Soil fauna as a useful tool for assessing the conservation status of riparian areas

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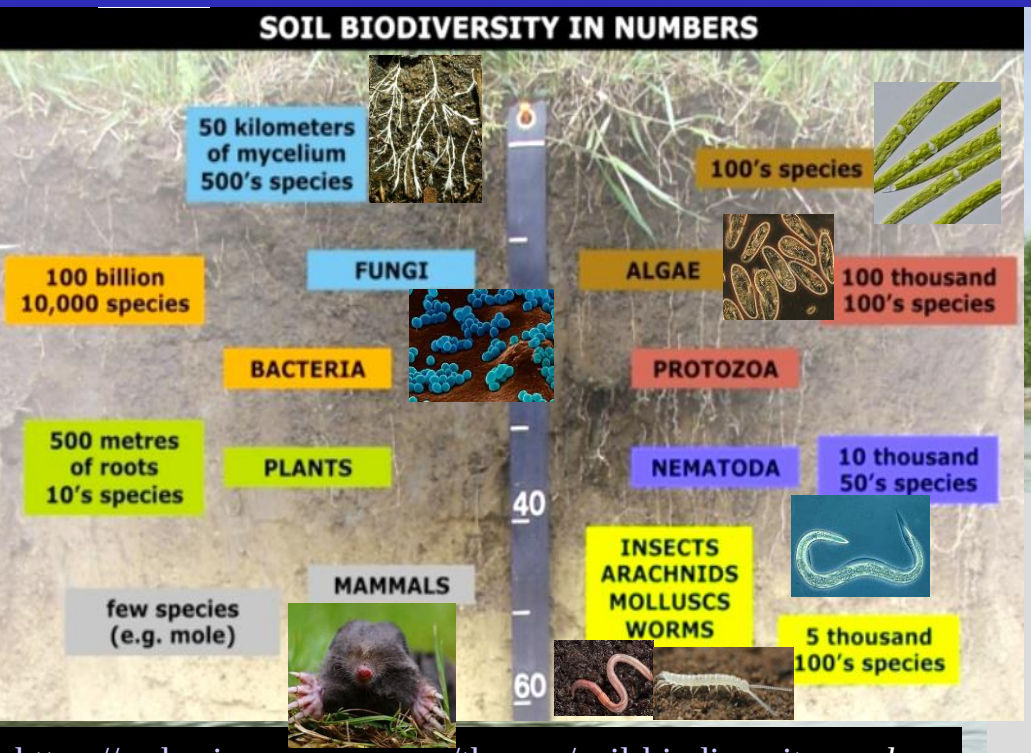
From: Springtails: Facts, Identification, and How to Control - Pest Wiki

From: https://balconygardenweb-lhnfx0beomqvnhspx.netdna-ssl.com/wp-content/uploads/2019/11/earthworm.jpg.webp

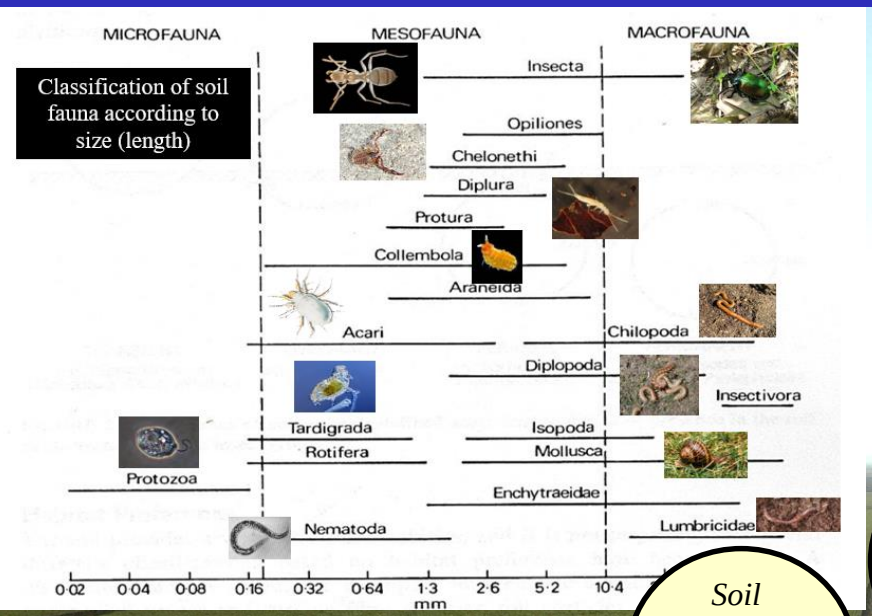
From: Oribatid Mite - BugGuide.Net

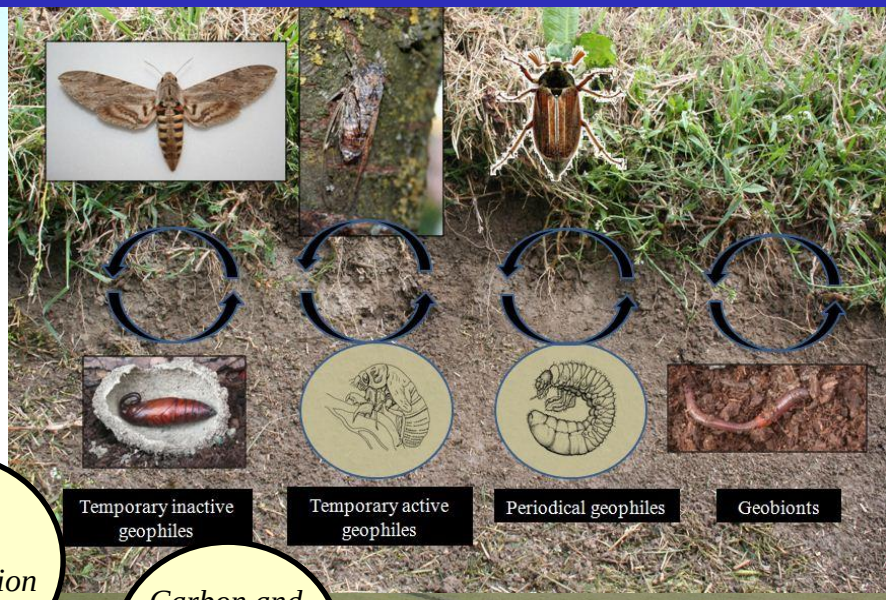
From: All about Protura - A Chaos of Delight



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.



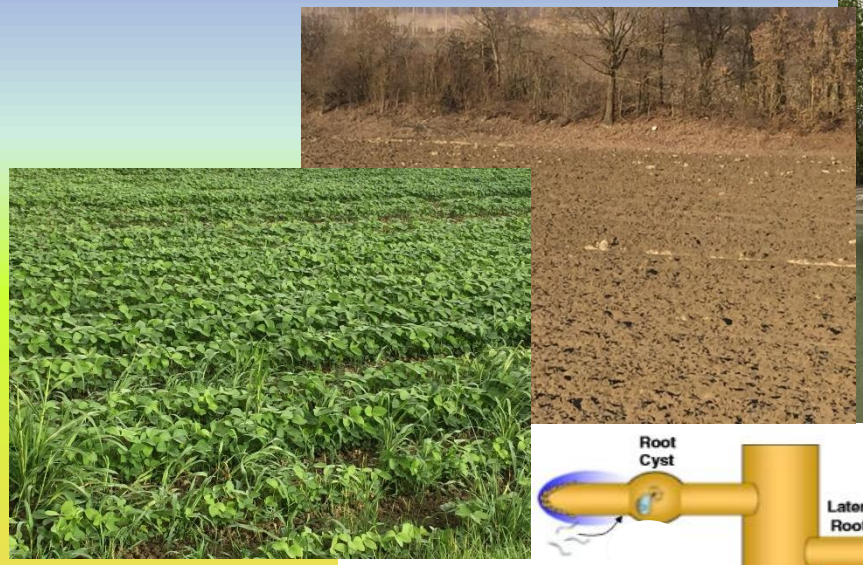


FUNCTIONS of SOIL FAUNA

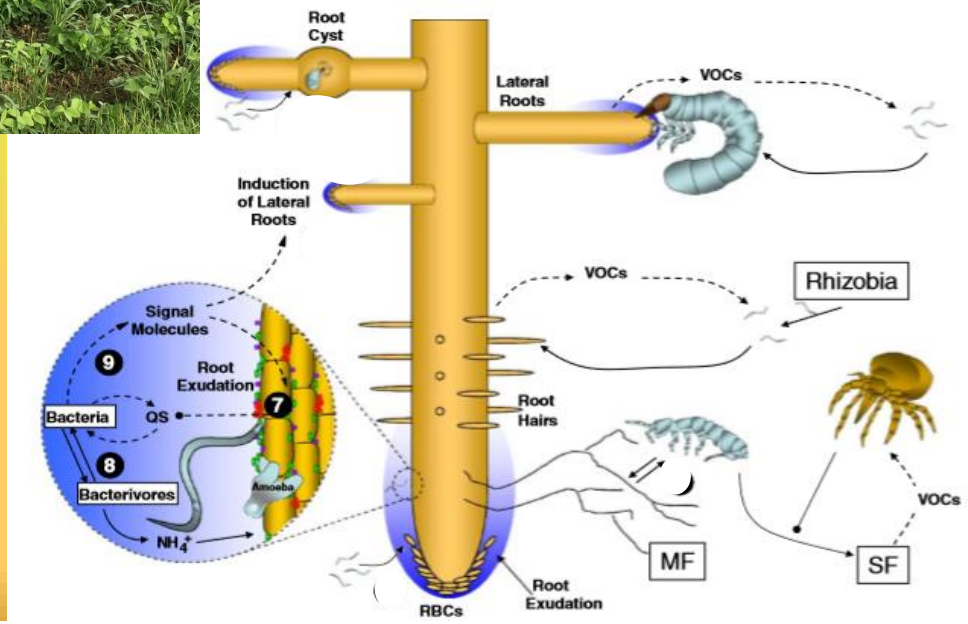
- *Organic matter decomposition*
- *Carbon and nutrient regulation*
- *Nutrient cycling*
- *Biocontrol of soil-borne phytopathogens*
- *Waste recycling and soil decontamination*
- *Soil pore creation*
- *Water flow regulation*
- *Soil aggregate formation*

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



Specific behaviour (e.g. aggregation)



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.

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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


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VT


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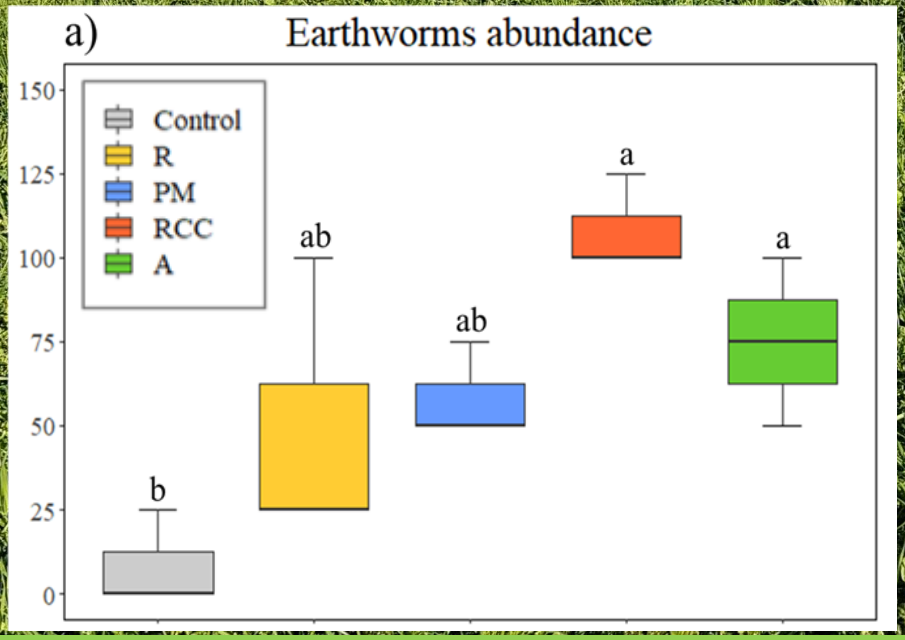
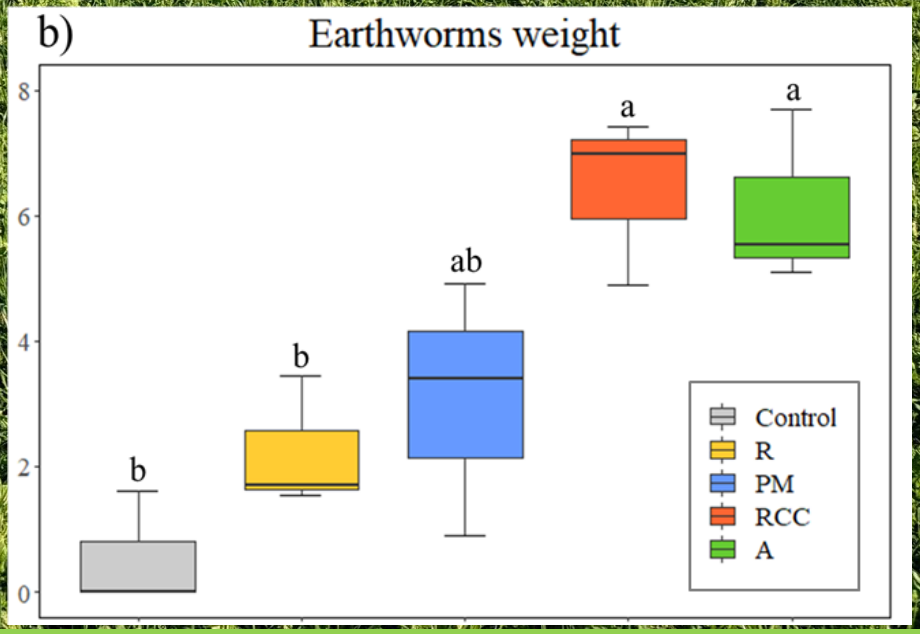
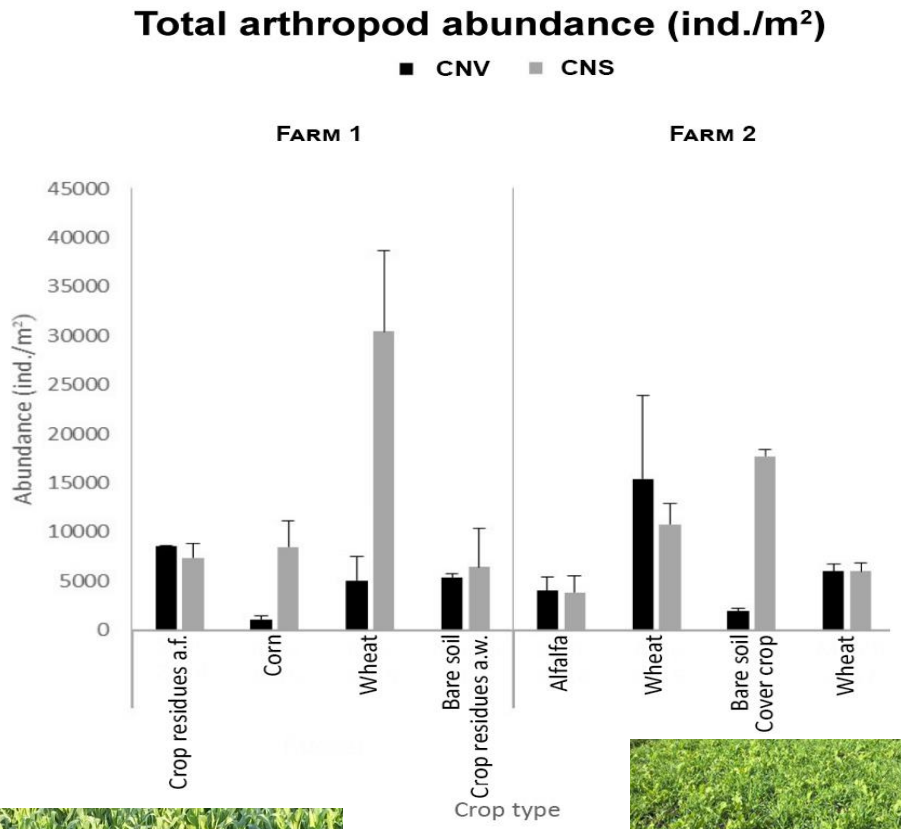


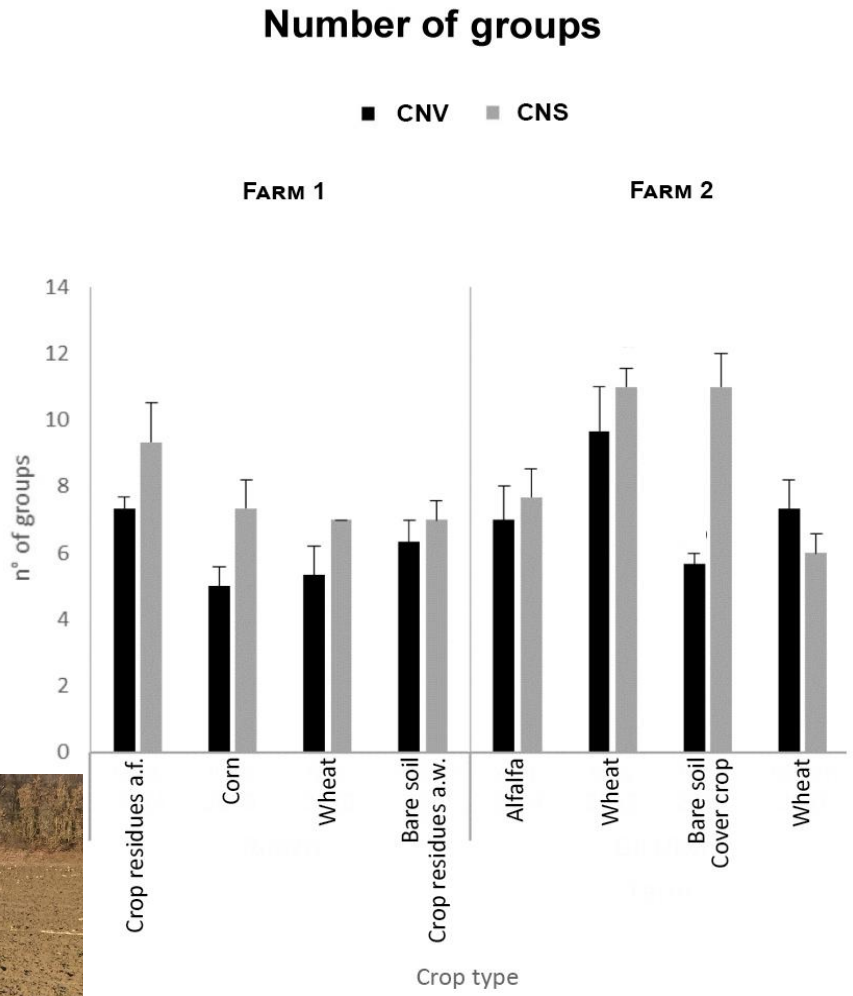


Control; rye (R); phacelia + white mustard (PM); Italian ryegrass + crimson clover + Persian clover (RCC); alfalfa (A) as permanent cover crop

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

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





Menta C., Conti F.D., Lozano-Fondón C., Staffilani F., Remelli S., 2020. Soil Arthropod Responses in Agroecosystem: Implications of Different Management and Cropping Systems Agronomy, 10(7),982

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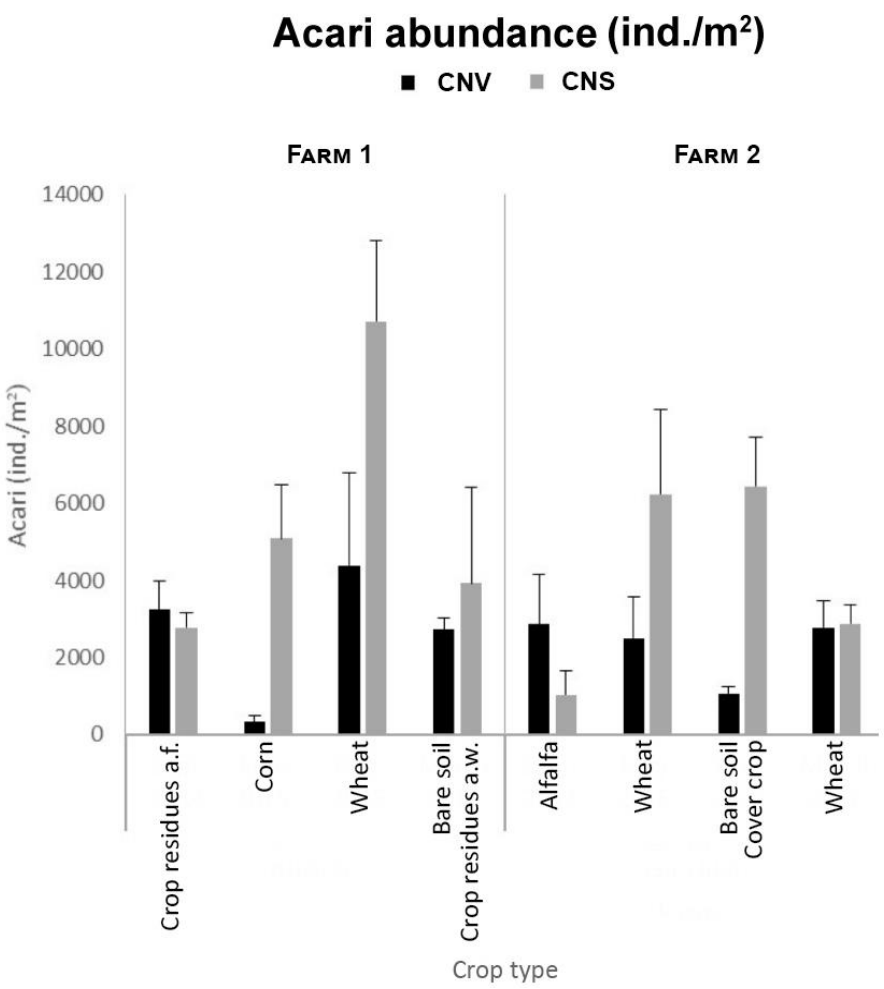

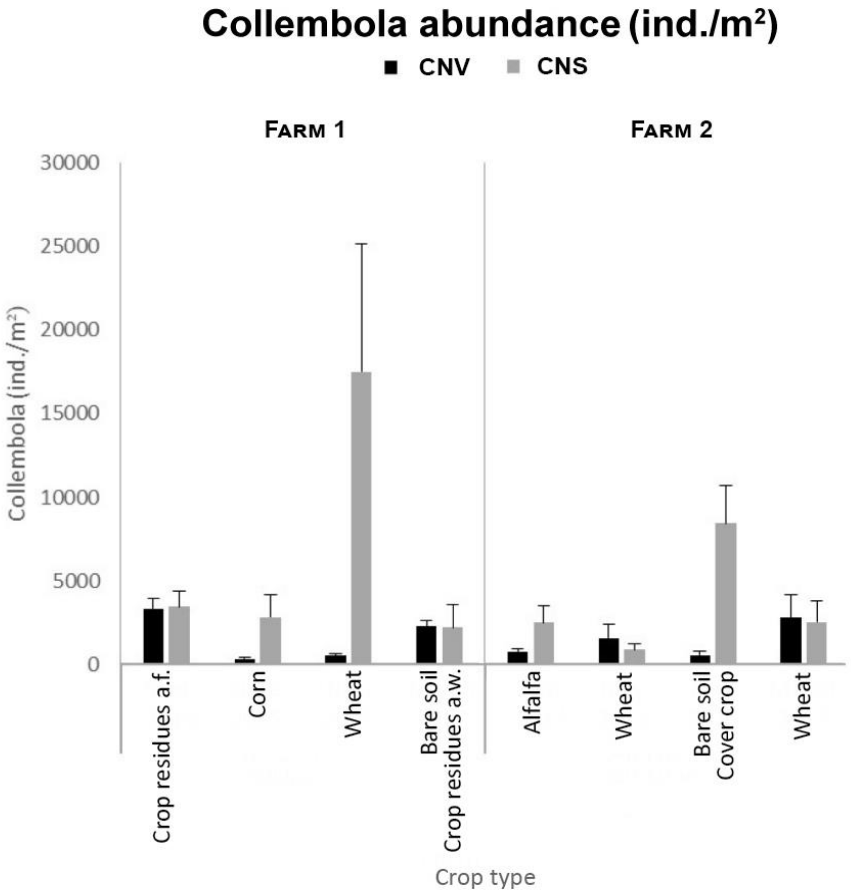

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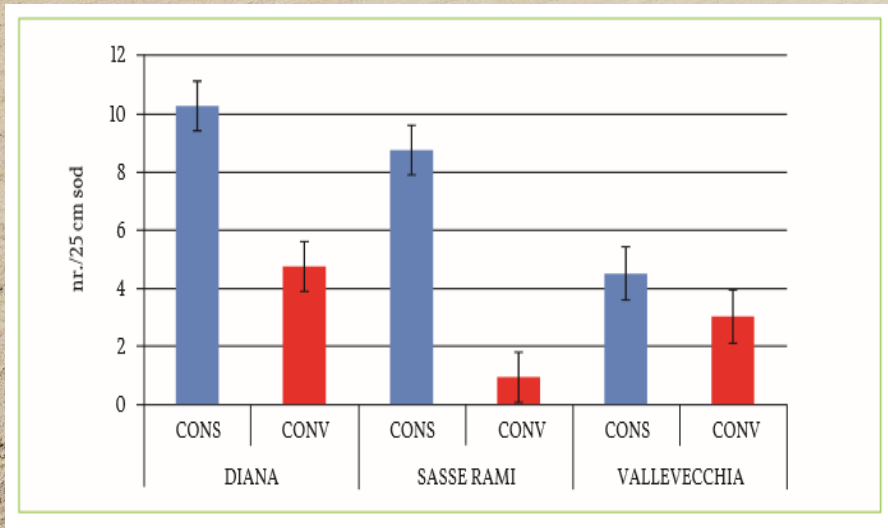
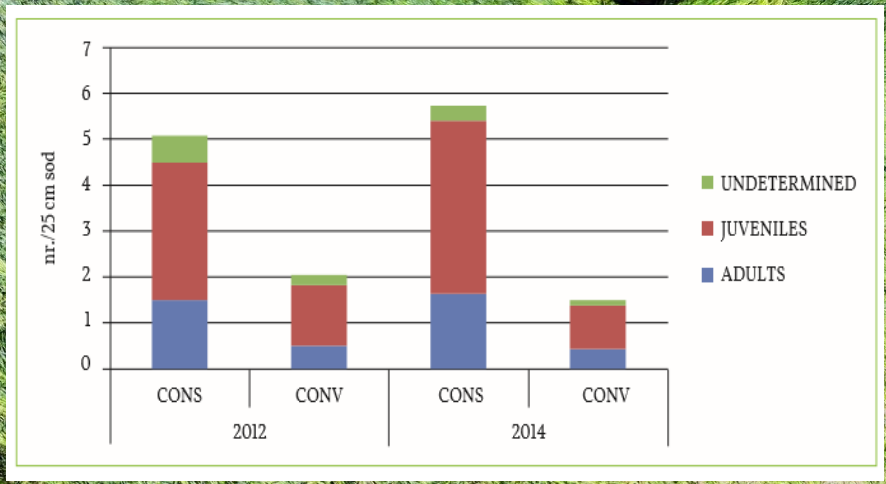
Conservation agriculture: no-till, cover crops (CONS) *vs* Conventional agriculture: tillage (CONV)



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



Earthworm density for the different management methods 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

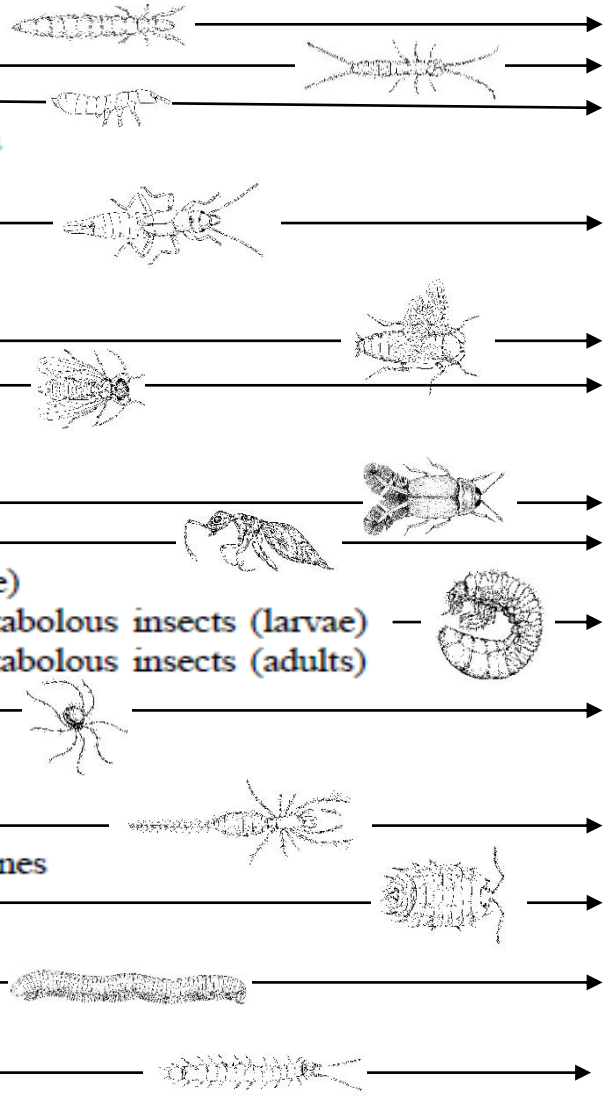
From:https://petehillmansnaturephotography.files.wordpress.com/2017/07/orchesella-villosa.jpg

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 ranges between 1-5/1-10/1-20

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

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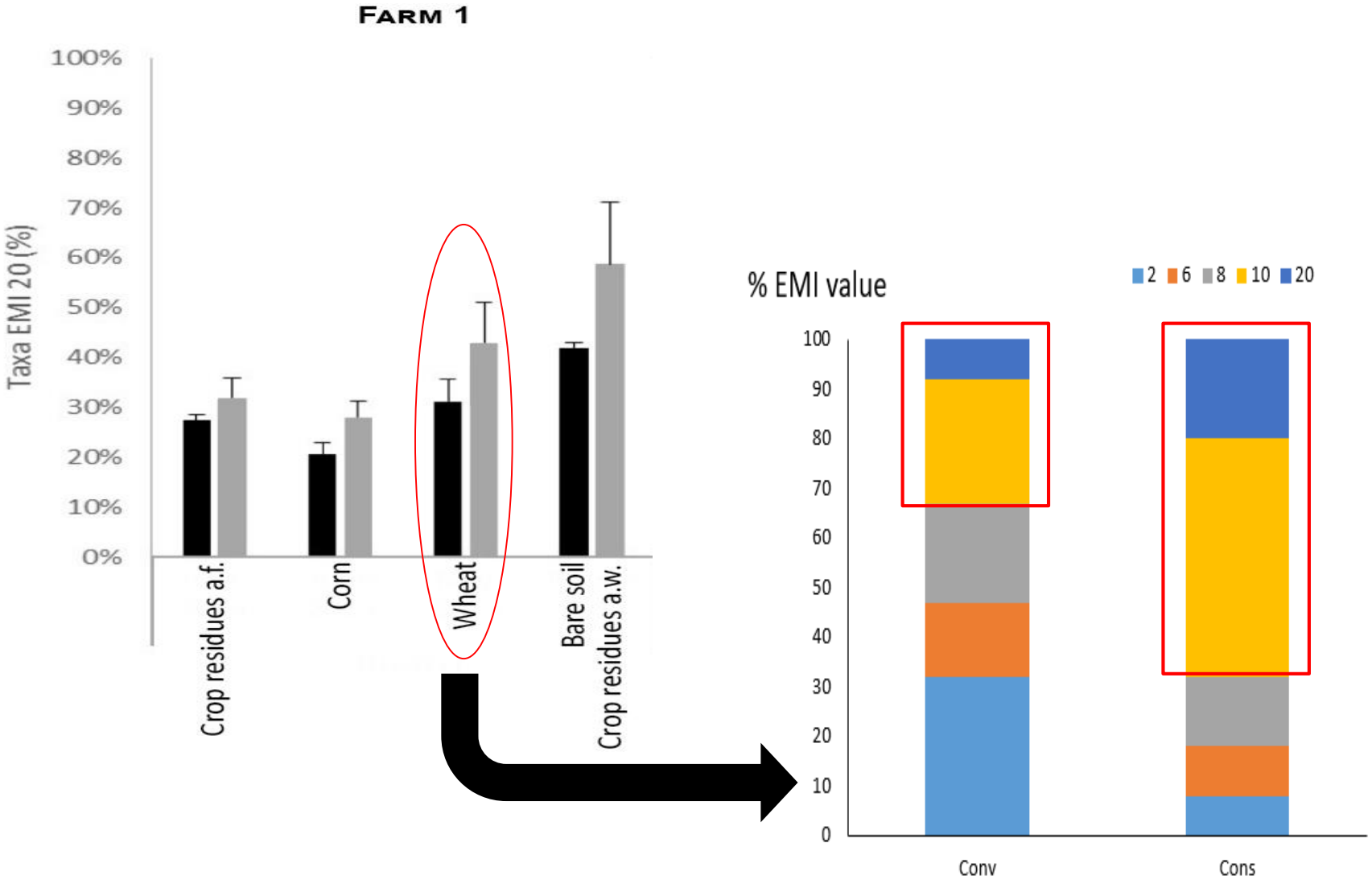
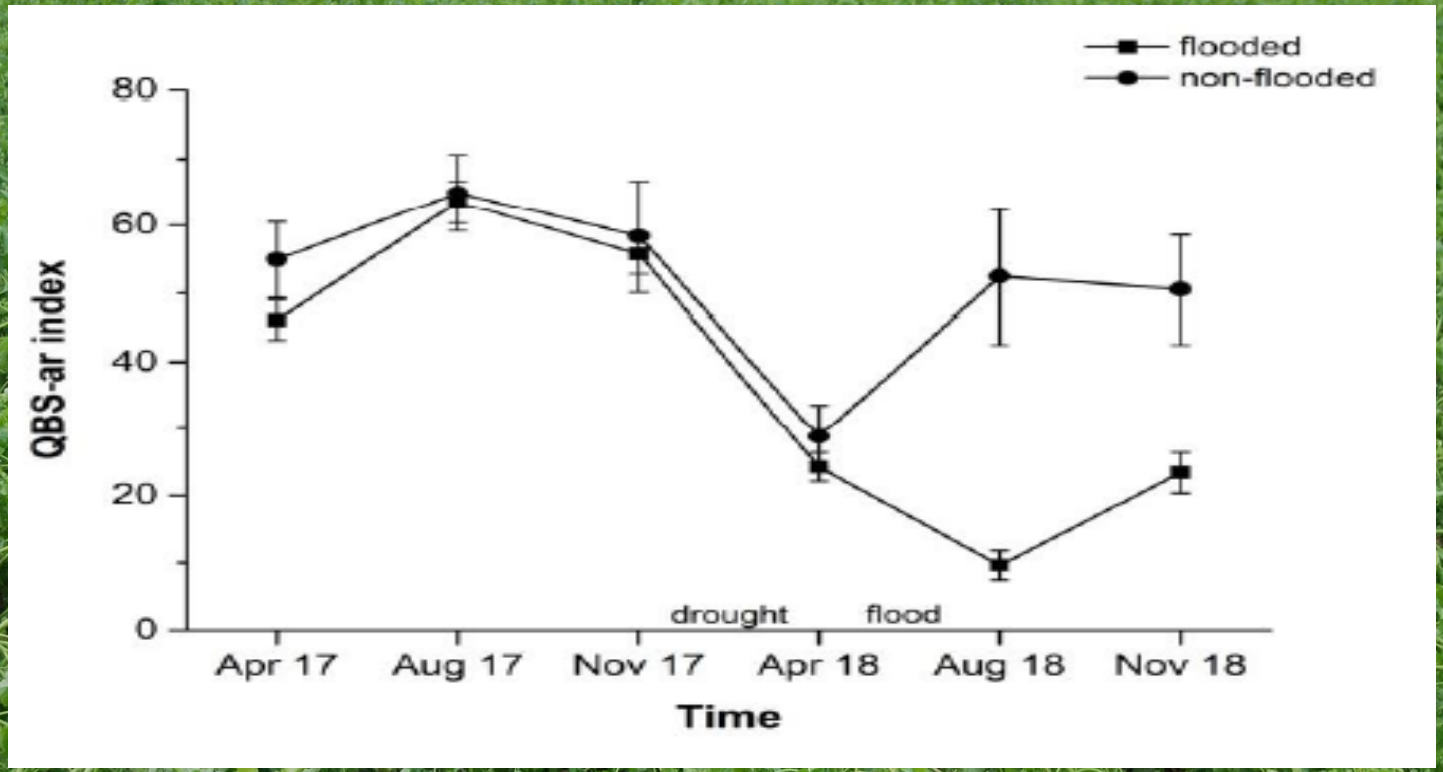


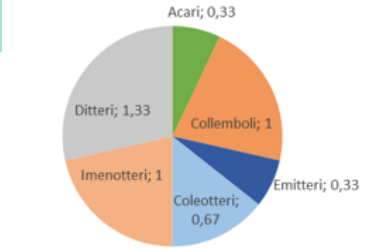


Lakshmi G., Beggi F., Menta C., Kumar N.K., Jayesh P., 2021. Dynamics of soil microarthropod populations affected by a combination of extreme climatic events in tropical home gardens of Kerala, India. Pedobiologia - Journal of Soil Ecology, 85-86, n. 150719.

ALBA (Albarella Laboratorio Biodiversità Ambiente) project

Scientific coordinator professor A. Zanella TESAF, Padova University and Ass. Comune Isola di Albarella (Rovigo)

1



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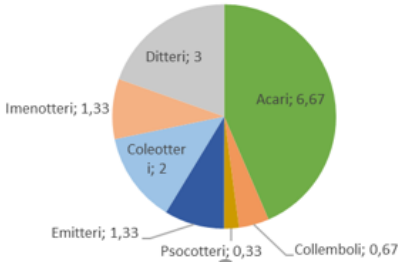

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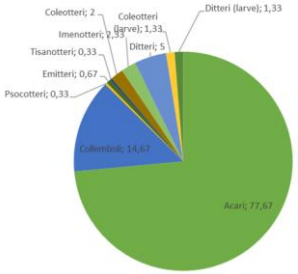

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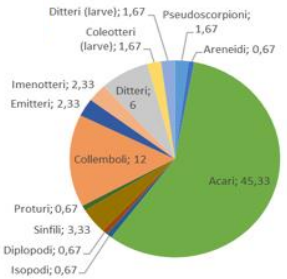

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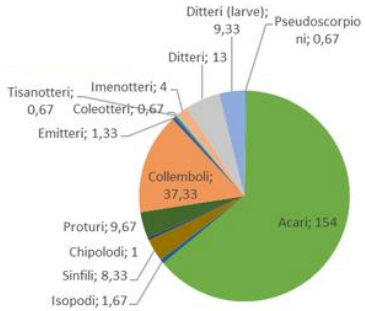
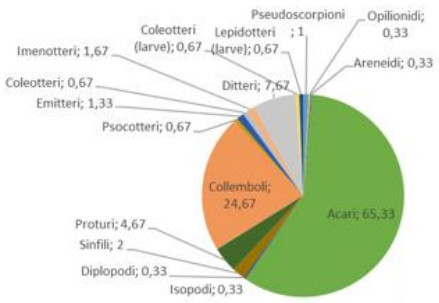
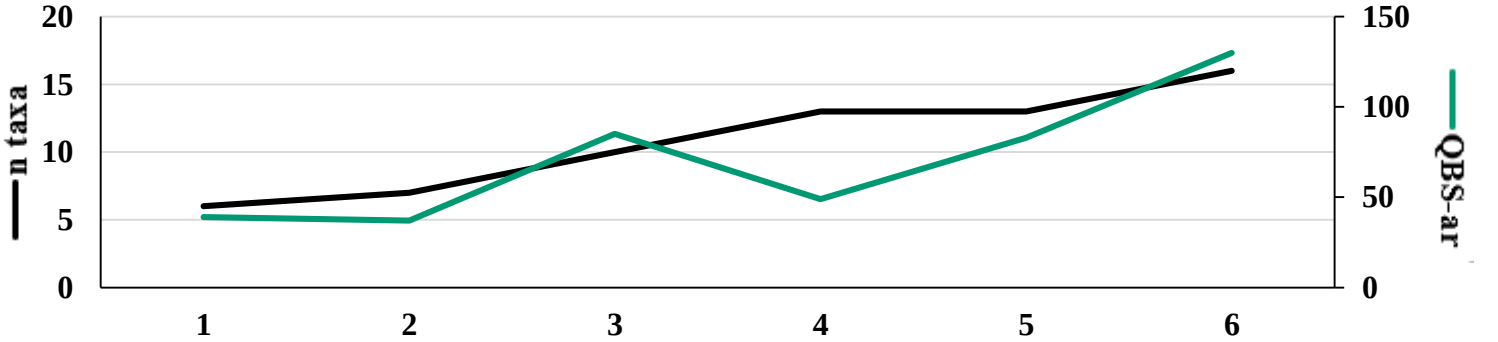


Increase of vegetation cover

6





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Working Group

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https://www.scienzadelsuolo.org/QBS-ar.php

Thank you for your attention

Email: cristina.menta@unipr.it