



The European Perspective on Soil Quality

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Soil quality (IRENA 29)

The indicator focuses on “soil organic carbon content”.

Topsoil (0-30cm) organic carbon content

Data background (2000)

European Soil Database,
CORINE Land Cover,
Global Historical Climatology Network,
Pedo-transfer model to calculate organic carbon content

Level of detail

NUTS 2 and 3

Necessary improvement

Development of the soil quality indicator concept is underway.
New assessment of soil quality will be carried out in the
framework of the Soil Thematic Strategy.

Soil quality indicator

(present IRENA 29)

Soil quality is the ability of soil

- to perform its functions**
- behave against threats**

Framework of soil protection in the EU

Based on the upcoming Directive on Protection and Sustainable Use of Soil and on EC Communication (2002/179)

→ Preservation of soil functions

- biomass production,
- biodiversity pool
- source of raw material
- storing filtering and transforming nutrients, substances and water
- physical and cultural environment for humans
- archive of geological and archeological heritage
- acting as carbon pool

→ Prevention of threats to soil

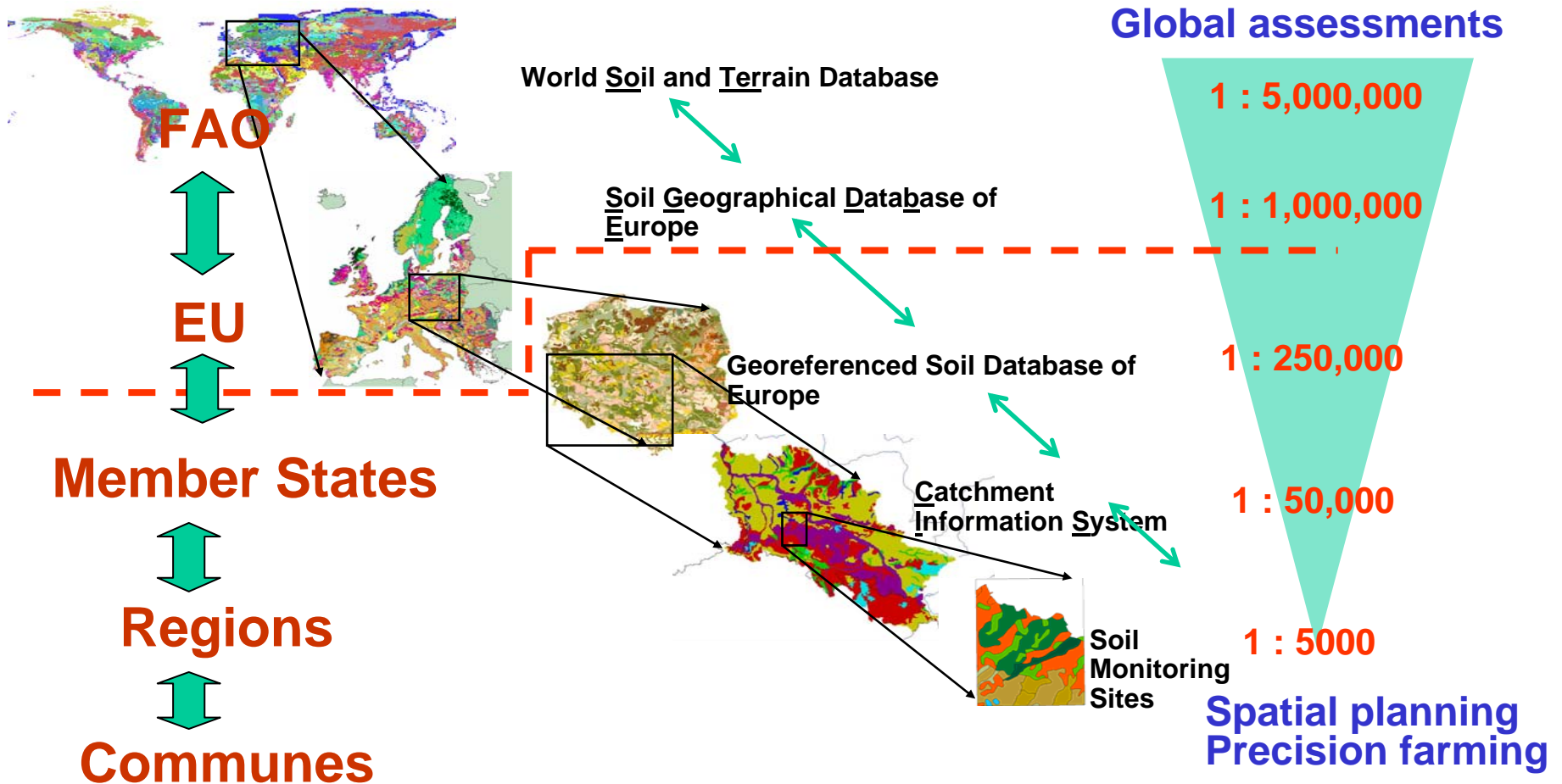
- erosion,
- salinization
- landslides
- soil organic matter decline,
- compaction,
- (soil sealing, contamination)

→ Integration of soil protection measures and principles to other policies

From the global to the local scale

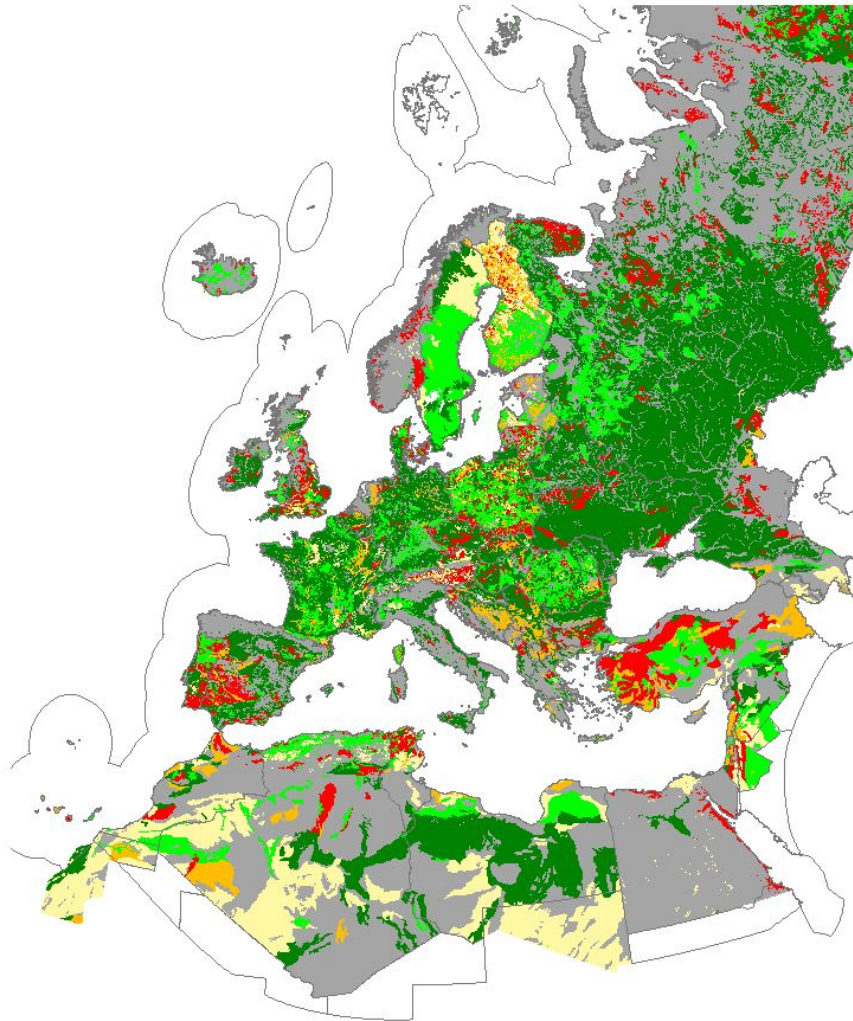
EUSIS - A nested soil information system for Europe

Different scales give answers to different questions





Soil functions



1) biomass production

2) storing filtering and transforming nutrients, substances and water

3) biodiversity pool

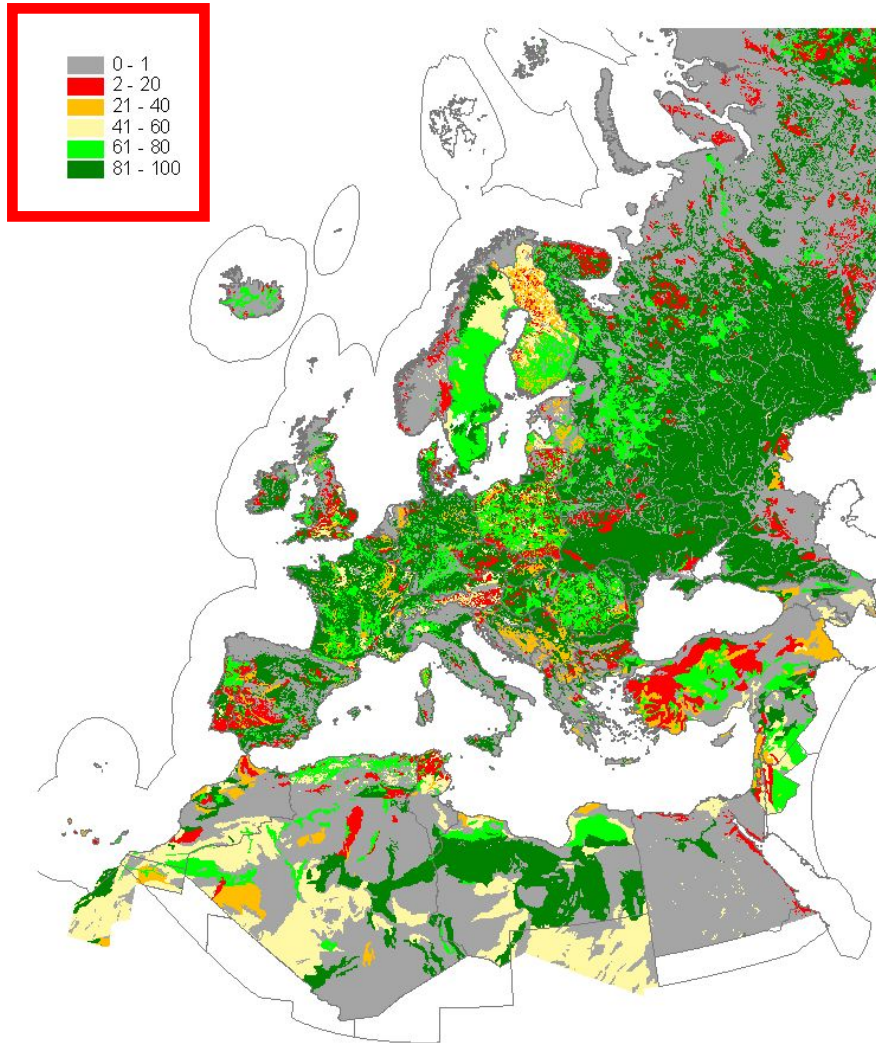
4) physical and cultural environment for humans

5) source of raw material

6) acting as carbon pool

7) archive of geological and archeological heritage

Soil functions



1) biomass production

- suitability for cereals

2) storing filtering and transforming nutrients, substances and water

3) biodiversity pool

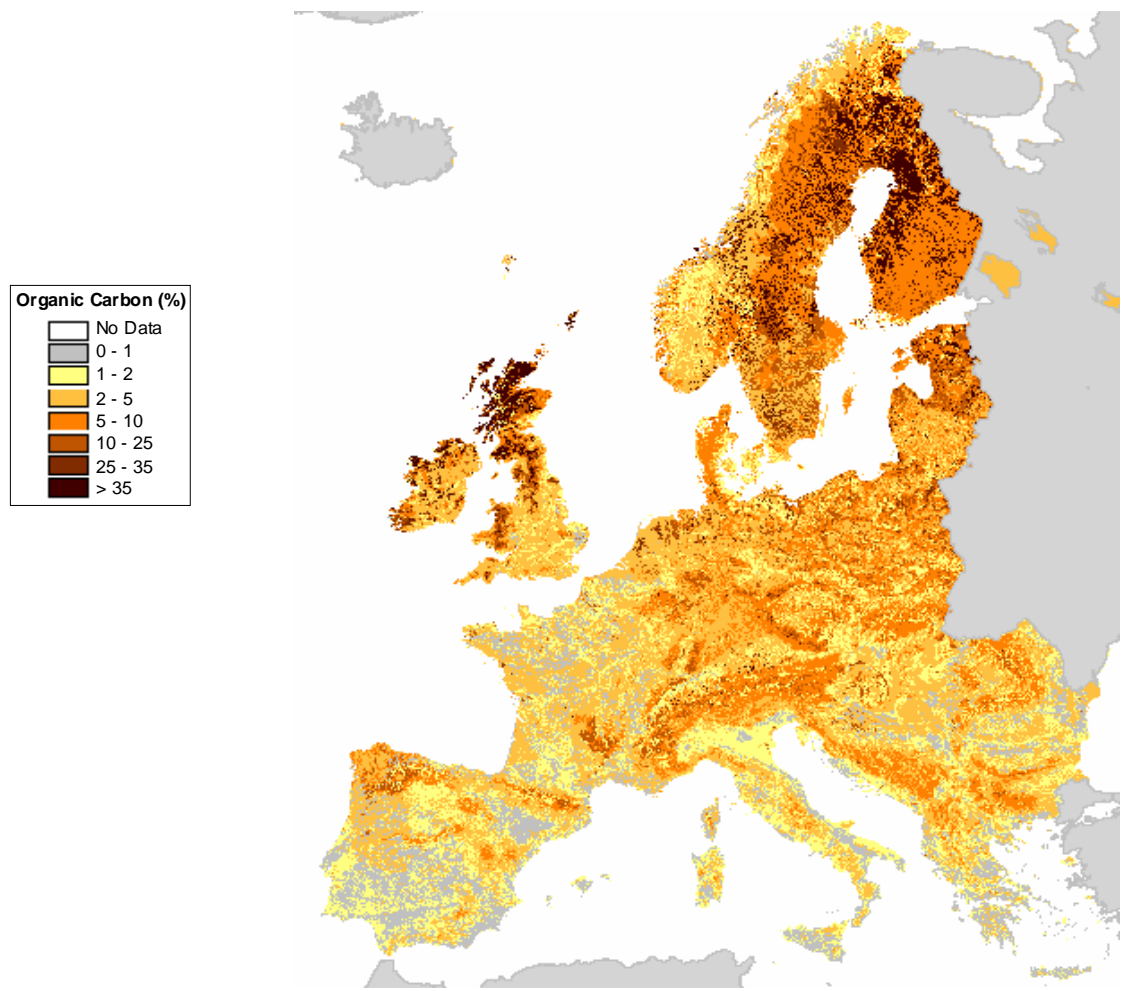
4) physical and cultural environment for humans

5) source of raw material

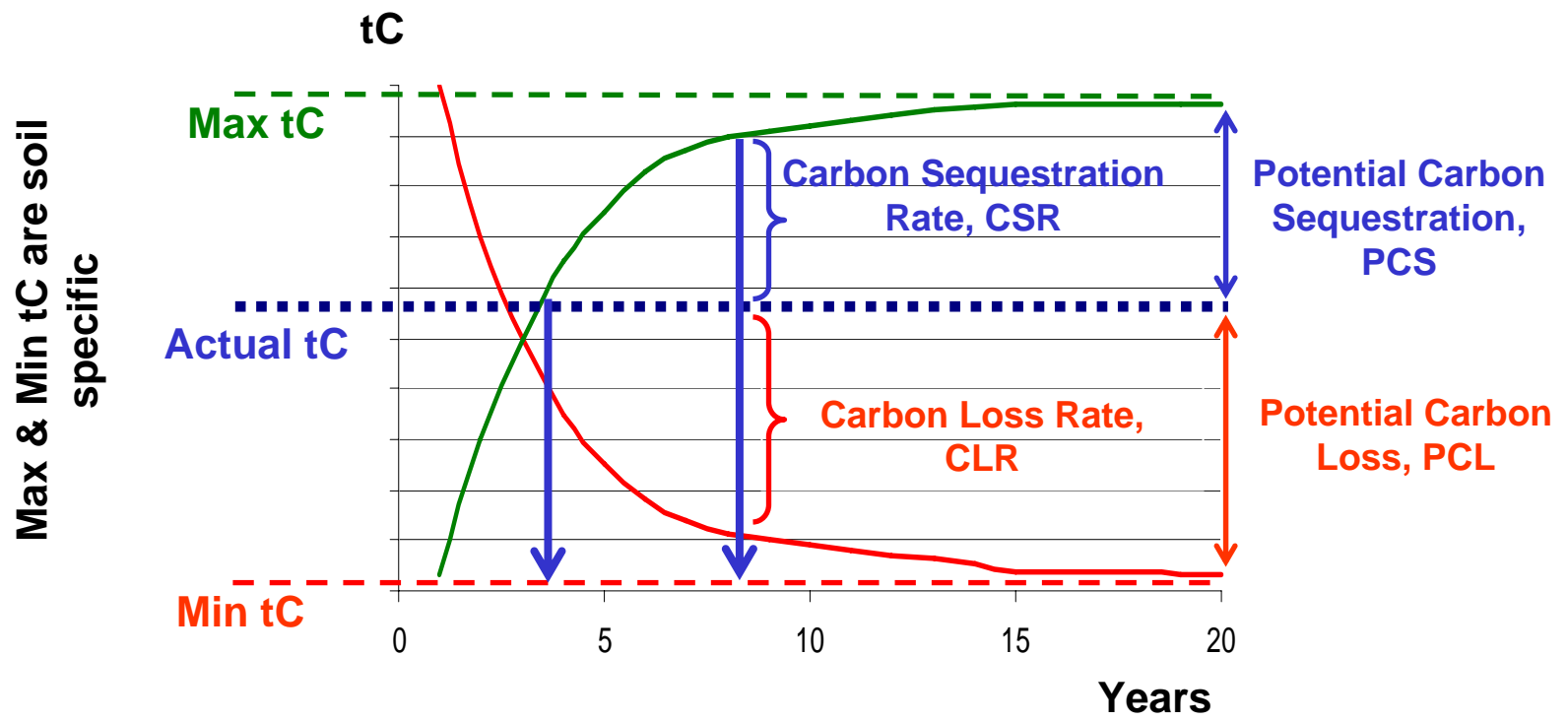
6) acting as carbon pool

7) archive of geological and archeological heritage

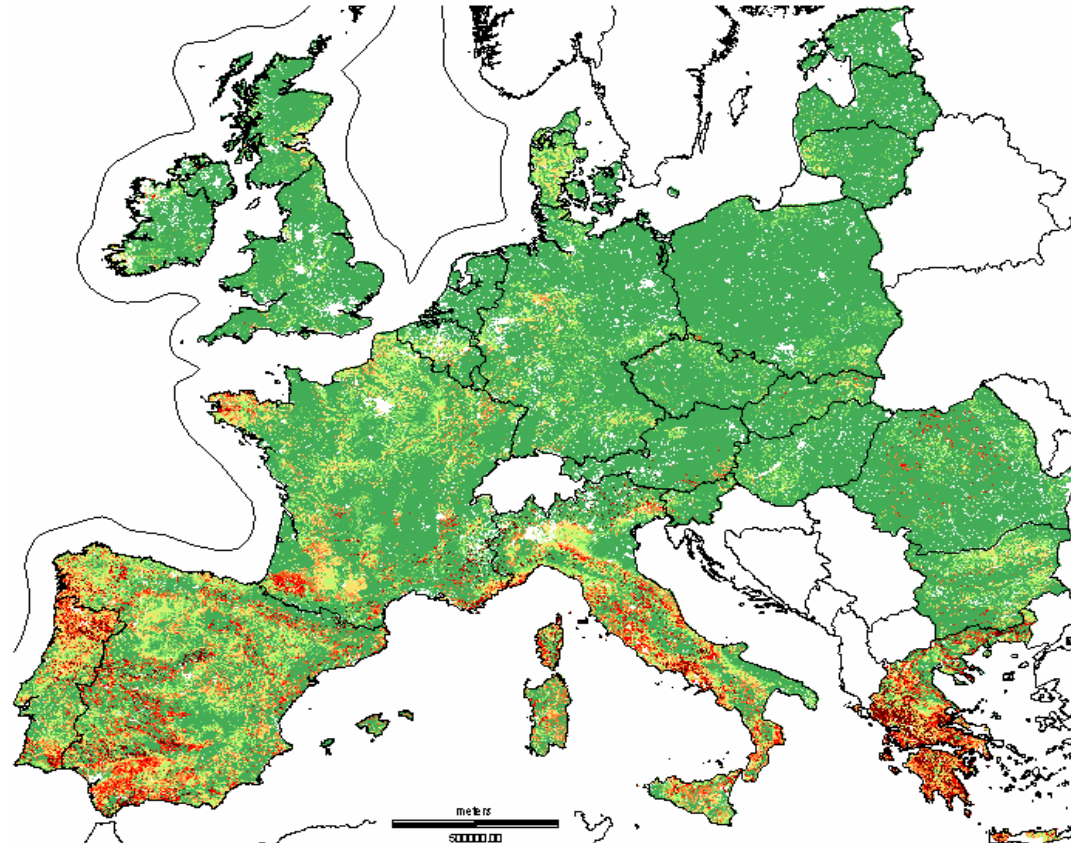
Organic carbon content in the surface horizon (0-30 cm) of soils in Europe



Example for quality perspective Bringing soil carbon to policy & decisions

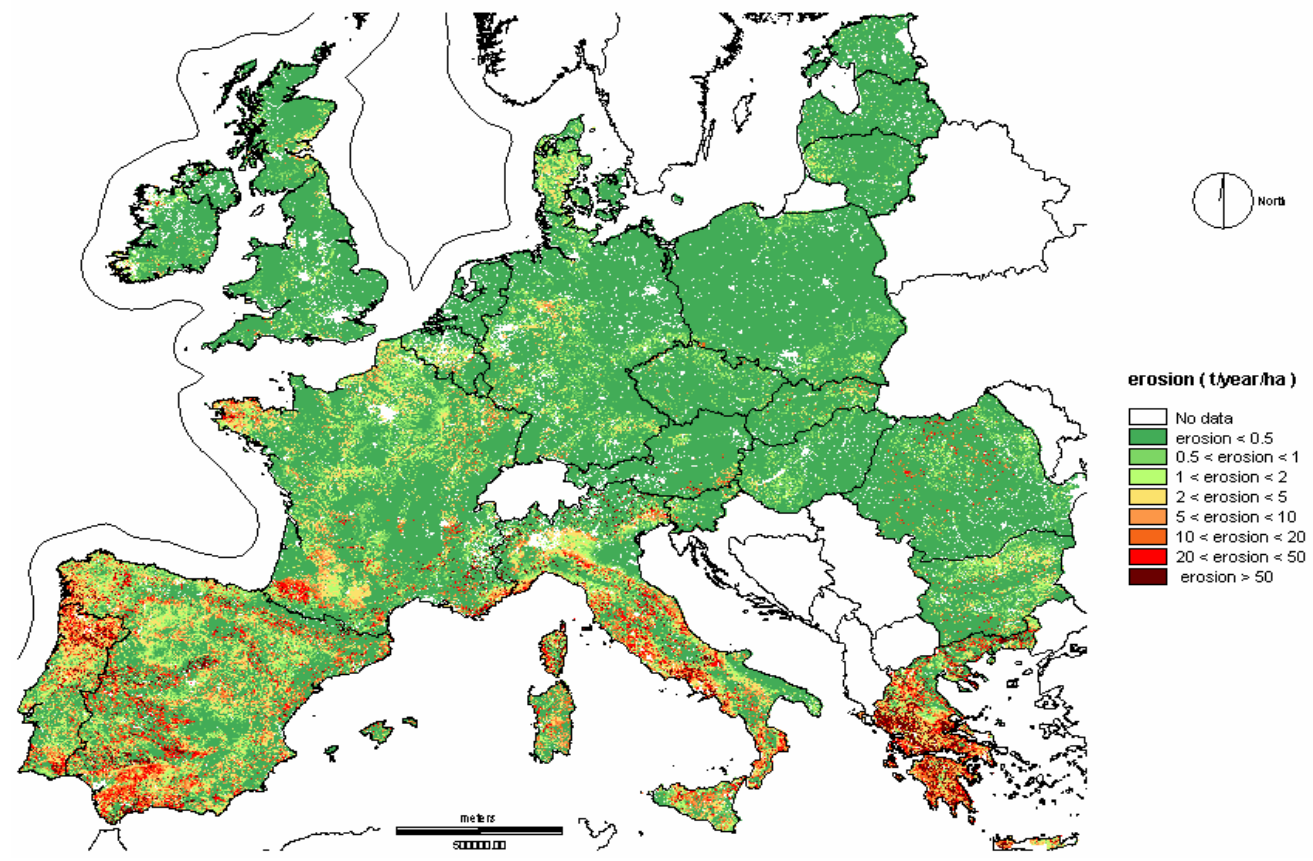


Soil threats



- erosion
- organic matter decline
- salinization
- compaction
- landslides,
(soil sealing)
(contamination)
(floods)

Soil threats



- erosion

- organic matter decline

- salinization

- compaction

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(soil sealing)

(contamination)

(floods)

Source: Pan-European Soil Erosion Risk Assessment (PESERA)



Targets of risk area identification: the soil threats

Threats which are soil and area specific in their appearance:

- soil organic matter decline
- erosion
- compaction
- salinisation/sodification
- landslides

Approaches to risk area identification and risk characterization

The 'Two Tiers' concept

'Tiers' correspond to different work steps, each requiring different (resolution and set of) data.

Tier 1, is a step to provide tool for risk area identification based on qualitative or model-based descriptions using data on lower resolution (European level).

Tier 2, is a second step, to provide tool, for risk area description and characterization based on higher resolution data (Member States level).

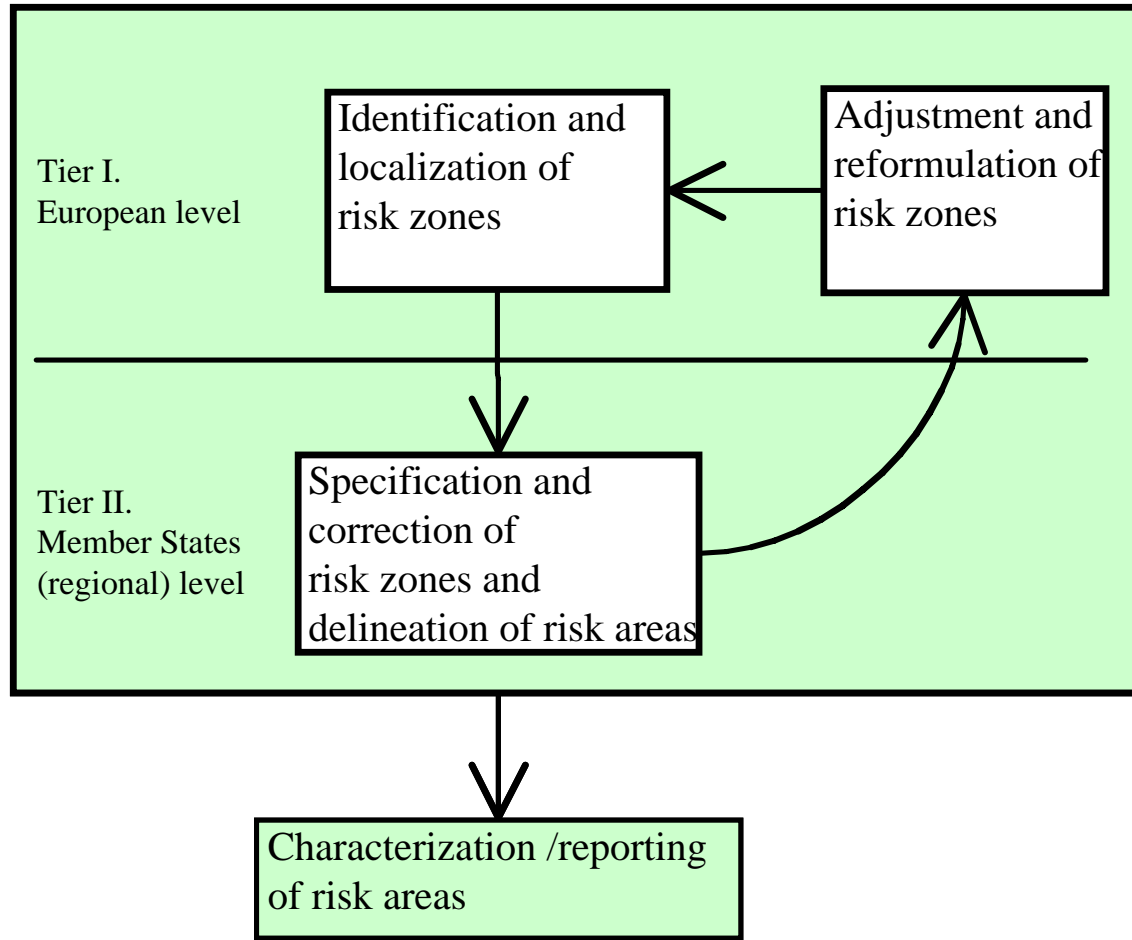


Application of the two tiers approach

Tier	Target	Description
Tier 1	Broad risk zones identification (problem identification and localization)	<ul style="list-style-type: none">– available data at European-level– Geographical scale of 1:1,000,000/1:250,000– Soil-specific qualitative approach, and/or– Model-based (pedo-transfer rule) approach combined with thresholds indicators
Tier 2	Detailed risk zone delineation. Measures/implementation plans to protect and/or prevent soils within the risk zones	<ul style="list-style-type: none">– Data available/relevant at the Member State level (e.g. regional soil maps)– Qualitative/quantitative/model approach



Flow of information on soil threat



Threat specific analysis

Each of the threats was considered separately within a common framework of practical questions.

- What is the required resolution of spatial and other information?
- What are the data requirements to establish baseline conditions and identify trends?
- Where models are used, what calibration data is required?
- What potential is there to use existing data, particularly that available at the European level?



Geographical scale of analysis, data quality and Information content

Scale of analyses, data quality

- 1:250,000 scaled thematic soil map can provide sufficient background for the Tier 1 delineation of risk areas.
- For Tier 2 descriptions, national databases (with spatial details at 1:250.000 scale or finer) may provide bases for reporting on risk areas.

The confidentiality of assessments (and reports) will largely depend on the detail of the available dataset.

Information content

Parameters required for Tier 1: Soil typological unit (soil type), texture, soil organic carbon (concentration and stock) bulk density, structure and soil hydraulic properties. Climate, topography, bedrock, land cover, land use, groundwater information complete the required dataset.

During Tier 2. assessment national/regional approaches developed in Member States may apply more detailed information, that consist of a wider datasets.



SOM Decline

Criteria	Data source/type of information	Minimum data quality /resolution	
		Tier 1	Tier 2
Soil typological unit (soil type)	Semantic attribute of the soil database	Soil map 1:1,000,000/1:250,000	Soil map 1:250,000 or more detailed
Soil texture/clay content	Semantic attribute of the soil database, standard analysis of texture; textural classes according to official classification	The same, SPADE database	National profile data base; soil inventory/monitoring
Soil organic carbon content/density/stock	Semantic attribute of the soil database, laboratory analysis: content [g/kg, %], or model computation density [kg/m ³], stock [kg, t, Tg, Pg]	The same, SPADE database, pedo-transfer rules, computational models	Forest floor, peaty layers, genetic horizons or layers
Climate	Annual average precipitation and temperature	10 km grid climatic data	Higher resolution raster data(modeled from national weather station network)
Slope, exposition, position in relief	DEM	250m	90m or higher
Land cover/land use	CORINE; LUCAS SSU; extended by soil typological units; management statistics	NUTS III	National statistics

Erosion

Criteria	Data source/type of information	Data Quality /Resolution	
		Tier 1	Tier 2
Soil typological unit (STU) (soil type)	European/national soil databases	Pesera/national level	Regional inventory/models
Soil texture (STU level)	Semantic data of the soil database, standard analysis of texture; textural classes according to official classification	SPADE database	National profile data base; soil inventory/monitoring
Soil density, hydraulic properties (STU level)	Semantic data of the soil database, standard analysis of texture; bulk density, packing density, water retention art field capacity and wilting point	Pedo-transfer-rules (PTR) or functions	Measured data
Topography	DEM, gradient (slope), length	250m (SRTM)	90m (SRTM)
Land cover	CORINE, land cover type	250m	100m
Land use	Eurostat, Land use, agricultural statistics	NUTS3	NUTS4
Climate	MARS climate grid, precipitation, rainfall, snowfall, number of rain days, storm events, PET, temperature	10 km daily average 50km daily average	1 km raster (modelled from national)
Hydrological conditions	Catchment information system, DEM	10km	1 km
Agro-ecological zones	Derive from soil map, climate, landscape	50km	1 km



Compaction

Criteria	Data source/type of information	Data Quality /Resolution	
		Tier 1	Tier 2
Soil typological unit (soil type)	Semantic data of the soil database	Soil map 1:1,000,000/1:250,000	Soil map 1:250,000 or more detailed
STU topsoil and subsoil	Semantic data of the soil database: sand, silt, clay content	Texture class	Particle size
STU data	Semantic data of the soil database: bulk density, water retention, soil organic carbon, structure, texture	Pedo-transfer-rules (PTR) or functions	Measurements
Climate	MARS climate grid: precipitations, potential evapotranspiration	Climate records: average annual/ monthly or 10-day	Climate records: average 20-30 yr. period/daily
Land use	Eurostat: statistical data about agriculture and forestry: crop types and forest areas, types of farming systems (annual crops, vineyards, animal breeding, etc.), type of forests	NUTS 3	NUTS 4
Farming and forest systems	Typology of farming systems or forestry systems in relation to land use data	Expert knowledge	Survey data
Land cover	CORINE: localisation of agricultural areas, forest areas, etc.	250 m	100 m
Slope	DEM	SRTM 250 m	SRTM 90 m

Salinization/sodification

Common criteria	Data source/type of information	Data Quality /Resolution	
		Tier 1	Tier 2
Soil typological unit (soil type)	European Soil Database, national soil databases; semantic data of the soil database	Soil map 1:1,000,000/1:250,000	Soil map 1:250,000 or more detailed
Soil texture (STU level)	European Soil Database, national soil databases; semantic data of the soil database: standard analysis of texture; textural classes	SPADE database; texture class	soil inventory/monitoring; particle size
Soil hydraulic properties	Semantic data of the soil database: hydraulic conductivity, water retention, drainage	SPADE database	National profile database; soil inventory/monitoring
Irrigation areas and chemical composition of irrigated water	Eurostat: irrigated area, irrigation intensity, salt content, sodicity, alkalinity of irrigation water	national registries	regional registry
Groundwater information	European Groundwater Database/ regional database: depth, salt content, sodicity, alkalinity	European Groundwater Database (salt concentration, type of salt)	regional database
Climate	MARS climate grid: average annual precipitation, annual potential evapotranspiration	1 km raster size (modelled from national weather station network)	1 km or finer raster size (modelled from national weather station network)



Landslides

Common criteria	Data source/type of information	Data Quality /Resolution	
		Tier 1	Tier 2
Occurrence/density of existing landslides	Eurostat NUTS III statistics	NUTS III	Larger-scale regional/local assessments
Bedrock	Expert list of bedrock (bedrocks with high porosity + cracks) + most common events	Map of Geology 1:1,000,000	Local / regional studies and maps
Soil properties	Semantic data of the soil database: texture, structure, permeability	Soil Mapping Unit at 1:1M	Soil properties at regional or local scale
Slope	DEM: 3 classes: 0-10°; 10-30°; >30°	250m	100m
Land cover/land use	CORINE, Eurostat: infrastructure; cultivation density/pressure, mining	250m	100m
Climate	likelihood of heavy rainfall events	daily events	Daily events (e.g. < 10, 10-70, >70 mm/day)
seismic risk	Density /Intensity	NUTS III	Local/ regional



Challenges for Soil Quality Assessment in the EU

OPINION of the Committee of the Regions on the COM(2002) 179 final

- Standardised methodologies, with appropriate quality control, are a pre-requisite for instituting coordinated soil quality assessments across Europe.
- Constructing a set of use-based quality indicators and associated targets, (and a pragmatic and local risk-oriented and cost-effective programmes).
- The definition of soil use must allow for the derivation of appropriate local and customised soil quality standards.



Thank you !

