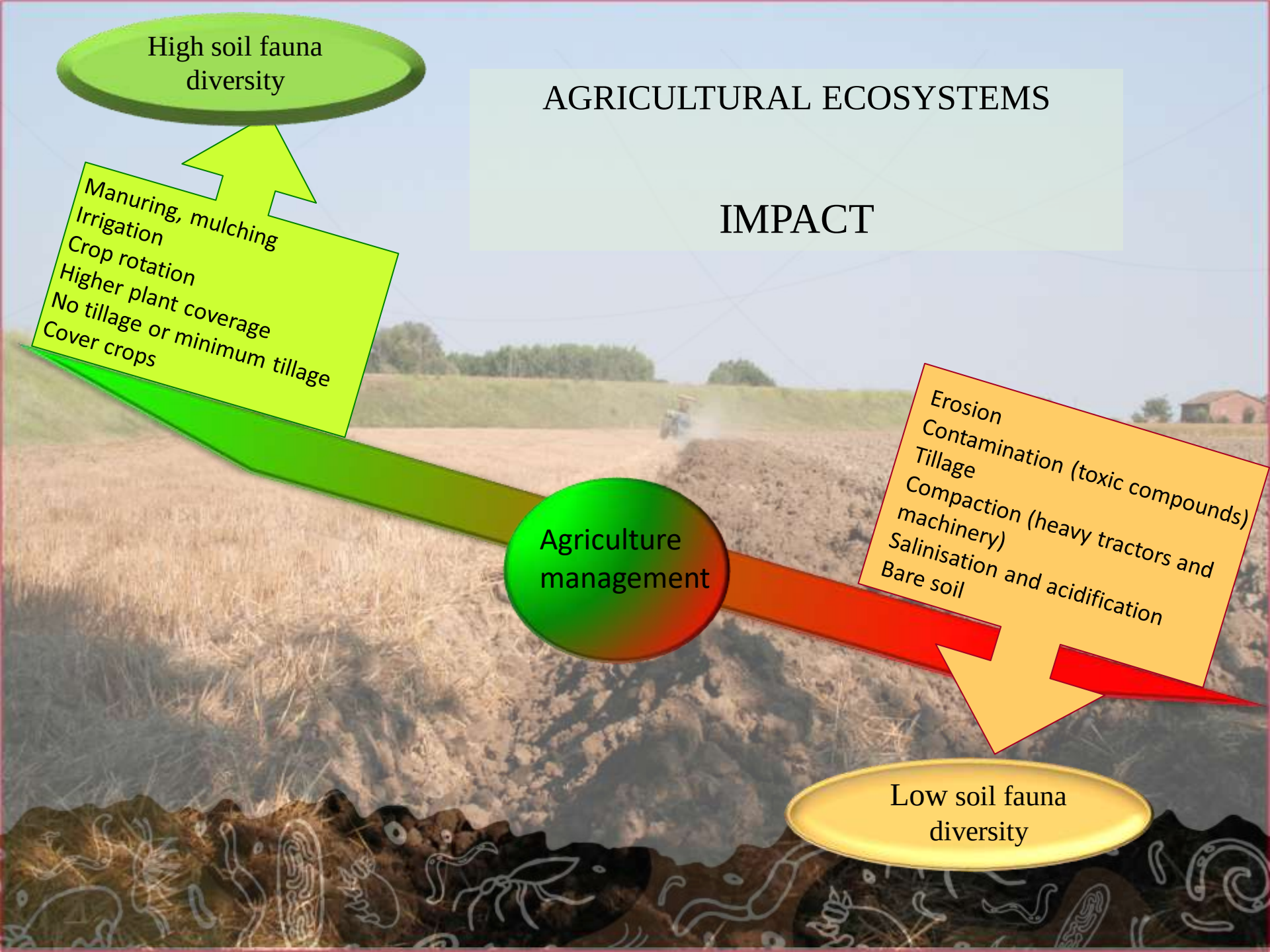
The distribution of soil fauna is driven by several factors

- Vegetation cover
- Rhizosphere
- Organic matter content
- Soil composition
- Soil porosity
- pH
- Temperature
- Water content
- Prey/ predators
- Contamination/degradation



RBCs root border cells MF mycorrhizal fungi SF saprophytic fungi

From: Bonkowski M., Villenave C., Griffiths B., 2009. Rhizosphere fauna: the functional and structural diversity of intimate interactions of soil fauna with plant roots. Plant Soil 321-213-233.


High soil fauna diversity
AGRICULTURAL ECOSYSTEMS
IMPACT
Manuring, mulching
Irrigation
Crop rotation
Higher plant coverage
No tillage or minimum tillage
Cover crops
Agriculture management
Erosion
Contamination (toxic compounds)
Tillage
Compaction (heavy tractors and machinery)
Salinisation and acidification
Bare soil
Low soil fauna diversity

VT

VT

Enhance soil structure (improve aeration, aggregation, infiltration)

Increase SOM (increase pH buffering, soil biota, nutrient cycling)

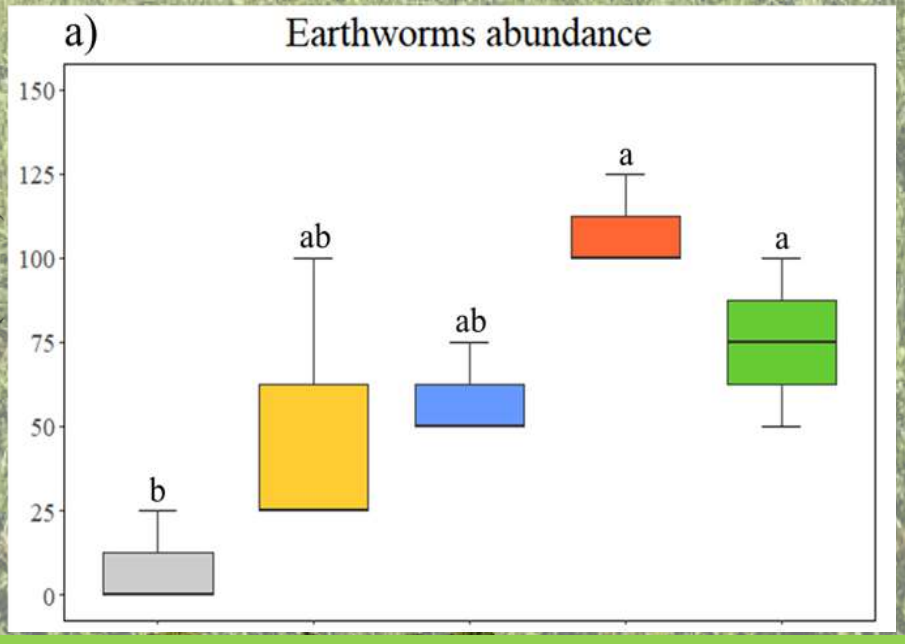
Cover crops

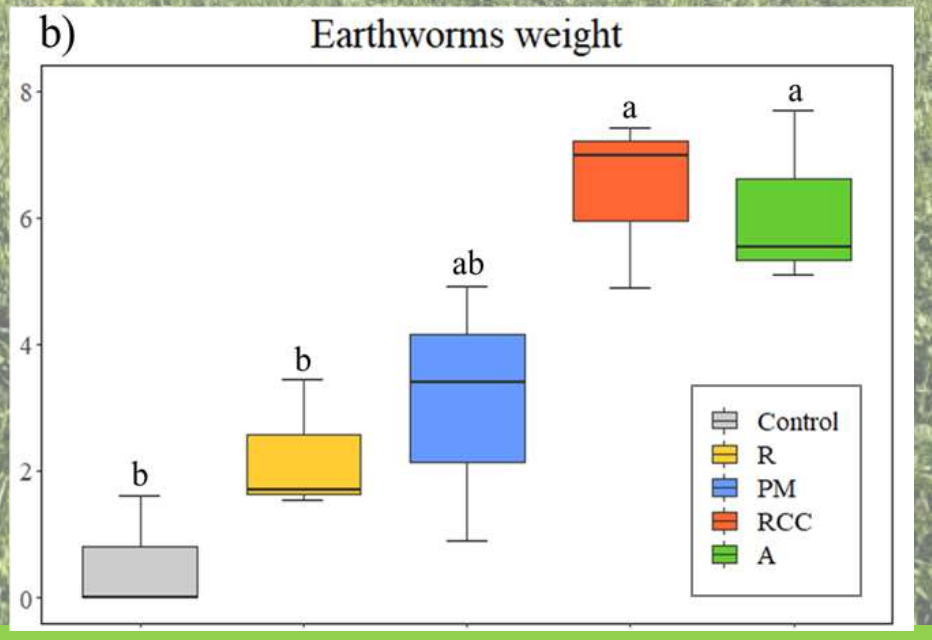
Improve pest management (weed, pathogen and, nematode suppression)

Environmental quality (reduce N-leaching, erosion and run-off)

VT

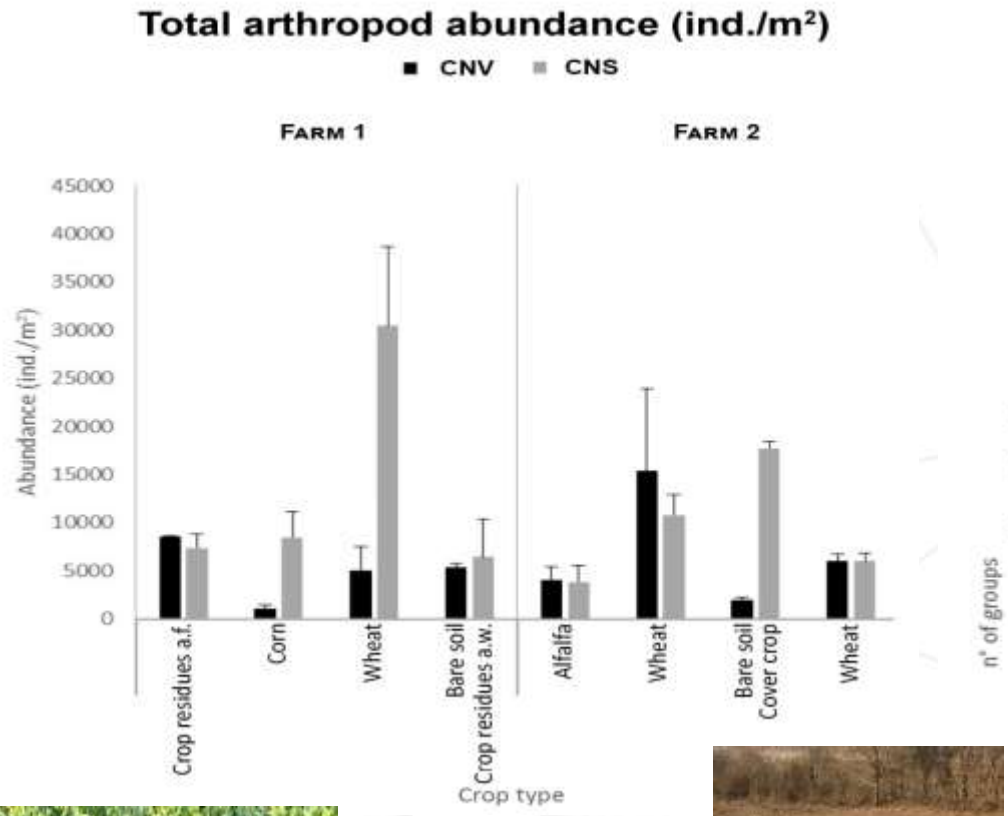
VT

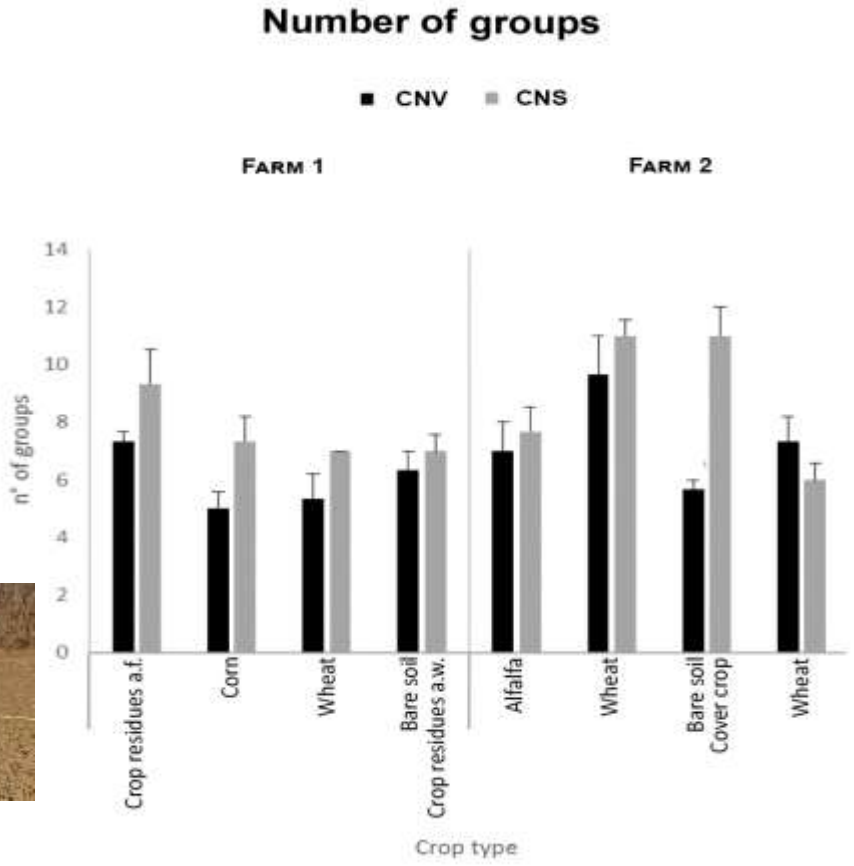




Control; rye (R); phacelia + white mustard (PM); Italian ryegrass + crimson clover + Persian clover (RCC); alfalfa (A) as permanent cover crop

From: Fiorini A., Remelli S., Boselli R., Mantovi P., Ardenti F., Trevisan M., Menta C., Tabaglio V. *Submitted – Photos by Tabaglio V.*





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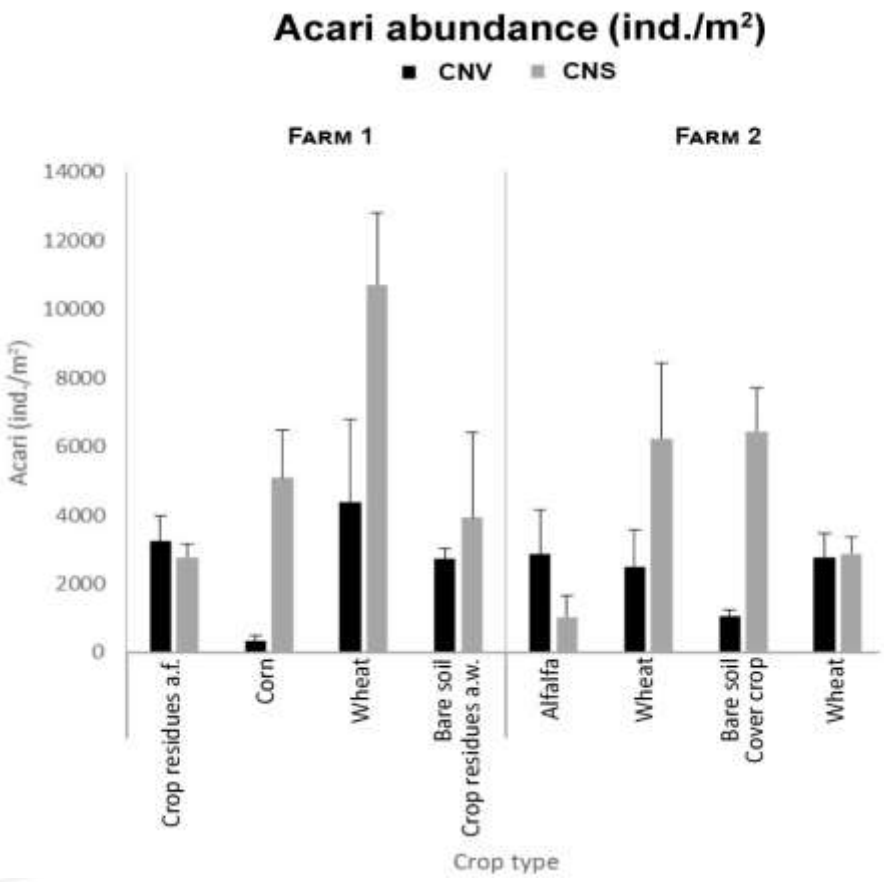
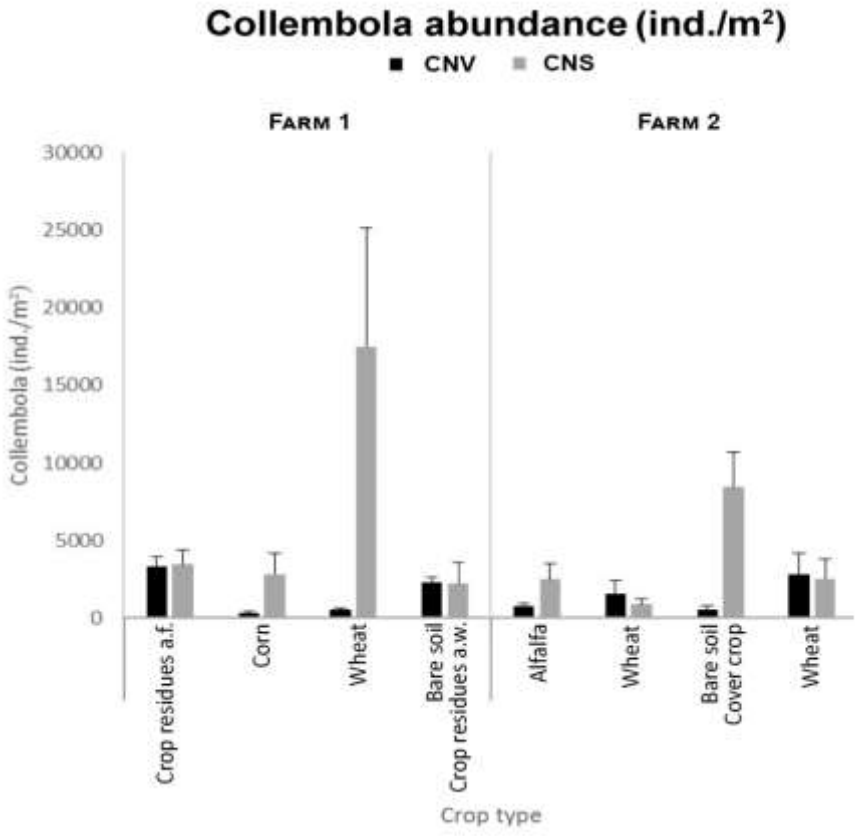
CNV: Conventional agriculture (tillage)
CNS: Conservation agriculture (no-till, cover crops)





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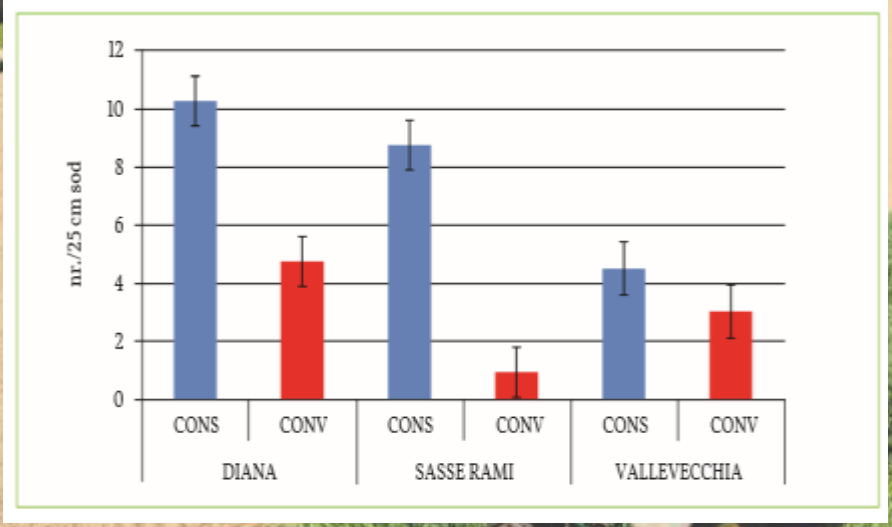
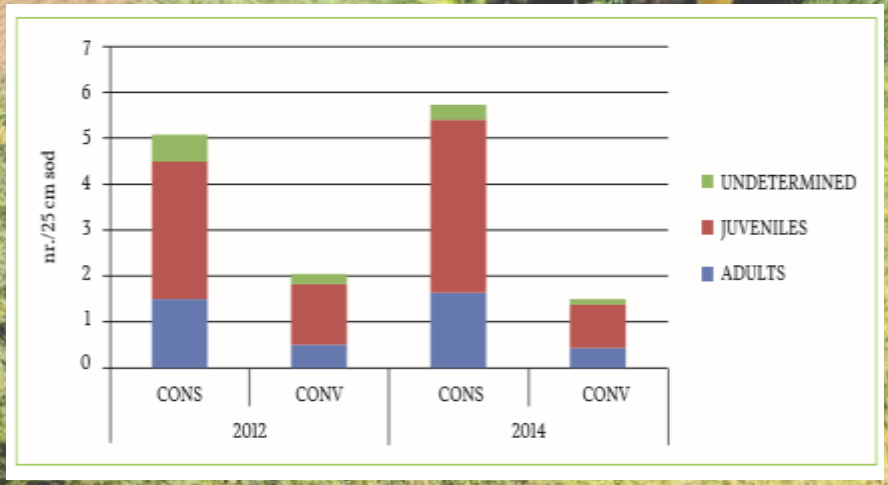
Conservation agriculture: no-till, cover crops (CONS) *vs* Conventional agriculture: tillage (CONV)



Earthworm density for the different managements on three farms (average for the two years 2012-2014).



Earthworm density for the different managements in the years of monitoring (2012-2014) for the different earthworm forms and stages (average of the three farms).

https://www.venetoagricoltura.org/2019/06/editoria/agricoltura-conservativa-8-anni-di-esperienze-in-veneto/

Photo by Tabaglio V.

Morphological adaptations to soil

- Small dimension
- Reduction of thickness of the exoskeleton and pigmentation
- Reduction or loss of eyes
- Reduced and more compact antennas and legs
- Reduction or loss of flying, jumping or running structures
- Reduced water-retention capacity

Adaptation to soil makes soil animals unable to leave it

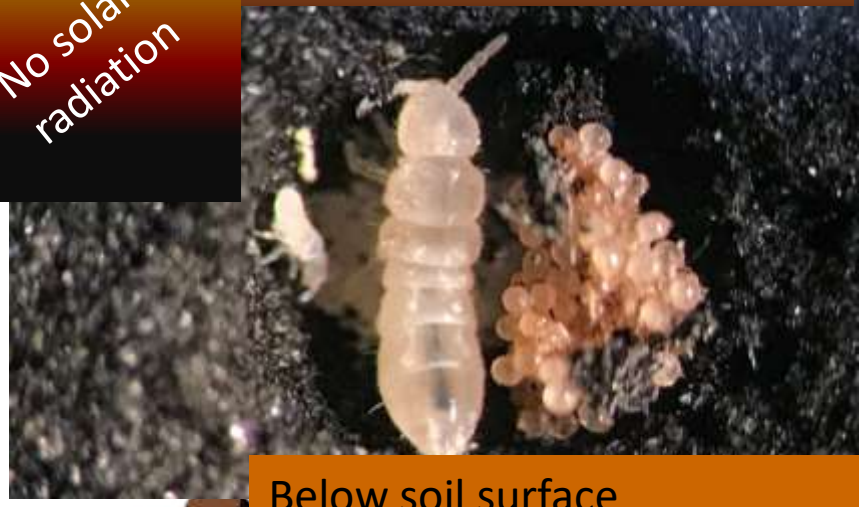
They are **more sensitive** to the change of physical and chemical parameters caused by natural or human activities.

QBS-ar index
Biological **Q**uality **I**ndex based on **S**oil micro-**ar**thropod community

On soil surface

From:https://petehillmansnaturephotography.files.wordpress.com/2017/07/orchesella-villosa.jpg

No solar radiation



Below soil surface

Eco-morphologic indices (EMIs) of edaphic microarthropod groups[a]

Group	EMI score
Protura	20
Diplura	20
Collembola	1–20
Microcoryphia	10
Zygentomata	10
Dermaptera	1
Orthoptera	1–20
Embioptera	10
Blattaria	5
Psocoptera	1
Hemiptera	1–10
Thysanoptera	1
Coleoptera	1–20
Hymenoptera	1–5
Diptera (larvae)	10
Other holometabolous insects (larvae)	10
Other holometabolous insects (adults)	1
Acari	20
Araneae	1–5
Opiliones	10
Palpigradi	20
Pseudoscorpiones	20
Isopoda	10
Chilopoda	10–20
Diplopoda	10–20
Pauropoda	20
Symphyla	20

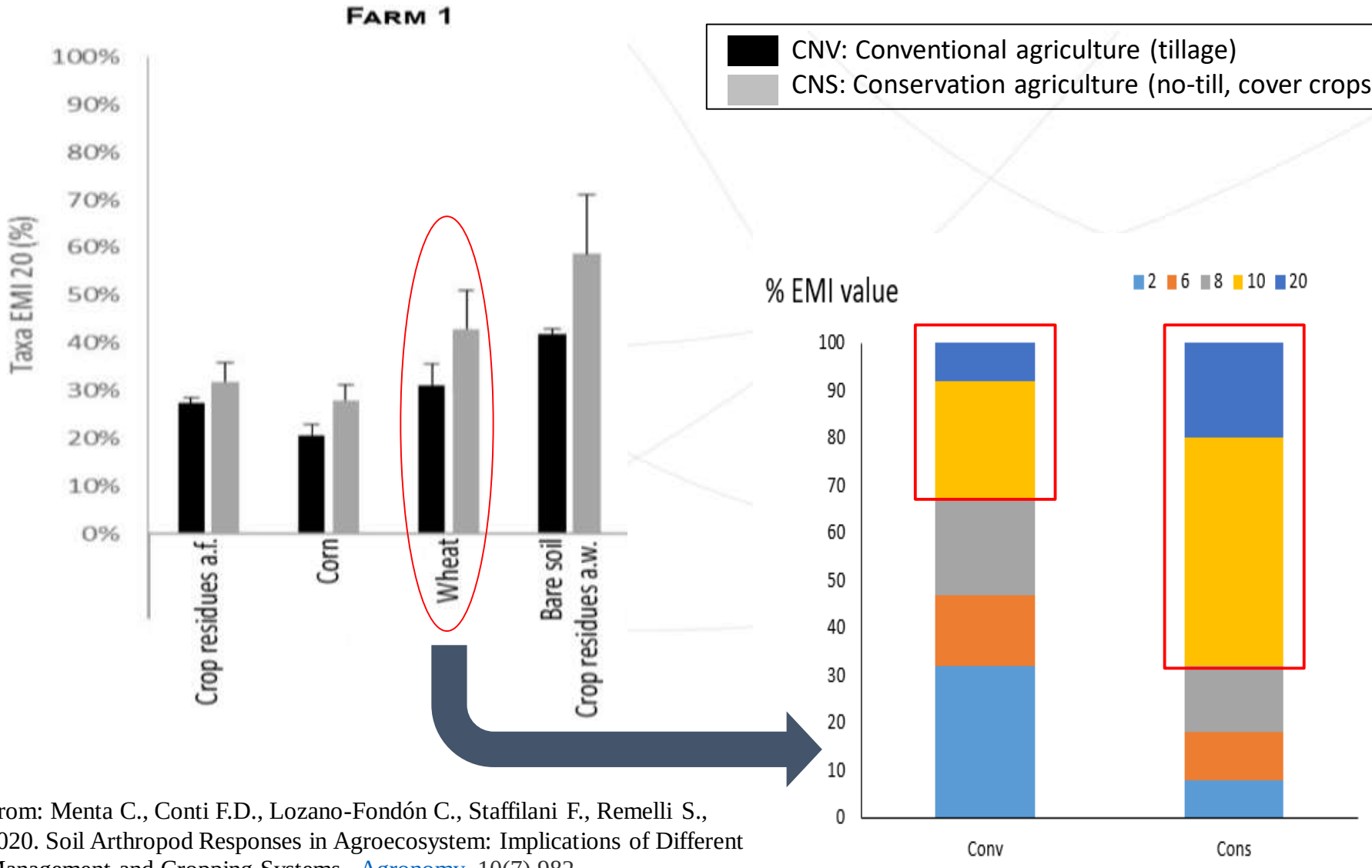
No adaptation
EMI = 1

Intermediate adaptation
EMI = 5-10

Total adaptation
EMI = 20

In relation to the degree of soil adaptation
EMI between 1-5/1-10/1-20

QBS-ar is the sum of the maximum EMI score for each group



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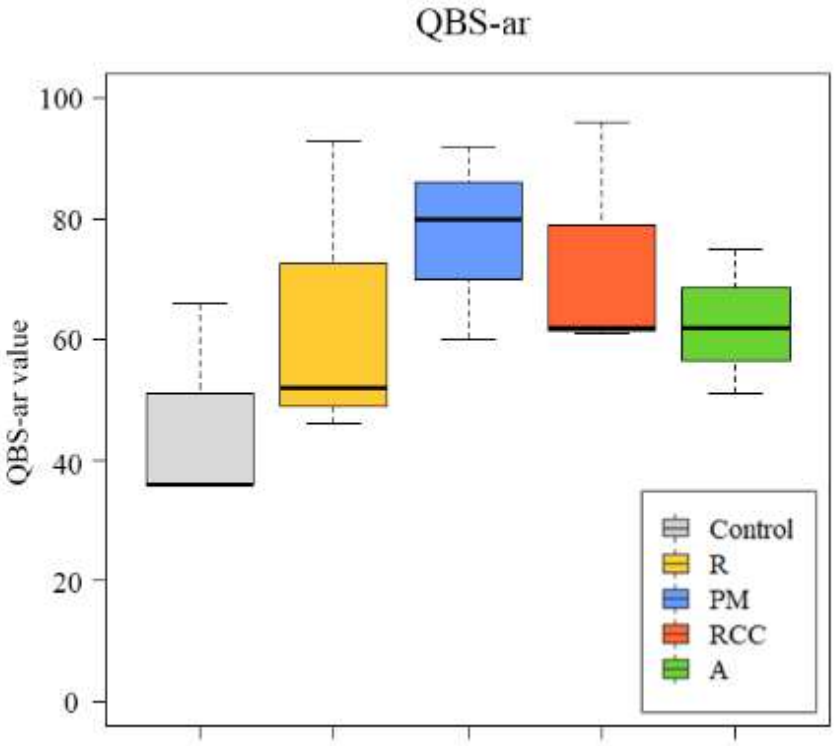

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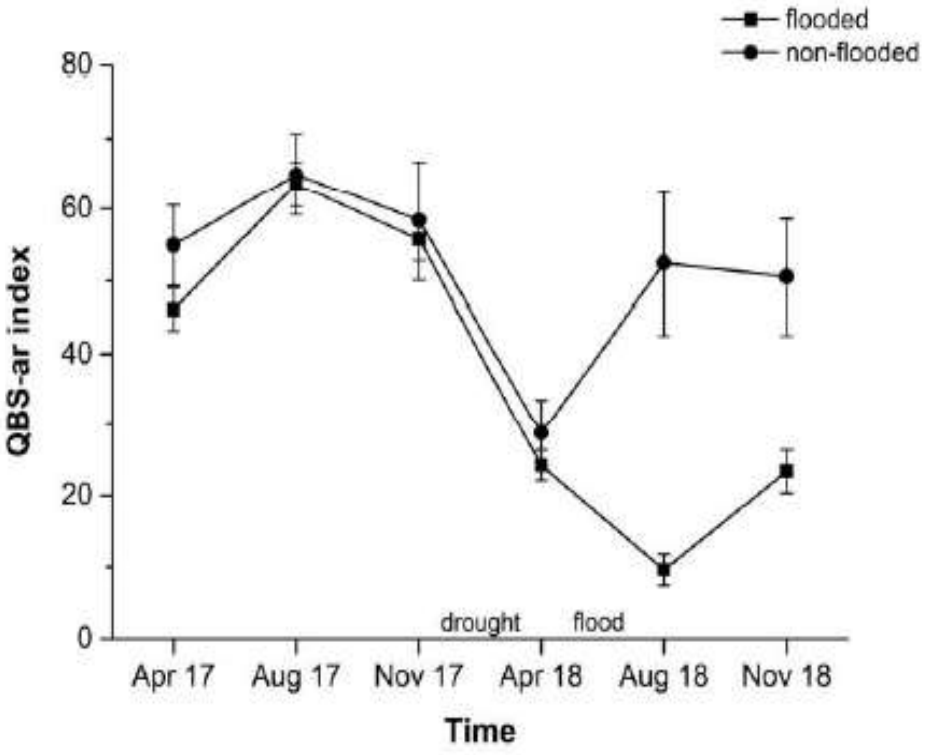
From: Lakshmi G., Beggi F., Menta C., Kumar N.K., Jayesh P., 2021. Dynamics of soil microarthropod populations affected by a combination of extreme climatic events in tropical home gardens of Kerala, India. Pedobiologia



498 data collected from 1993 to 2015

(from 40 papers published)

Considering land uses, 8 groups were identified:

Agriculture lands (several crops, till and no-tillage, organic, conventional)

Woods and forests (several species), Mediterranean maquis, bushes

Plant **remediation**, **restored** pit mine, peri-urban uncultivated areas, etc.

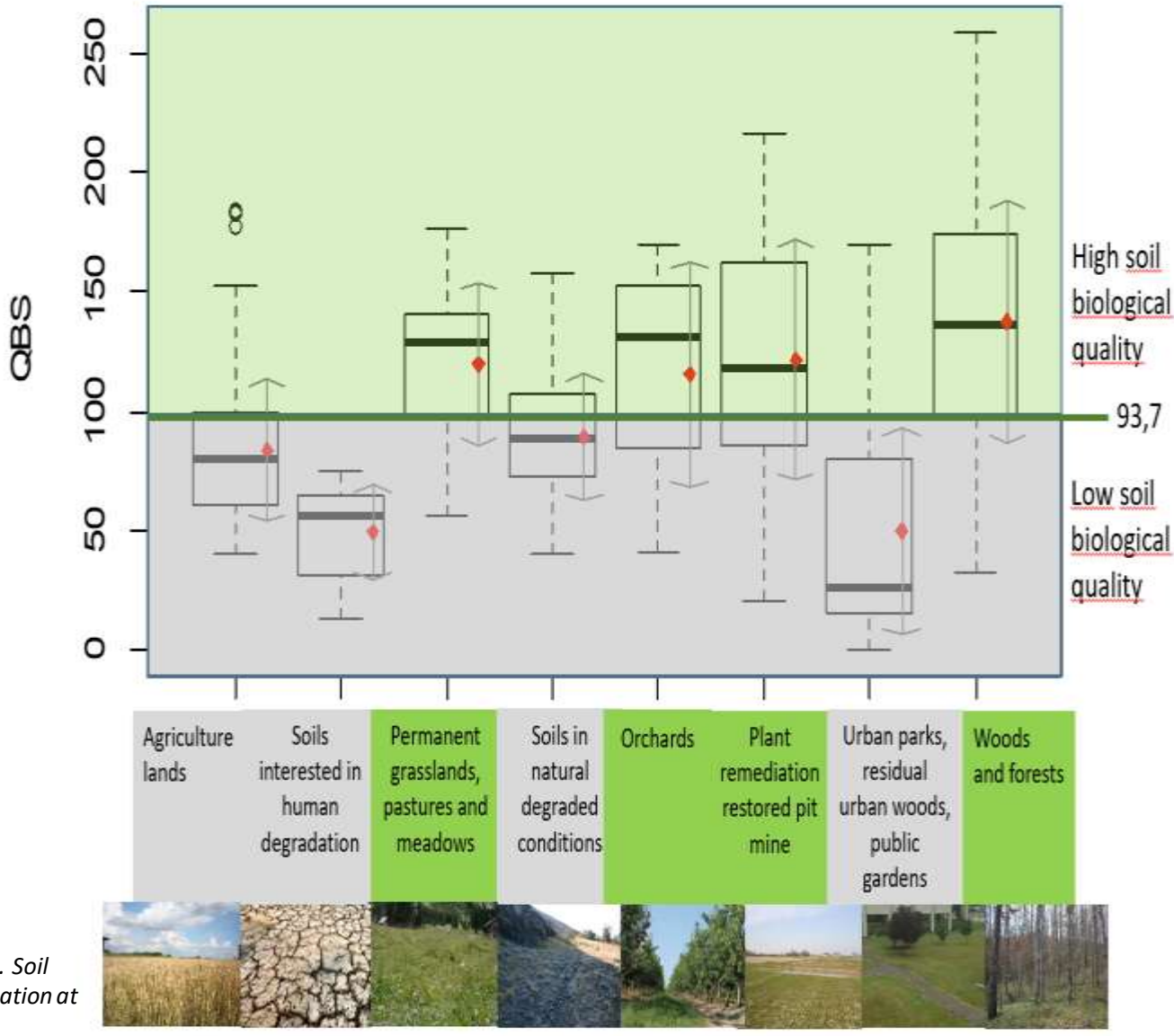
Soils in **natural degraded** conditions (e.g. serpentine soils, soil in the brûlé etc.)

Permanent **grasslands**, pastures and meadows

Orchards

Urban parks, residual urban woods, public gardens, botanical gardens, home gardens

Soils affected by human **degradation**.



From: Menta C., Conti F.D., Pinto S., Bodini A., 2018. Soil Biological Quality index (QBS-ar): 15 years of application at global scale. Ecol. Indic. 85, 773-780.

Thank you for your attention

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