The potential of soil management practices to address soil challenges across Europe

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EJP SOIL
European Joint Programme

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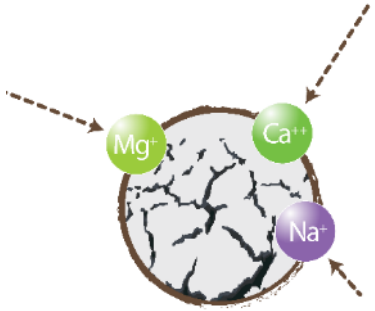
Agricultural soils face many challenges

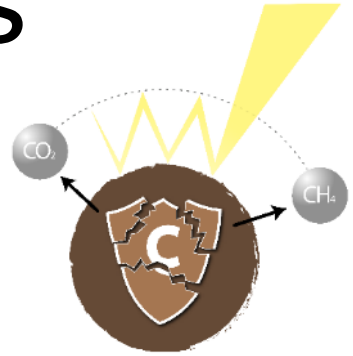
Erosion



Salinization
& sodification

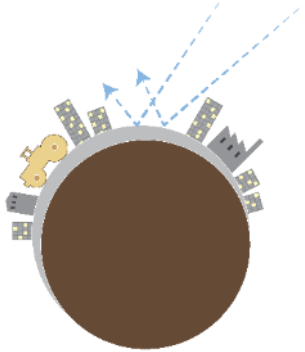
Contamination

Compaction

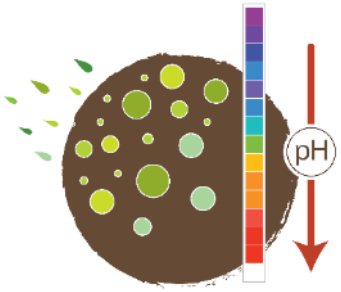


Carbon loss

Nutrient
imbalances



Sealing



Acidification

Biodiversity loss

Soil management is key

On-land ploughing

Cover crops

Drip irrigation

Liming

Reduced tillage

No-till

Agroforestry

Biochar

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The i-SoMPE Project

Goal

- Create European inventory of practices
- Summarise the impacts of practices
- Assess the current application of practices
- Assess the potential application of practices

Stocktake Project

- Expert survey in 24 EJP SOIL countries
- Review of European research projects

EJP SOIL Countries

Reviewed projects

EJP SOIL European Joint Programme · Catch-C · SmartSOIL · AGFORWARD Agroforestry for Europe · iSQAPER Interactive Soil Quality Assessment · AGRI · WOCAT · BEST4SOIL · SoilCare · smartAKIS Smart Farming Thematic Network · DiverIMPACTS · RECARE

Inventory A & B

Inventory A

Review of EU projects
[58 practices]

Description by experts
[49 practices]

Inventory B

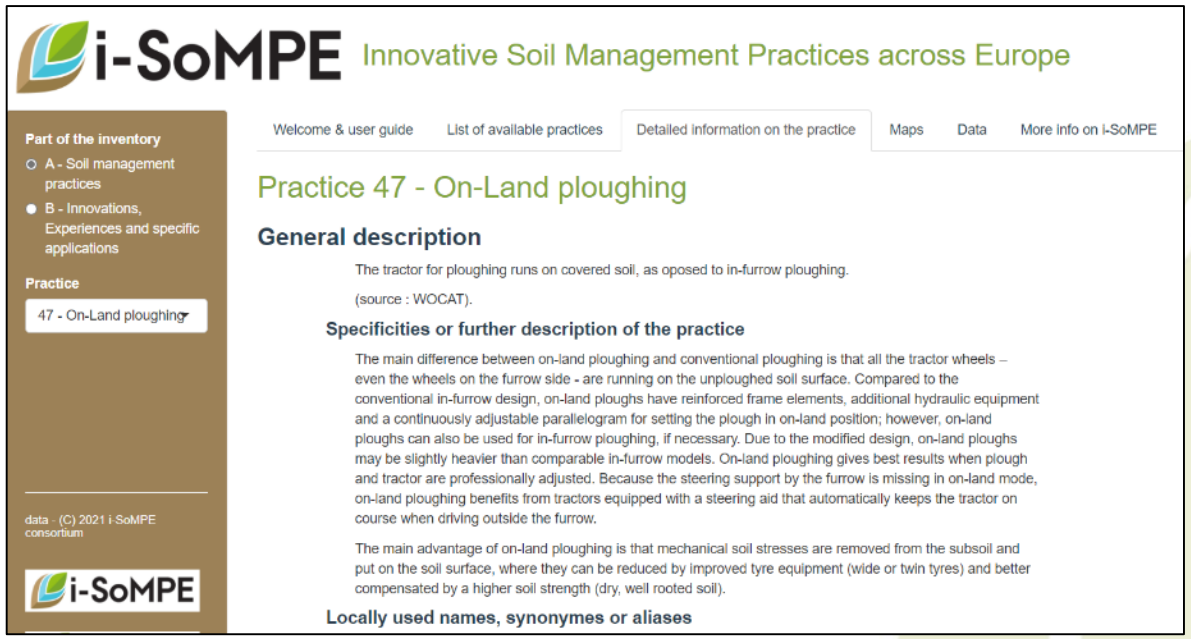
Survey among partners

Description by experts
[51 practices]

Inventory A & B: 100 practices

- Literature review + survey among partners
- Peer-reviewed description by experts
- Available online and as PDF

bit.ly/3J6rKyk



Inventory A: 58 soil management practices

13 Crops and crop rotations

- Cover crops
- Cover crops in permanent crops
- Crop rotation
- Deep rooting plants
- Establishment and maintenance of permanent grassland
- Extensive use of permanent grassland
- Grassland with legumes
- Intercropping
- Legume integration
- Diverse sward of permanent grasslands
- Perennial crops
- Strip cropping
- Undersowing

8 Organic matter and nutrient management

- Biochar
- Cover crop grazing
- Inorganic fertilizers
- Liming
- Mulching
- Organic fertilizers
- Use of biofertilizers
- Variable rate fertilizer application

12 Tillage and traffic

- Conservation tillage
- Contour cropping
- Controlled traffic farming
- Deep Ploughing
- Dyker
- Low pressure in tires
- No till
- On-Land ploughing
- Reduced tillage in permanent crops
- Ridging
- Strip tillage
- Temporary ditches

7 Water management

- Drainage systems, water table management and flooding
- Drip irrigation
- Irrigation scheduling
- Monitor soil salinisation
- Monitor the quality of irrigation water
- Paludiculture
- Water harvesting practices

4 Agricultural systems

- Conservation Agriculture
- Organic Farming
- Agroforestry
- Terrace Farming

4 Buffer strips and small landscape elements

- Buffer strips
- Hedgerow
- Retention ponds
- Semi-natural habitat creation and enhancement

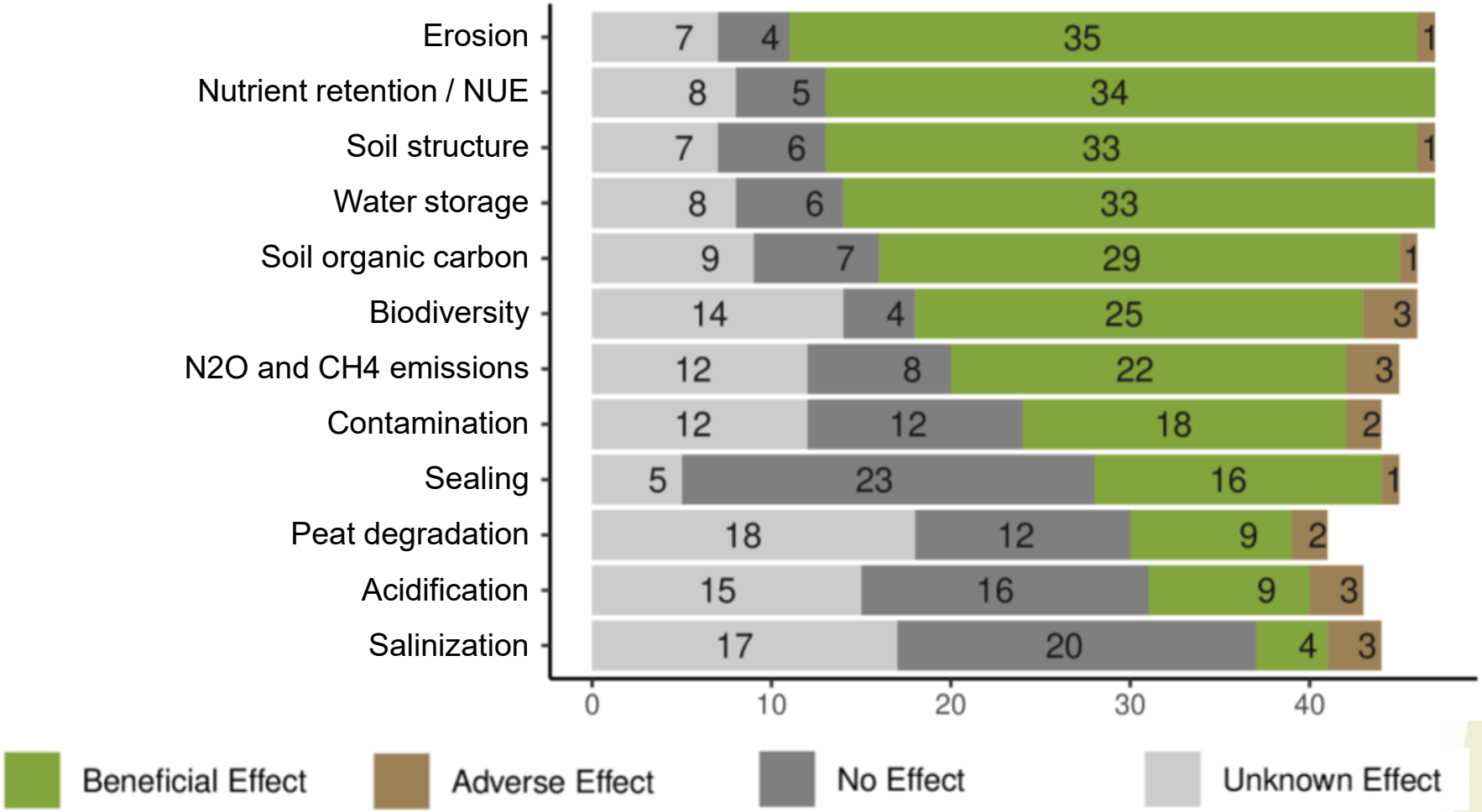
8 Crop protection

- Anarobic soildisinfection
- Biofumigation
- Integrated pest management
- Nematod protection
- Precision of herbicide application
- Push-Pull Methods
- Soil solarization
- Mechanical weeding

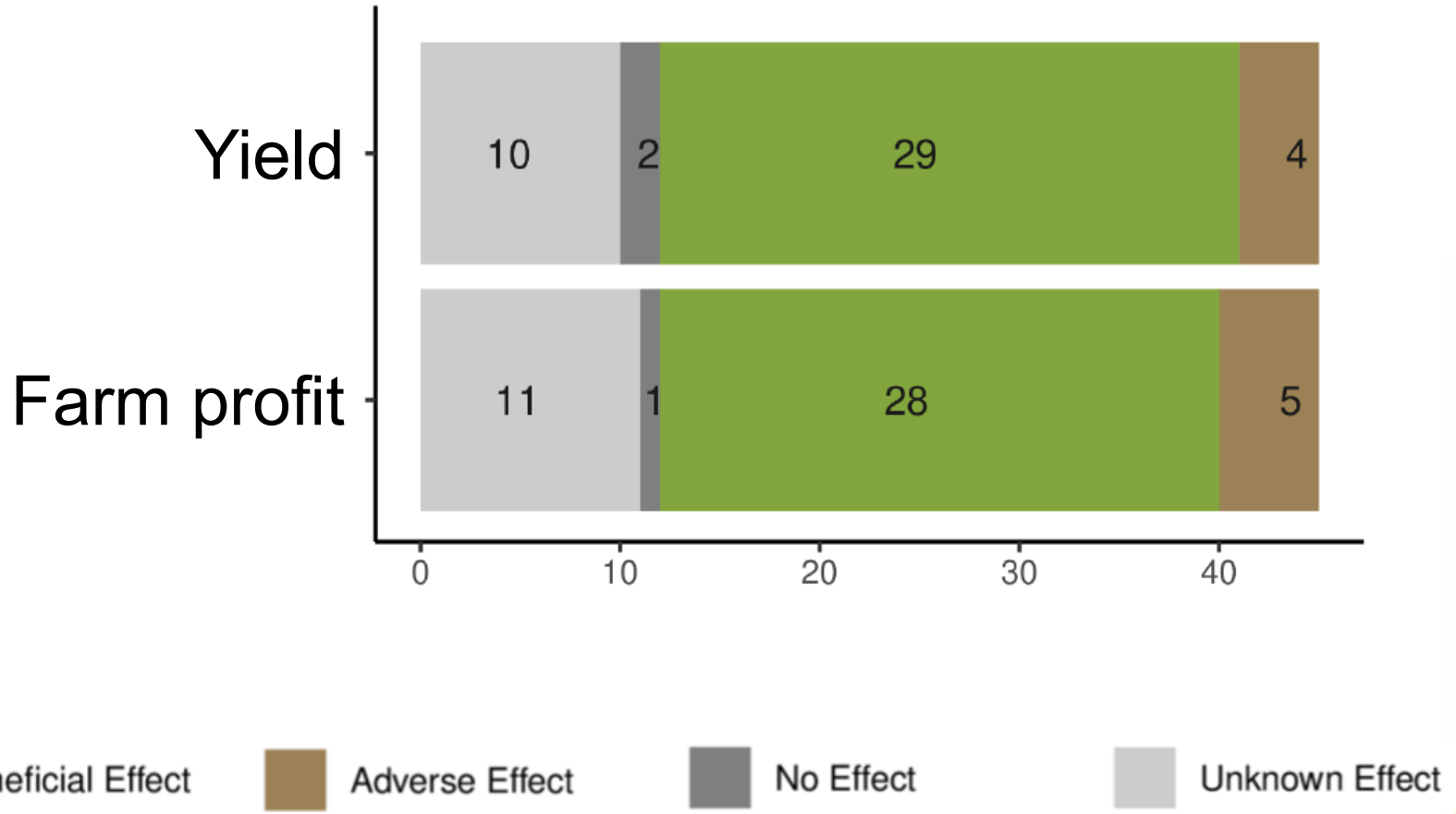
2 Other

- Land reclamation
- Soil compaction risk modelling

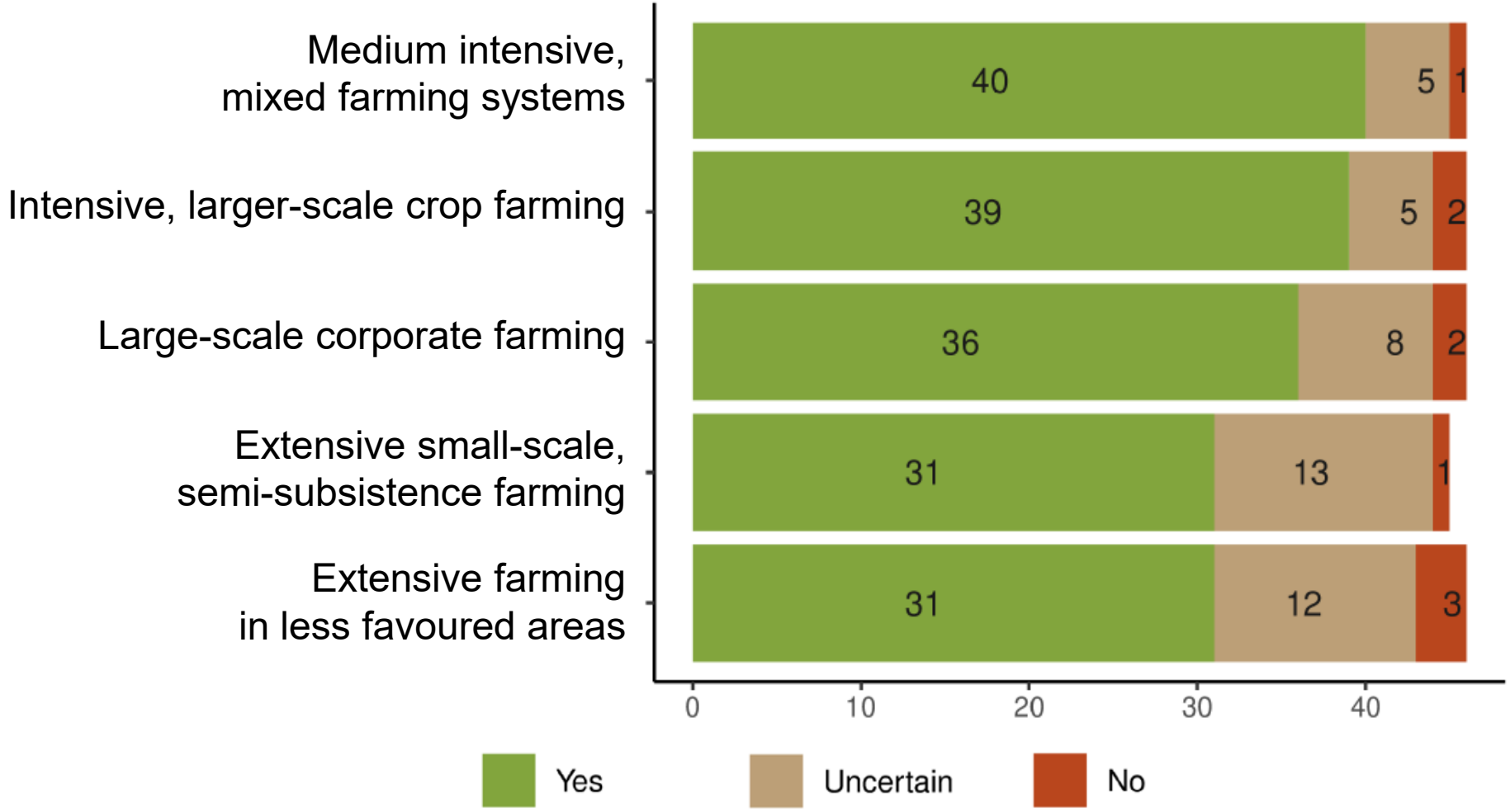
Impacts


Erosion
Nutrient retention / NUE
Soil structure
Water storage
Soil organic carbon
Biodiversity
N2O and CH4 emissions
Contamination
Sealing
Peat degradation
Acidification
Salinization
7 4 35 1
8 5 34
7 6 33 1
8 6 33
9 7 29 1
14 4 25 3
12 8 22 3
12 12 18 2
5 23 16 1
18 12 9 2
15 16 9 3
17 20 4 3
0 10 20 30 40
Beneficial Effect
Adverse Effect
No Effect
Unknown Effect

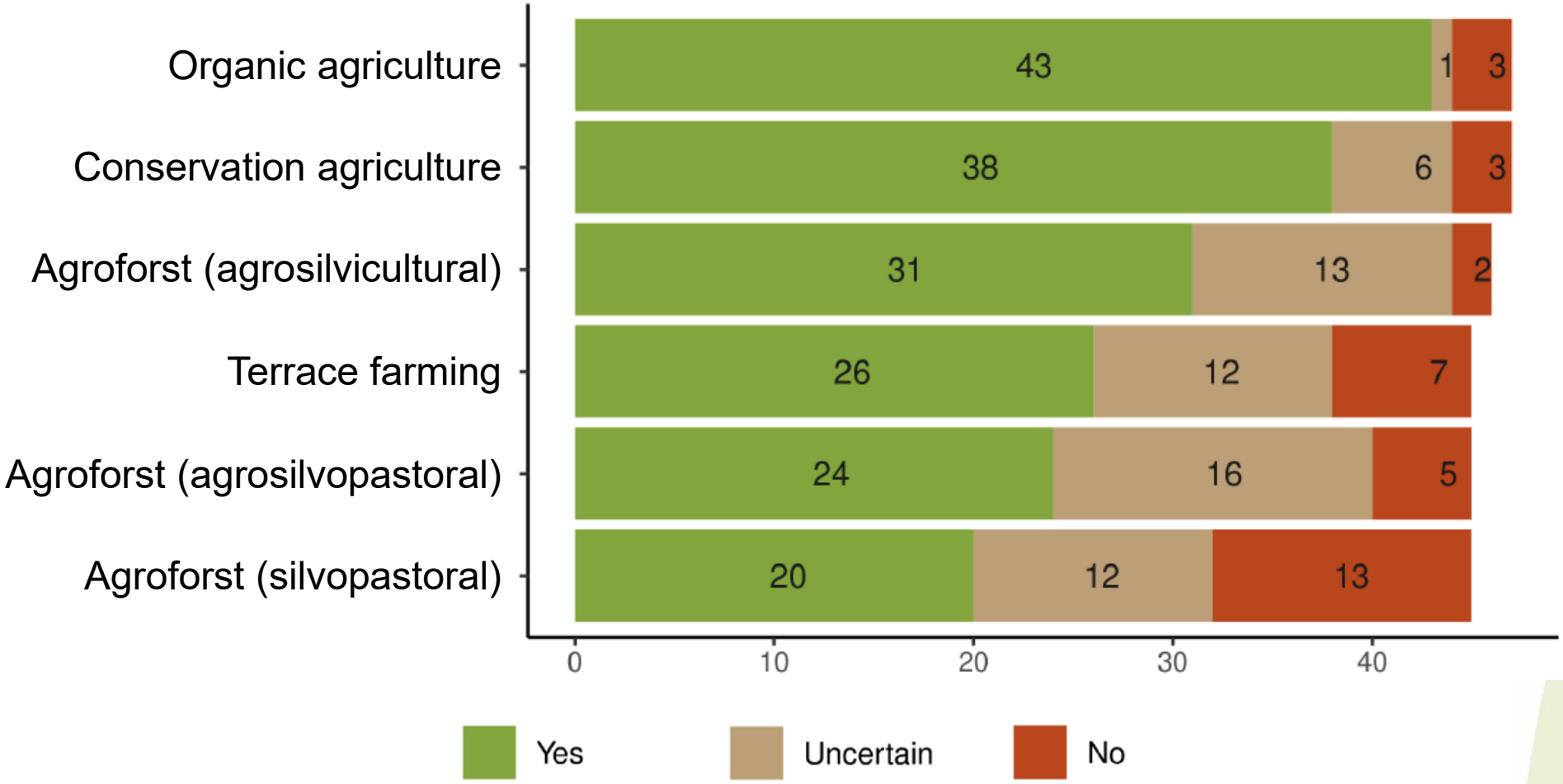
Other impacts



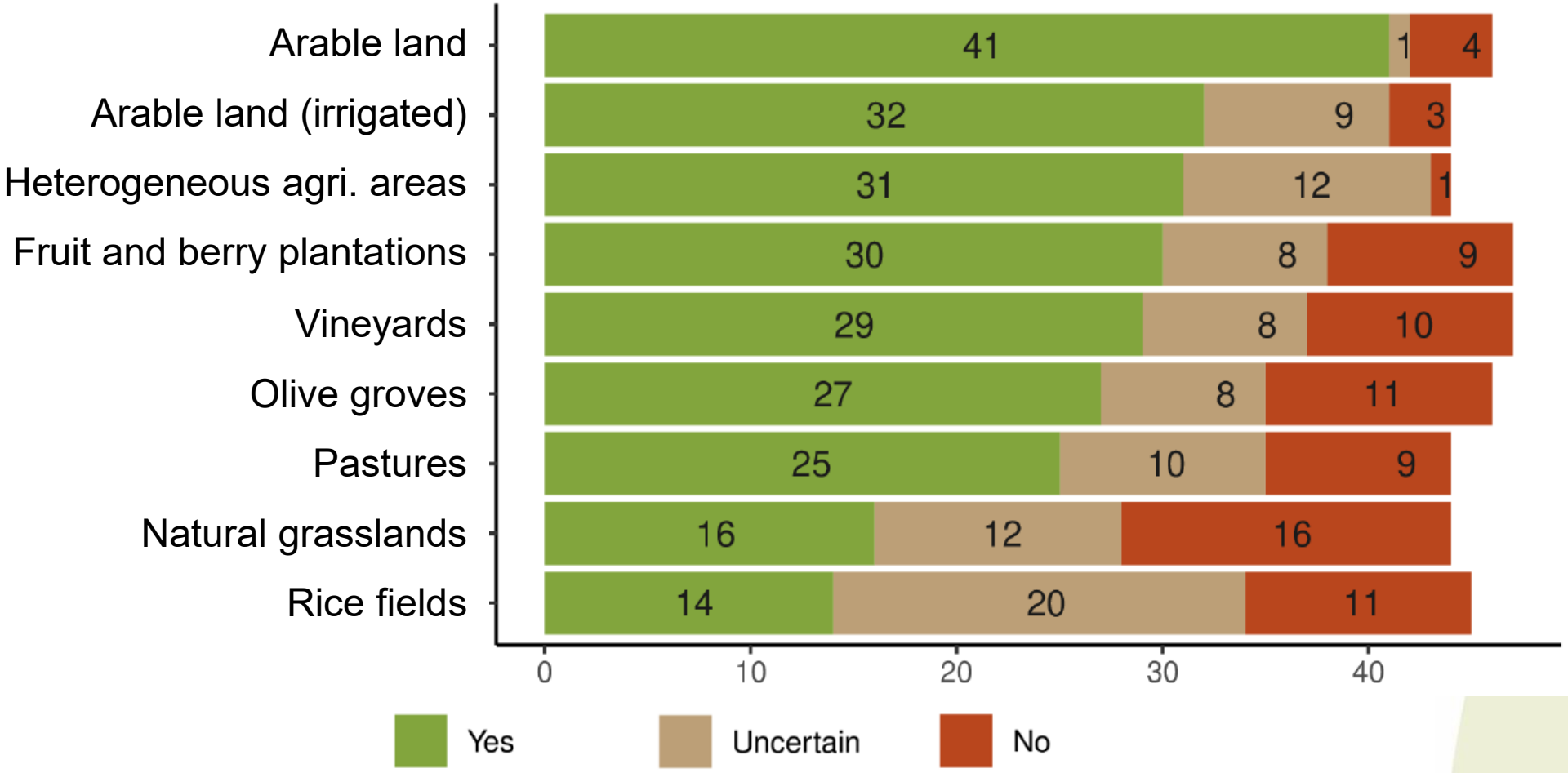
Compatibility with farming system



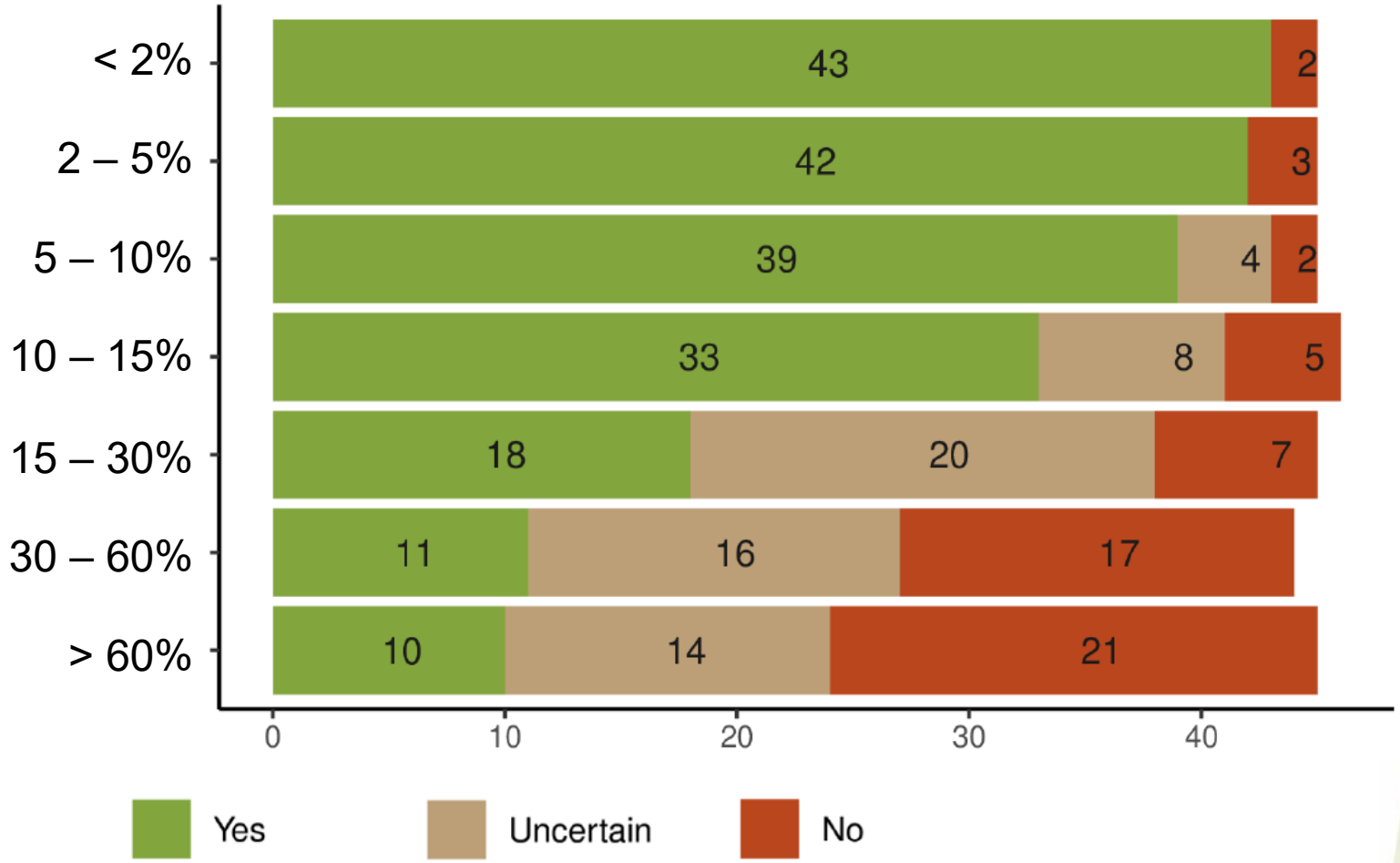
Compatibility with system approaches



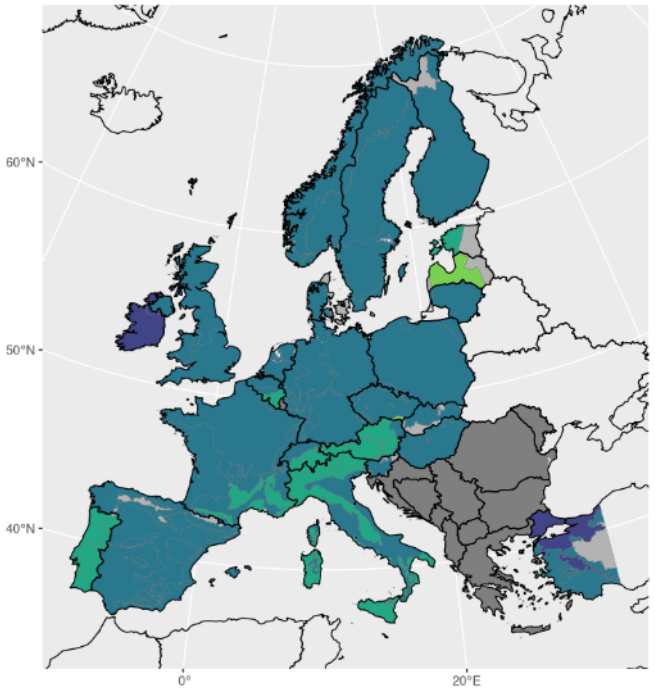
Compatibility with land use



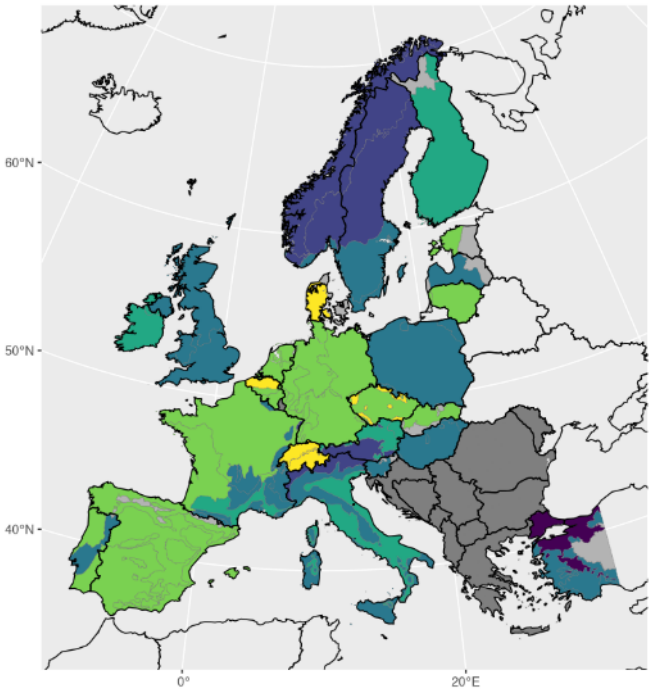
Compatibility with slope



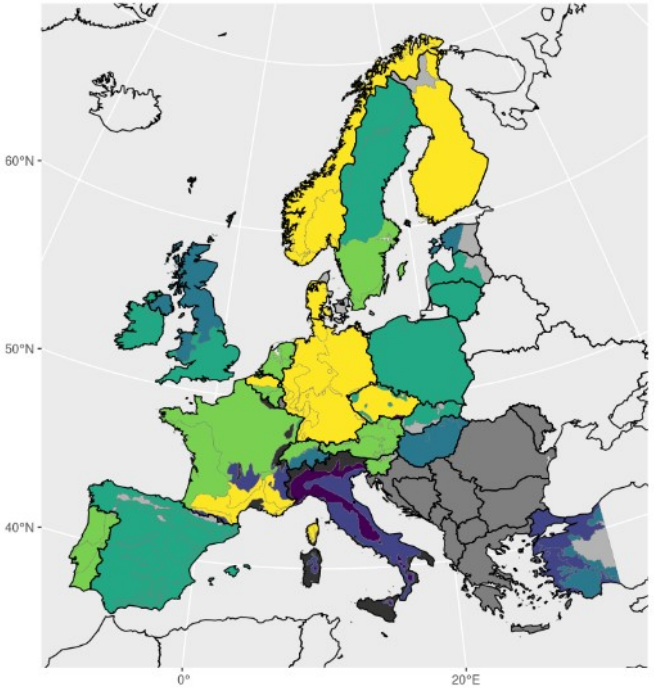
Current application



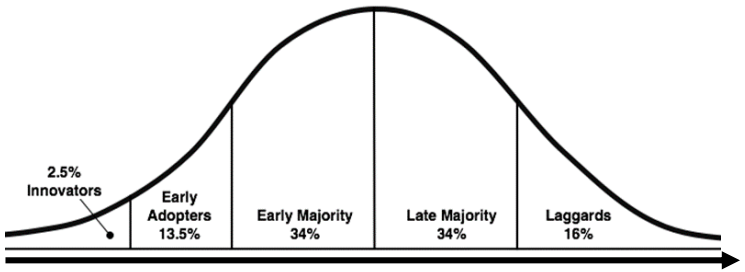
Biochar



Cover crops



Liming



Diffusion of innovation (Rogers, 2003)

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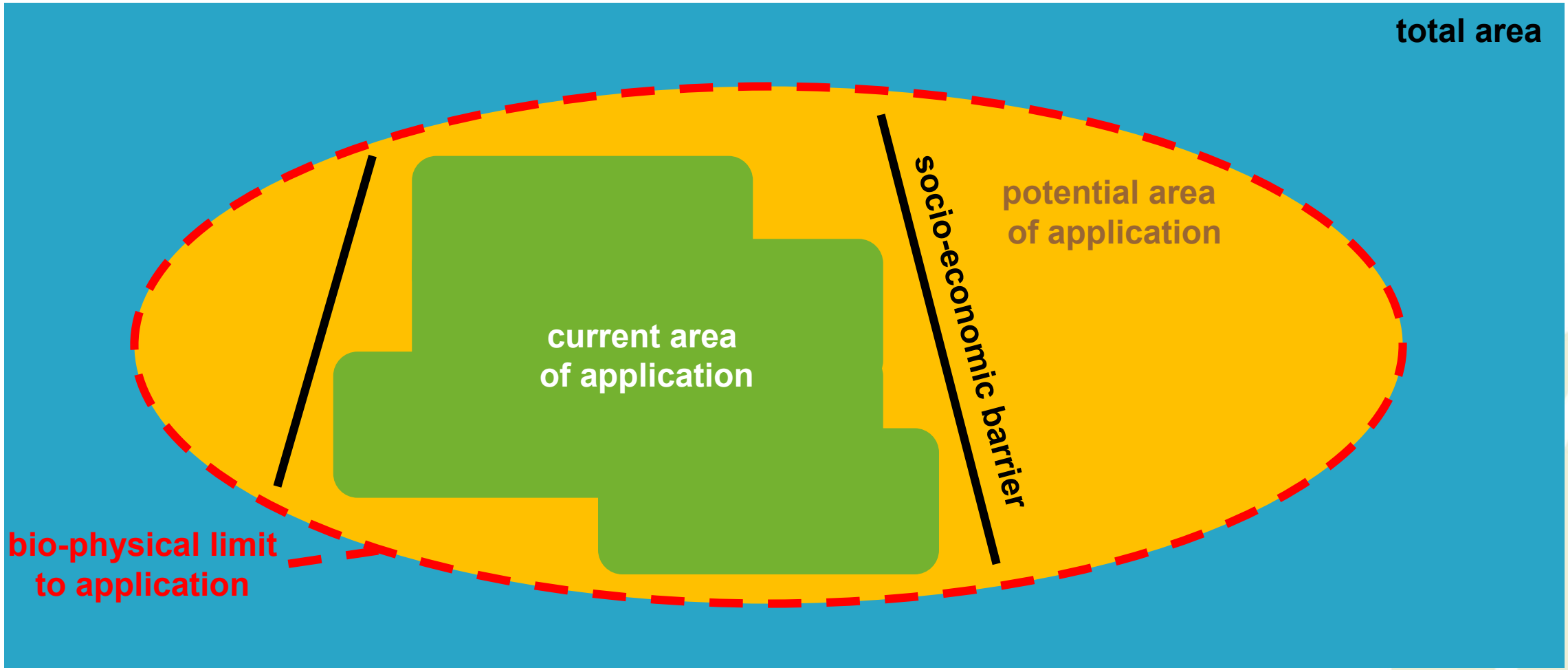
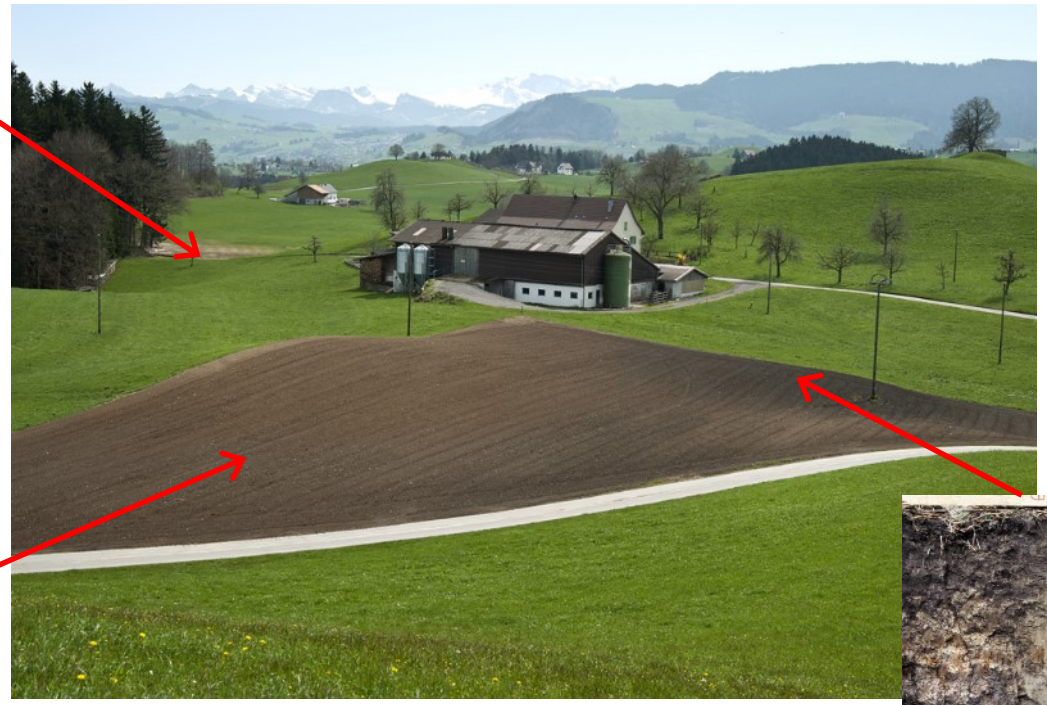
Concept of limits and barriers

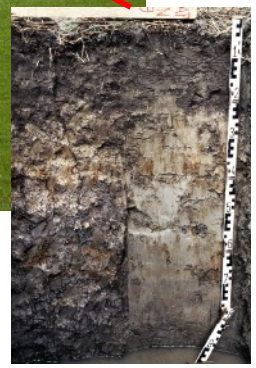


Bio-physical limits

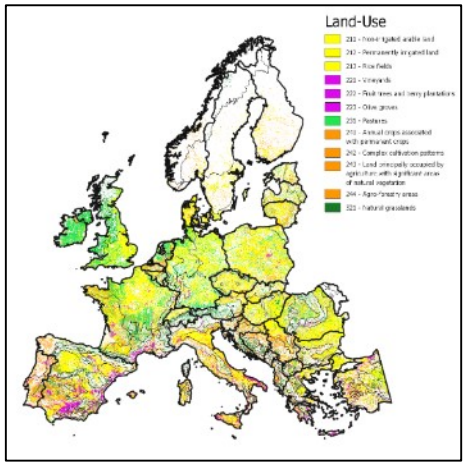
Histosol



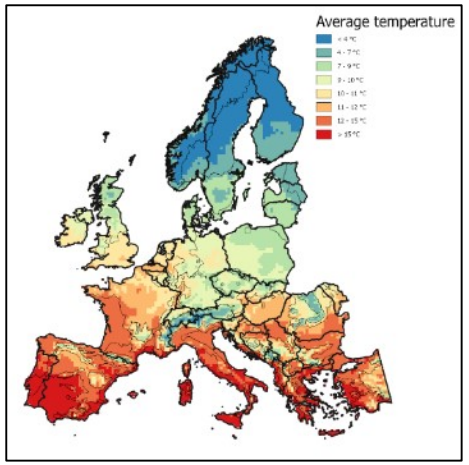
Cambisol



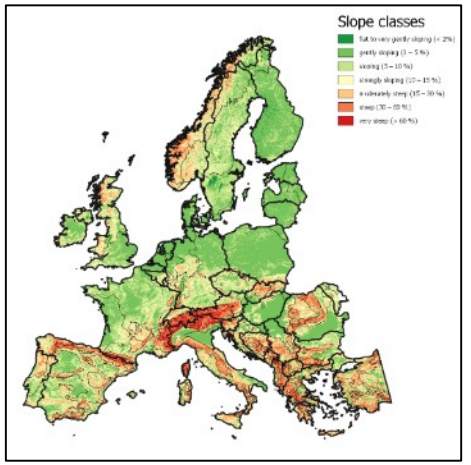
Gleysol



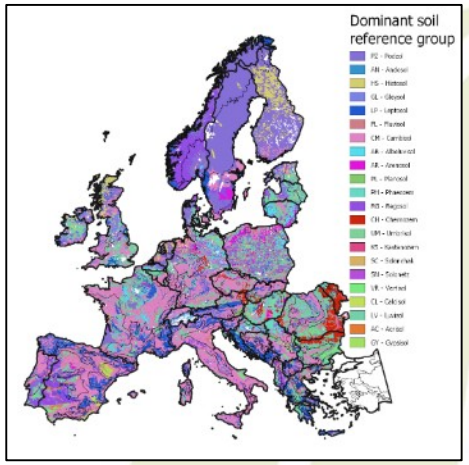
Land use



Climate



Topography



Soil type

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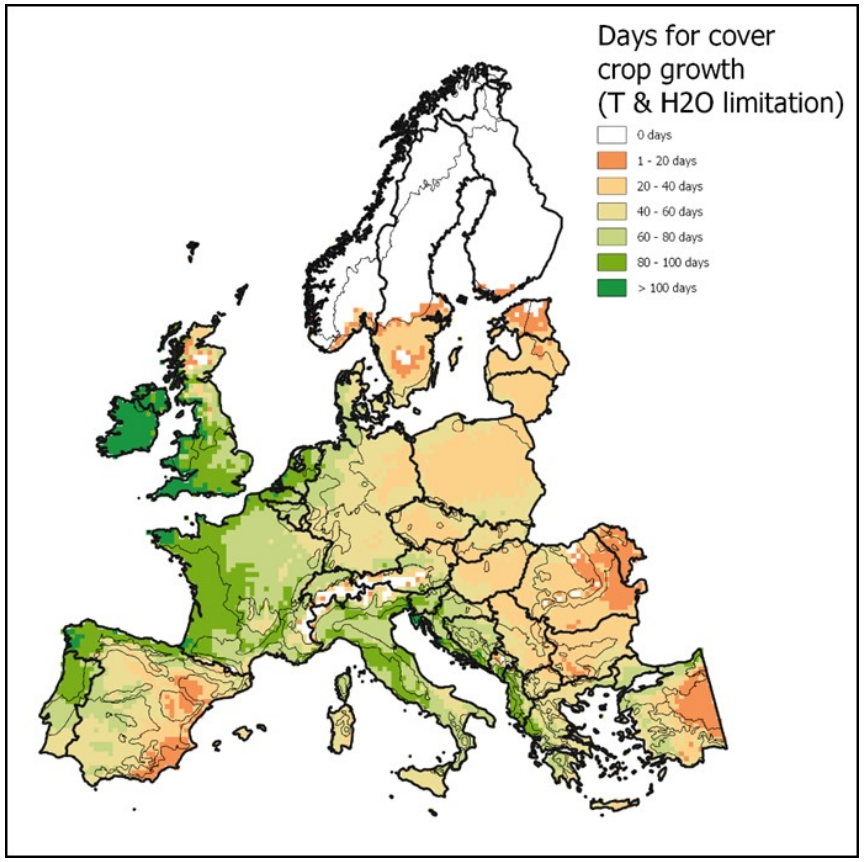
Bio-physical limits of cover crops



Days for cover crop growth

Assumptions:

- after winter wheat on arable land
- > 40 days of growth
- < 30% slope

Result:

- Cover crops are limited on ~40% of Europe's arable land due to:
  - Slope: 0.2%
  - Temperature: ~6%
  - Available Moisture: ~34%

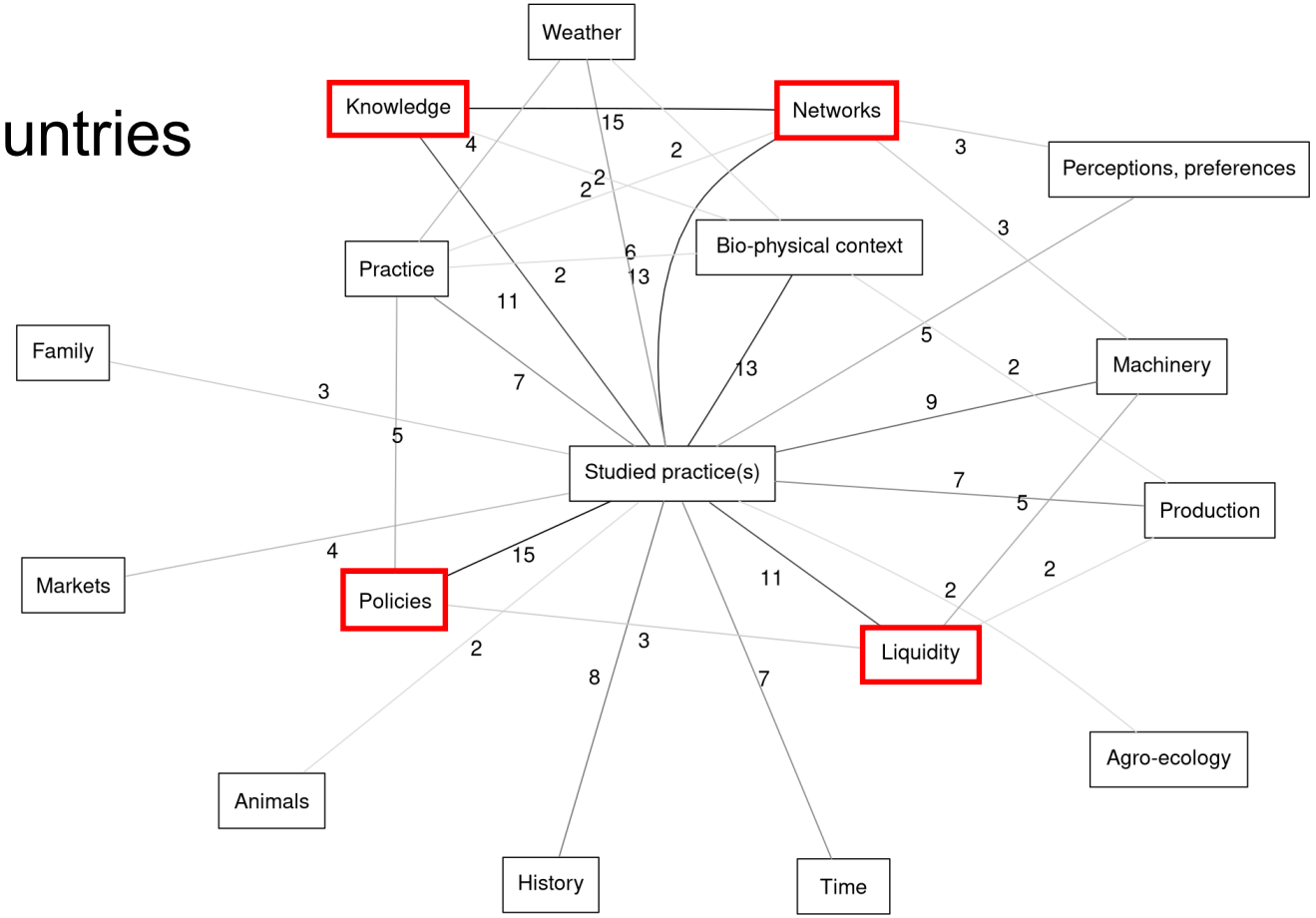
Socio-economic barriers

Methods:

- Qualitative Interviews in 20 countries
- Social cognitive mapping

Case Study on
Conservation Agriculture (CA)

- Knowledge on CA practices
- Network around the farmer
- Liquidity for machinery
- Policies can support adoption



Conclusions

- Many (innovative) soil management practices in Europe
- Many practices adress multiple soil challenges
- The application of many practices may be increased
- Bio-physical limits to adoption exist
- Regional and context-specific socio-economic barriers are relevant
- Policies and marked based instruments can support the application by considering these points

Thanks to all partners

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More information / reports / etc.

- ejpsoil.eu
- isompe.gitlab.io/blog/
- Inventory on website: bit.ly/3J6rKyk
- Open data on Zenodo: zenodo.org/communities/i-sompe/
- Scripts and programs on Gitlab:
  - gitlab.com/FrdVnW
  - gitlab.com/heoi

Q & A