



SOiLO-LiVE

SOIL BIODIVERSITY AND FUNCTIONALITY
OF MEDITERRANEAN OLIVE GROVES

July 11th 2023

European Commission

DG Agriculture and Rural Development

Civil Dialogue Group on Olives

Brussels

Antonio J Manzaneda

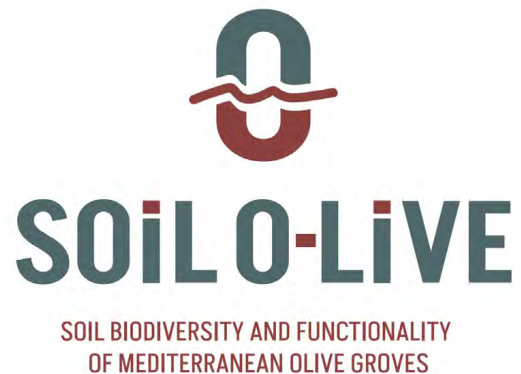
UJa.
Universidad de Jaén



Instituto Universitario
de Investigación en
Olivar y Aceites de Oliva



Funded by the
European Union



Horizon Europe Programme



**Call: HORIZON-MISS-2021-SOIL-02-03 —
Linking soil health to nutritional and safe food**

Project Information

SOIL O-LIVE

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€ 6 988 660,00

EU contribution

€ 6 988 660,00

Coordinated by

UNIVERSIDAD DE JAEN

 Spain

SOIL O-LIVE CONSORTIUM



UJA
Universidad de Jaén



ROMA TRE
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National Research Council of Italy



University of Basel

JRC
EUROPEAN COMMISSION

UNE
Normalización Española

Deoleo[®]
The Olive Oil Company.



INTERNATIONAL OLIVE COUNCIL

SOIL O-LIVE
SOIL BIODIVERSITY AND FUNCTIONALITY OF MEDITERRANEAN OLIVE GROVES

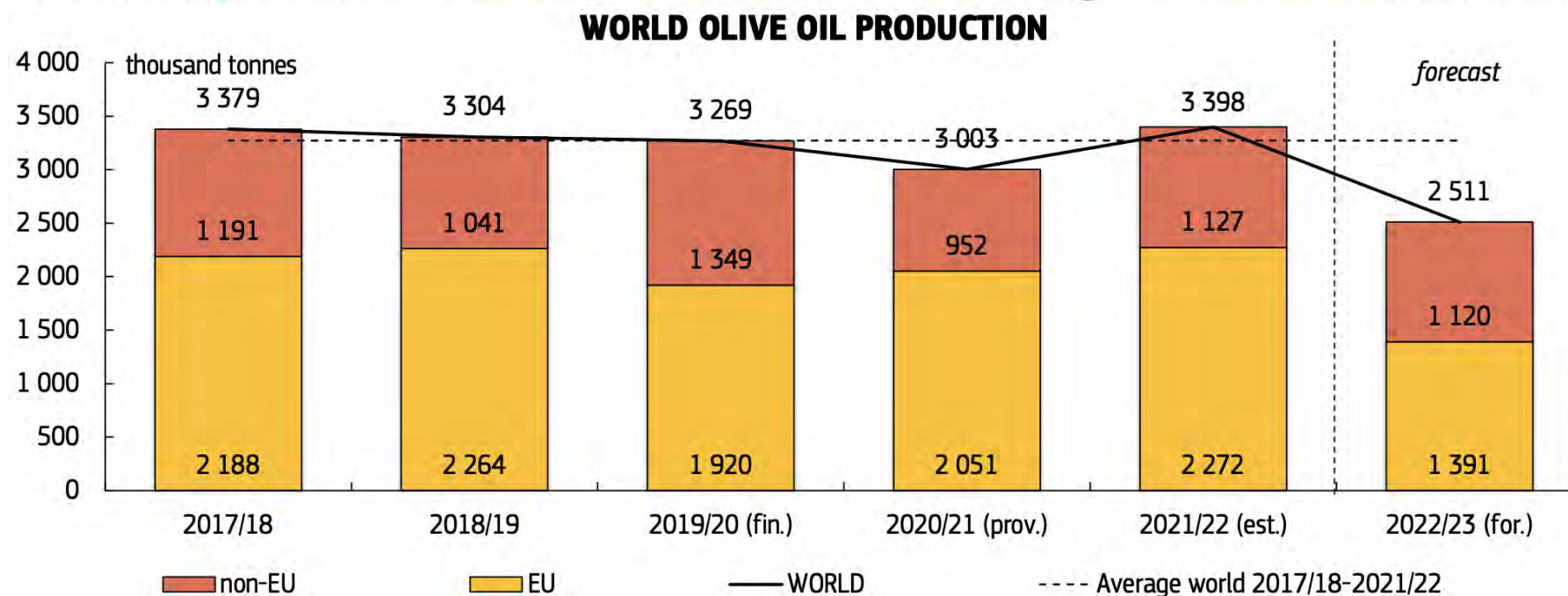


Olive is the most prominent and the most socioeconomically important fruit tree in Europe, especially across the Mediterranean Basin.

Olive provides edible fruits and, more importantly, high-quality storable oil which is an essential part of the Mediterranean diet



World production below average in 2022/23...



Source: International Olive Council, Member States declarations. Note: excl. pomace oil.

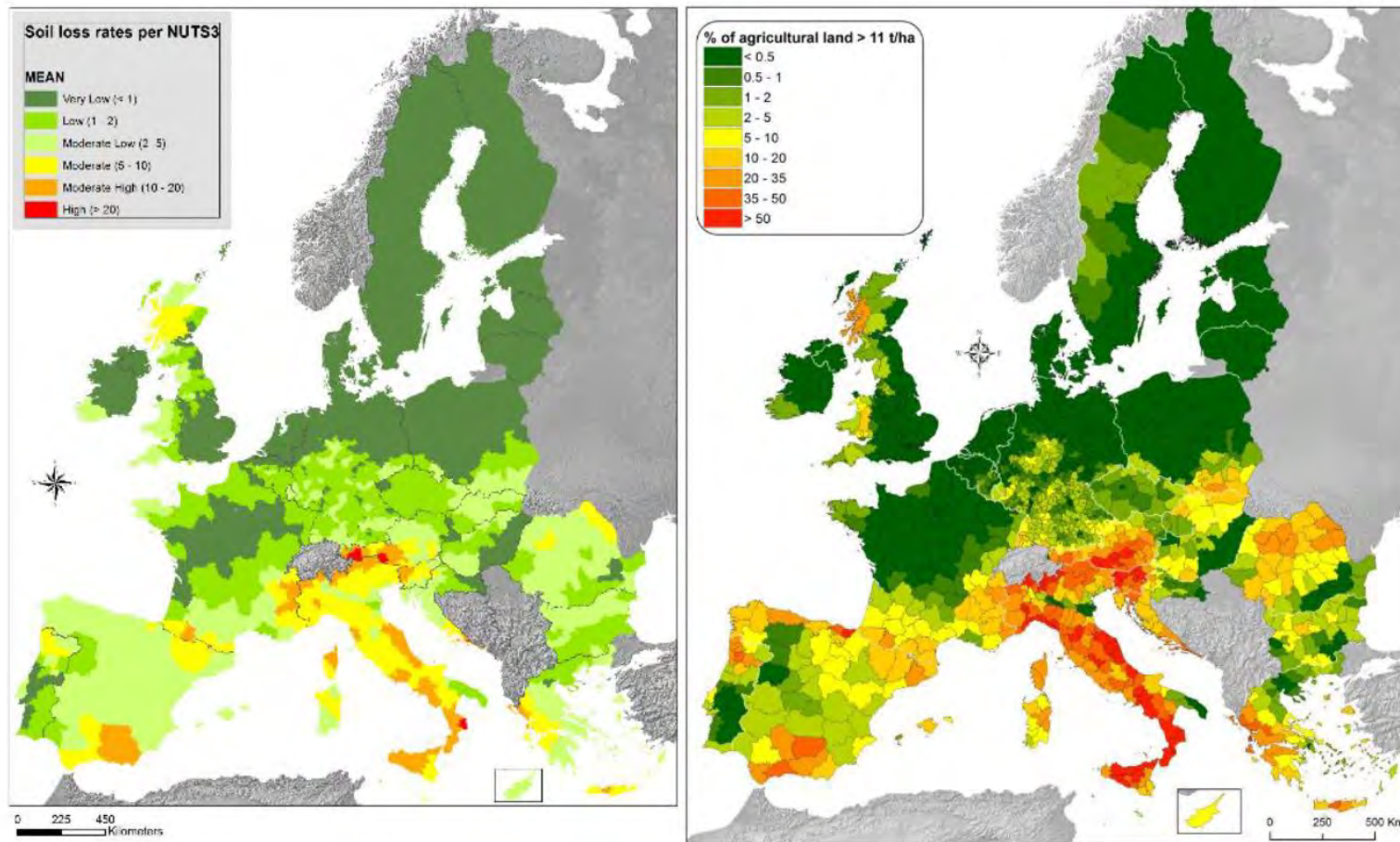
<u>2022/23 vs. 2021/22</u>	
WORLD	-26%
EU	-39%
non-EU	-1%

<u>2022/23 vs. 5-y average</u>	
WORLD	-23%
EU	-35%
non-EU	-1%



To reach such production, around **six millions of hectares**, predominantly in the EU Mediterranean countries, are dedicated to cultivating olives trees, combining organic, traditional, intensive high-density intensive groves





Soil erosion by water (tonnes per ha per year), 2010, EU-28, NUTS 3 (left) and Severe soil erosion in agricultural lands (right) - % of agricultural land with > 11t/ annually.

Source: Joint Research Centre, European Commission



**Poor land management is extensive across the cultivation area. Absence of plant cover along the whole year
There is a massive use of phytochemicals is used since late 70's for pest control and productivity**



J. Calero



J. Calero



[Credit: José Guerrero Casado](#)
[@PepeGuerre](#)



29-47 tones of soil x ha yr⁻¹
29- 40% of fertile soil



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journal homepage: www.elsevier.com/locate/agee



Quantifying the effect of historical soil management on soil erosion rates in Mediterranean olive orchards

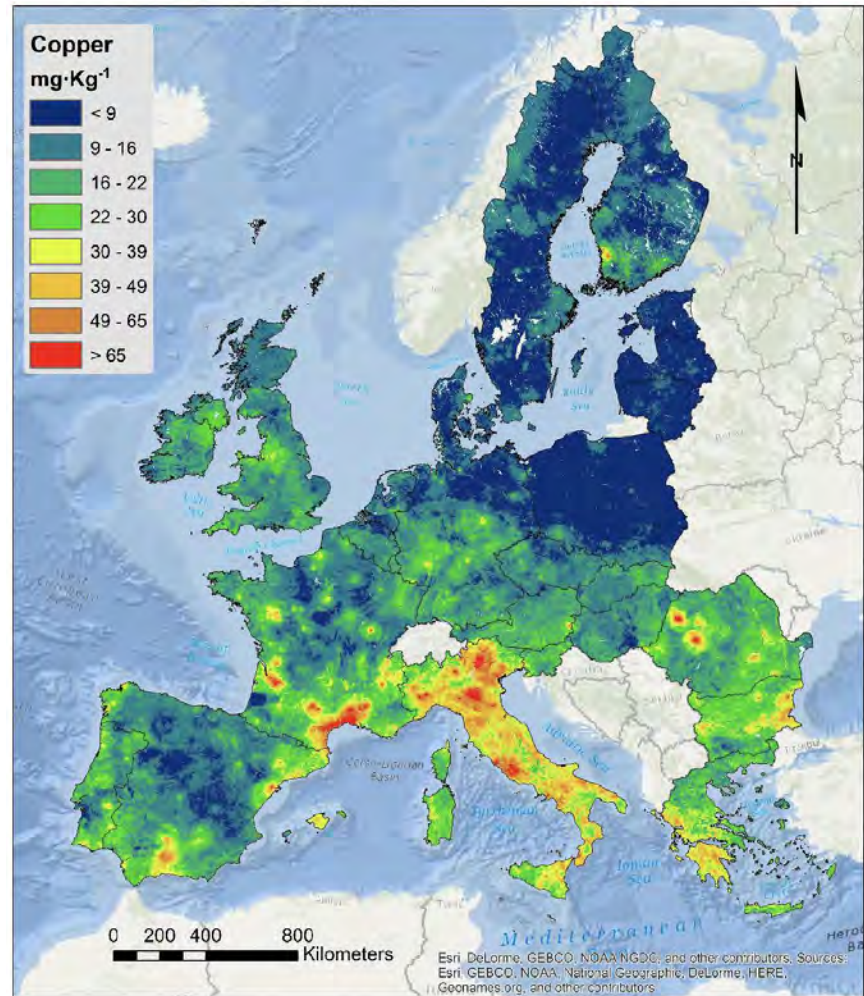
Tom Vanwallegghem^{a,*}, Juan Infante Amate^b, Manuel González de Molina^b, David Soto Fernández^b, José Alfonso Gómez^a

^a Instituto de Agricultura Sostenible, CSIC (Córdoba), Apartado 4084, 14080 Córdoba, Spain
^b Universidad Pablo de Olavide (Sevilla), Spain



Credit. Antonio Estévez

Copper distribution in European Union



21,682 LUCAS soil samples for an analysis of copper(Cu) in EU

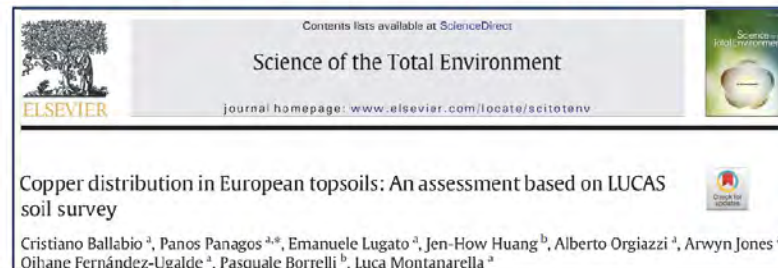
Copper (Cu) is **correlated** to soil properties(pH, texture, Organic Carbon), climate, geology and management.

Vineyards has the highest mean Cu concentration: 49.3 mg kg⁻¹. Cu is relatively high also in **olive groves**(33.5 mg kg⁻¹) and **orchards**(27.3 mg kg⁻¹) [**Threshold: 100 mg kg⁻¹**]

Cu highest concentration is found in **wet areas** due to **frequent fungicide treatments**

Similar developments for Mercury (2021).

Under development: Cadmium, Zinc, Arsenic



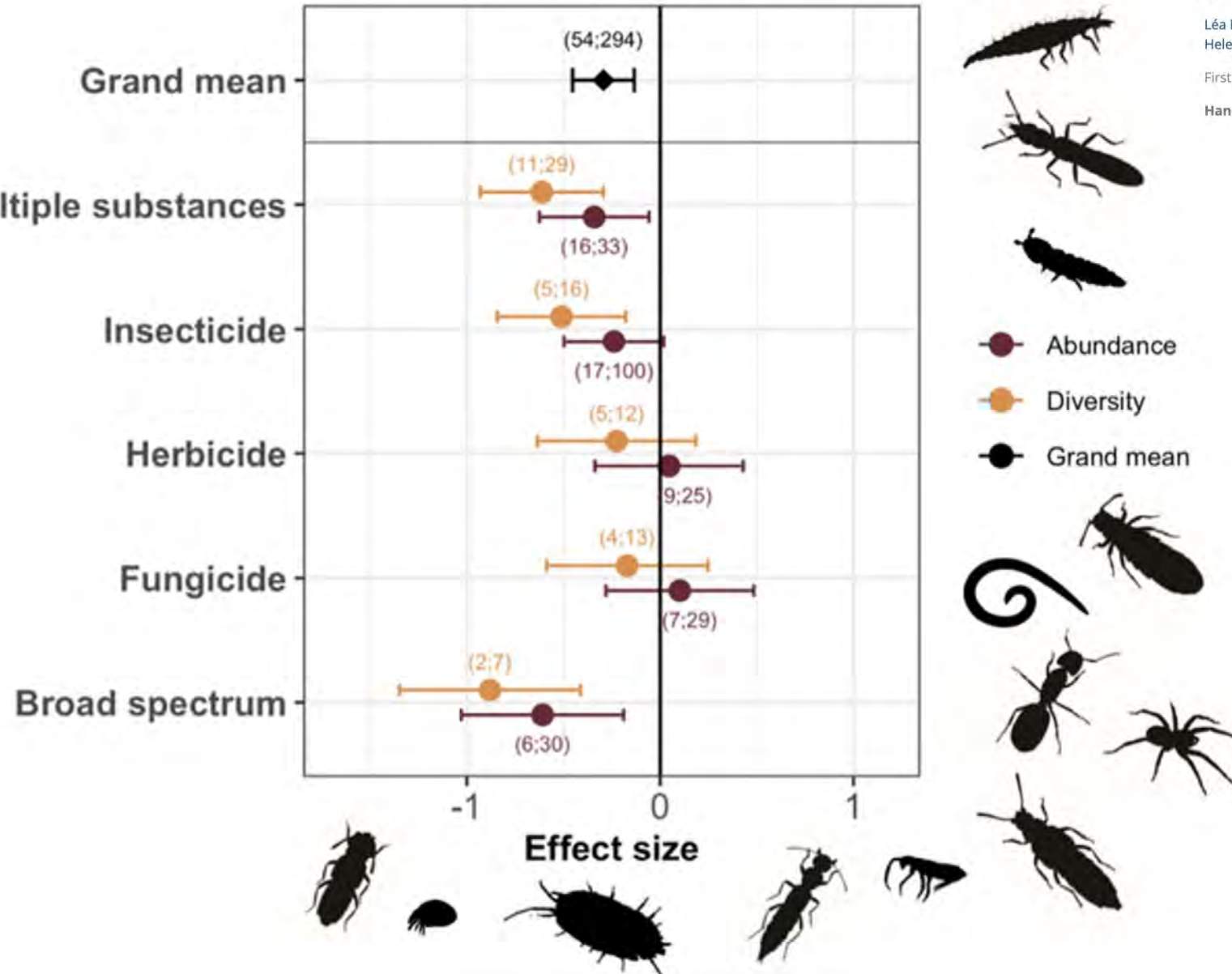
Pesticide effects on soil fauna communities—A meta-analysis

Léa Beaumelle , Léa Tison, Nico Eisenhauer, Jes Hines, Sandhya Malladi, Céline Pelosi, Lise Thouvenot, Helen R. P. Phillips

First published: 07 June 2023 | <https://doi.org/10.1111/1365-2664.14437>

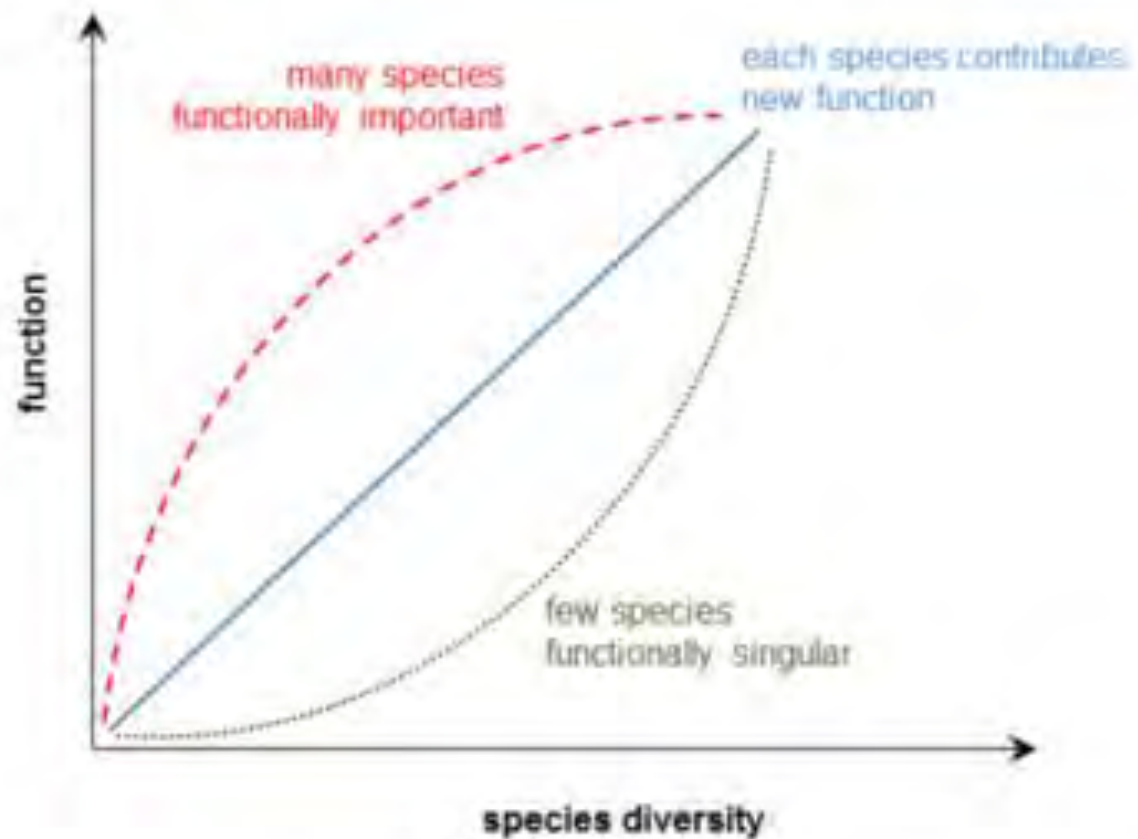
Handling Editor: Margaret Stanley

Multiple substances



"Healthy and nutrient-rich soil that supports plant growth and biodiversity."

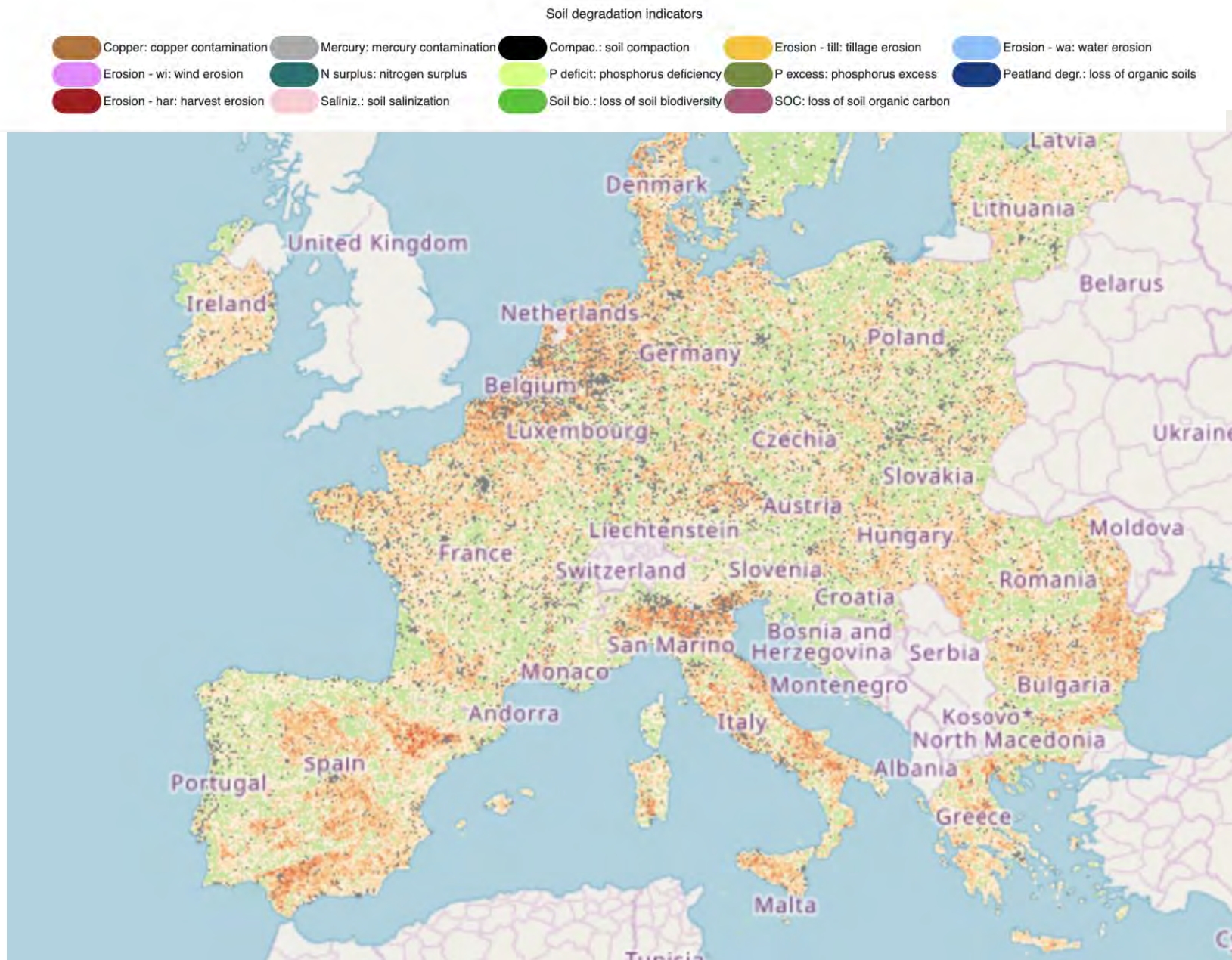




Nutrient recycling
Soil Fertility
Pest Control
Water quality
Carbon Stock



Figure 2.2: Theoretical relationship between diversity and function (Image: A Le Brocq, after Naeem & Wright 2003)



Proportion of land affected by soil degradation in the EU



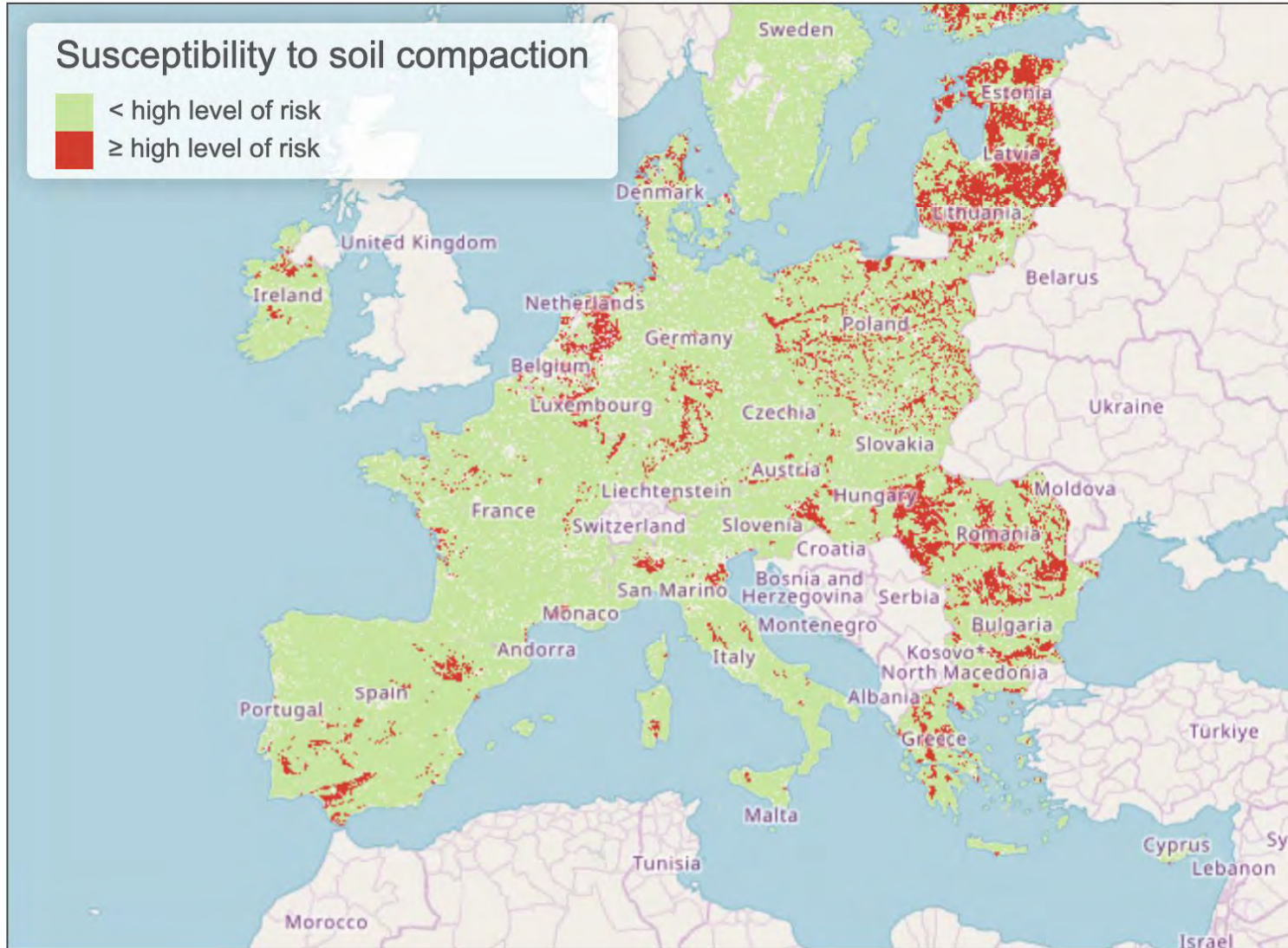
60-70 % of EU soils are unhealthy

EU SOIL OBSERVATORY

EUSO Soil Health Dashboard

Susceptibility to soil compaction

- < high level of risk
- ≥ high level of risk



Proportion of land affected by soil degradation in the EU



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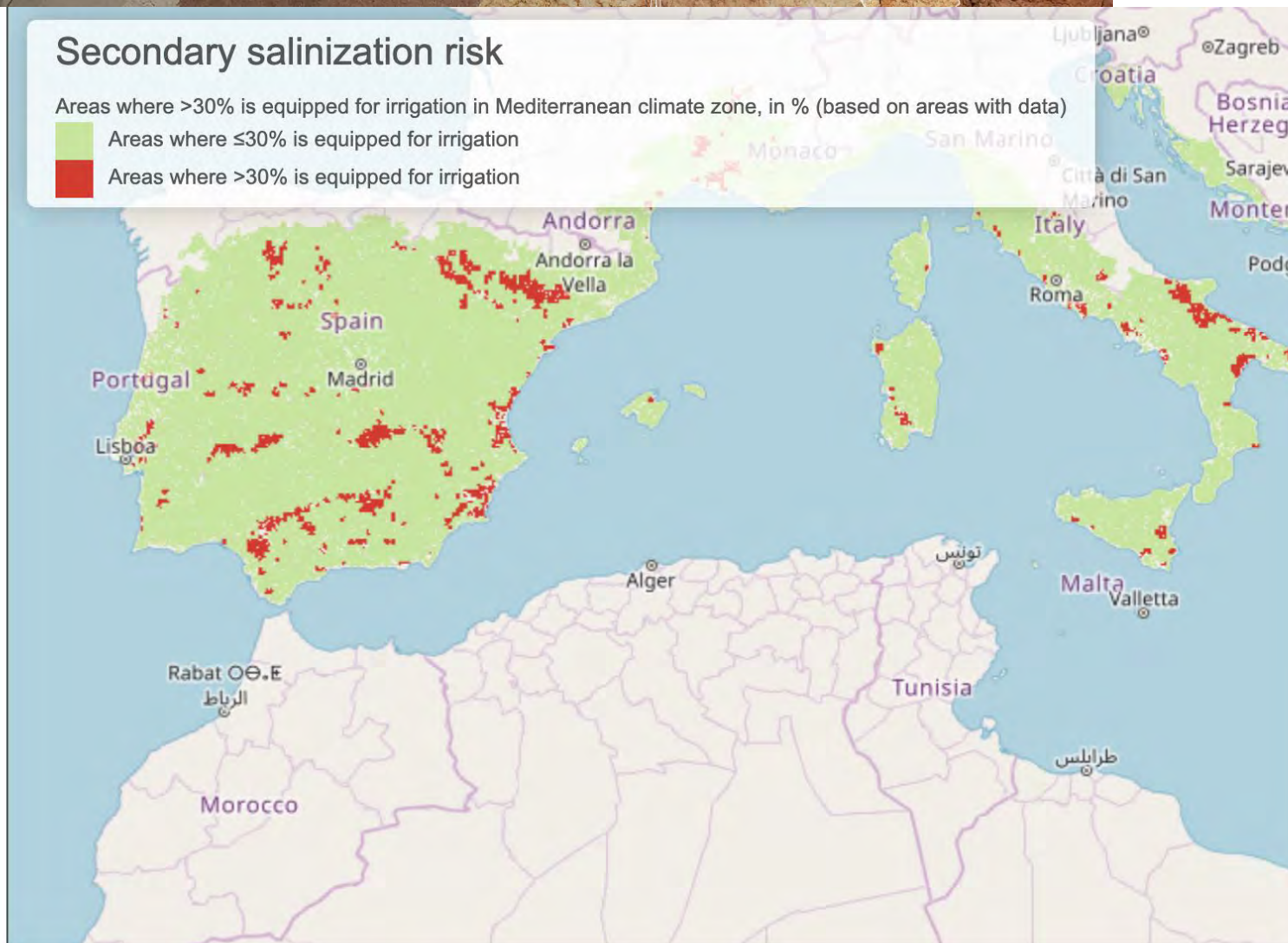
EU SOIL OBSERVATORY

EUSO Soil Health Dashboard

Secondary salinization risk

Areas where >30% is equipped for irrigation in Mediterranean climate zone, in % (based on areas with data)

- Areas where $\leq 30\%$ is equipped for irrigation
- Areas where $> 30\%$ is equipped for irrigation



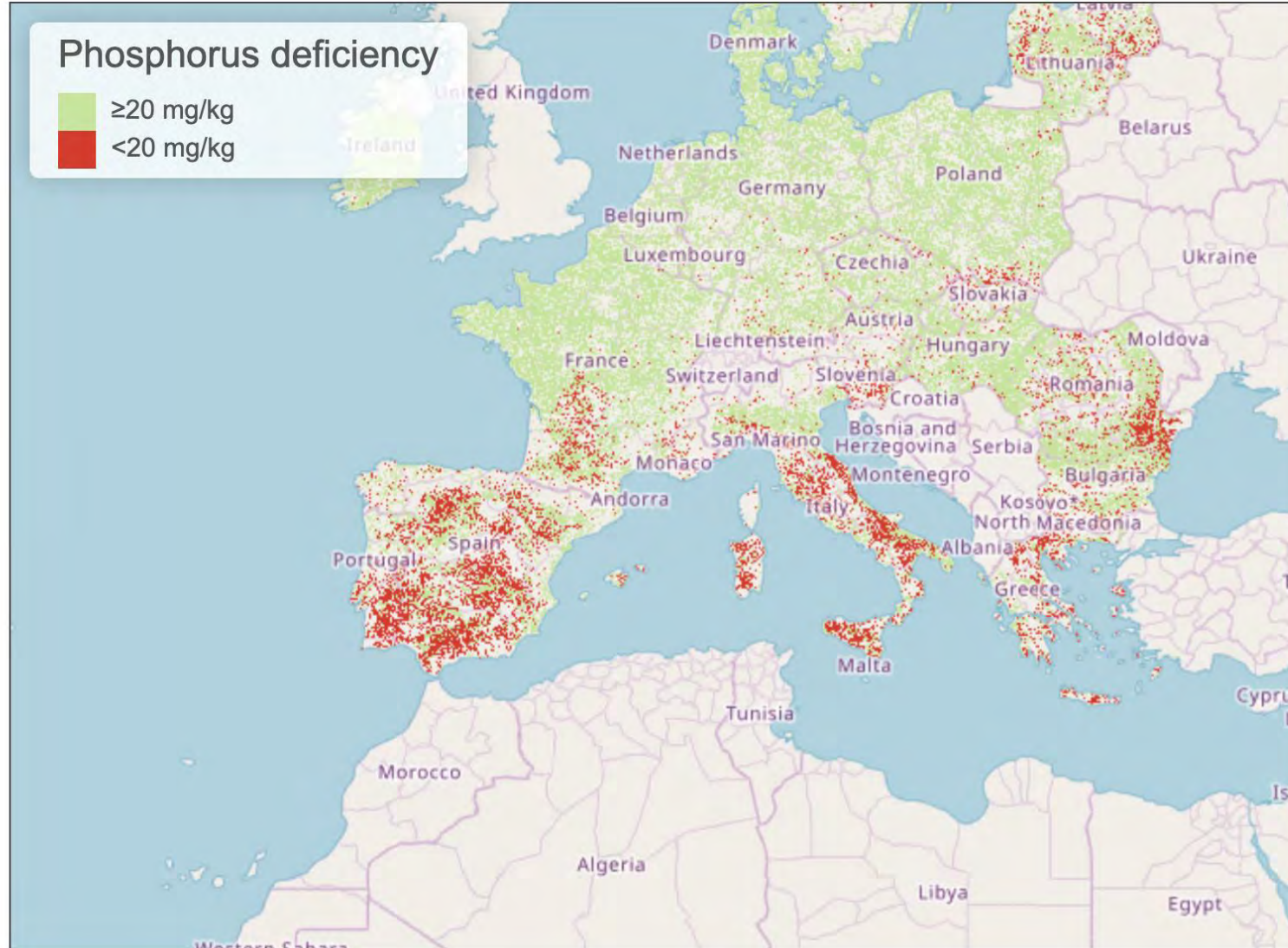
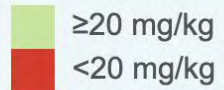
Proportion of land affected by soil degradation in the EU



EU SOIL OBSERVATORY

EUSO Soil Health Dashboard

Phosphorus deficiency



Proportion of land affected by soil degradation in the EU



SOIL O-LIVE

SOIL BIODIVERSITY AND FUNCTIONALITY
OF MEDITERRANEAN OLIVE GROVES

GENERAL GOAL

To perform the first rigorous diagnostic of the whole environmental situation of olive orchards soils at a broad scale, comprising the most important areas and agronomic modes of olive production across the Mediterranean region and its relationships to olive oil quality across the food chain.



PARTICULAR GOALS

GOAL 1

To analyze the impact of pollution and land degradation on soils from olive groves in terms of multi-biodiversity and ecological function at different levels of organization and scales.

GOAL 2

To investigate the relationship of soil health status with the quality and safety of olive oil.

GOAL 3

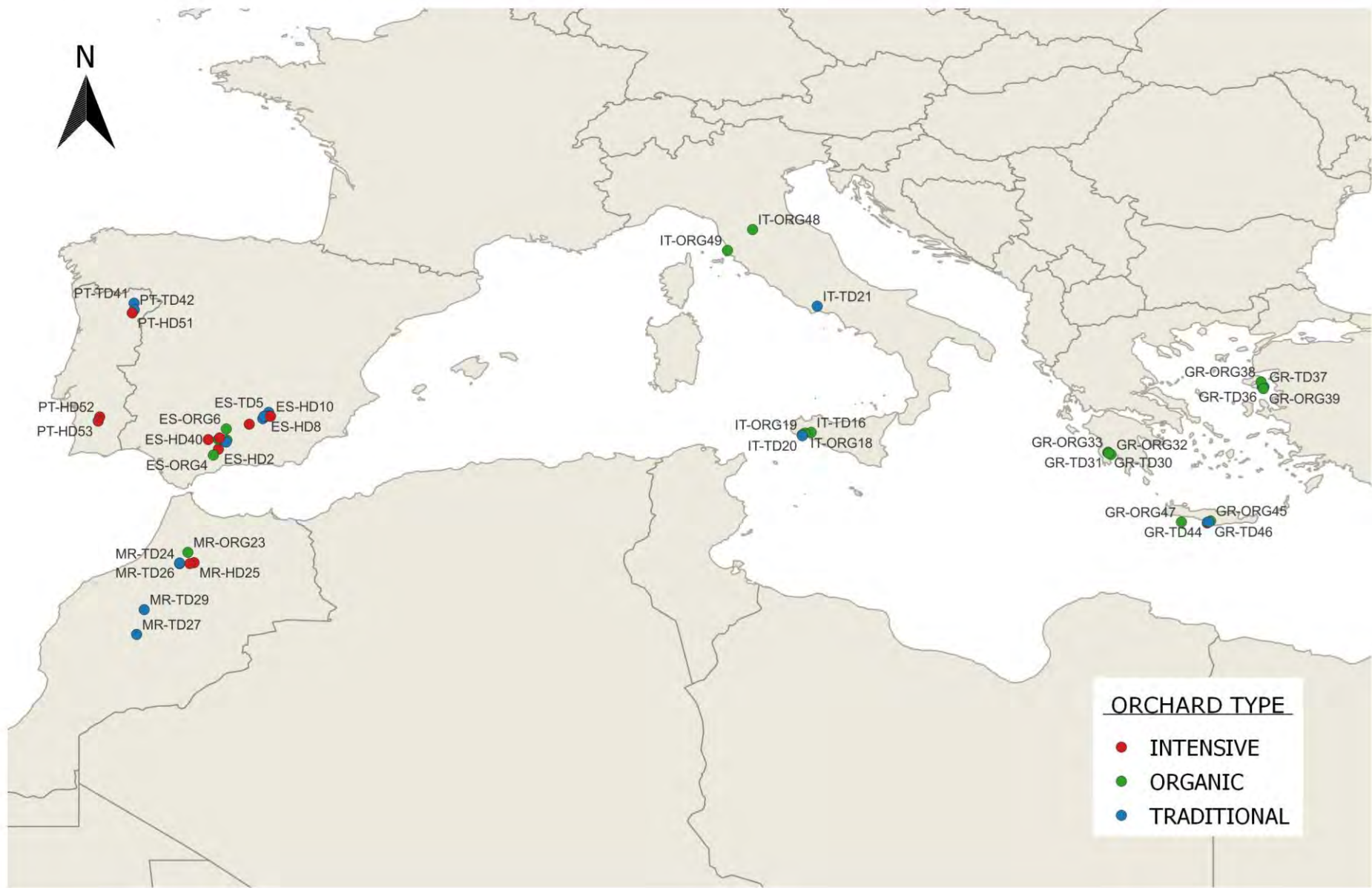
To implement effective soil amendments and cutting-edge ecological restoration practices that promote manifest soil biodiversity and functionality enhancements that should be eventually translated to improvements in olive oil quality and safety.



GOAL 4

To define rigorous ecological thresholds that allow implementing future explicit norms and regulations to design a novel future certification for healthy soils in European olive oil.

ZONAS DE ESTUDIO



SOIL O-LIVE METHODOLOGY

General Holistic Model: Understanding agronomic drivers of olive quality in Mediterranean Olive groves.

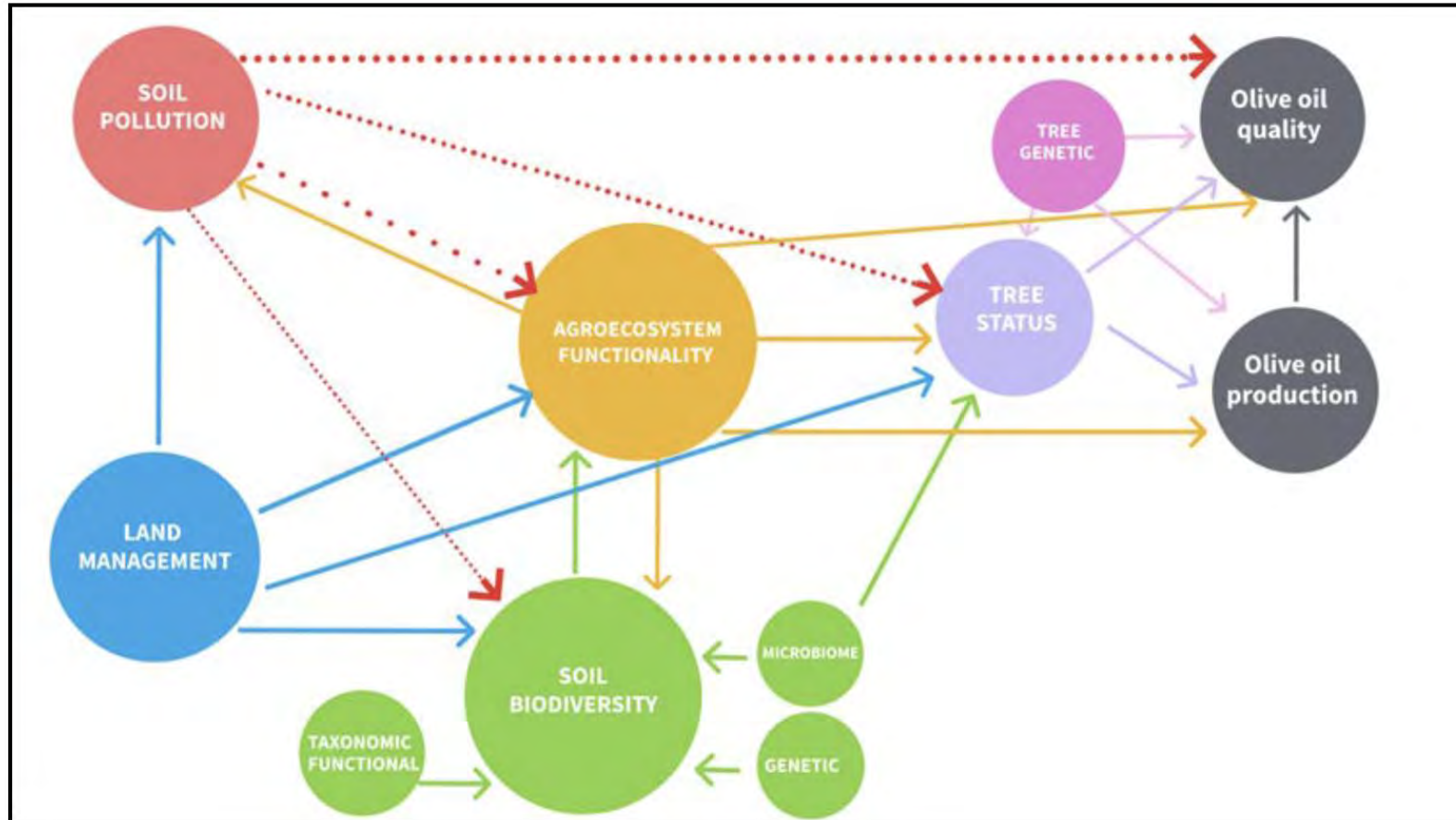
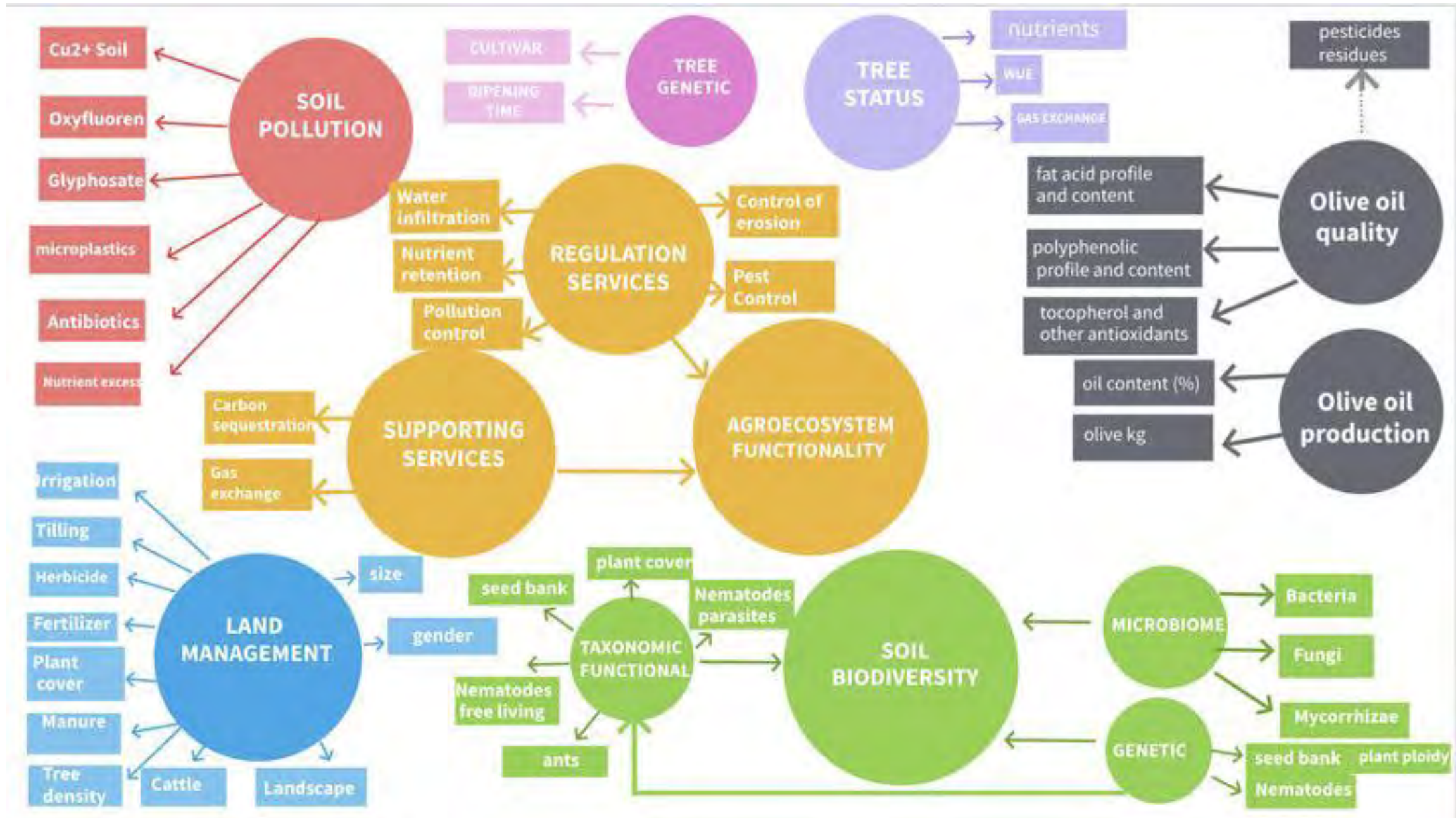


Figure 4. Structural Equation Model hypothesized to investigate the relative contribution of the main agronomic factors on olive oil quality and production. Dotted lines are presumed negative links. Only latent variables are shown.

SOIL O-LIVE METHODOLOGY

General Holistic Model: Understanding agronomic drivers of olive quality in Mediterranean Olive groves.



SOIL O-LIVE STAGES

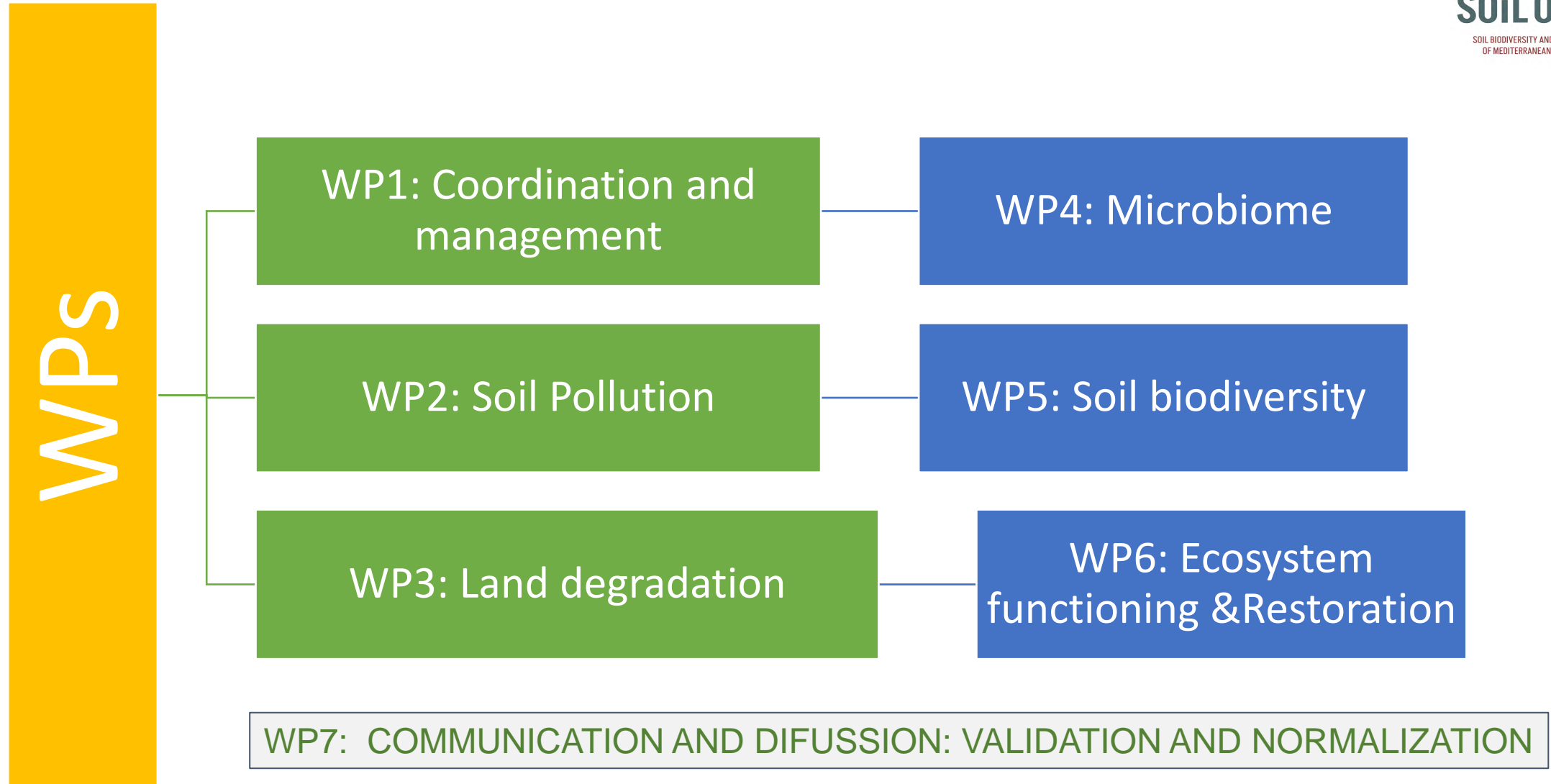
STAGES

Diagnosis. Pre-operational stage
(18 months)

Operational stage. Soil Health
Restoration (24 months)

Validation stage. Definition of
ecological thresholds (18
months)

We will be able to develop measurable key performance indicators (KPIs) that elicit the connection between soil health and the main food quality-related characteristics for olive oil.



SOIL O-LIVE STAGES



SOIL O-LIVE TASKS

OPERATIONAL. SOIL RESTORING WPs

ex-situ cultivation of soil microbiomes and specific microbiome or synthetic communities inoculation, along with seed bank restoration. Biochar infiltration

BIOLOGICAL RESTORATION

**PHYSICAL AND CHEMISTRY
REMEDIATION.**

electrokinetic remediation

Peroxides & ozone

SOIL O-LIVE TASKS





SOIL O-LIVE TASKS

Geoderma 436 (2023) 116528

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Geoderma

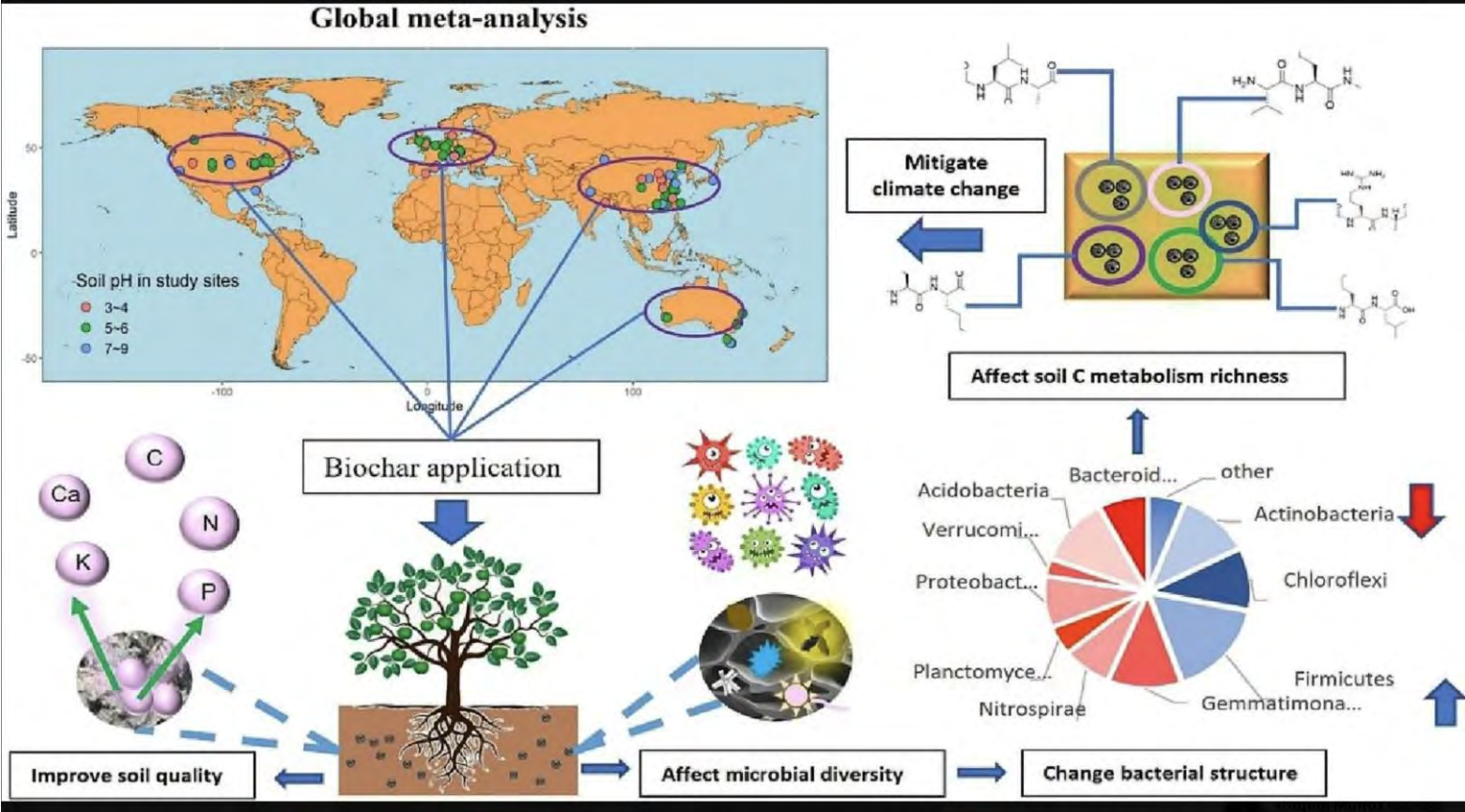
journal homepage: www.elsevier.com/locate/geoderma



Global *meta*-analysis reveals positive effects of biochar on soil microbial diversity

Wenhuan Xu ^{a,b}, Hanmei Xu ^a, Manuel Delgado-Baquerizo ^c, Michael J. Gundale ^d, Xiaoming Zou ^{a,c}, Honghua Ruan ^{a,*}

^a Department of Ecology, Nanjing Forestry University, Co-Innovation Center for Sustainable Forestry in Southern China, Nanjing 210037, PR China
^b Department of Forest and Conservation Sciences, University of British Columbia, Vancouver, BC V6T 1Z4, Canada
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^d Department of Forest Ecology and Management, Swedish University of Agricultural Sciences, SE901 83 Umeå, Sweden
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PLANT COVERS

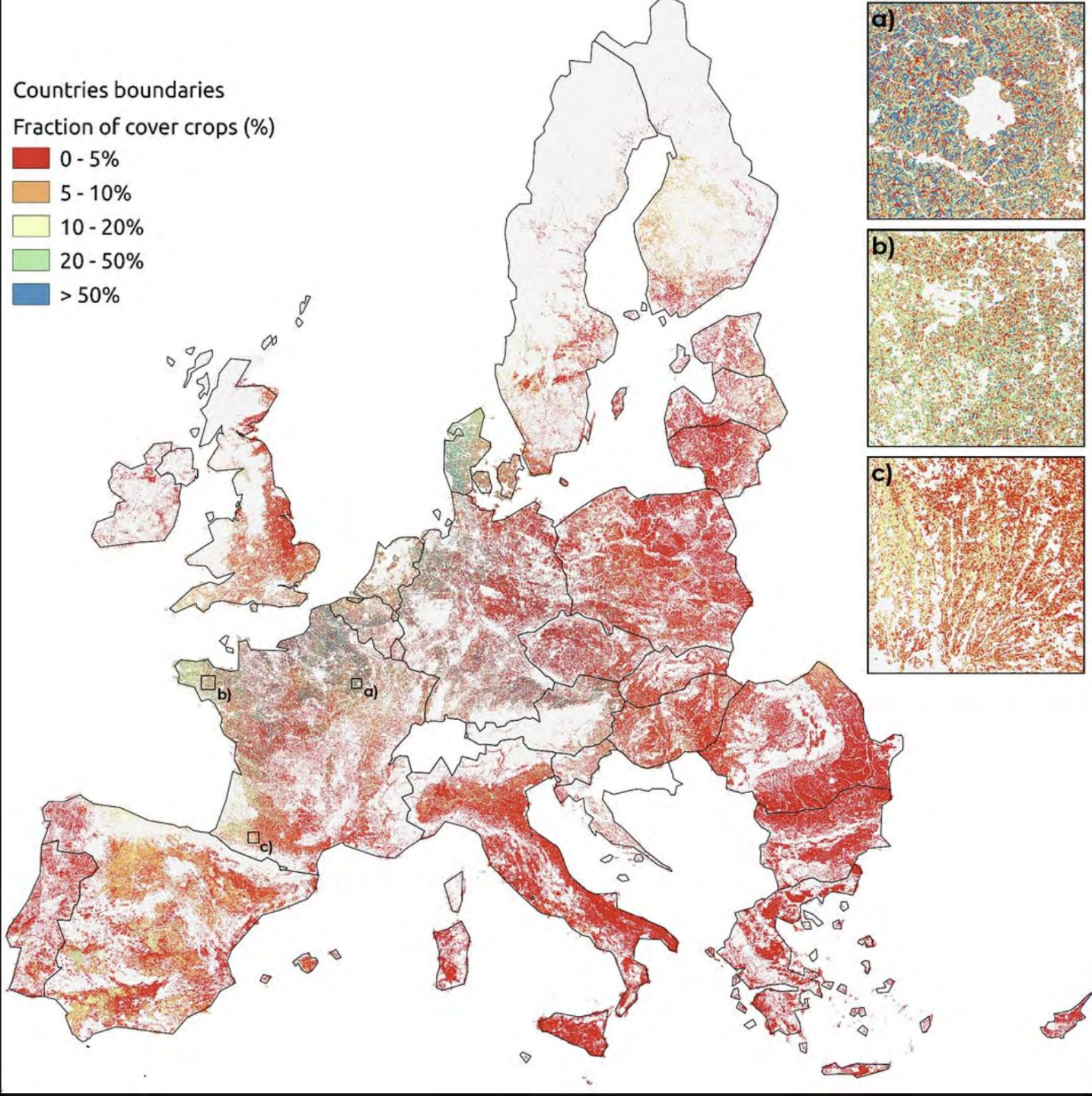


PLANT COVERS

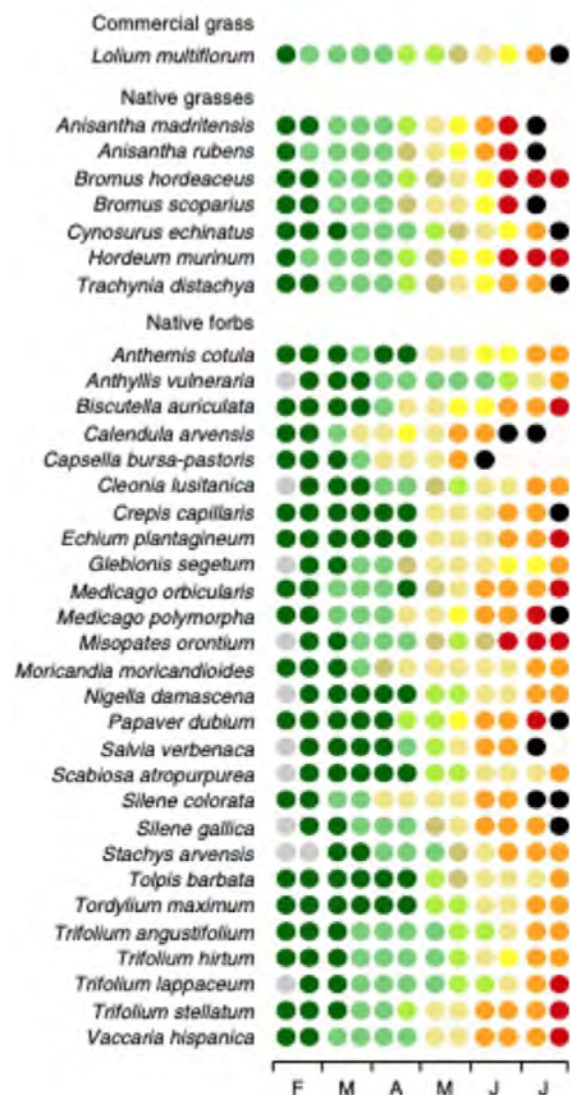
Using cover crops in olive groves can offer a series of significant advantages

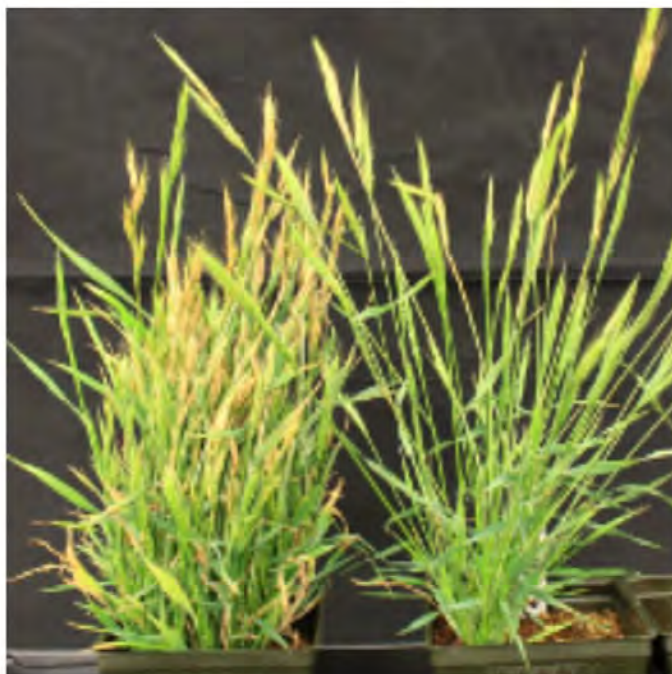
1. **Soil conservation:** Cover crops protect the soil from erosion caused by rain and wind. The roots of the cover plants maintain soil structure, preventing nutrient loss and minimizing compaction.
2. **Weed control:** Cover crops compete with weeds, reducing their growth and decreasing the need for herbicides. By covering the soil, they prevent weed seeds from germinating and establishing.
3. **Biodiversity enhancement:** The presence of cover crops promotes biological diversity in the olive grove. They attract beneficial insects, pollinators, and other beneficial organisms that contribute to a healthy ecological balance.
4. **Water cycle regulation:** Cover crops help regulate the water cycle in the olive grove. They absorb and retain rainwater, preventing surface runoff and promoting its infiltration into the soil. This helps maintain soil moisture and reduces the risk of erosion.
5. **Improvement in oil quality?:** Cover crops can positively influence the quality of the produced olive oil. Some cover plants release volatile compounds that can enhance the aromas and flavors of the oil. Additionally, the presence of diverse cover crops can **provide additional nutrients to the soil, enriching the nutrition of the olive trees and improving the quality of the harvest.**

PLANT COVERS



5) ACTUAR SOBRE EL BANCO DE SEMILLAS. RESIEMBRA





OE 
Oficina Española
de Variedades Vegetales

La Universidad de Jaén muestra en EXPOLIVA 2021 soluciones frente a la erosión producida en el olivar

MULTIMEDIA

Fotos



Videos

COMPARTIR



LO MÁS VISTO

Un estudio de la UJA muestra que el aceite de oliva virgen extra causa un cambio en la flora bacteriana intestinal relacionado

 Añadir a favoritos



Antonio José Manzaneda muestra una de las variedades obtenidas.

Sábado, 25 Septiembre, 2021

La Universidad de Jaén ha dado a conocer este viernes en su stand en EXPOLIVA 2021 dos soluciones para evitar y luchar contra los problemas de erosión en olivar. El primero consiste en varios tipos de semillas patentadas para la generación de cubiertas vegetales y el segundo, en los trabajos en los que ha participado el grupo Sistemas Fotogramétricos y Topométricos, para el control de cárcavas con diques y cubiertas vegetales autóctonas.











CLIMATE CHANGE AND COVER DESIGN

BRACHYCOVER PROJECT



SOIL O-LIVE GOALS

GOAL 3

VALIDATION: Ecological
thresholds &
Normalization WPs

**DATA QUALITY VALIDATION
EFFECTIVENES OF RESTORATION**

**NORMALIZATION IN NATIONAL
AND EU CONTEXT**

Table 3. European and International Technical Committees related to SOIL O-LIVE

Area	Technical Committee
Soil	CEN/TC 444 "Test methods for environmental characterization of solid matrices"
	ISO/TC 190 "Soil quality"
Microplastics	CEN/TC 249 "Plastics"
	ISO /TC 61/SC 14 "Plastics. Environmental aspects"
Geographic information	ISO/TC 211 "Geographic information/Geomatics"
Oil quality	CEN/TC 307 "Oilseeds, vegetable and animal fats and oils and their by-products - Methods of sampling and analysis"
	ISO/TC 34/SC 11 "Animal and vegetable fats and oils"
Environmental management	ISO/TC 207 "Environmental management"

3.7. Standards related to environmental management.

The international committee **ISO/TC 207"Environmental management "**, is responsible of the standardization in the field of environmental management to address environmental and climate impacts, including related social and economic aspects, in support of sustainable development.

Key datasets to be produced (Open access)

- ❖ Spatial and temporal geo-referenced data on:
 - Soil copper concentration.
 - Pre-emergence and post-emergence herbicide soil concentration (e.g., oxyfluorfen, glyphosate, etc.).
 - Insecticide soil concentration (organophosphate insecticides and pyrethroid-based insecticides).
 - Microplastics.
 - Antibiotic & occurrence of gene resistance genes in soil bacteria.
 - Nitrogen + Phosphorus content.
 - Seed bank biodiversity (taxonomic, functional and genomic).
 - Nematode biodiversity (taxonomic, functional and genomic).
 - Ant biodiversity (taxonomic, functional and genomic)
 - Microbiome biodiversity (bacteria, fungi, mycorrhizae: taxonomic, functional and genomic)
 - pH
 - Particle-size distribution
 - Soil Organic carbon
 - Cation Exchange Capacity
 - Electrical conductivity
 - Soil gas exchange & soil water flux
 - Pest incidence (*Prays oleae* and *Bactrocera oleae*)
 - Olive tree performance (nutritional status and water-use efficiency)
 - Olive oil quality and yield variation among management and restoration practices.
- ❖ Effectiveness of restoration methodological tests.
- ❖ Genomic sequencing data for microbiome & plants
- ❖ Soil erosion indicators and forecasts for Mediterranean Olive groves.
- ❖ Survey data on drivers influencing land management in soil management, including gender studies

IMPACT



European Commission
DG Agriculture and Rural Development
Unit E.4. Arable crops & olive oil



POLITICAL LEVEL



CONSUMERS
& DISTRIBUTION



IMPACT

PRODUCERS & FARMERS

>90 % of soil pollutants removed in restored soils.
Net contribution to carbon fixation by groundcover implementation.
Soil functionality increased. Tree physiology enhanced.
Increase in 50 % production of olive oil of highest quality (i.e., EVOO) per olive grove.
10 % increase in polyphenol content.
Zero pollution in olive oils

INDUSTRY

Zero pollution in olive oils
Higher relative production of EVOO
Devices for electrochemical & chemical pollutant removal (TRL4)

A photograph of a lush green field with dew drops on the grass. In the background, there are trees and a person standing in the distance. The text "Thanks for your attention" is overlaid on the image.

Thanks for your attention

amavila@ujaen.es