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STRUCTURAL AND COHESION POLICIES
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Preserving agricultural soils in the EU

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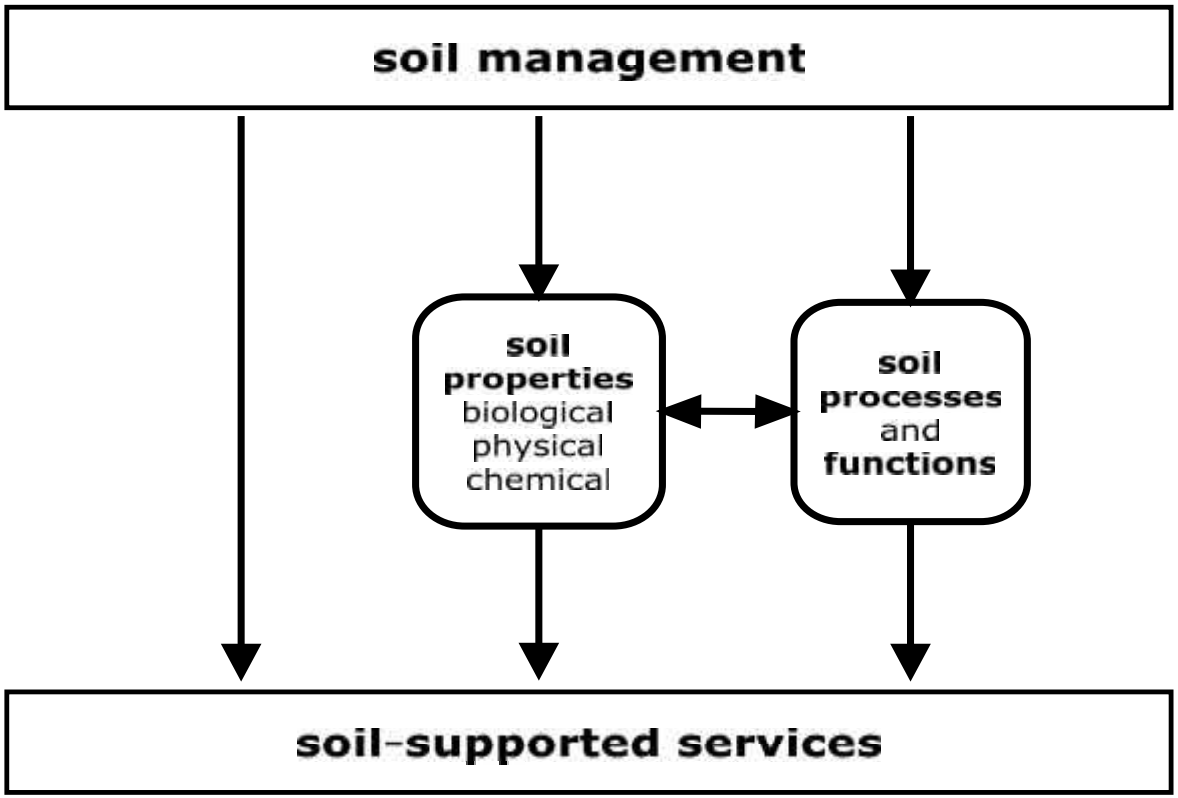
Structure of the Presentation

1. Soil functions and services
2. Distribution of soil types
3. Soil threats
4. Soil management
5. Elements for policies
6. Conclusions and recommendations

1. Soil functions and services



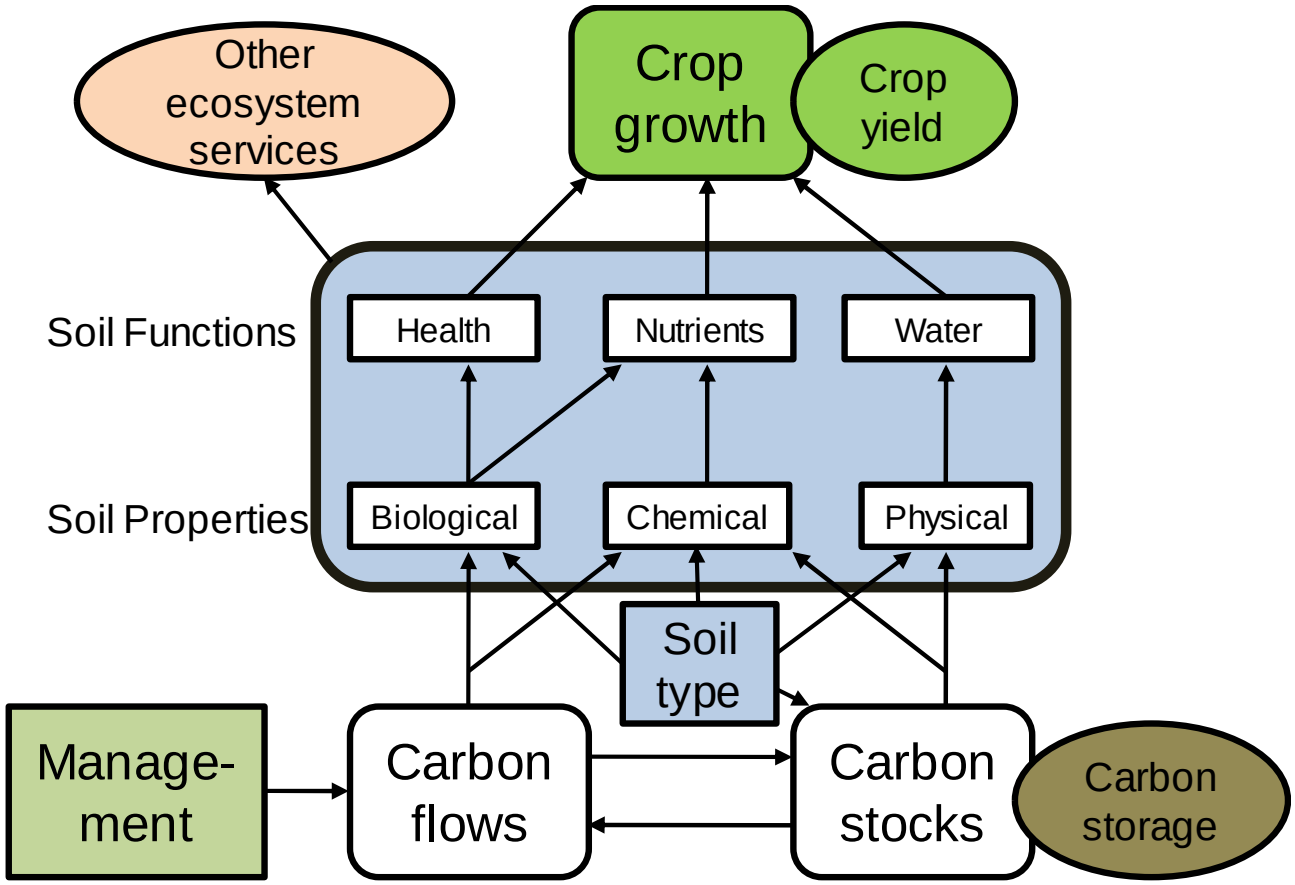
Soil functions

- Primary production
- Water regulation
- Nutrient cycling
- Habitat support
- Climate regulation

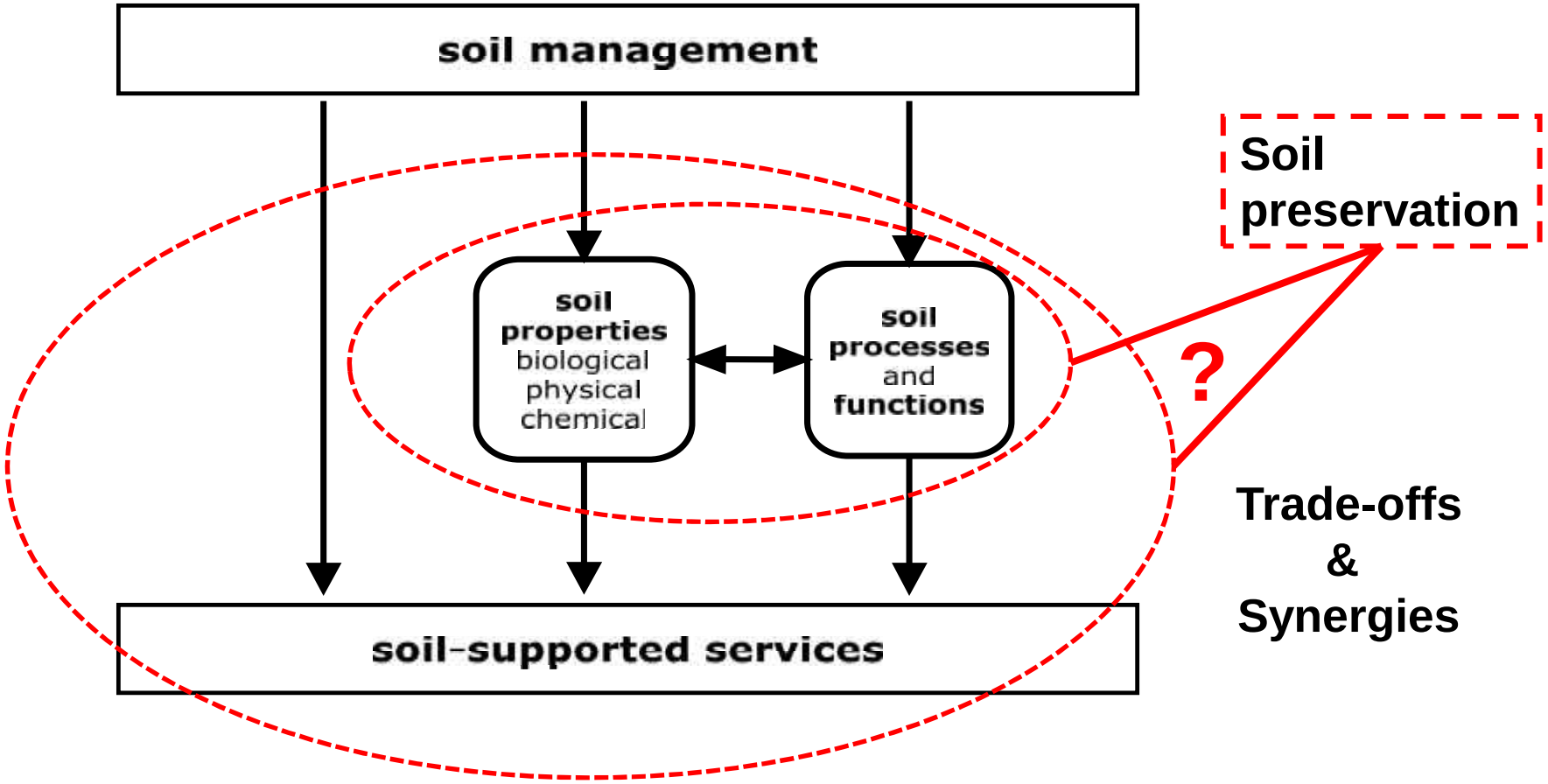
Soil-supported services

- Harvestable crops
- Clean fresh water
- Re-use of resources
- Habitat for biodiversity
- Benign climate

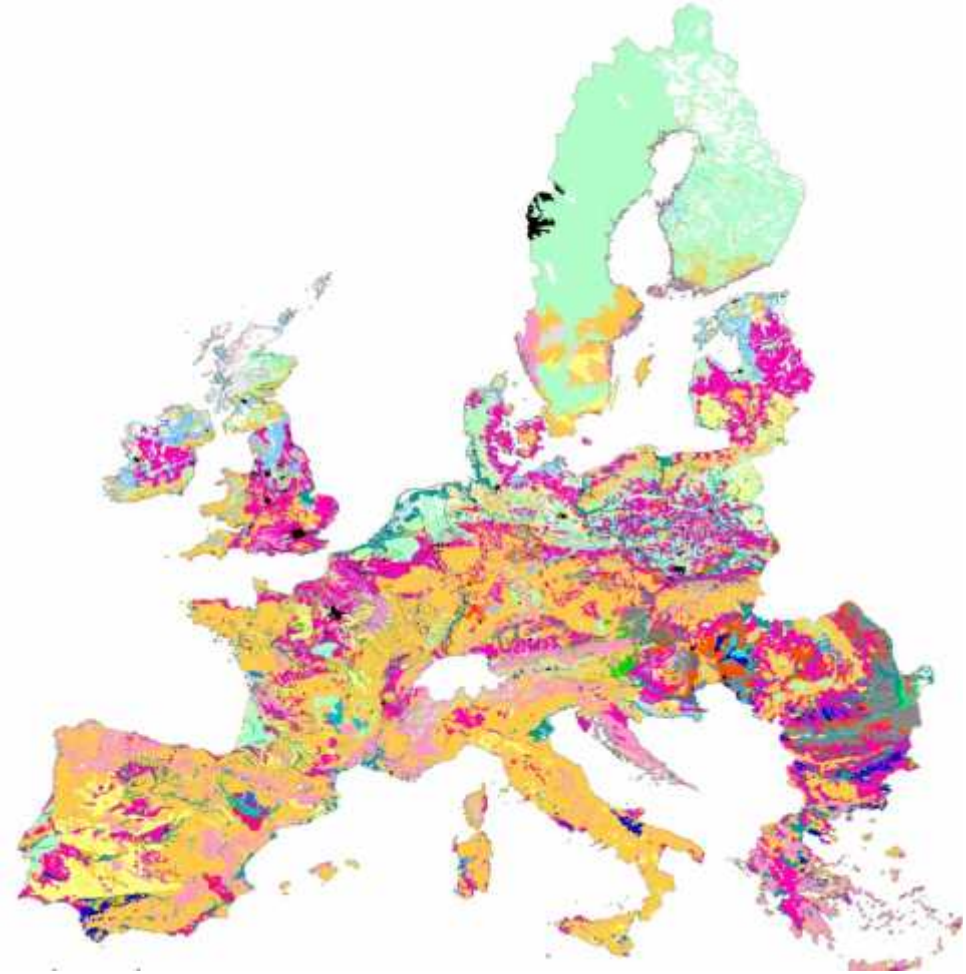
(Schulte et al., 2014)



(Smartsoil FP7)


soil management
soil properties biological physical chemical
soil processes and functions
soil-supported services
Soil preservation
?
Trade-offs & Synergies

2. Distribution of soil types

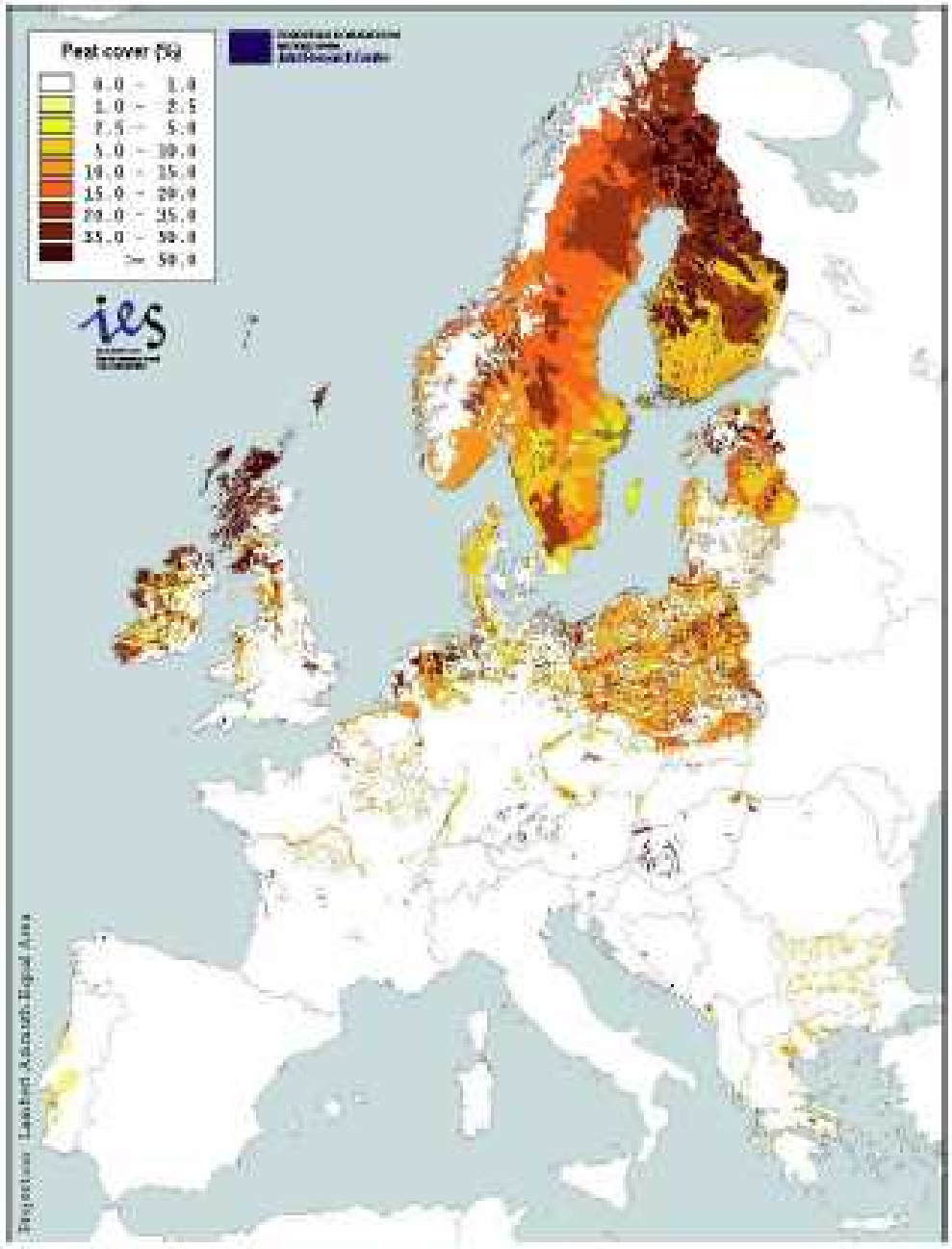


- Very relevant interactions between soil type (S), environment (E) and soil management (M)
- E includes climate, slope, and the socio-economic context
- Soil requirements, and measures effective to protect soils, differ by S x E x M
- **Implication: Policies aiming to steer M must be differentiated across Europe**

(courtesy of Dr P. Panagos, 2017)

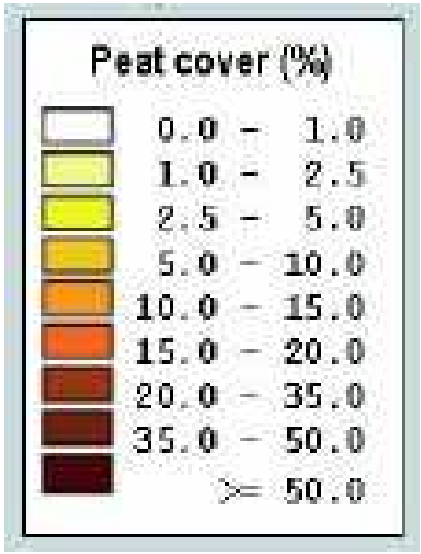
3. Soil threats

Erosion by wind	Acidification
Erosion by water	Low fertility
Floods & Land slides	Desertification
Carbon-loss peat soils	Loss of biodiversity
Carbon-loss mineral soils	- in the soil - above-ground - soil-borne diseases
Compaction	
Sodification	Sealing (land-grabbing)
Contamination	



Peat soils (Histosols) and peat-topped (0-30 cm) soils

(Montanarella et al., 2006)
(RECARE Soil Threats, 2016)



Degradation of peat soils

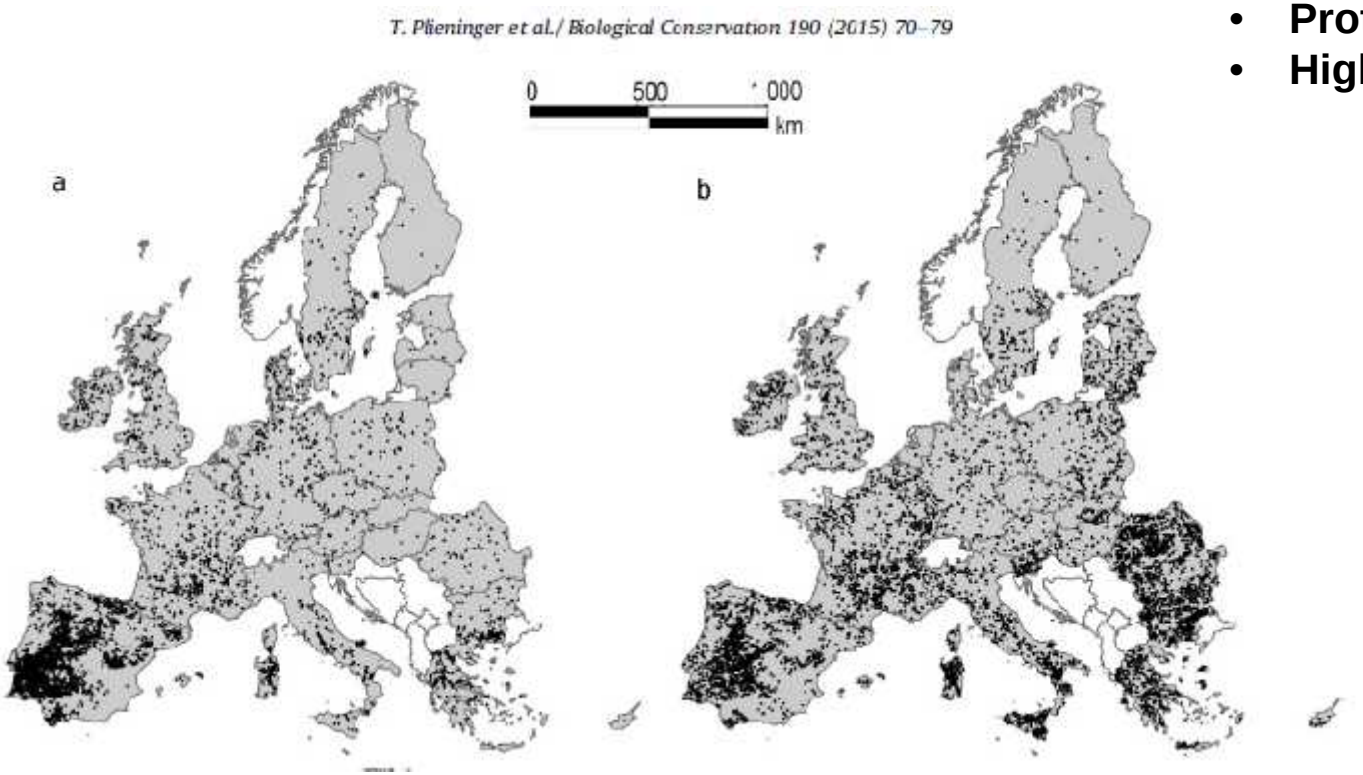
- Peatlands store 455,000 Mt of C (globally)
- = twice global forest biomass-C
- 17,000 Mt C in EU peat soils
- = 25% of EU soil C stock (70,000 Mt)
- 27 t CO_2/ha/y from peatland under agriculture
- 27 t/ha/y * 3.6 Mha = 100 Mt CO_2/y (EU)
- = 2.2% of EU-28 annual CO_2 from fossil fuels

  (4,420 Mt CO_2/y in 2015)
- Pristine peatlands sequester 350 Mt CO_2/y (globally)
- ... and have high nature value

Agro-forestry / silvo-pastoral systems

- **High C stocks**
- **Protect from erosion**
- **High nature values**

(Plieninger et al., 2015)



Pastures in open woodland

Pastures with sparse trees

<u>% of territory</u>

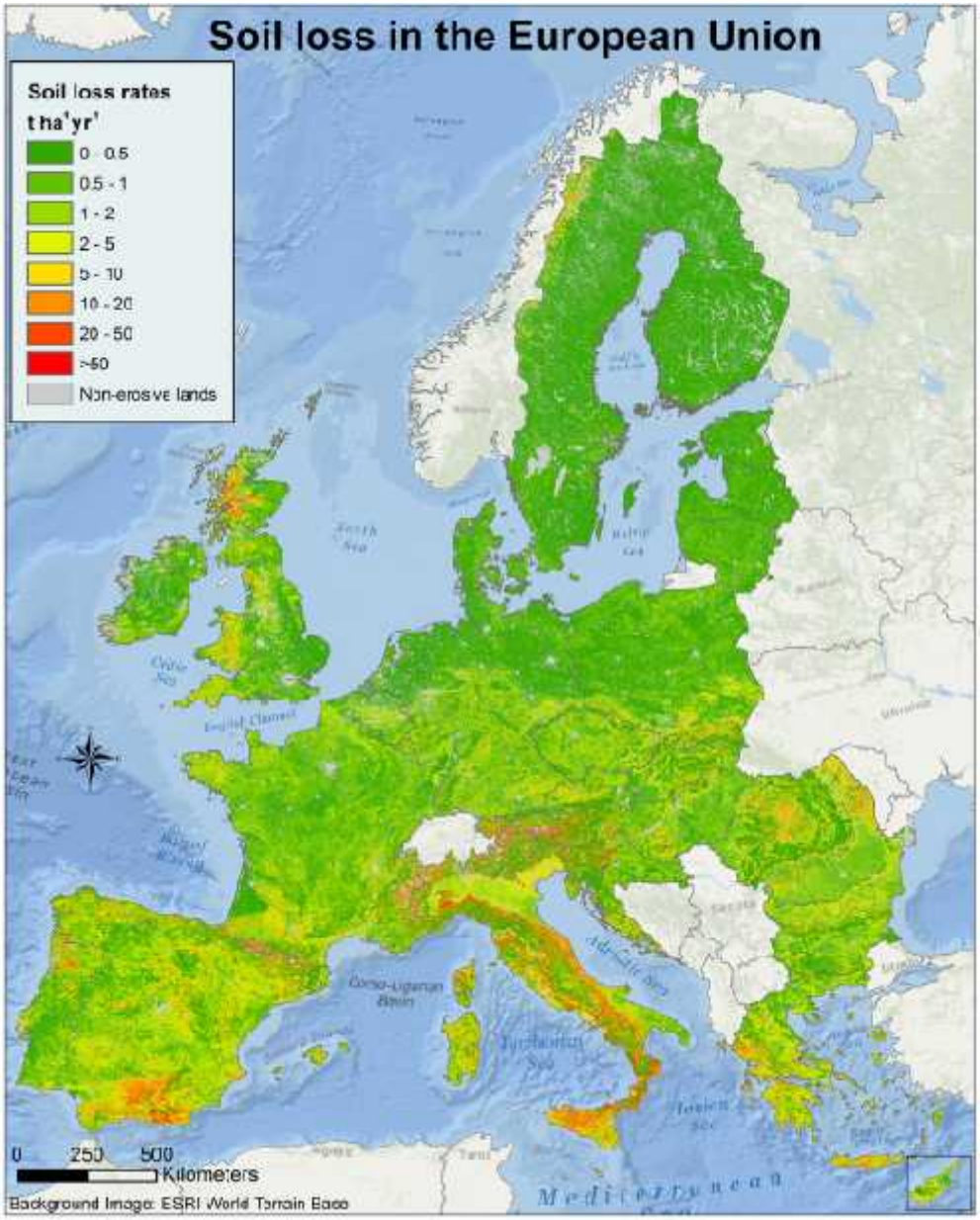
Bulgaria	*10.3*
Greece	*10.1*
Ireland	*5.1*
Italy	*5.3*
Portugal	*16.4*
Romania	*7.2*
Slovenia	*5.4*
Spain	*11.7*
EU-27	*4.7*

Transsylvania
Fagus
Romania

'dehesa',
Quercus
Spain

Fruit
Orchard
Germany

Water erosion

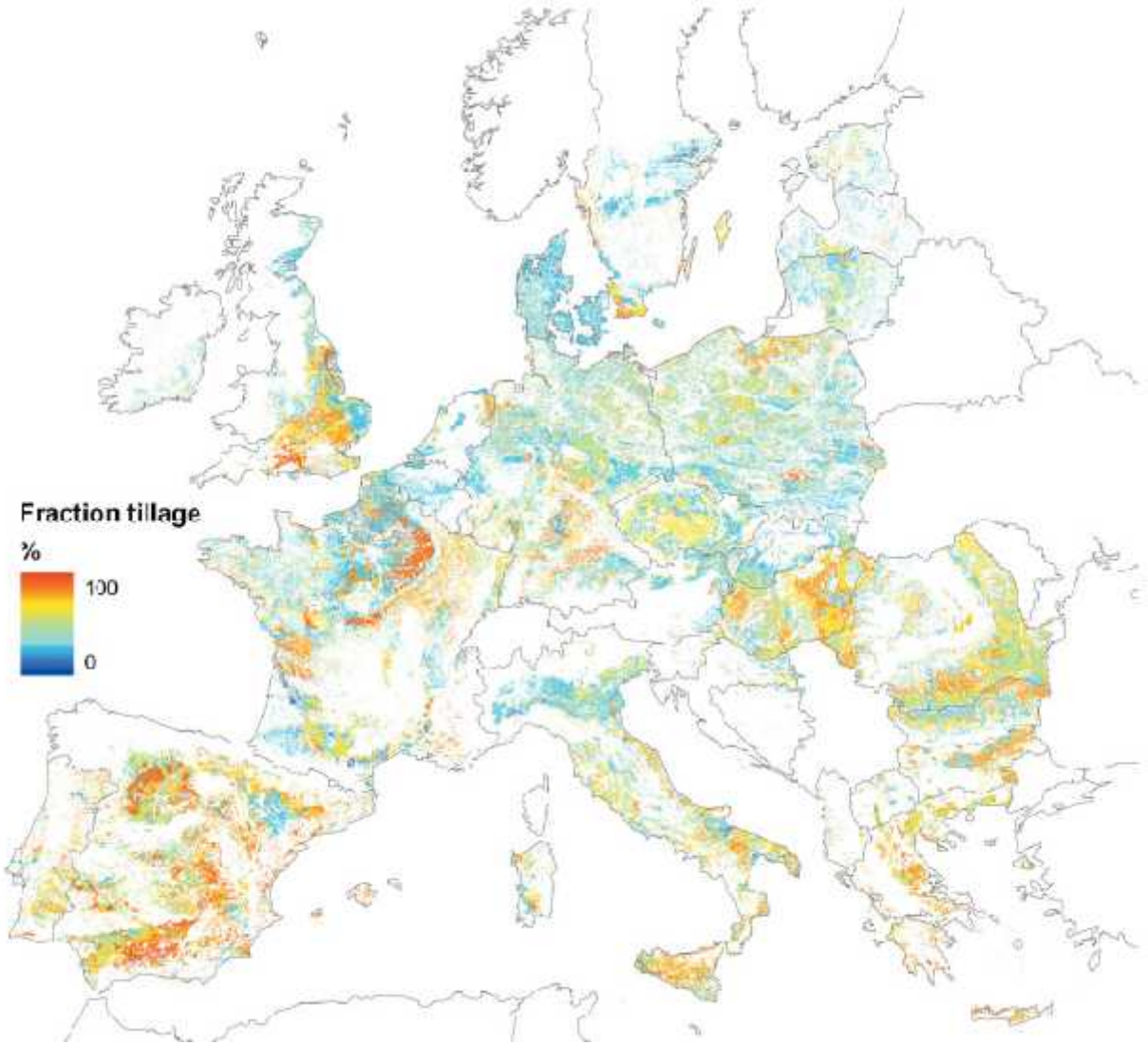


Model-based approximation

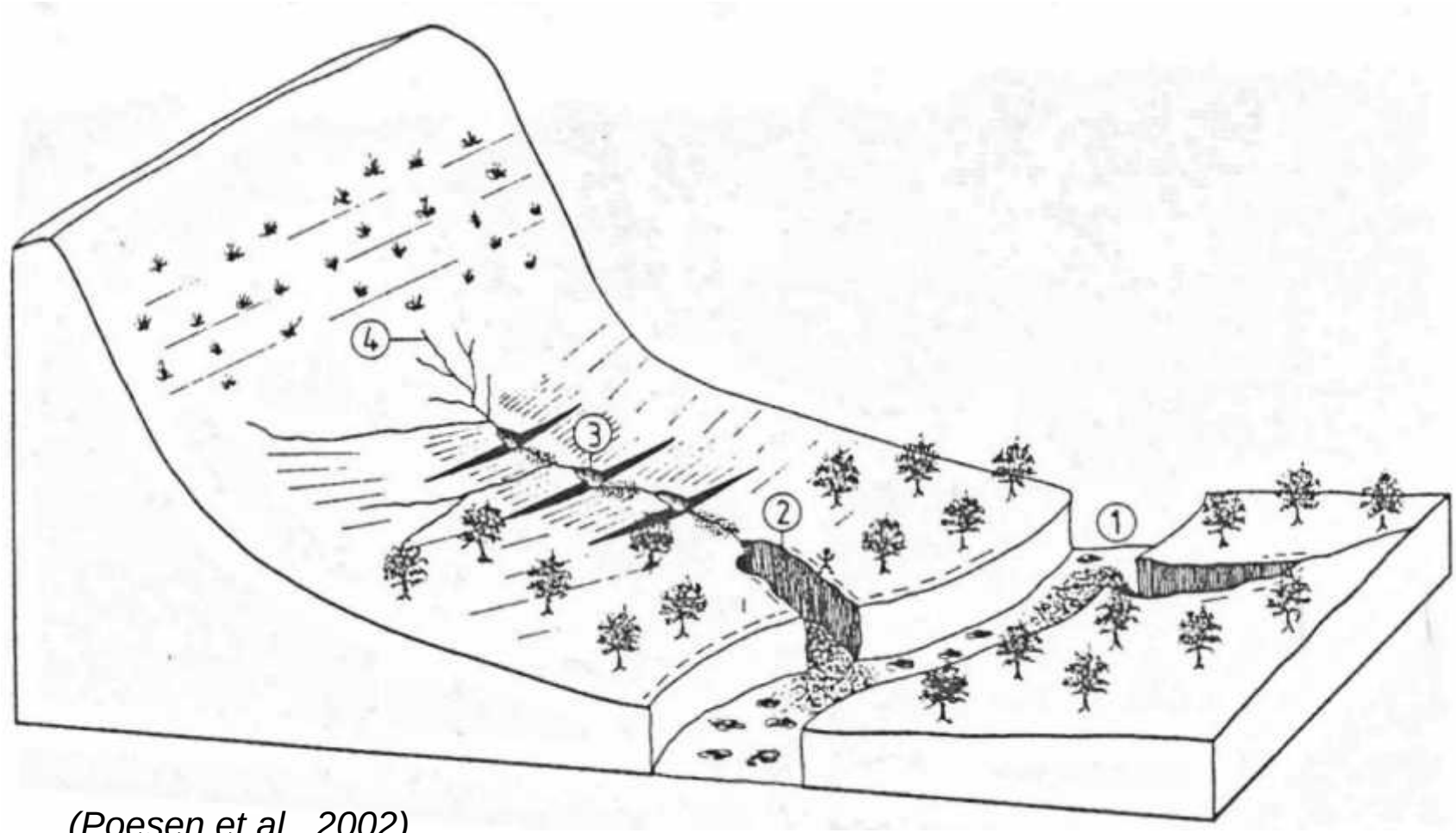
(Panagos et al., 2016)

Fraction of tillage erosion in total erosion (sum of water and tillage erosion)

(van Oost et al., 2009)



Water erosion: gully formation processes

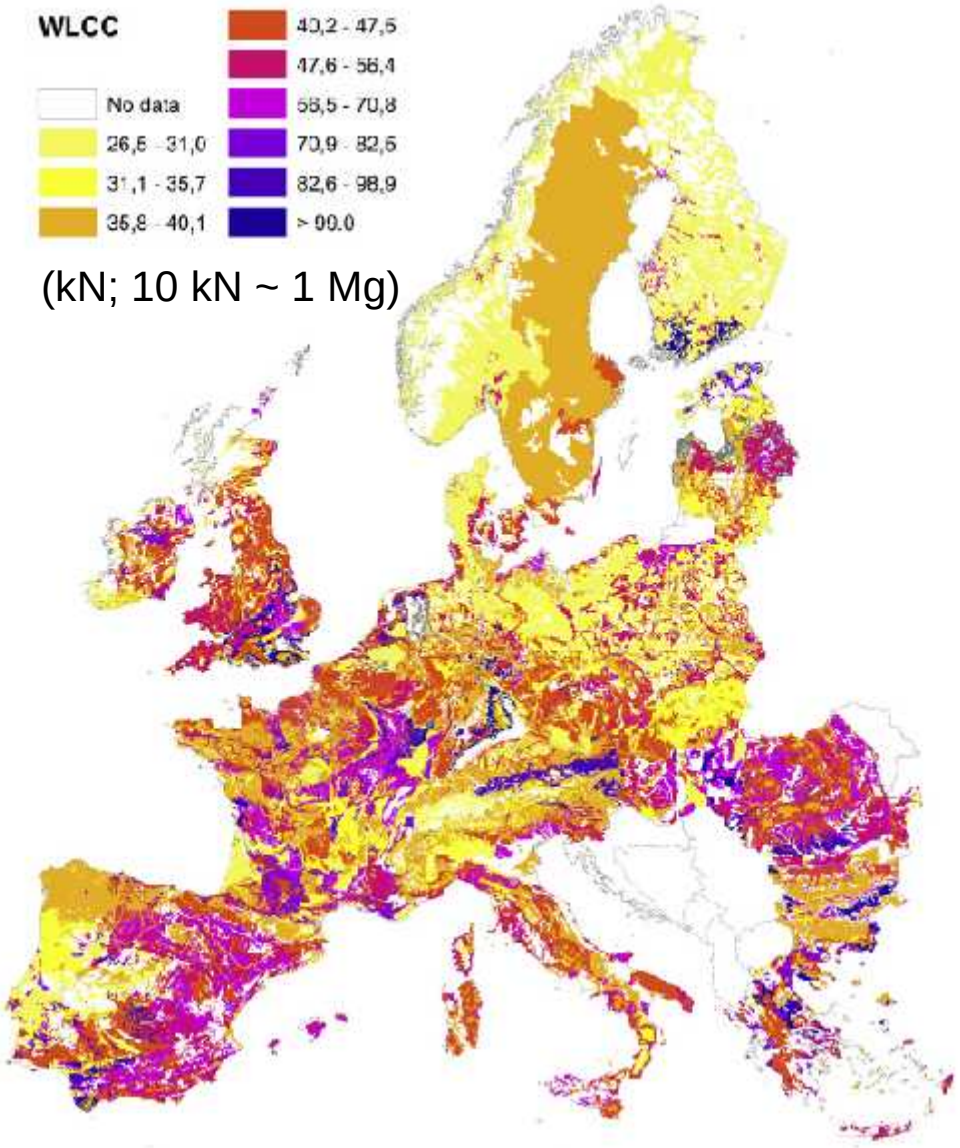


(Poesen et al., 2002)

Soil compaction

Subsoil !

Wheel load carrying capacity (WLCC)

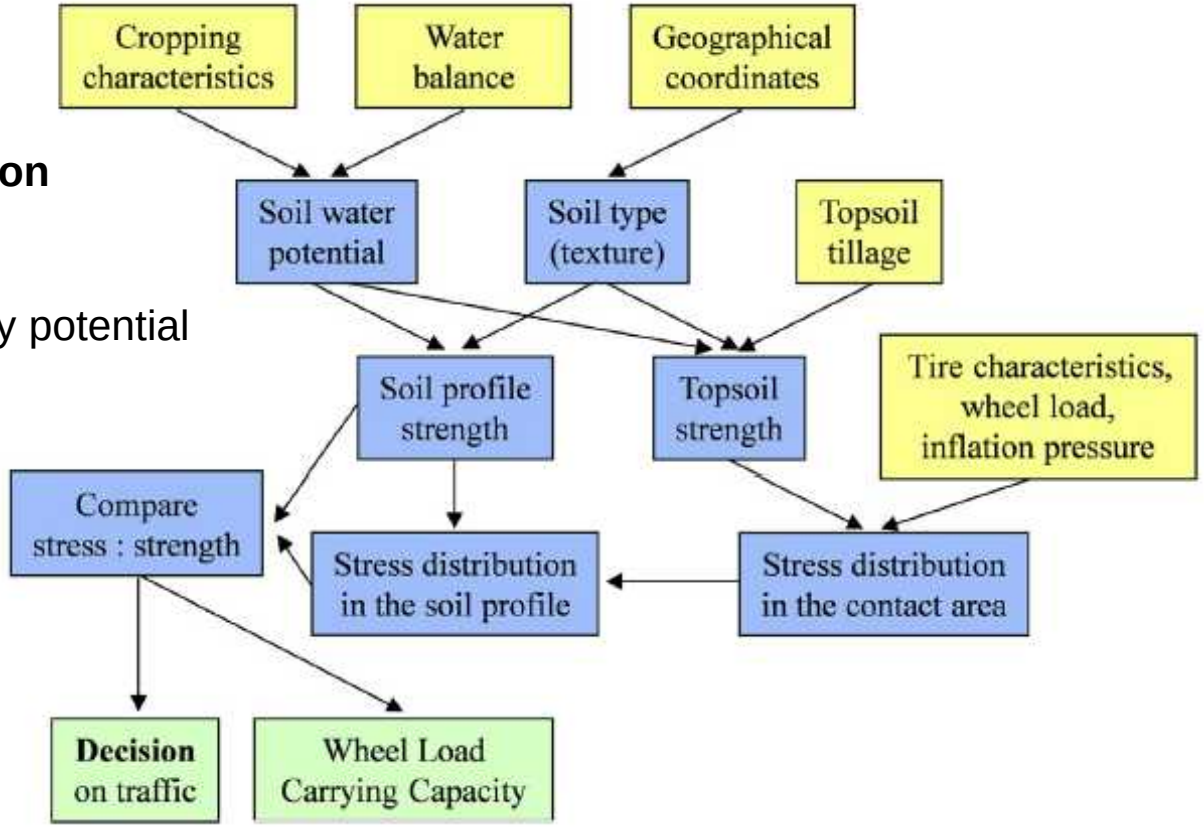


(kN; 10 kN ~ 1 Mg)

(Schjønning et al., 2015)

Limiting mechanical load based on WLCC

- It is about **subsoil protection**
- Including plough-sole
- Avoid permanent damage
- Account for natural recovery potential
- Light soils zero potential
- No driving in open furrow



Impacts on

- GHG emissions
- Hydrology
- Productivity

(Schjønning et al., 2015)

4. Soil management

Tillage

Soil fertility management

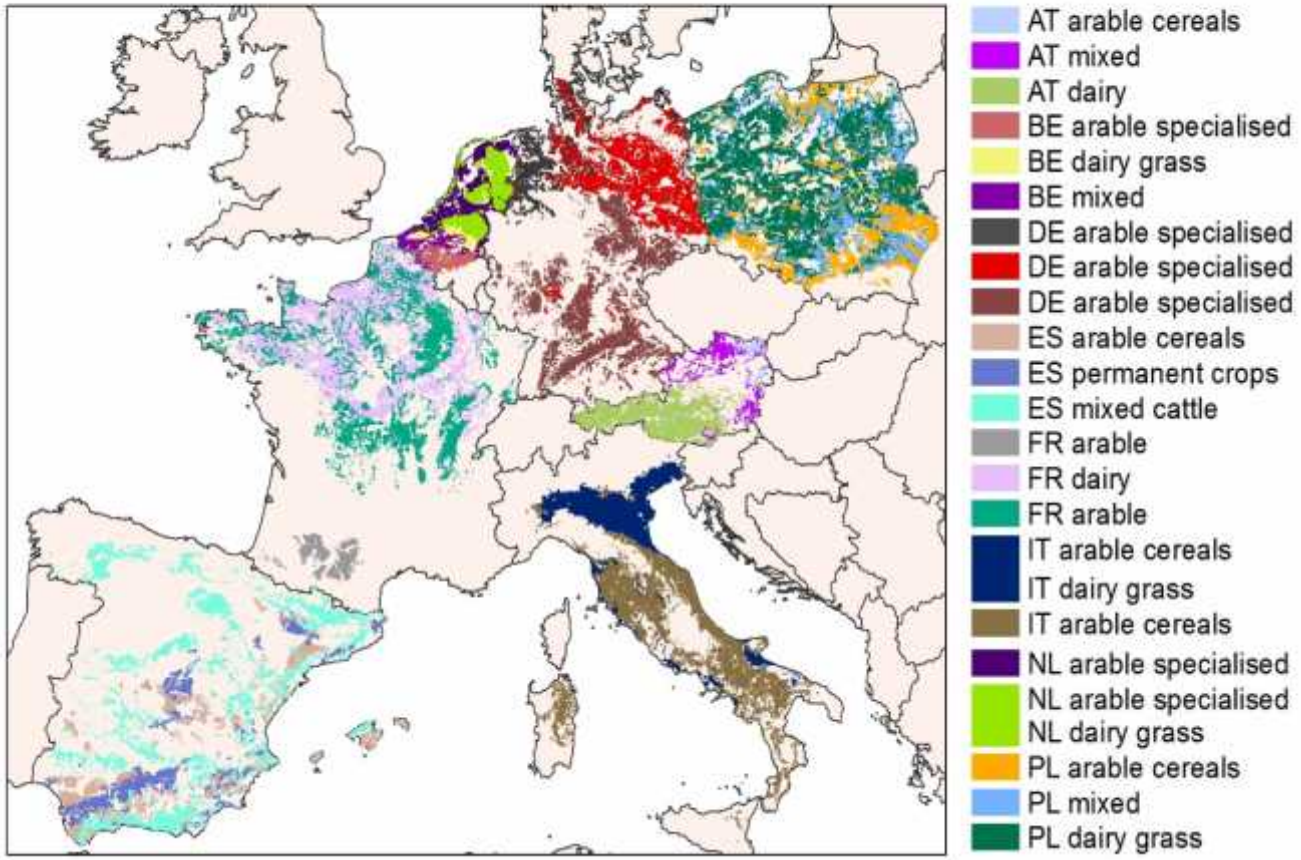
Water management

Catch & cover crops – green manures

Residue management

Farming systems (Conservation Agriculture; Organic Farming)

Many farmers are well aware that soil care is important – but they face trade-offs



(CATCH-C, FP7)

Widely recognised agro-ecological principles

- **Soil cover** protects soil
- **Fresh organic material** input feeds soil biota and promotes various chemical, biological and physical soil properties
- **Soil disturbance** has negative impact on soil macro-fauna
- **Traffic load** and passing frequency damages soil structure (top- and subsoil)
- **Host crop** species promote soil-borne **diseases**

On “soil improving practices”

„Conventional“ practices	So-called „soil improving practices“ →	Examples of disadvantages
Monoculture	Crop rotation	Income loss; equipment; processing industry
Ploughing	No Tillage Non-inversion tillage Minimum tillage	Weed control/herbicides Structure (root crops) N_2O
Bare fallow	Catch crops Cover Crops Green Manures	Competition for water Pest pressure Soil structure (traffic) N_2O
Remove residues	Incorporate Crop Residues	Income loss Fungal diseases N_2O
Mineral fertilizers	Organic Fertilizers (compost, FYM, slurries)	Nutrient emissions N_2O

Potential win-win's (+) and trade-offs (-) and mixed (+/-) cases – a few examples

Measure	Farming System	Soil function: Primary productivty	Water regulation	Climate regulation	Biodiversity support	Nutrient cycling
crop rotation	(CA, Org F)	+	+, -	+, -	+, -	+, -
soil cover	(CA, Org F)	+, -	+	+, -	+	+
minimum tillage	(CA)	+, -	+, -	+, -	+	+, -
no pesticides	(Org F)	-	+	?	+	+, -
manures	(Org F)	+, -	-	+	+	+

Each cell is subject to debate

5. Elements for policies

Protect soils or soil services?

No-regret actions

Monitoring and enforcement

Knowledge and innovation systems (AKIS)

Integrated soil management plan

Various bases for ranking of threats

6. Conclusions - Recommendations

- Protect soil **services** – **not just soils**: soil protection as part of **integrated environmental protection** plan
- Recognise **diversity of contexts**, and **trade-offs**
- **Local ranking** of suitable measures (practices)
- Mandatory integrated **soil management plan** per farm (nutrient balance; organic matter balance; water management; IPM soil borne diseases, etc.)
- Farm-level: **compliance** monitoring (**practices**)
- Catchment level: **effect** monitoring (**soil services**)
- Promote **innovation** to overcome barriers / trade-offs
- Guidance by independent **advisers**

Conclusions – Recommendations Contd.

Climate – water regulation – biodiversity

- Protect **pristine peatland** from encroachment (by agriculture)
- Conserve **agro-forestry systems** (cross-sectoral policies)
- Protect all other **high-carbon soils** from degradation

Primary production – water regulation

- Protect productive agricultural land from **land-grabbing**

Primary production – climate - water regulation - nutrients

- Control **water erosion** (mandatory practices – locally defined)
- Control **subsoil compaction** (statutory limits to soil loading)

Thank you for your attention