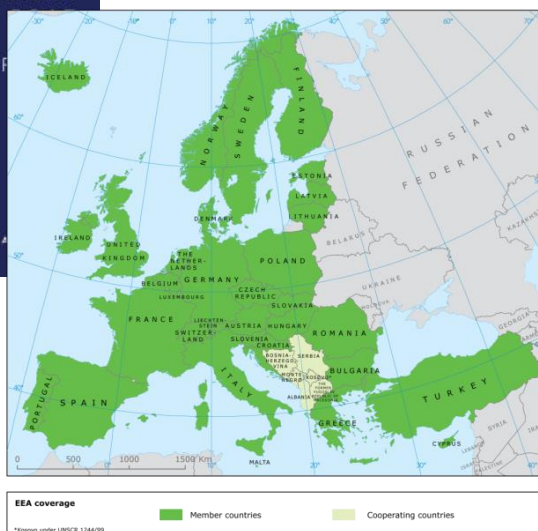


# Soil Condition in Europe 2020

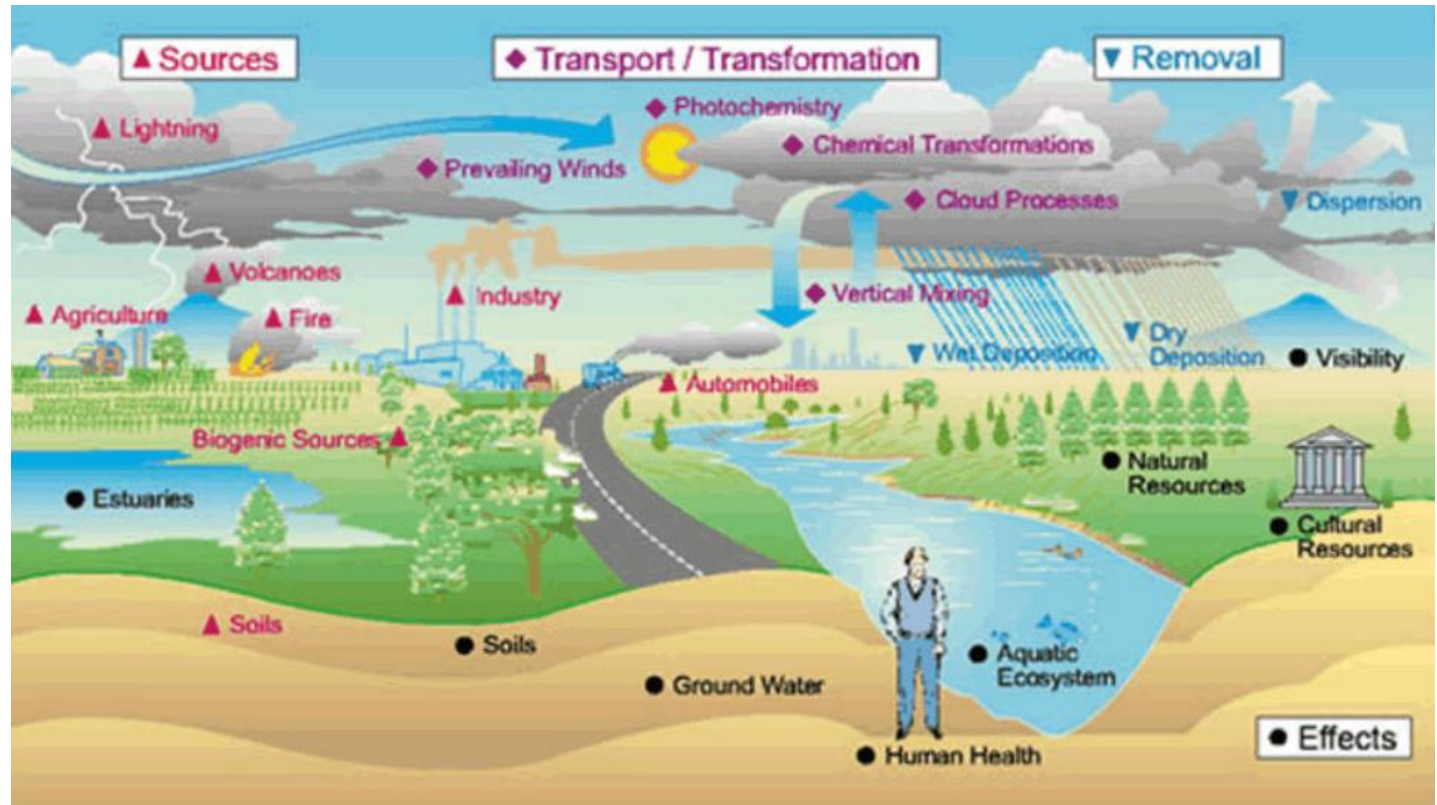


*Rainer Baritz*

*European Environment Agency*



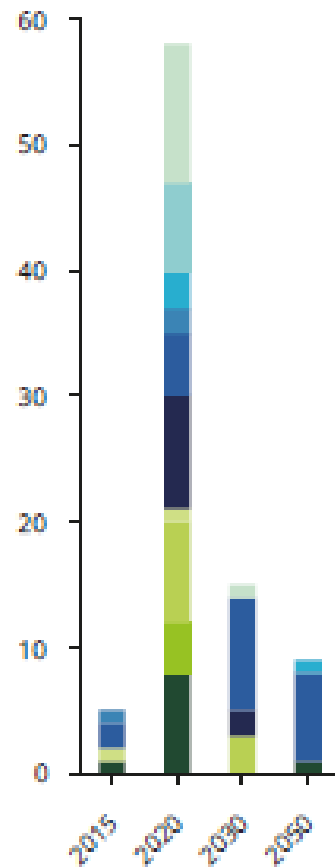
# 40 years of EU environmental policies in the EU



**Many persistent and emerging environmental challenges**

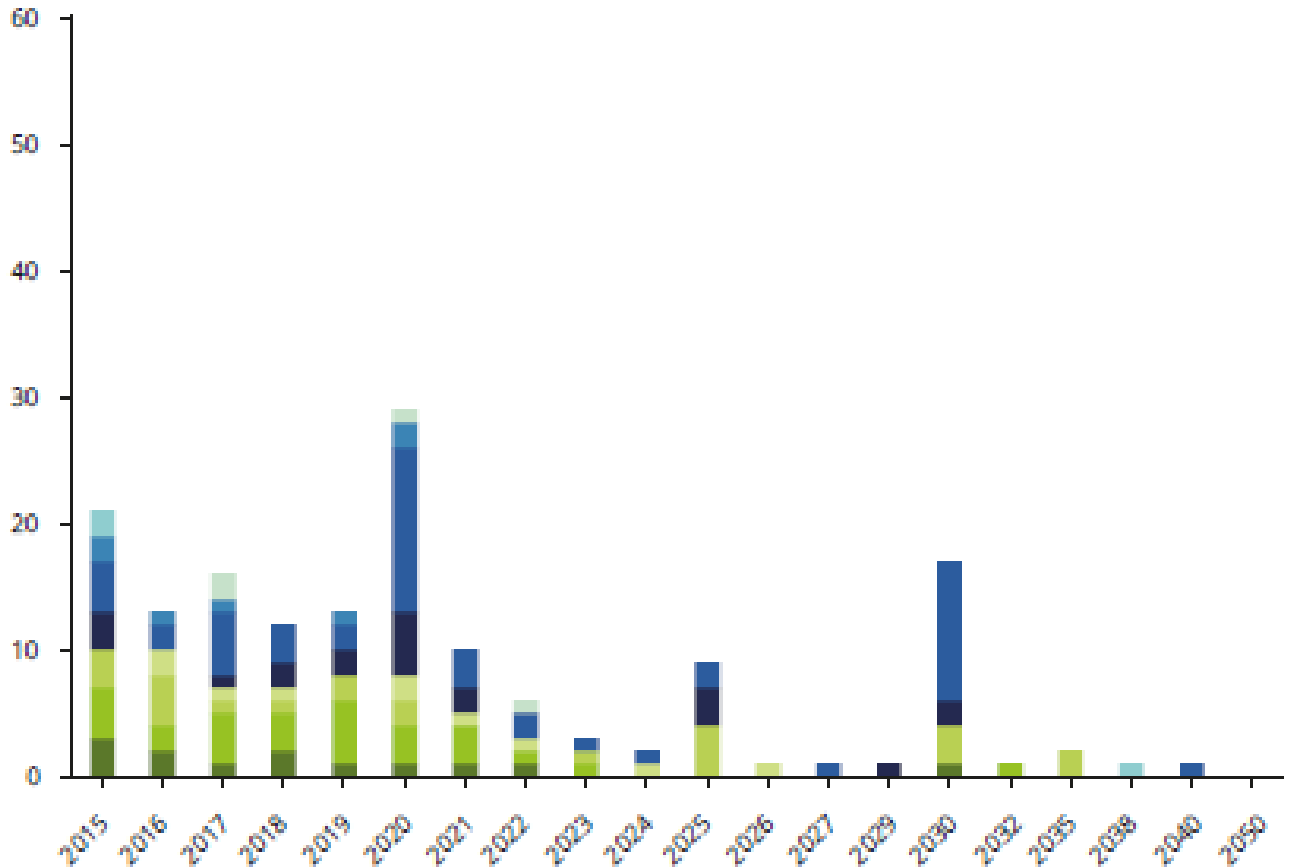
# Objectives & targets in EU environmental policies

Number of objectives



Biodiversity and nature  
Climate change  
Chemical pollution

Number of targets



Freshwater  
Land and soil  
Marine environment  
Air pollution  
Environmental noise  
Waste and resources  
Industrial pollution  
Cross-environmental area

# Unsustainable production and consumption

7<sup>th</sup> EAP priority themes

Protecting, conserving  
and enhancing natural  
capital

Resource efficiency  
and the low-carbon  
economy

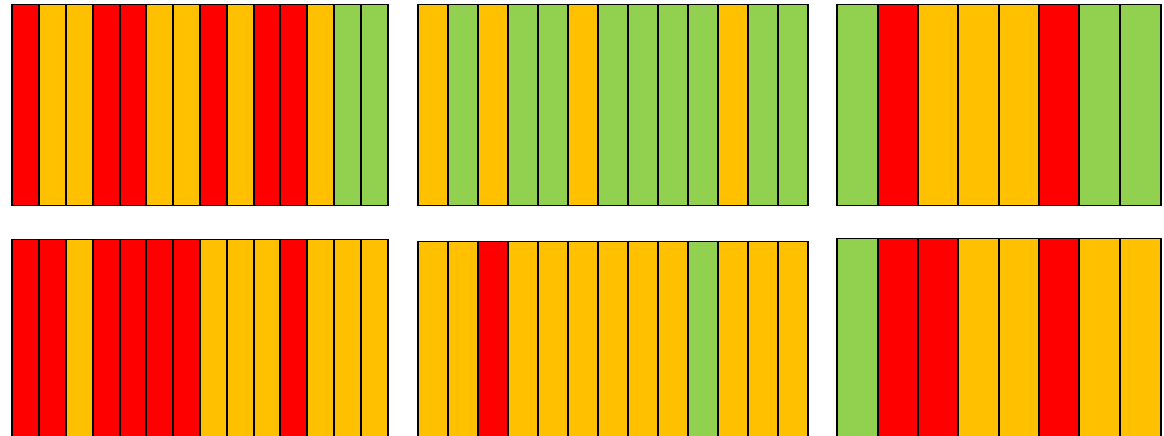
Safeguarding from  
environmental risks to  
health




**“Efficiency improvements have  
not secured long-term  
resilience”**

**SOER  
2020**

Past  
(5–10)  
year  
trends

20+  
years  
outlook



Improving trends dominate   
Trends show mixed picture   
Deteriorating trends dominate 

European Environment Agency





# Soil-related policies in Europe

Policy Document	Relevant Policy Target
UN Agenda for Sustainable Development	Target 15.3: By 2030, combat desertification, restore degraded land and soil, (...), and strive to achieve a <b>land degradation-neutral world</b> : Monitoring of indicators (EU-SDG: soil erosion, soil organic carbon)
Roadmap to a Resource Efficient Europe	<ul style="list-style-type: none"><li>• Soil erosion is reduced by 2050</li><li>• Achieve no net land take by 2050</li><li>• SOM increase by 2050</li></ul>
Environment Action Programme to 2020 'Living well, within the limits of our planet'	<ul style="list-style-type: none"><li>• The loss of biodiversity and the degradation of ecosystem services are halted; at least 15 % of degraded ecosystems have been restored.</li><li>• Land is managed sustainably, soil is adequately protected.</li><li>• Increasing efforts to reduce soil erosion and increase soil organic matter</li></ul>
Thematic Strategy for Soil Protection	<ul style="list-style-type: none"><li>• Soil threats</li><li>• EC Communication 2002: soil monitoring to identify risk areas</li></ul>
Water Framework Directive	<ul style="list-style-type: none"><li>• Identification of local sources polluting water bodies</li><li>• Lists pollutants and their thresholds in water bodies</li></ul>
IPPC/IED	<ul style="list-style-type: none"><li>• Inventories of industrial operations (emitting SO<sub>2</sub>, NO<sub>x</sub>, dust); monitoring</li></ul>
NEC	<ul style="list-style-type: none"><li>• Emission ceilings for acidifying substances (by country)</li><li>• Select representative (soil) sites, monitoring</li></ul>

# SOER 2020 – Chapter Land and Soil

## Thematic summary assessment

Theme	Past trends (10-15 years)	Outlook to 2030	Prospects of meeting policy objectives/targets	
Expansion of urban and transport infrastructure areas	Deteriorating trends dominate	Deteriorating developments dominate	2050 	Not on track
Soil condition	Deteriorating trends dominate	Deteriorating developments dominate	2050 	Not on track

# SOER 2020 – Soil

Soil condition		
Past trends (10-15 years)		Land cover change and management intensity significantly affect soil condition and levels of contamination. <b>Progress in the remediation of polluted soils is slow.</b> Despite recent reductions in soil sealing, fertile soils continue to be lost by continued land take. On intensively managed land, <b>soil biodiversity is endangered.</b> <b>Soil loss</b> as a result of sedimentation through erosion <b>is still significant.</b> The effects of <b>soil compaction and historical and current losses of soil organic carbon are becoming increasingly visible under climate change.</b>
Outlook to 2030		The underlying <b>drivers</b> of soil degradation are not projected to change favourably, so the functionality of soils is under even <b>more pressure.</b> Harmonised, representative <b>soil monitoring</b> across Europe is needed to develop early warnings of exceedances of critical thresholds and to guide sustainable soil management.
Prospects of meeting policy objectives/targets	2020 ✗	Europe is not on track to protect its soil resources based on the existing strategies. There is a lack of binding policy targets; and the threats to soil — compaction, salinisation and soil sealing — are not addressed in existing European legislation. There is a high risk that the EU will fail some of its own and international commitments such as land degradation neutrality
Robustness	A consistent set of indicators and representative databases for all soil threats across Europe has not yet been established. <b>Measurements and monitoring of soil threats are incomplete.</b> For selected indicators, data on changes in the condition of topsoils can be derived from the LUCAS soil programme (pesticide and soil biodiversity components are currently being added). The assessment of the outlook for and prospects of meeting policy objectives relies primarily on expert judgement.	

# Soil Condition – 3 sub-sections

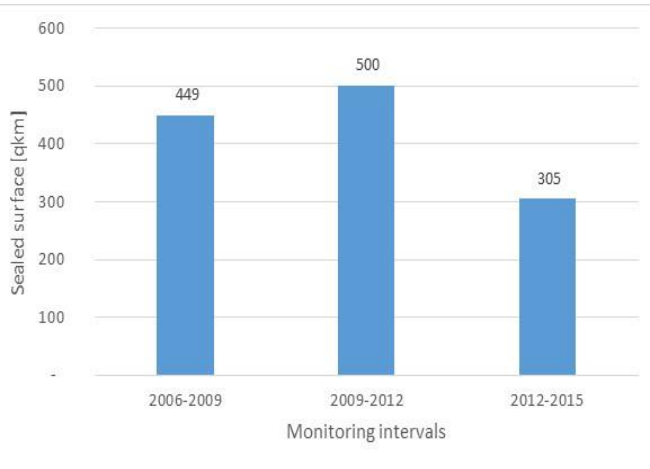
- **Physical degradation of soils**  
*(includes: soil sealing, erosion, compaction)*
- **Chemical degradation of soils in urban areas and under intensive agriculture increases**  
*(includes: local and diffuse contamination, acidification and eutrophication)*
- **Biological degradation of soils, soil organic matter decline and multi-functionality of soils**  
*(includes: soil organic carbon, soil biodiversity)*





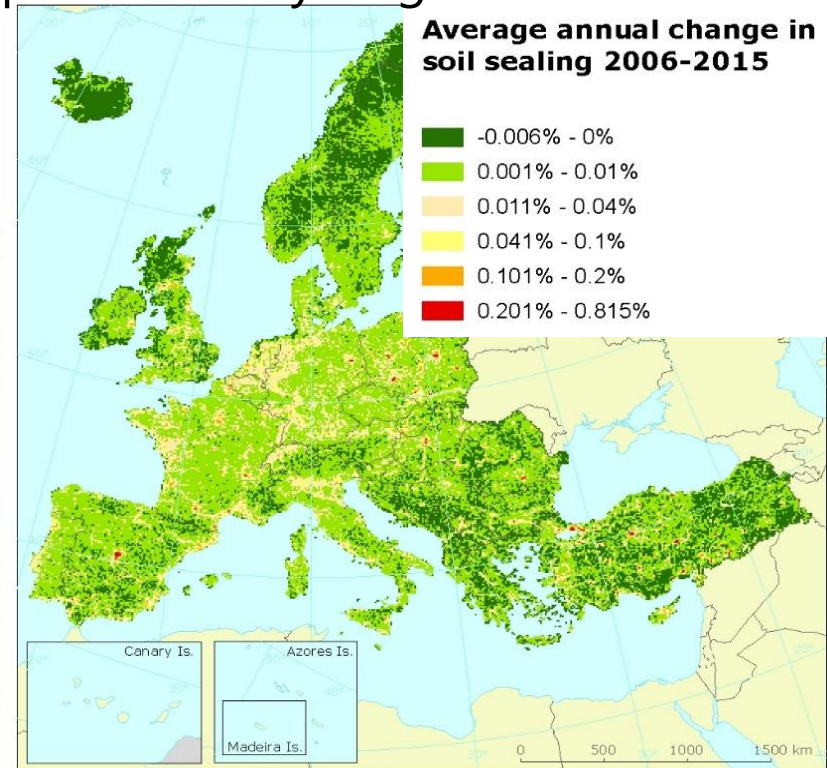
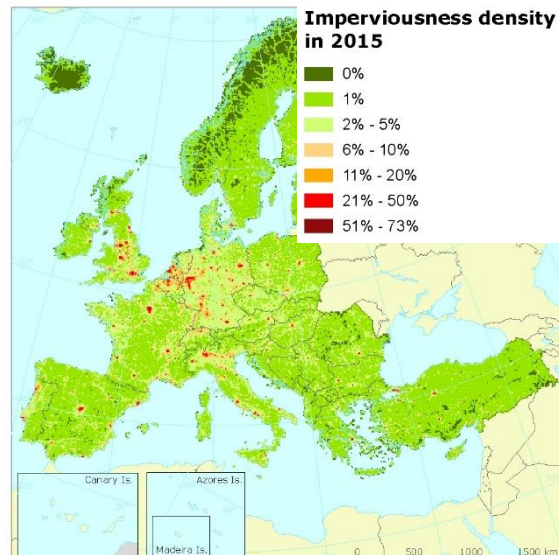
# Soil physical condition

## Soil sealing



Average annual rate of soil sealing in EEA-39 (Copernicus 20m)

- Land take and **soil sealing continue**, predominantly at the expense of agricultural land. Europe is at **risk of not meeting the 7th EAP objective of no net land take by 2050**.
- The annual rate of land take and consequent habitat loss has gradually slowed; only 13 % of urban development is recycling.



# • Soil physical condition

## Erosion

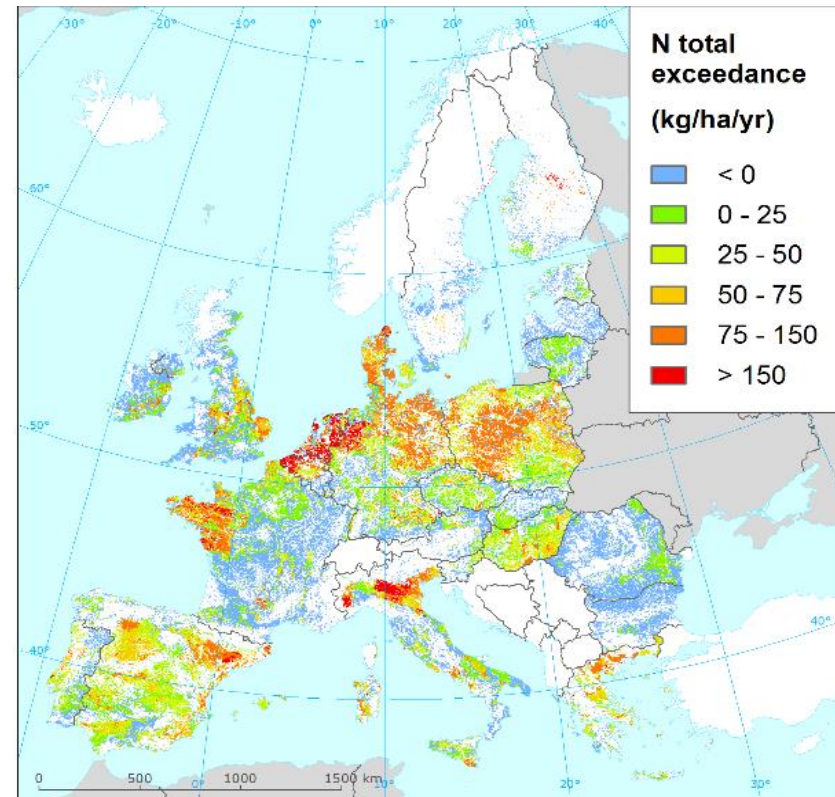
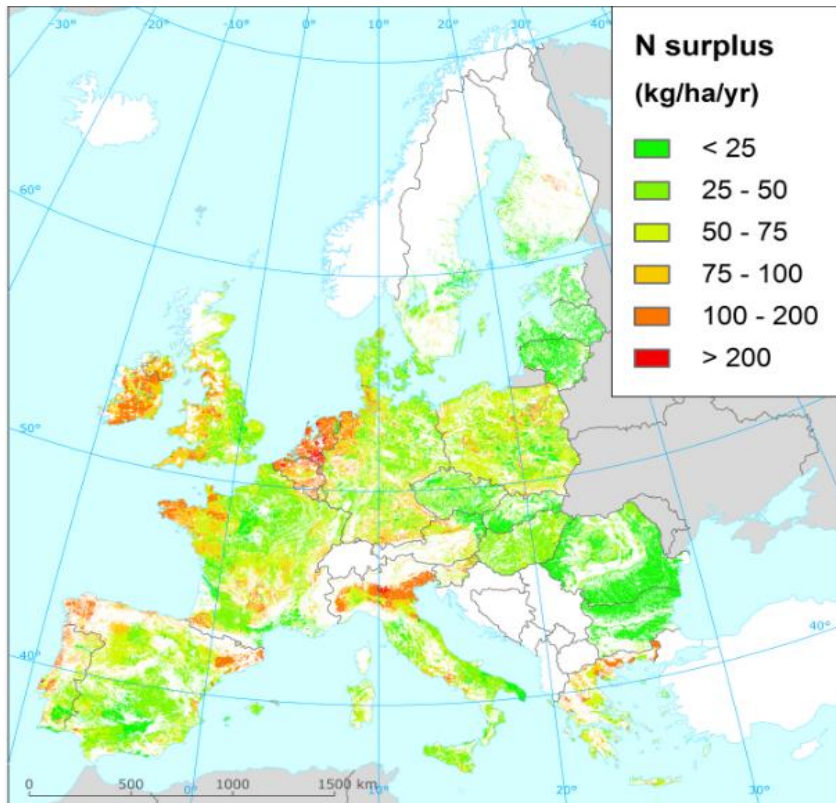
- Current erosion estimates only include water erosion (sheet and rill erosion), while other forms of erosion (gully erosion, wind erosion, losses due to harvest) have less significant effects
- **11.4% of Europe's land area** is affected by moderate to high erosion (soil loss rates  $> 5 \text{ ton ha}^{-1} \text{ yr}^{-1}$ ) mostly in Italy, Slovenia, Austria, Malta and Greece (Panagos et al. 2015)
- Existing **policy efforts**, in particular the CAP-GAEC measures, may have reduced estimated soil loss rates over the past decade (Panagos et al. 2015).
- Annual **cost** of agricultural production (losses in crop yield) due to severe erosion in the EU is estimated to be EUR 1.25 billion (Panagos et al., 2018)

## Compaction

- Mechanical stress; precursor of erosion; may reduce crop yields 2.5-15 %
- About **23 % of European soils** (ca. 43 % in NL) are estimated to have critically high densities in subsoils, indicating compaction (Schjønning et al. 2017)

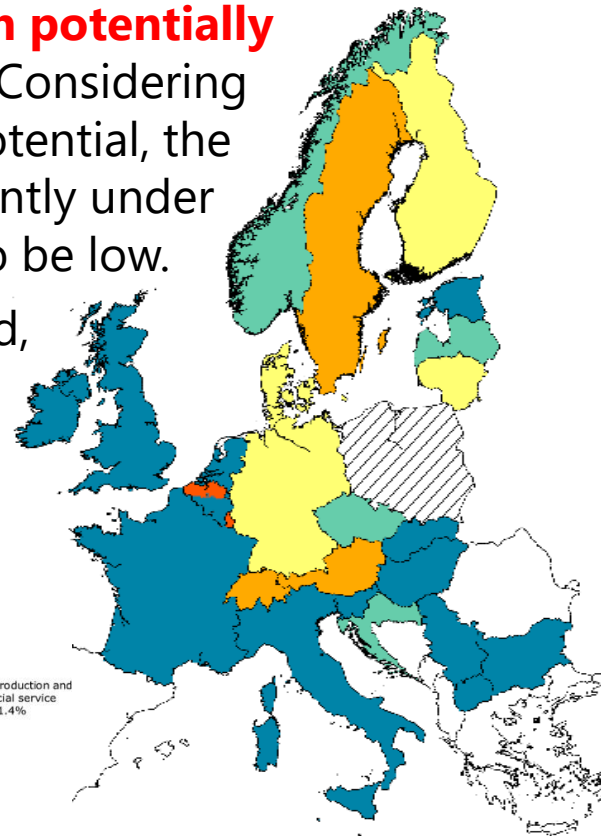
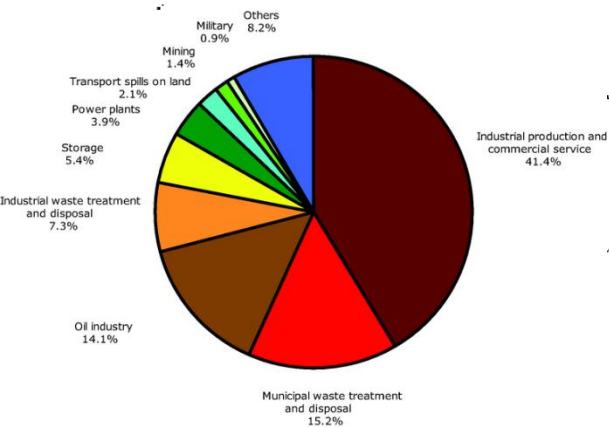
# Soil chemical condition

- Nutrient inputs to soils through fertilizers: for ca. **65-75 % of EU-27** agricultural soils, N inputs **exceed critical values beyond which eutrophication can be expected** (De Vries et al.forthcoming; data 2010)
- A 40 % reduction in nitrogen inputs would be needed to prevent this exceedance

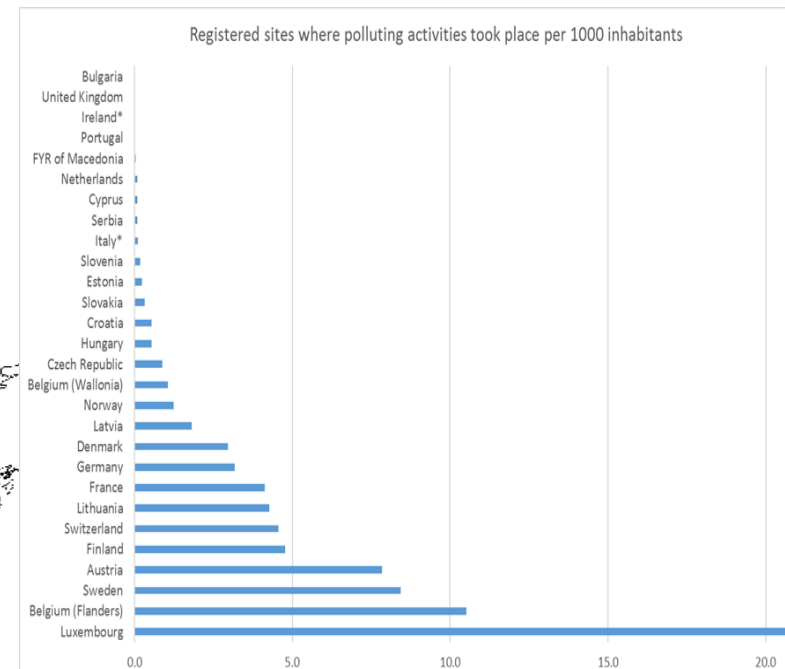
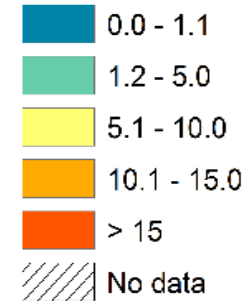


# Contaminated sites

- The dominating activities for contamination at local level are municipal and industrial waste (37%) together with industrial emissions and leakages (33%) Panagos et al. (2013).
- **2.8 million sites with potentially polluting activities**; Considering the contamination potential, the number of sites currently under remediation seems to be low.
- Only 24 % inventoried, of that 28 % investigated.



## Density of contaminated sites per km<sup>2</sup> of artificial surface



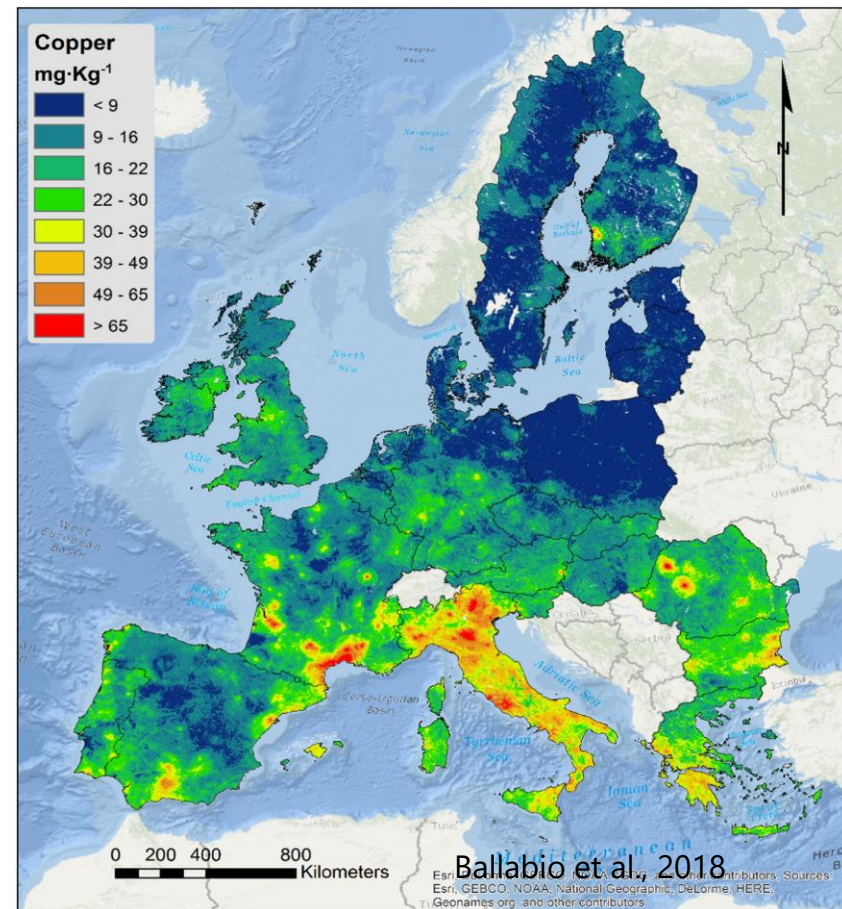
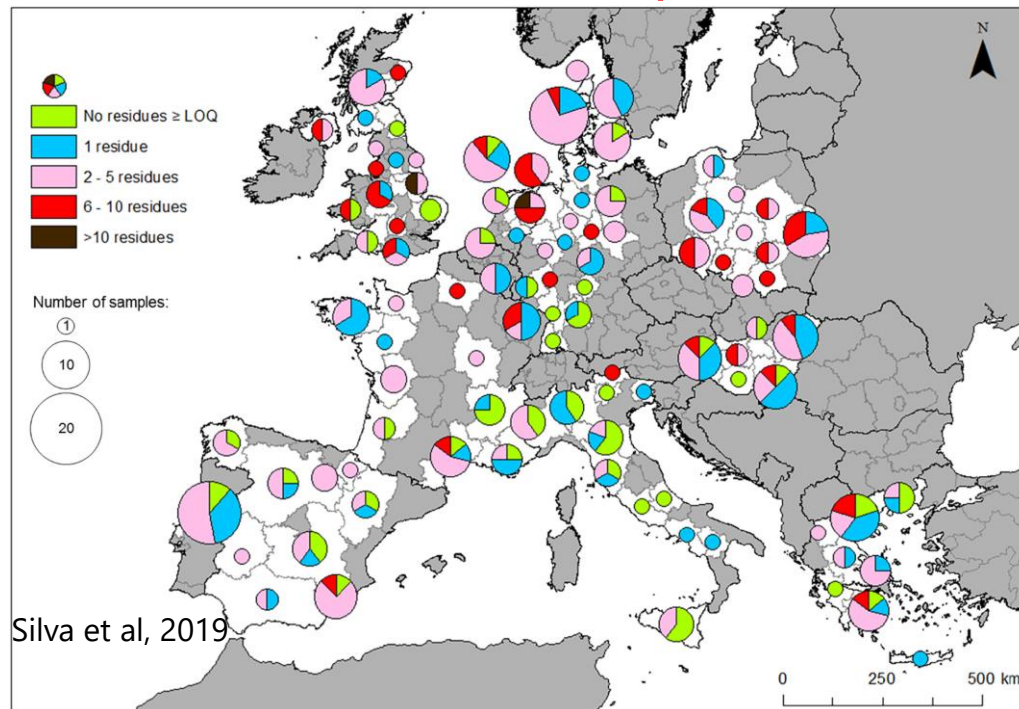


# Diffuse pollution: heavy metals and POPs

- In **21% of the soils**, the Cd concentration in the topsoil solution exceeds the limit for ground water
- Concern about the storage of pesticide residues and metabolites (> 80% of tested "LUCAS soils")

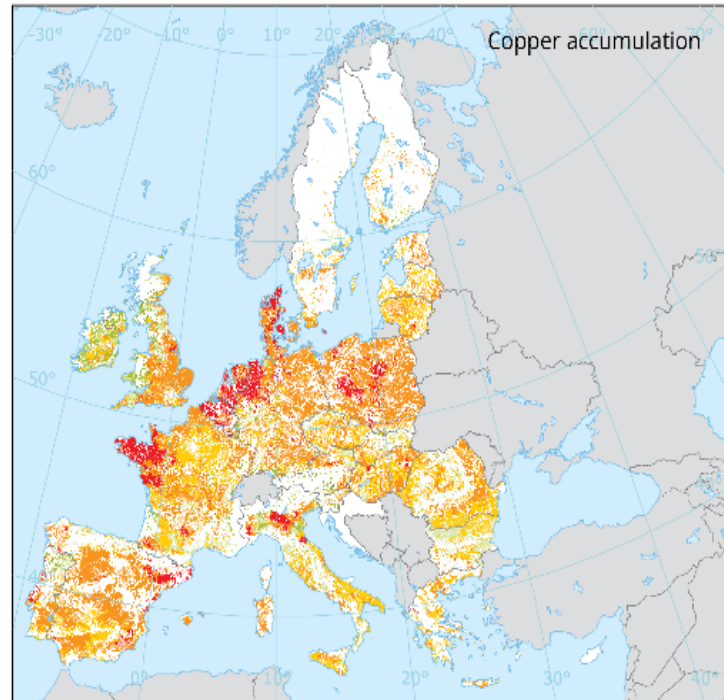
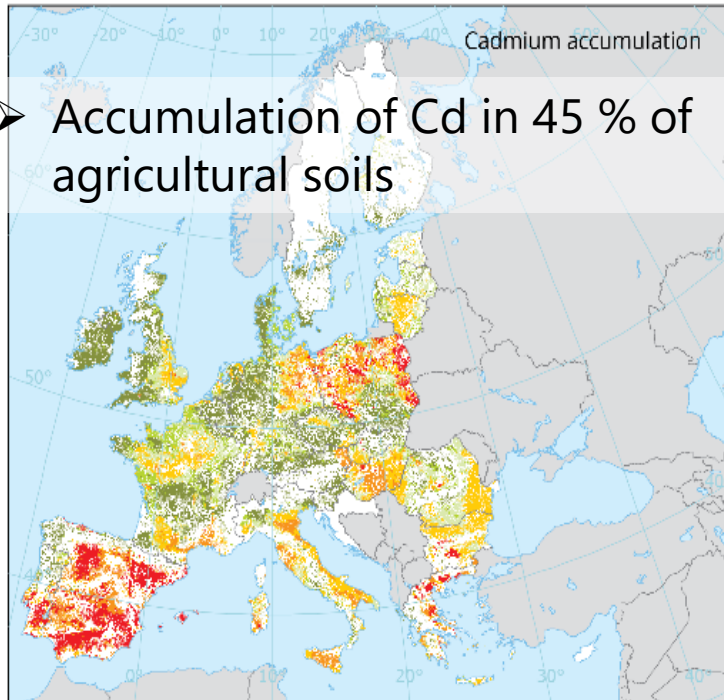
## Copper in topsoils

## Pesticide residues in topsoil



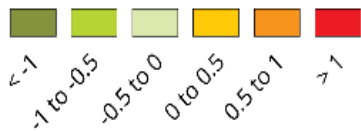
# Diffuse pollution: heavy metals

- Accumulation of Cd in 45 % of agricultural soils



Accumulation rates of Cadmium (left) and Copper (right), 2010

g/ha/yr

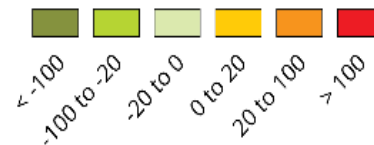


0 500 1 000 1 500 km

No data Outside coverage

De Vries et al, 2019

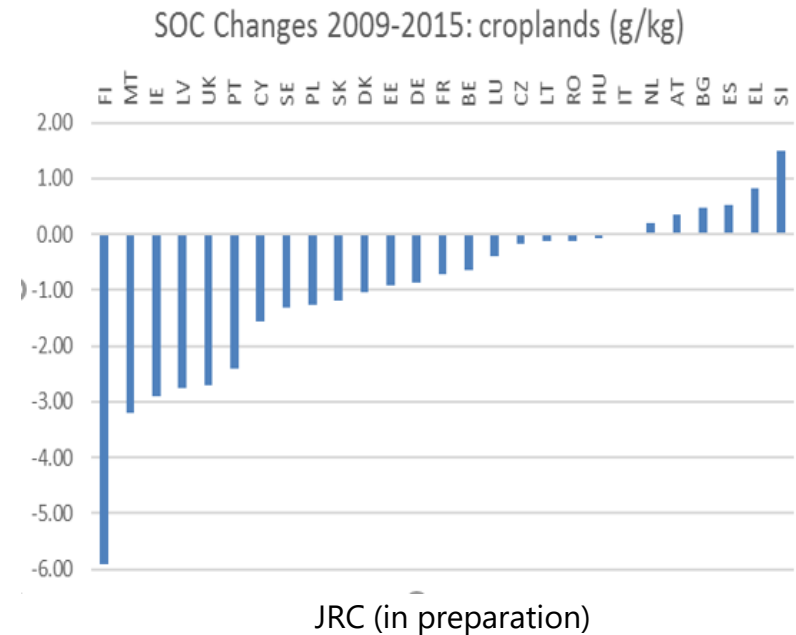
g/ha/yr



# Soil biological condition

## Soil biodiversity, soil organic matter and multi-functionality of soils

- SOC in cropland soils tends to be stable or slightly declining; grasslands show slight increases (JRC 2018) (2009-2015)
- SOC losses from cultivated organic soils contribute to the negative GHG balance for some countries (Schils et al. 2008). **13-36%** of the current SOC stock might be **lost** by the end of this century (Gobin et al. 2011).
- Soil degradation reduces soil habitat availability, negatively impacts soil and above ground biodiversity.
- Species richness of earthworms, springtails and mites was negatively affected by increased land-use intensity (Tsiafouli et al. 2015).



# Towards the European Soil Condition Assessment 2021












EEA, JRC, DG ENV, NRC Soil, other national experts



# Information challenges

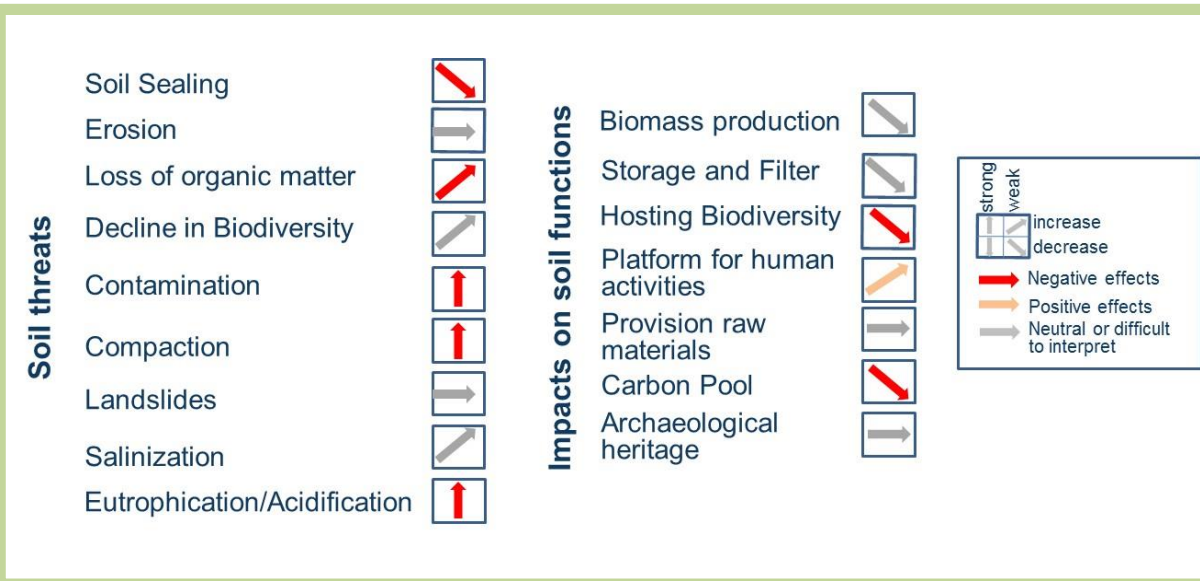
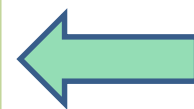
Status of the World's Soil Resources (FAO and ITPS, 2015)

## Global Summary of Threats to Soil Functions

Region	Soil erosion	Organic carbon change	Nutrient imbalance	Salinization	Soil sealing	Loss of biodiversity	Soil pollution	Acidification	Compaction	Water-logging	Comments
 <b>Europe and Eurasia</b>	Fair 	Poor 	Poor 	Poor 	Poor 	Fair 	Poor 	Poor 	Fair 	Fair 	In densely populated Western Europe, soil ealing is one of the most threatening phenomena. Salinization is a widespread threat in Central Asia and in some areas in Spain, Hungary, Turkey, and Russia.



- Update
- Refine
- Validate
- Improve



# Where do we stand?

- Continued loss of soils and soil quality is evident
- Existing hot spots for soil degradation will worsen (e.g. southern Europe)
- Lack of targets and monitoring
- Various soil threats not covered by existing policies
- Lack of an operational indicator system
- Lack of knowledge about the impact of loss of soil quality

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