CLIMAte change adaptation through SOil and crop MAnagement - synthesis & ways forward -

presented by Sarah Garré (ILVO)

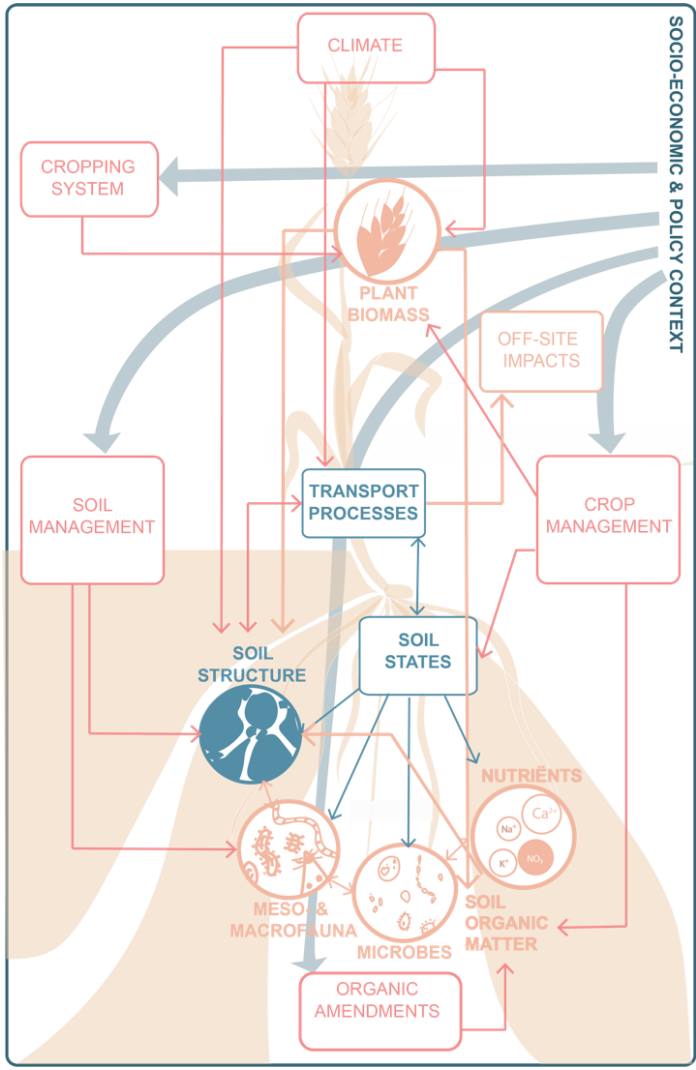
EJP SOIL
European Joint Programme

EJP SOIL has received funding from the European Union's Horizon 2020 research and innovation programme: Grant agreement No 862695

CLIMASOMA Context – soil, its role in climate change adaptation

Flanders, May 2022
Middelkerke

Flanders, Jan 2021
Halle



What is the effect of these agricultural practices on soil parameters?

Practices:

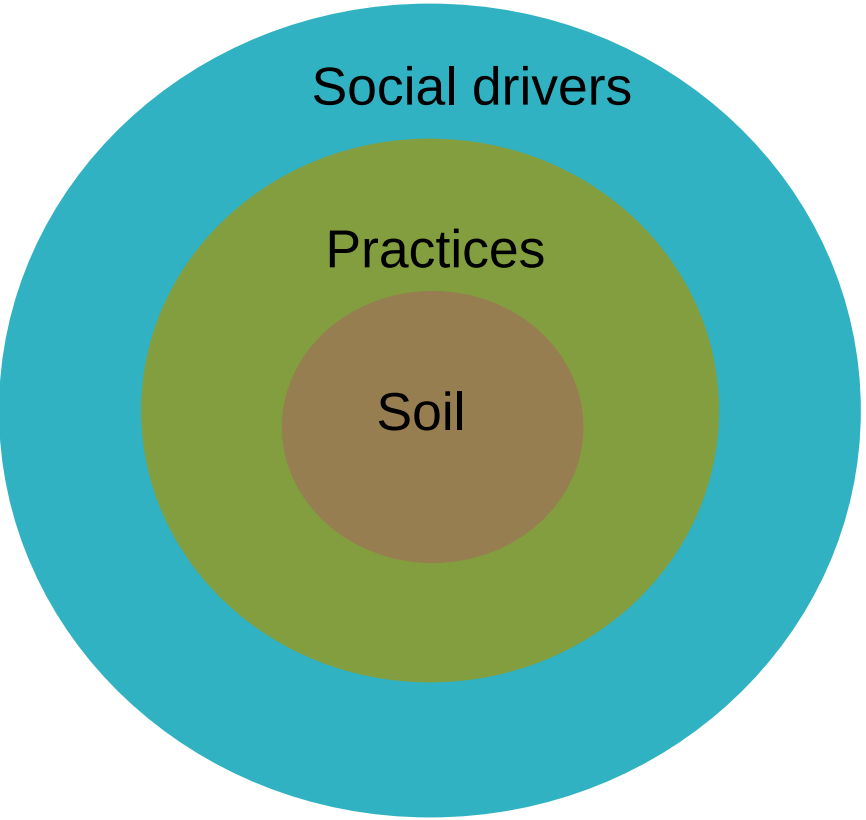
- zero or reduced tillage
- cover crops

Soil parameters:

- plant available water
- run-off

Go to www.menti.com and insert 4009 2805

Context



CLIMASOMA aims at **synthesising** existing evidence based on scientific literature for Europe.

Focus on the effect of

agricultural practices (drivers)

on **soil parameters** (variables)

taking into account **existing policy**

and **farmer perception**.

→ towards a **climate-resilient** agriculture

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REVIEW OF META-ANALYSES

Guillaume Blanchy, Gilberto Bragato, Claudia Di Bene, Nicholas Jarvis, Mats Larsbo, Katharina Meurer, Sarah Garré

Original research article submitted to SOIL in April 2022

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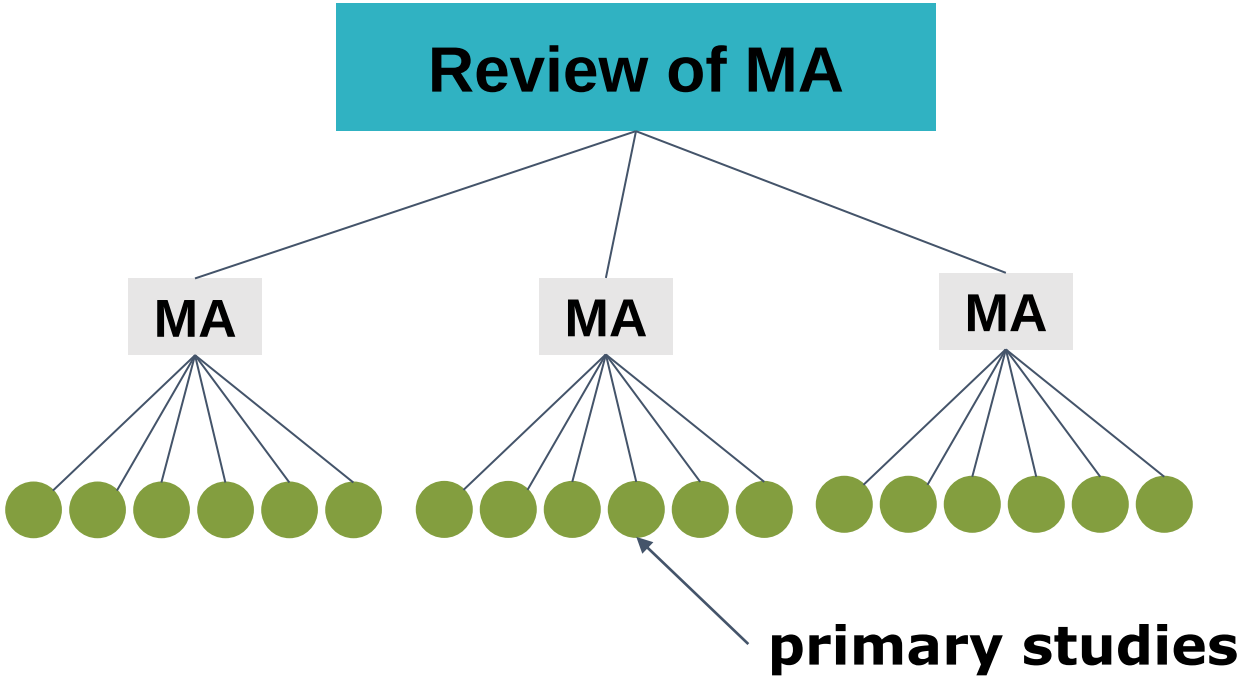
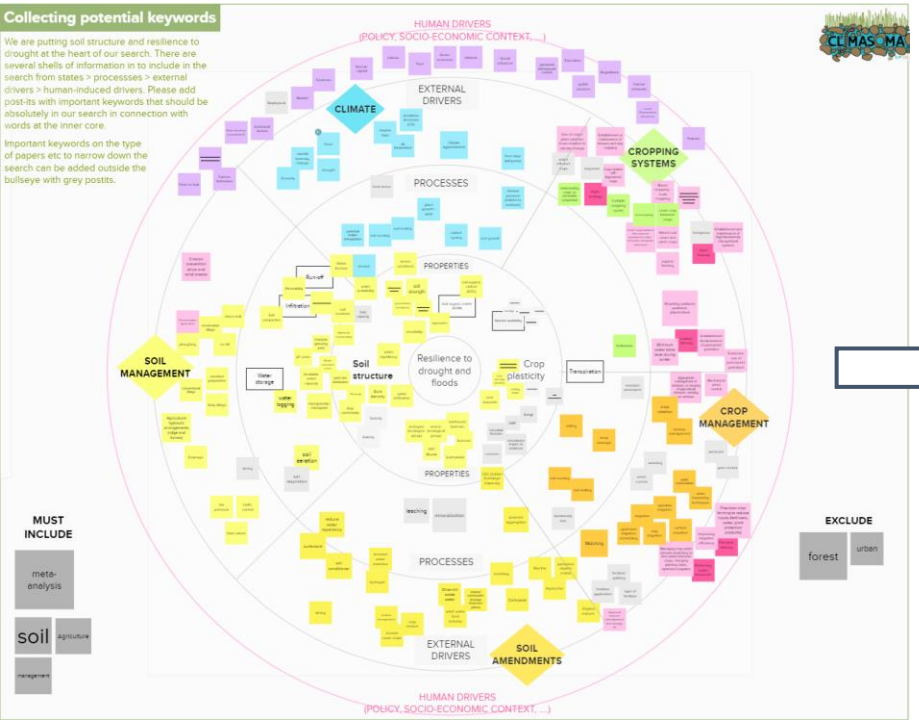
Review of meta-analysis

Meta-analysis (MA)
= paper which reviews scientific finding from other papers in a quantitative way



List of keywords



soil AND meta-analysis NOT forest NOT urban AND

(management or tillage or cropping or crops or crop or (cover and crops) or (catch and crop) or residue or residues or fertilizer or manure or amendment or liming or compost or traffic or biochar or irrigation or intercropping or agroforestry) AND

hydraulic conductivity OR
water retention OR
available water OR
runoff OR
infiltration OR
bulk density OR
macroporosity OR
penetration resistance OR
soil strength OR
aggregate stability OR
aggregation OR
transpiration OR
(water and consumption) OR
yield OR
organic matter OR
organic carbon OR
(microbial OR faunal OR earthworm) AND (biomass OR activity)
root AND (depth or biomass or growth)

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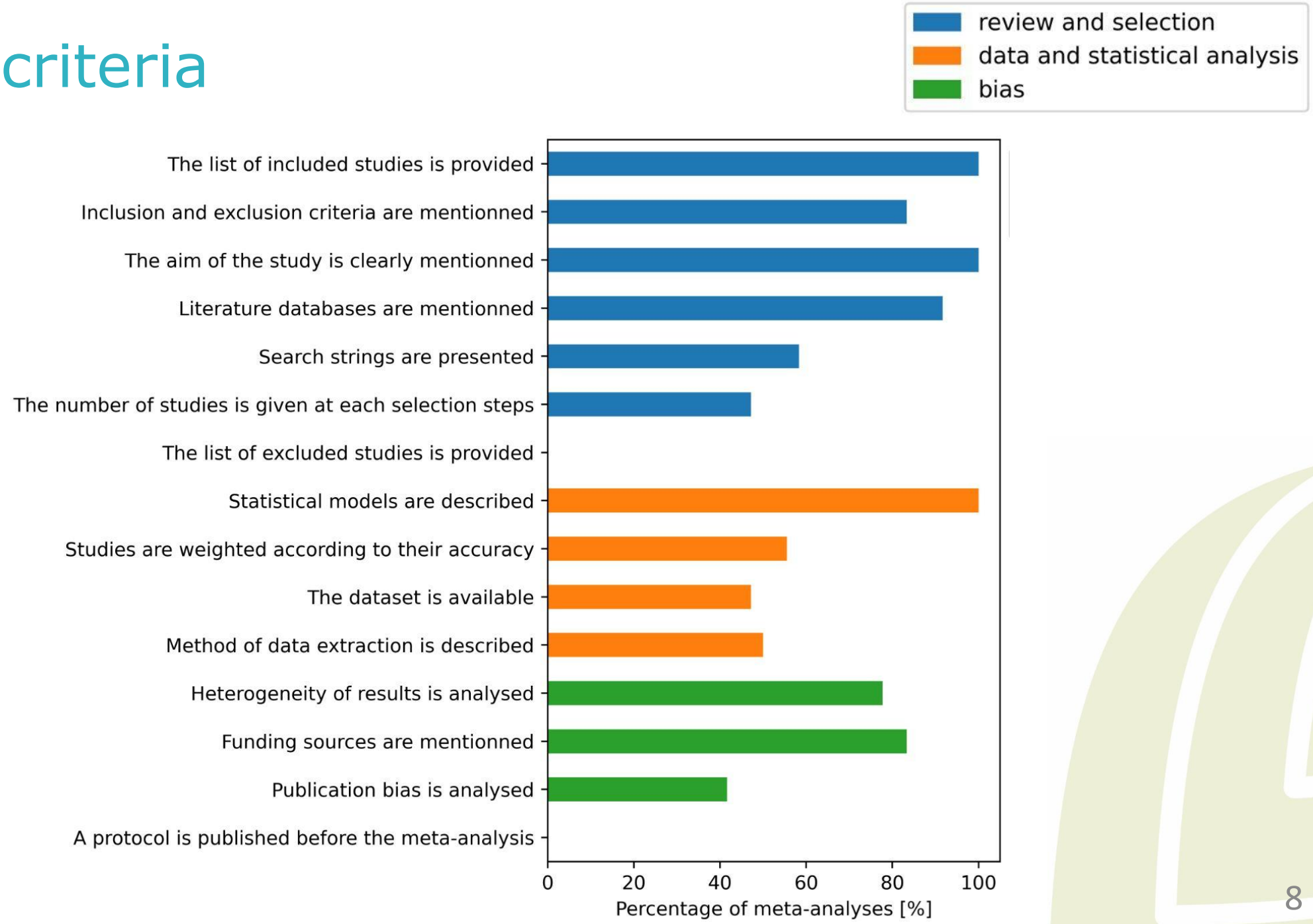
Quality criteria



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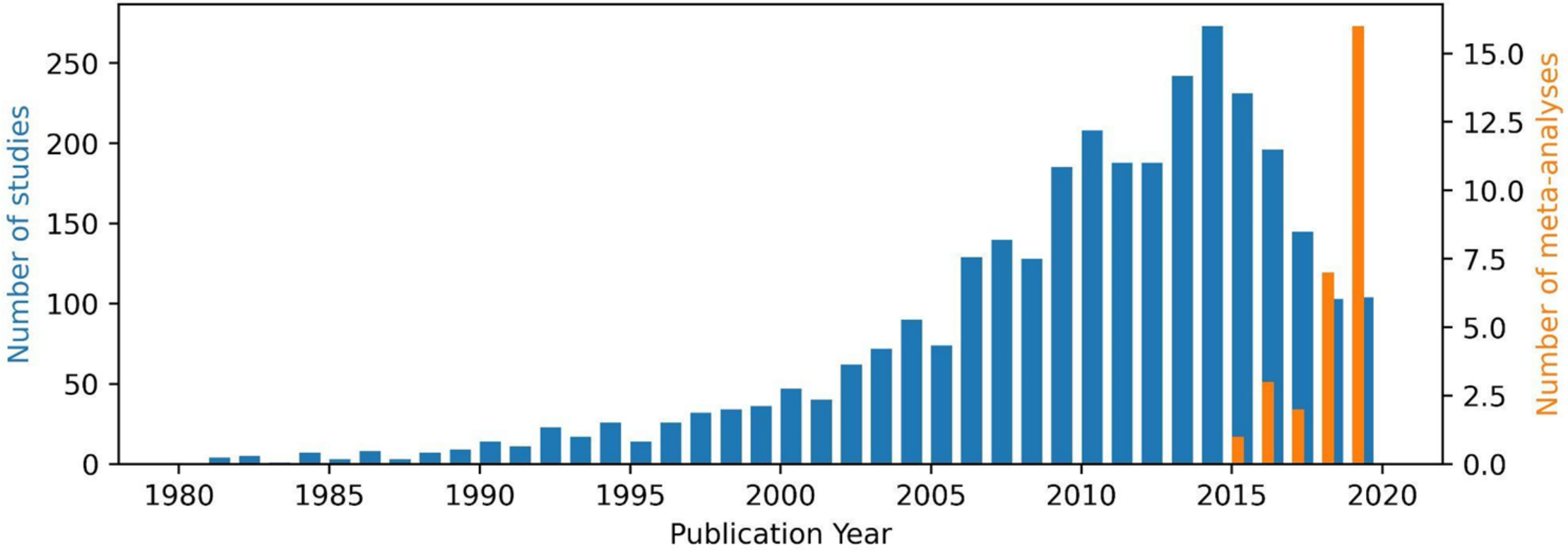
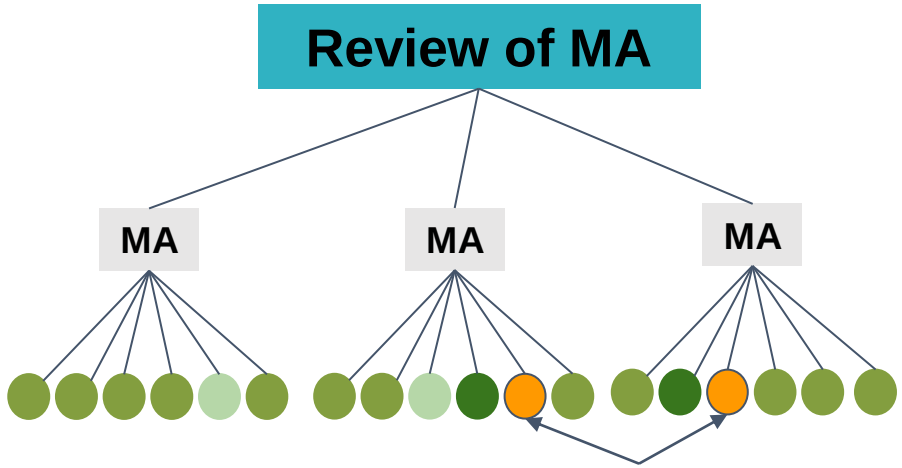
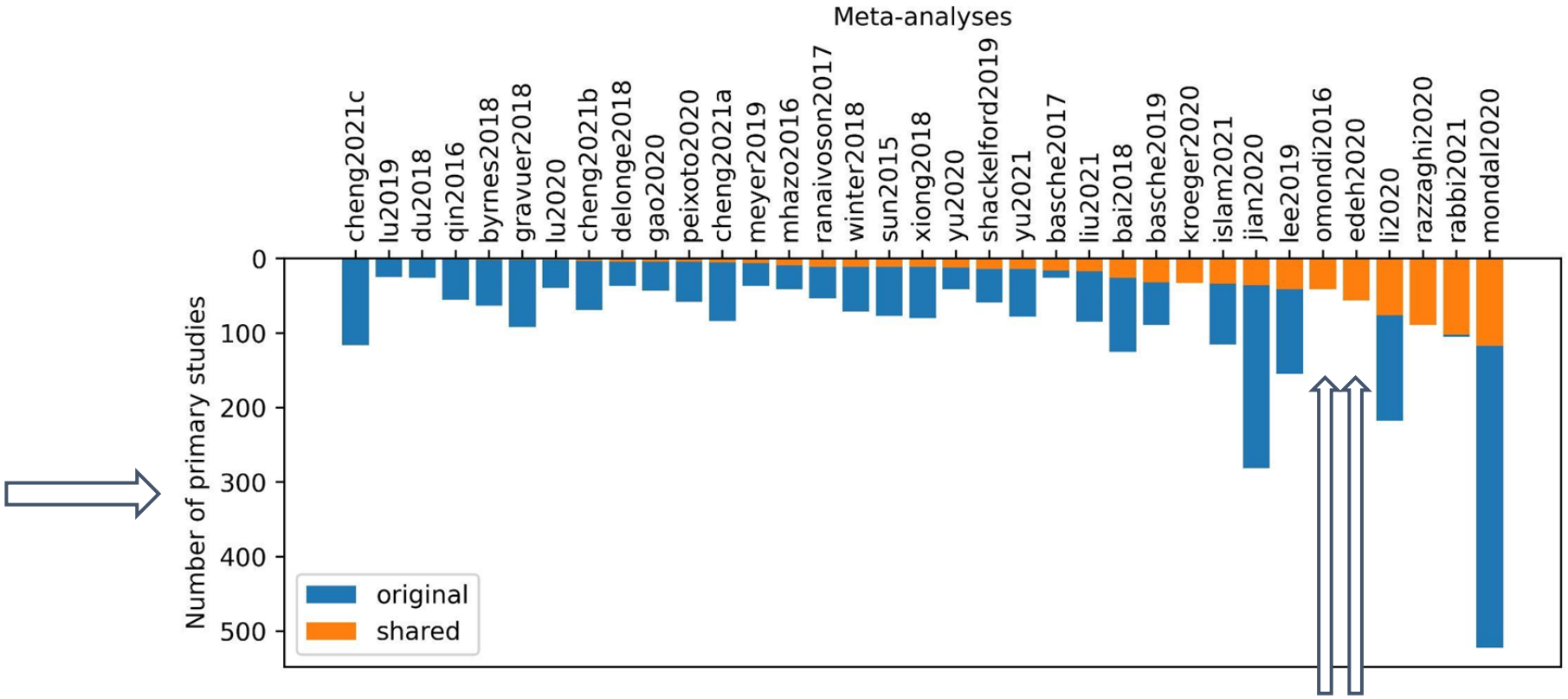
Selected meta-analysis



Redundancy analysis



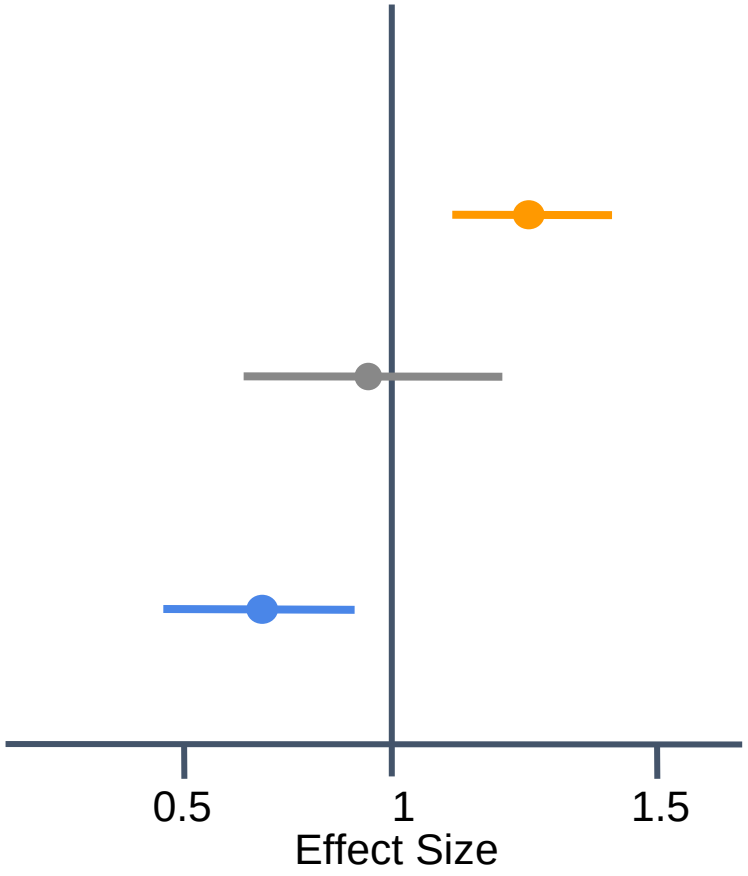
shared primary studies



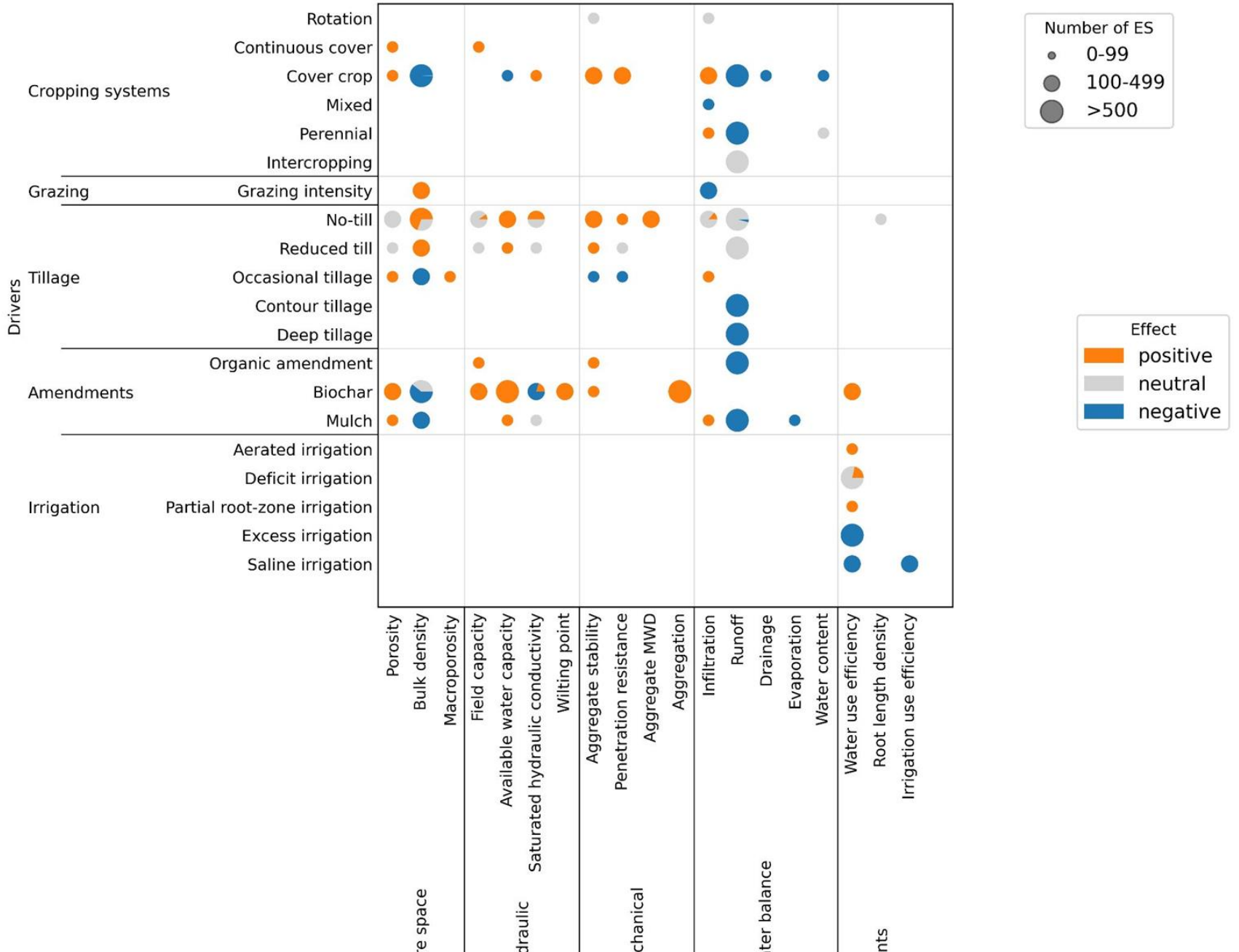
share 100% of their primary studies

Extracting effect sizes from meta-analysis

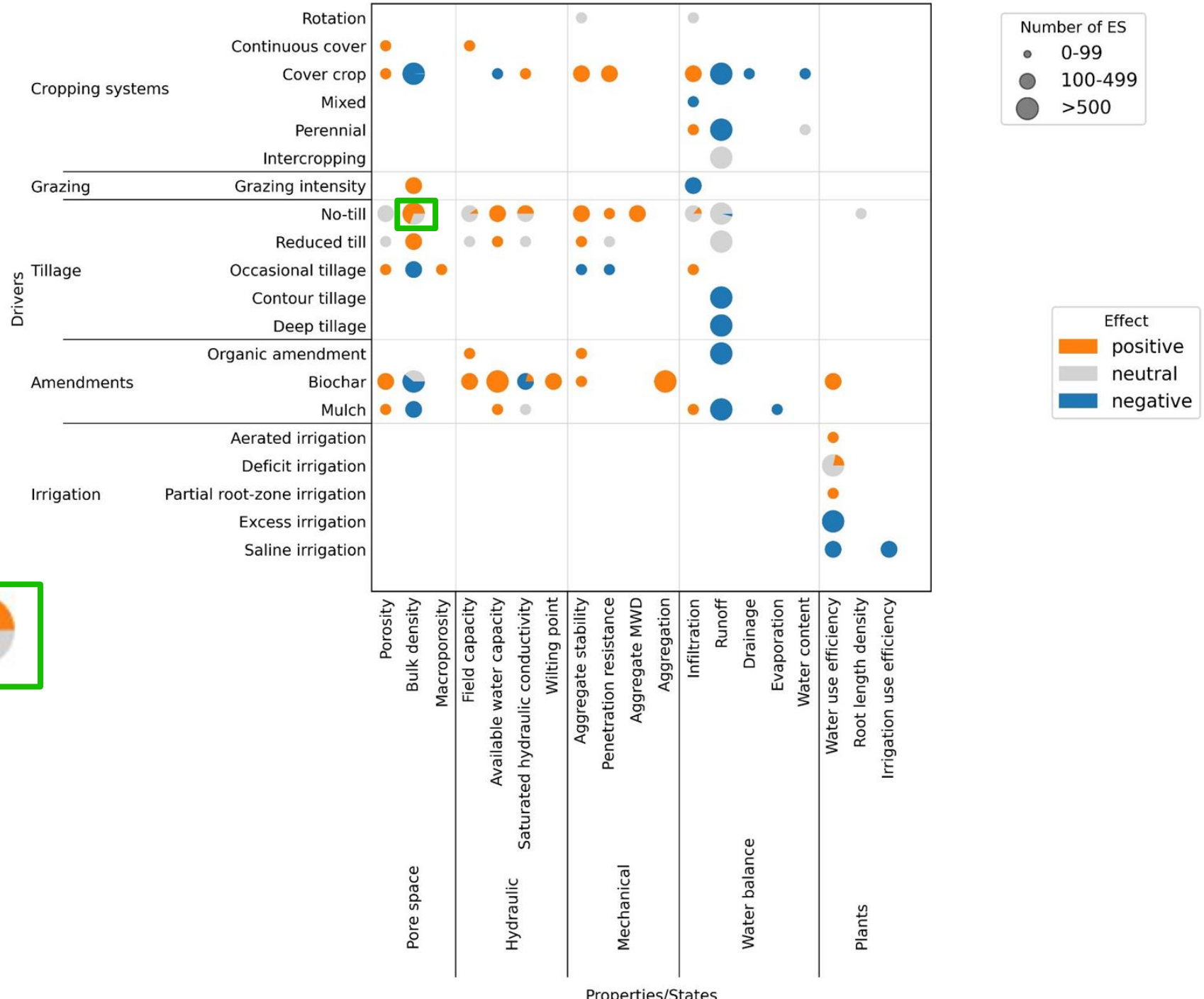
Meta-analysis compute the ratio between two effects = the effect size (ES)



Average effect size for each pair of driver and variable



no dots
= no MA available



No-till has a positive effect (increase) bulk density in most cases

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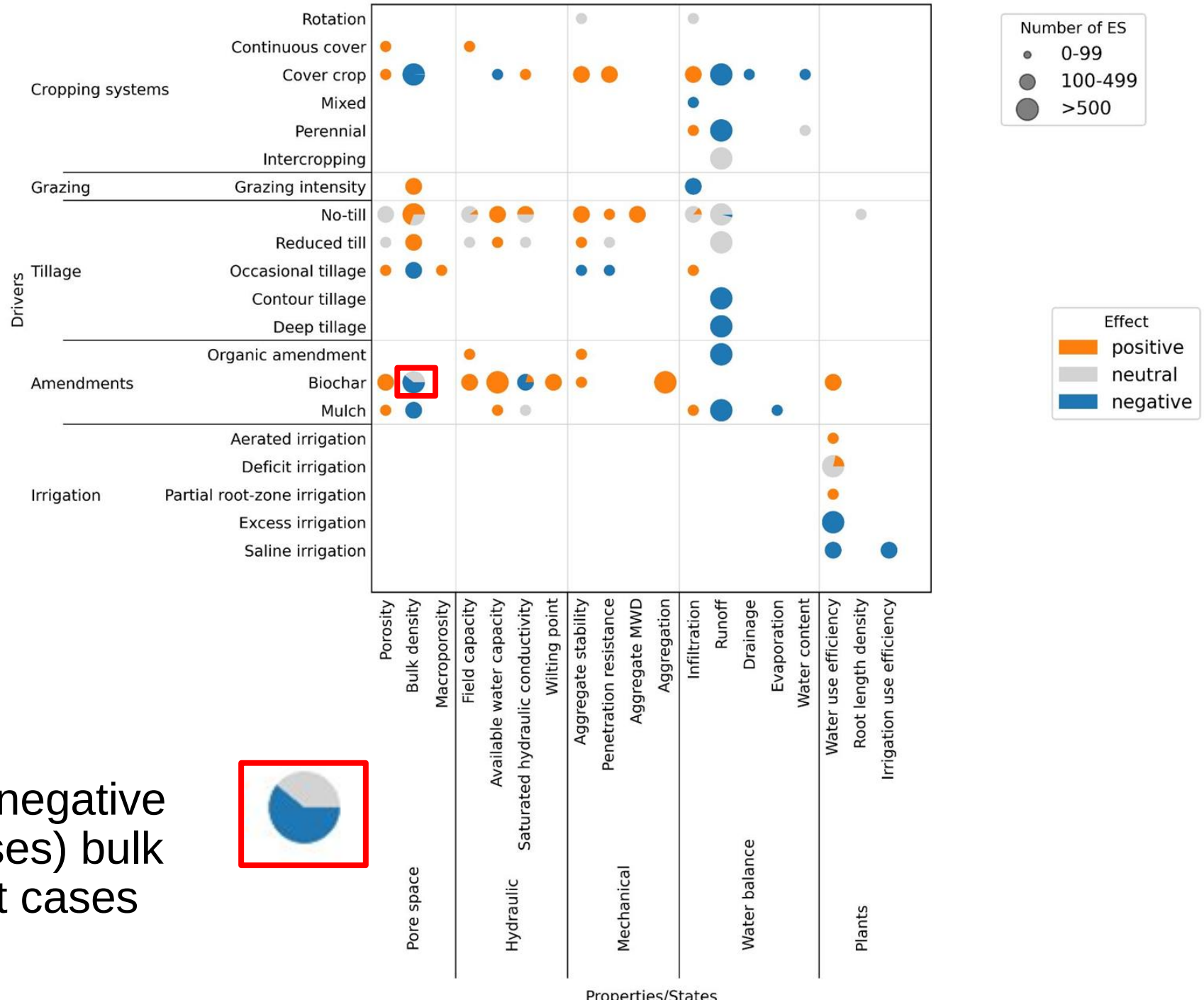

Biochar has a negative effect (decreases) bulk density in most cases

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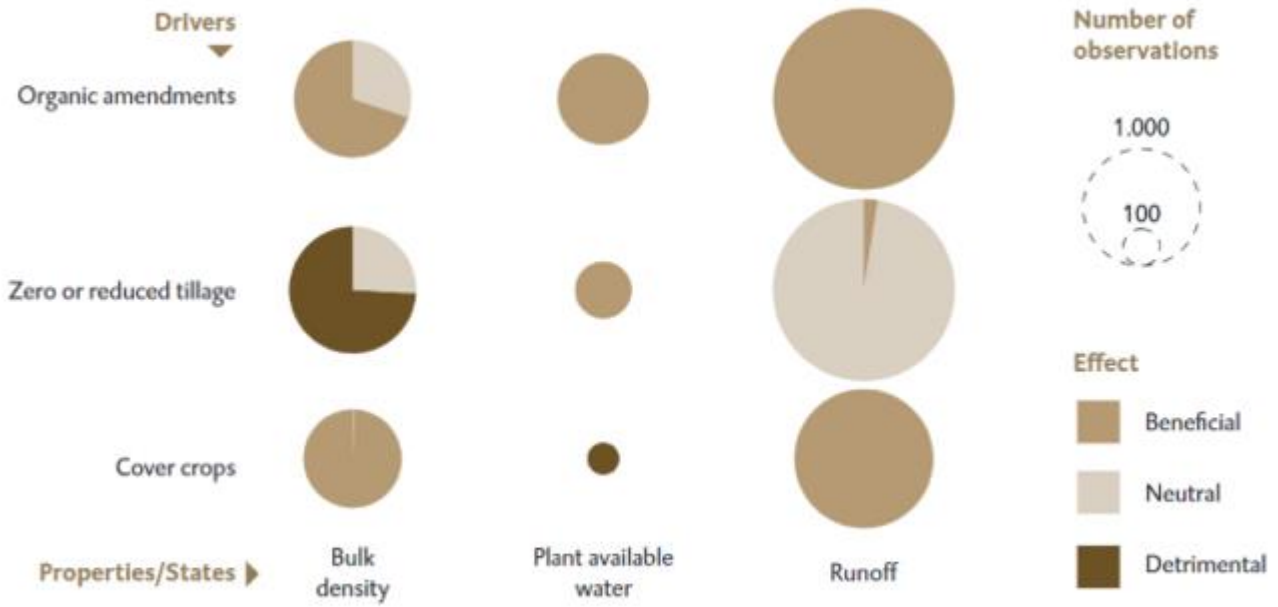
3 clear tendencies in the data

Figure 1: Scientific evidence for three (combinations of) practices



These relationships are often specific to local soil type & climate.

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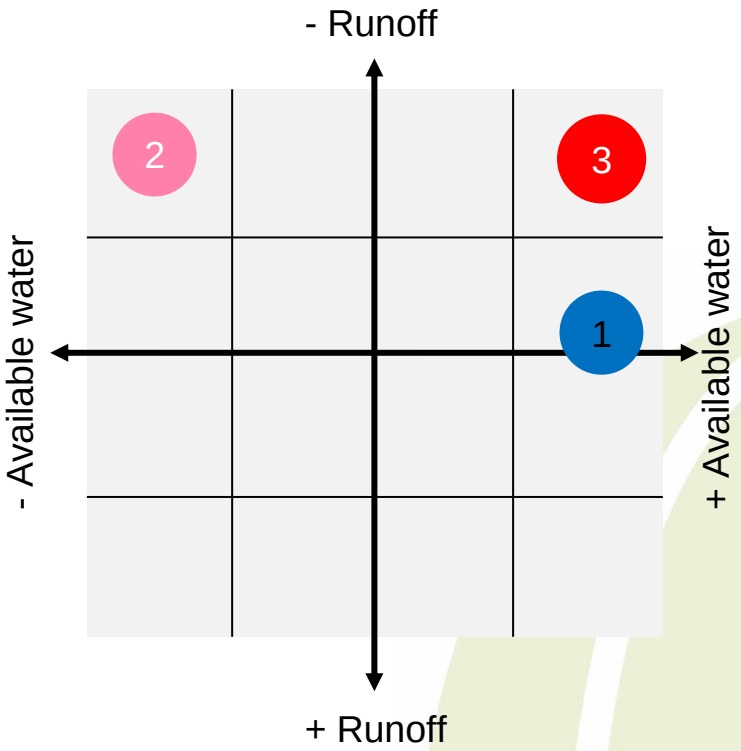
YOU ! ☺

Literature



QUANTITATIVE ANALYSIS OF NEAR-SATURATION HYDRAULIC CONDUCTIVITY OF SOILS

Johannes Koestel, Lucas Albrecht, Guillaume Blanchy

Original research article in preparation for submission in May 2022

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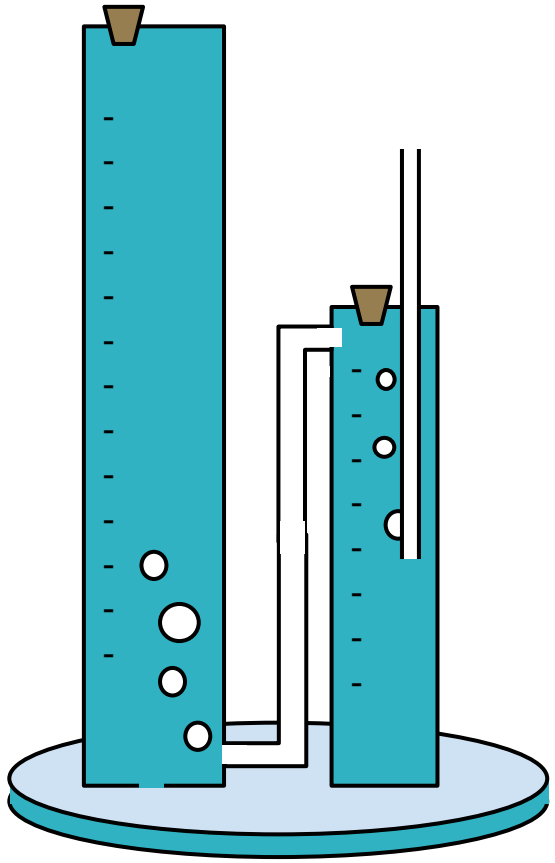
How management practices influence soil hydraulic conductivity?



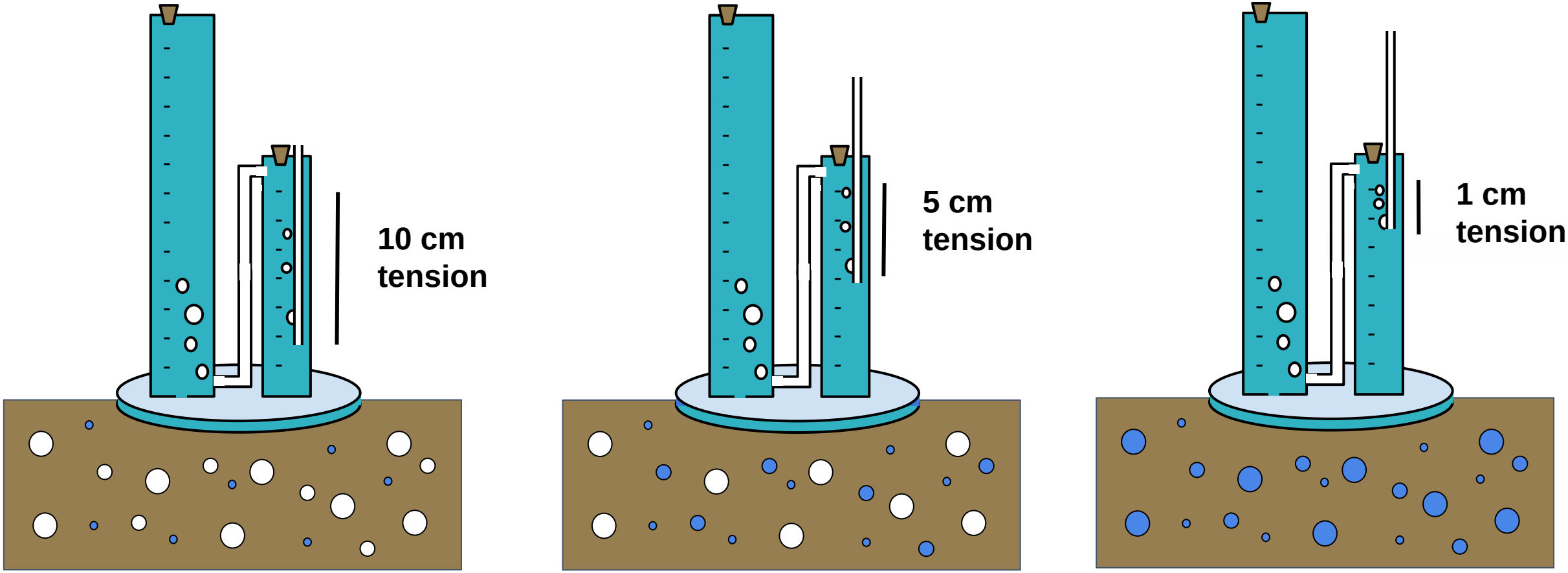
Agronomic importance:

- speed of water infiltration
- information on pore network and soil structure

Why near-saturation and not at saturation?

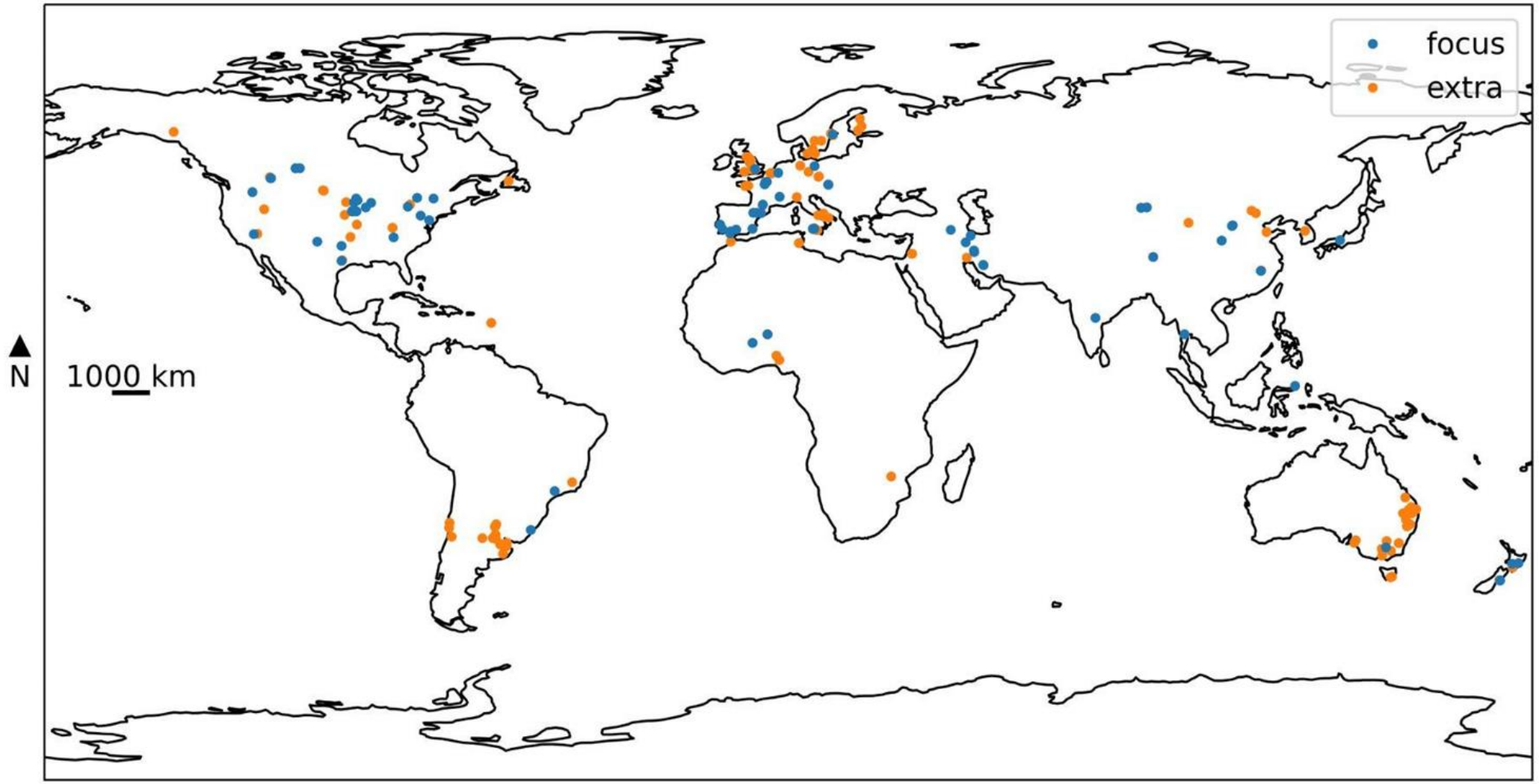
- saturated hydraulic conductivity is influenced by preferential flow
- near-saturated hydraulic conductivity is more representative of soil structure

Tension-disk infiltrometer

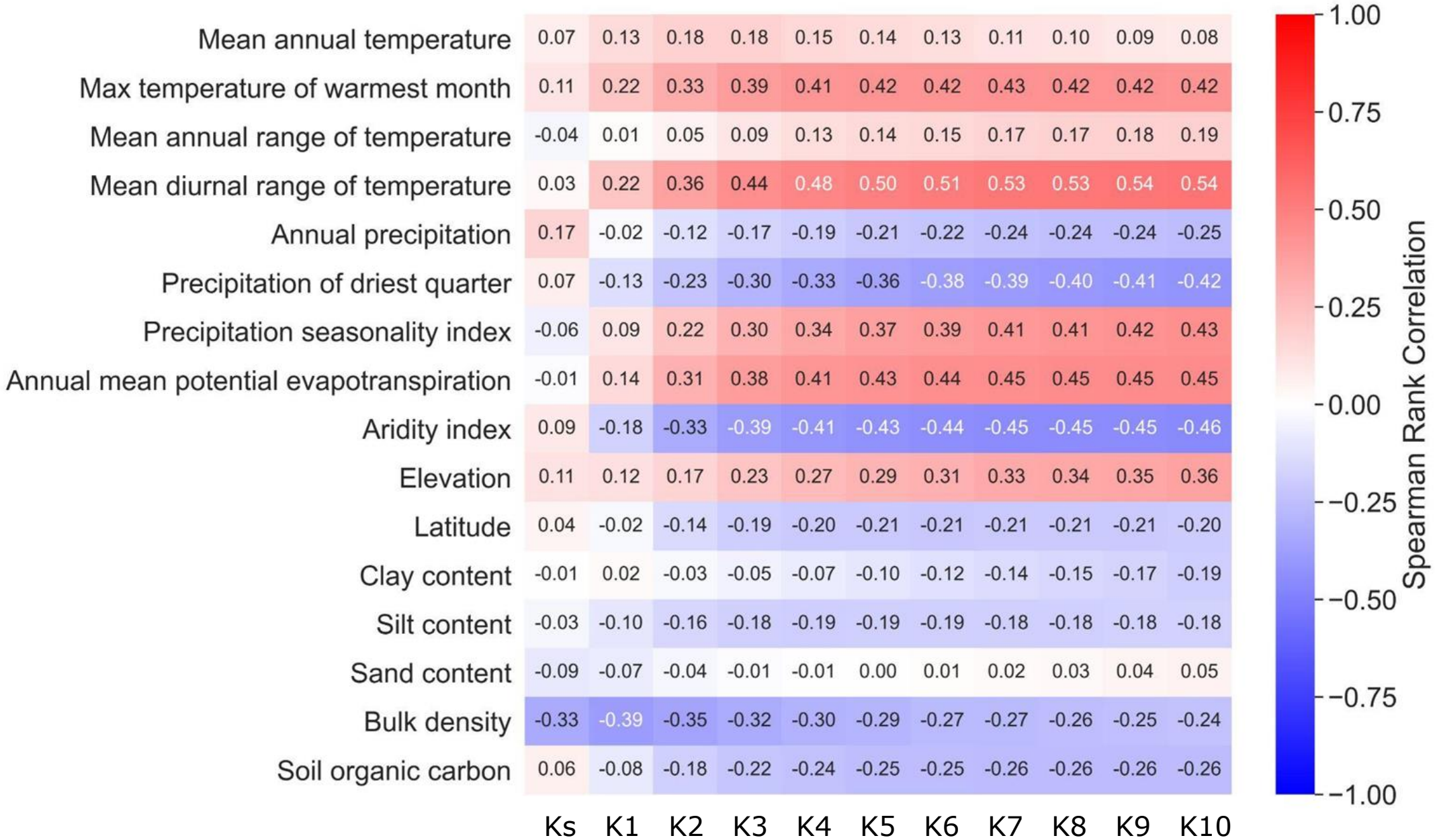


For each tension, the speed of infiltration (= hydraulic conductivity K) is measured

Open-source database of tension-disk infiltrometer (OTIM-DB)

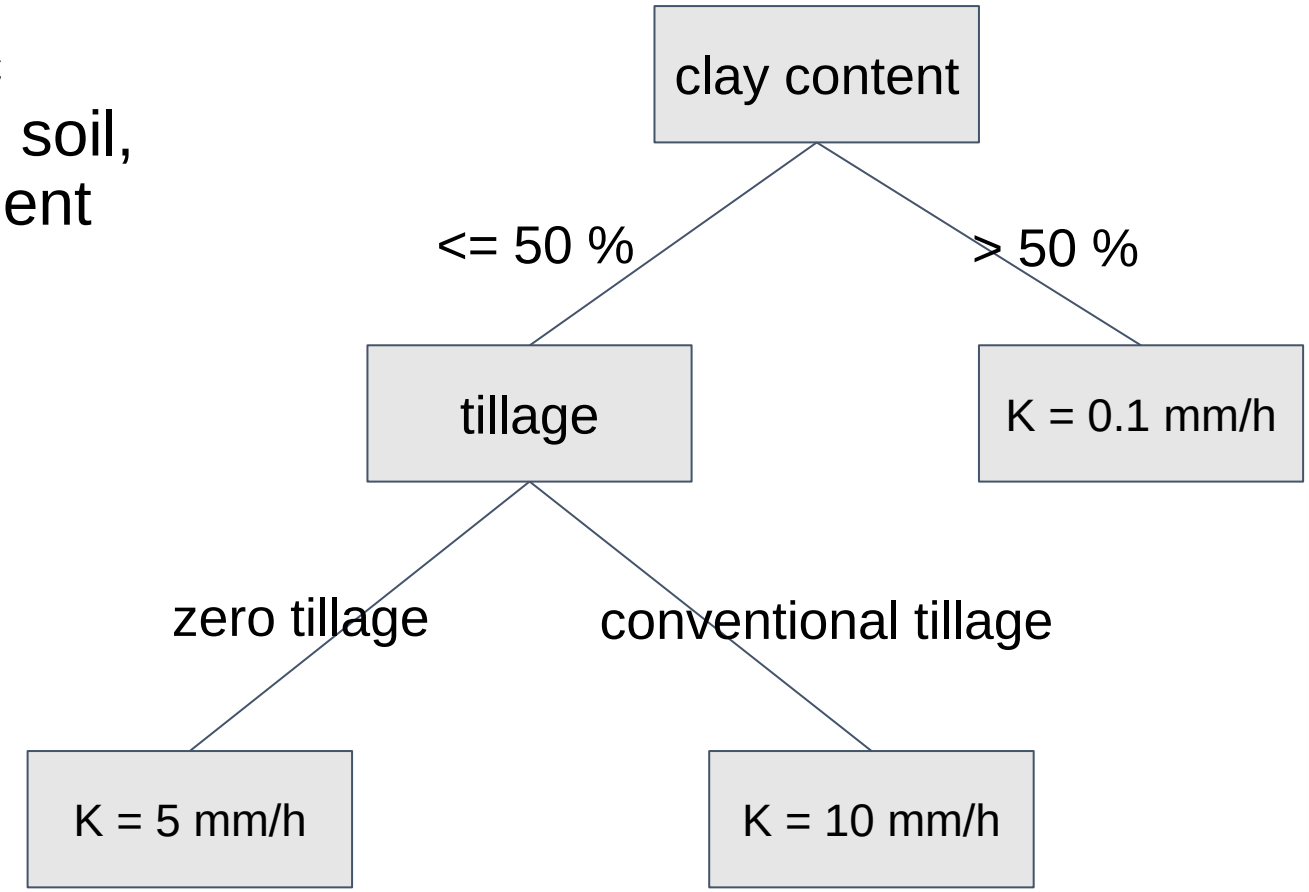


OTIM-DB: Correlation



Machine learning

Prediction of hydraulic conductivity (K) based soil, climate and management parameters



Example of decision tree

Key messages

- Relationships between agricultural practices and soil parameters from literature have been summarized
- Some driver/variable pairs are not studied/summarized -> knowledge gaps
- Pedo-climatic results need large database

Farmer perceptions

Sinead O'Keeffe, Jan Verhagen, Jan Hassink

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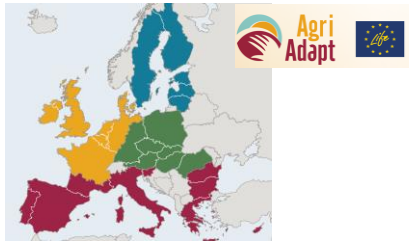
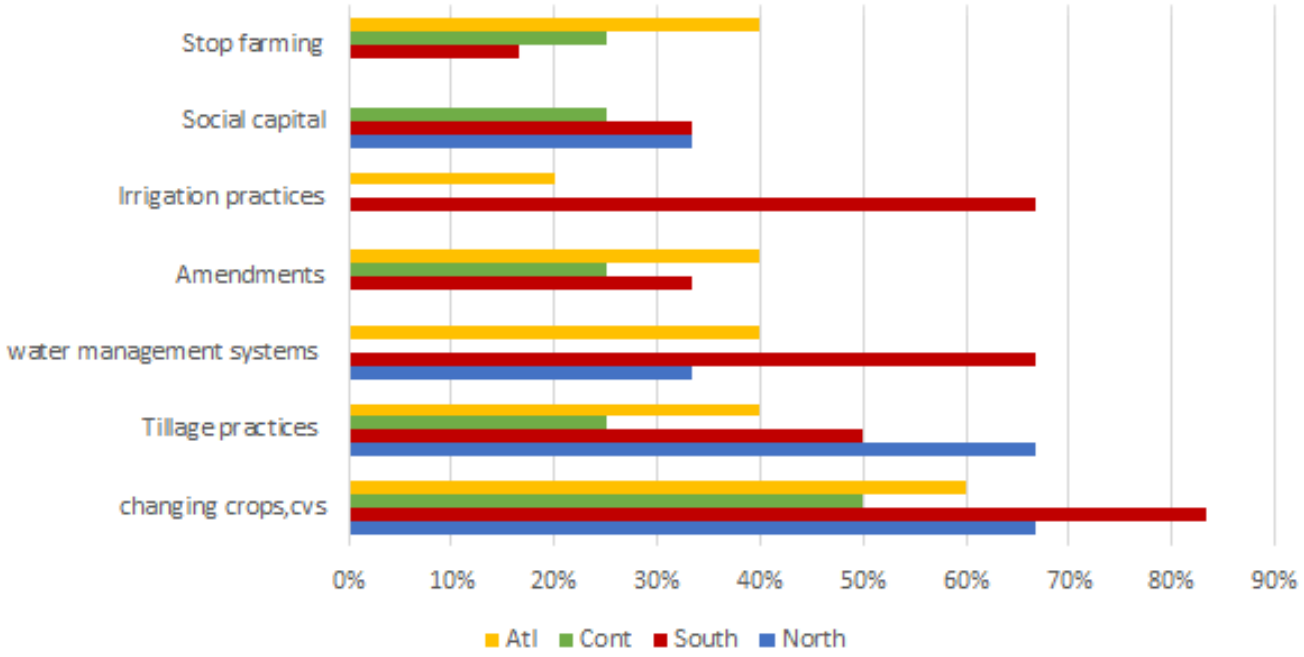
Farmer preferences for adaptation measures (Climate change literature)



Map source:
Agri Adapt (https://agriadapt.eu/)



Soil management as a means for climate change adaptation
Conclusions and some suggestions

Incentivize the implementation of a year-round soil cover with financial help and/or legislation.

Make sure organic matter from agricultural activities stays or returns as much as possible to the field and encourage addition of organic amendments.

Reward a reduction of traffic on agricultural land rather than focus only on a reduction of tillage.

Farmer engagement is crucial - connect with farmers and their motivations for adaptation

Use existing instruments via the CAP and the Green Deal

- Pedo-climate regions and other context specific factors are missing
- Engagement strategies need to consider the context & needs of the farm as well as type of farmer

CONTEXT IS KEY – NO ONE SOLUTION WILL FIT ALL
Technologies , techniques, farmers or regions/landscapes

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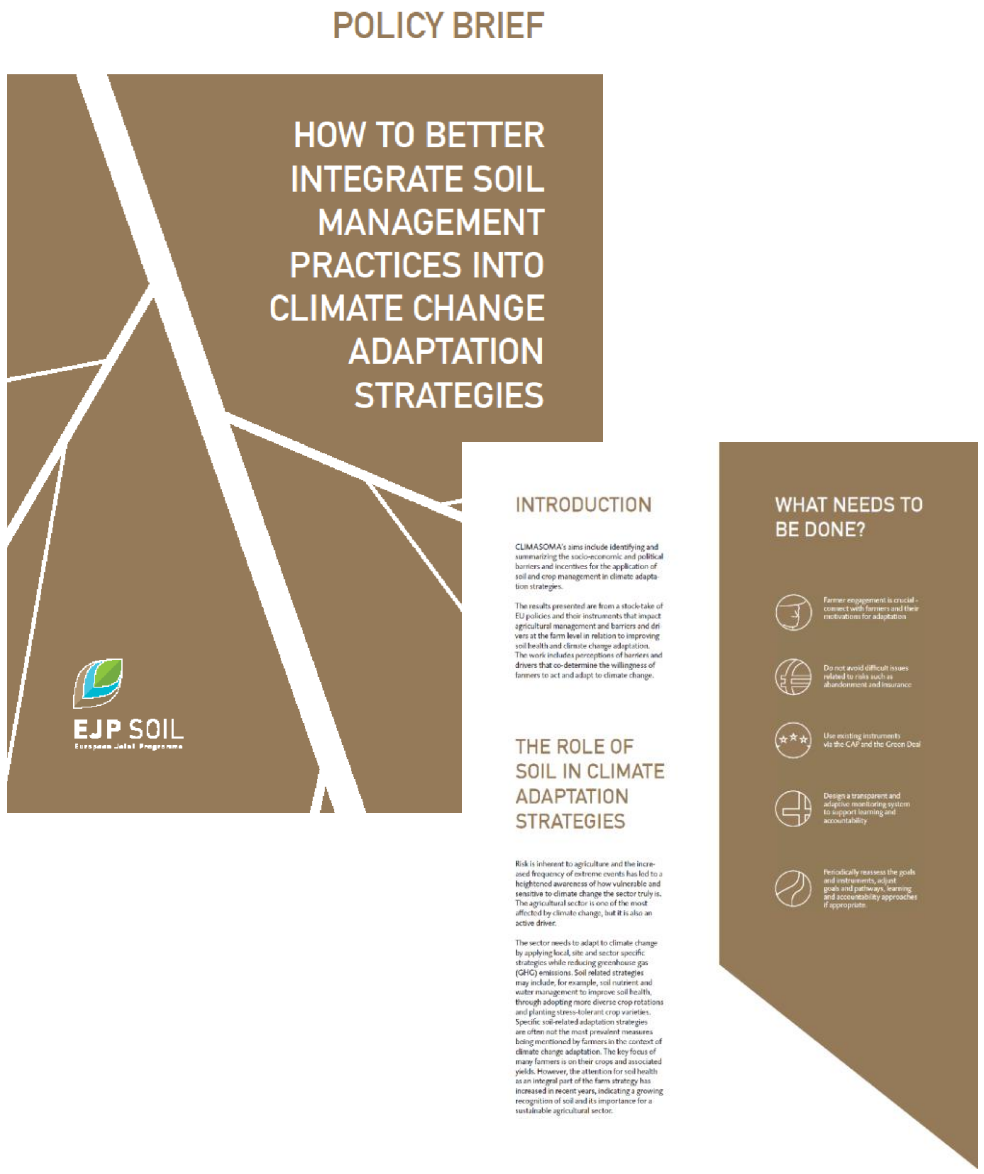
Policy briefs



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Available at : https://ejpsoil.eu/soil-research/climasoma

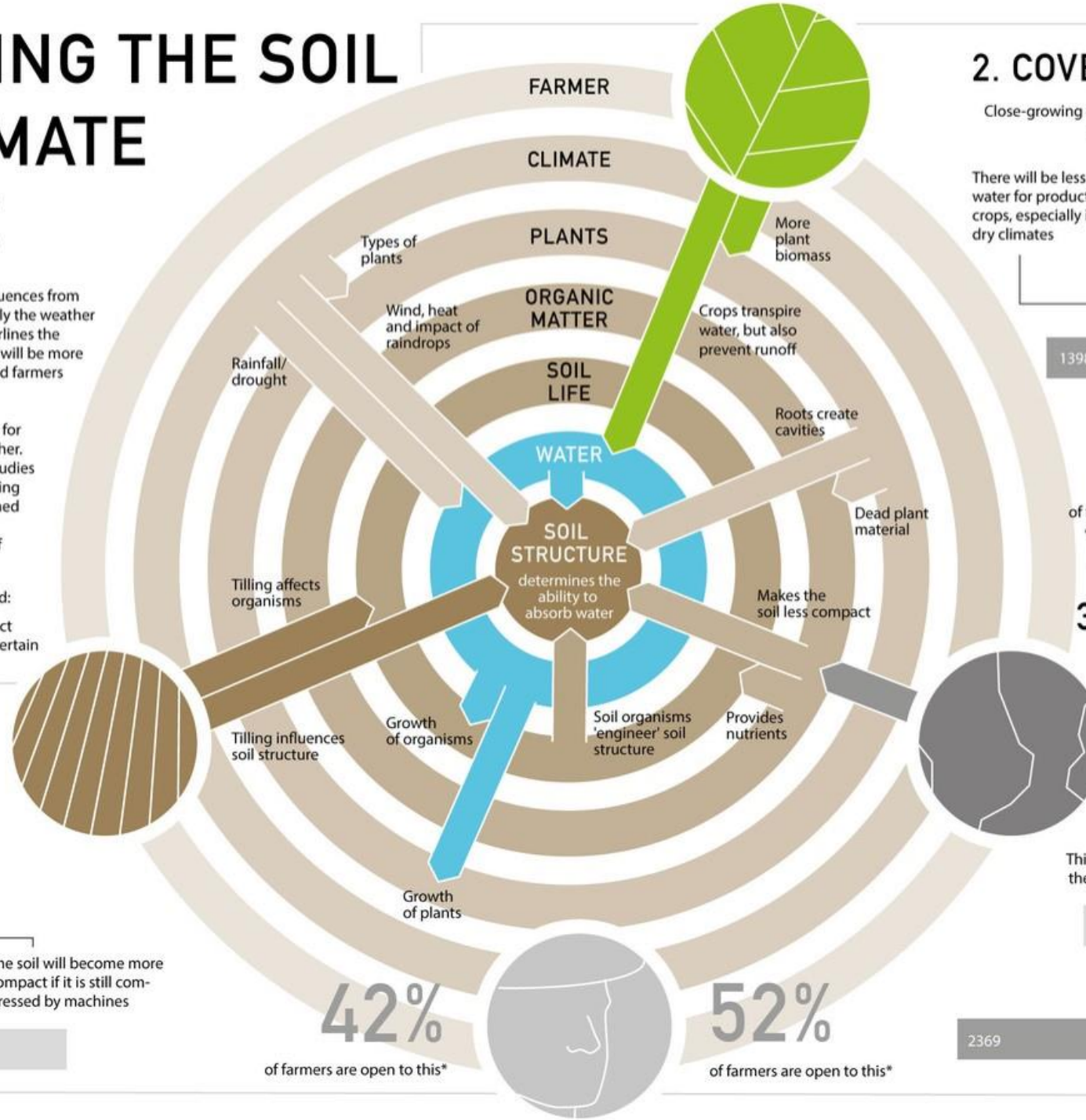
PREPARING THE SOIL FOR CLIMATE CHANGE

Farmers have always depended on influences from outside, especially the weather. Recently the weather has been more extreme, and this underlines the vulnerability of our food system. There will be more of both heavy rainfall and droughts, and farmers will pay the costs.

Crop and soil management are the key for farmers to adapt to the changing weather. Scientists have analized hundreds of studies to find evidence for the impact of farming methods on the soil. They also researched the willingness of farmers to learn and change, because farmers must know of

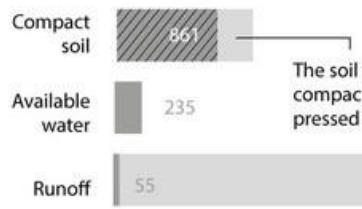
Almost 10.000 observations were found:

Beneficial effect | Detrimental effect | Effect uncertain



1. ZERO OR REDUCED TILLAGE

No, or a minimum of tilling between crop rotation



The soil will become more compact if it is still compressed by machines

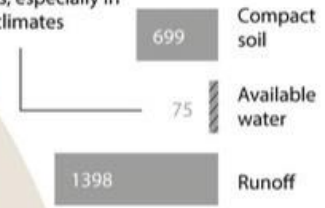
42%

of farmers are open to this*

2. COVER CROPS

Close-growing crop between periods of normal crop production

There will be less water for production crops, especially in dry climates



63%

of farmers are open to this*

*from the EUFP7-CATCH-C project

52%

of farmers are open to this*

3. ADDING ORGANIC MATTER

Examples are compost, wood chips, biochar, animal manure, straw.

This practice is restricted by the availability of materials.

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CLIMASOMA

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Agroecosystems, Policies, and Meta-analysis

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