PREP SOIL

Regions SOIL Needs Assessment

Soil Needs and Drivers of Change Across Europe and Land Use Types

March 2024

Funded by the European Union

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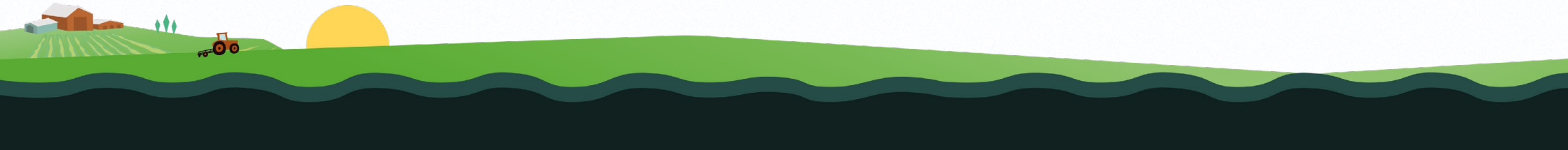

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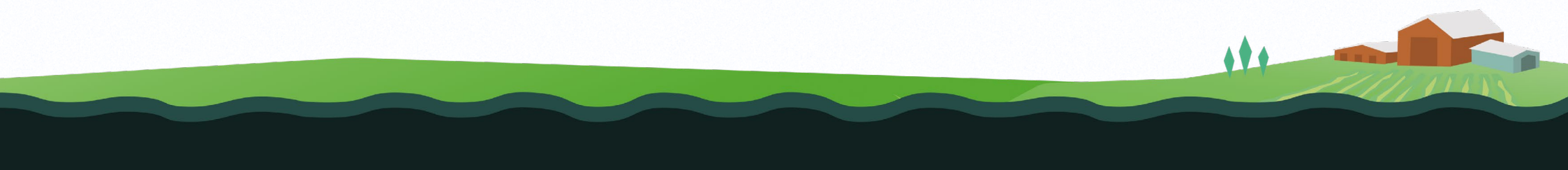

Introduction

Key Recommendations

- Soils needs must be taken into consideration when land use decisions are made at all the levels starting from regional to national or European.
- Limiting land abandonment with a clear renaturing plan, monitoring process should be developed to further avoid harmful consequences (erosion, pests etc.,).
- In addition, de-sealing of land should be a high priority and should be a frequently occurring action, especially in rural areas.
- Forest management and restoration activities should be adapted to mitigate the climate change impacts (avoid diebacks, control pests, and release of greenhouse gases).
- Economic incentives for farmers, foresters, land users and city developers should target to further enhance the provision of ecosystem services from soils alongside business activities.
- Multiple income sources in rural areas should be generated and incentivized to avoid the soil degradation processes such as long abandonment.
- Agricultural production should be redirected to stay within the boundaries of ecosystem services from soils.
- New governance models such as soil districts, living labs/light houses should be equipped, maintained from the bottom up with long term sustainability through sufficient finances.
- Soil needs assessment research approach shall be adapted in the other EU Soil Mission Projects.

The European Union's Soil Mission implementation plan lists multiple societal needs from healthy soils. To meet these demands PREPSOIL is supporting the implementation of the Soil Mission by creating awareness and knowledge on soil needs among stakeholders in regions across Europe. PREPSOIL aims to increase awareness of Living Labs as a means of involving stakeholders in soil enhancements across various land use categories (agriculture, forest and natural, urban and post-industrial). Within the framework, as a first step towards developing a long-term collaboration with stakeholders, a stock taking of soil needs in 20 representative regions are conducted (Figure 1). The booklet presents the summary and key recommendations from this analysis.

Soil Needs Assessment Approach

The PREPSOIL research adopted a Soil Needs Assessment (SNA) as a fully interdisciplinary and participatory that combines both natural science knowledge on the functioning of soils and ecosystem services with research methods from the social sciences. The expert knowledge and literature analysis with participatory approaches in the form of workshops to elicit knowledge and to generate awareness and literacy on the importance of soils. The whole research is conducted by employing the five categories of the Driver-Pressure-State-Impact-Response (DPSIR) framework (Figure 2). The framework analyses the systems interactions between human socio-cultural-economic and the soil eco systems. Such drivers differ across European regions; therefore 20 different representative regions across Europe are selected through a study design of a most different case study approach. Our focus was to present cases to reflect the diversity of European land use types, socio-economic and geo-biophysical conditions for soils. Therefore, various agricultural production systems, forestry systems, urban and (post)industrial systems, and mixed land use systems were considered.

The novelty of the SNA is a systems research perspective on soils, focusing on the functioning of social systems and their impacts on the multifunctionality of soils and the ecosystem services. Consequently, SNA systems approach helps us understand and address the drivers for soil management decisions. In furtherance of understanding the societal needs from healthy soils and soil needs from a healthy society, SNA approach describes the complex interaction between society and the soil ecosystem.

In the following pages, the PREPSOIL project presents 20 regions' analysis and results from literature review, workshops, and interviews in the DPSIR categories. The participatory approach used for acquiring the knowledge necessary to fill the DPSIR conceptual framework was a series of workshops and interviews which spanned all of Europe. The workshops served as a way of validating the knowledge acquired from the desk analysis and gathering identified gaps in knowledge More than 500 stakeholders from farmers, policy and government, soil and other advisors, research, business, CSOs and NGOs were interacted during the participatory research process (Figure 3). Regional focused knowledge is co-generated on the existing and emerging socio-economic and geo-biophysical perspectives that determines the health of soils as indicated by their ability to provide ecosystem services. The emerging results were abstracted to a level to find commonalities but also specificities. These findings will be validated in the EU Soil Week (21-23 November, Madrid) and developed into a synthesis report. The synthesis report will elaborate the findings for each land use category.

> *"Soil Needs are defined as the requirements from existing and emerging socio-economic and geo-biophysical perspectives that determine soil health and related services to human society."*
>
> **Helming & Bayer**

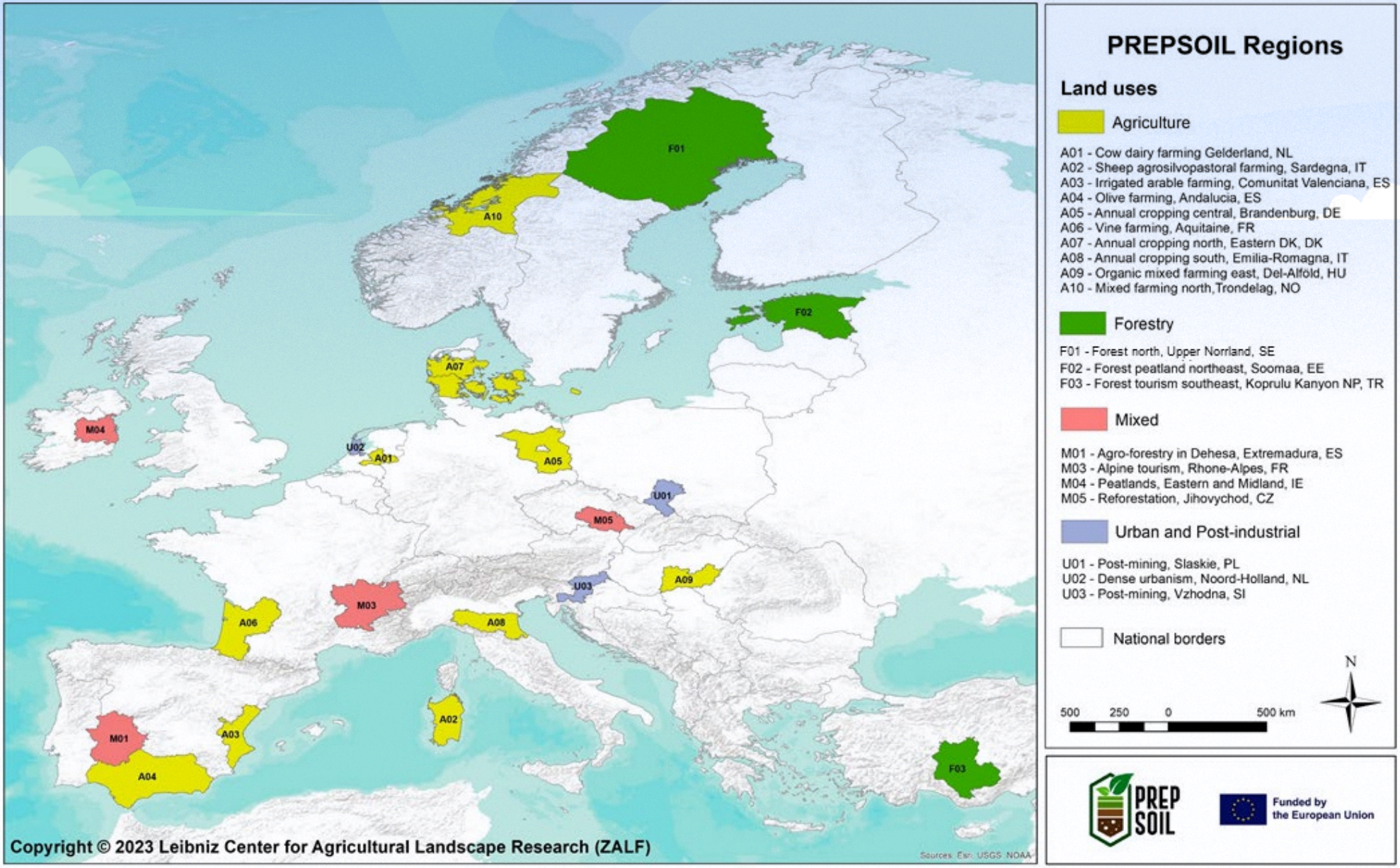

***Figure 1**: Regions of the soil needs assessment in Europe.*

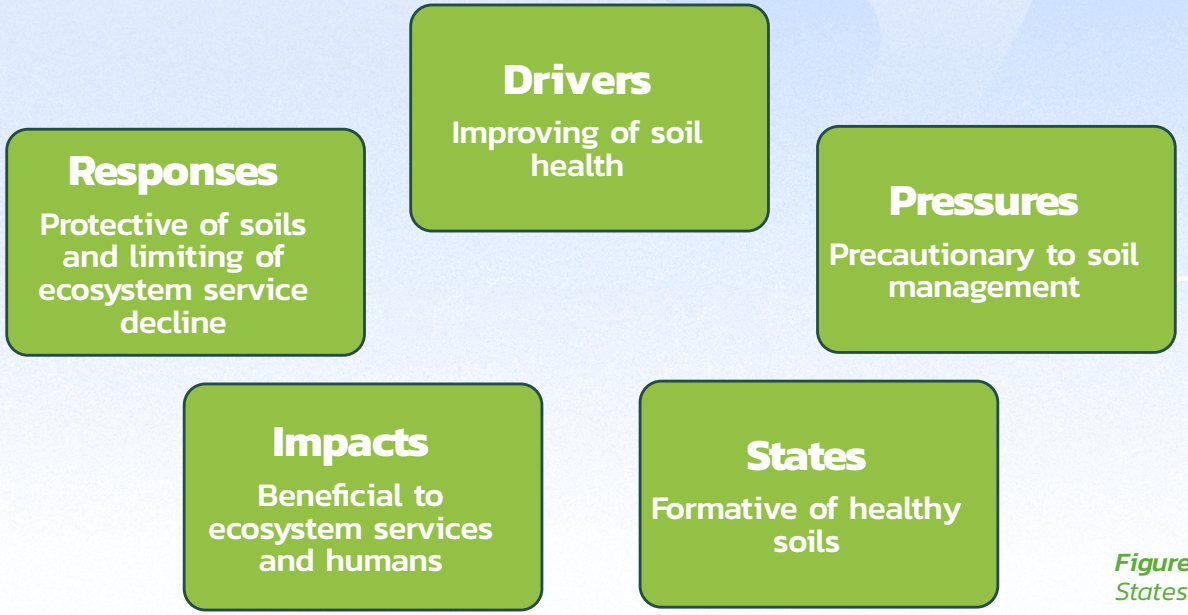

***Figure 2**: PREPSOILs Driver-Pressure-States-Impacts-Response Framework*

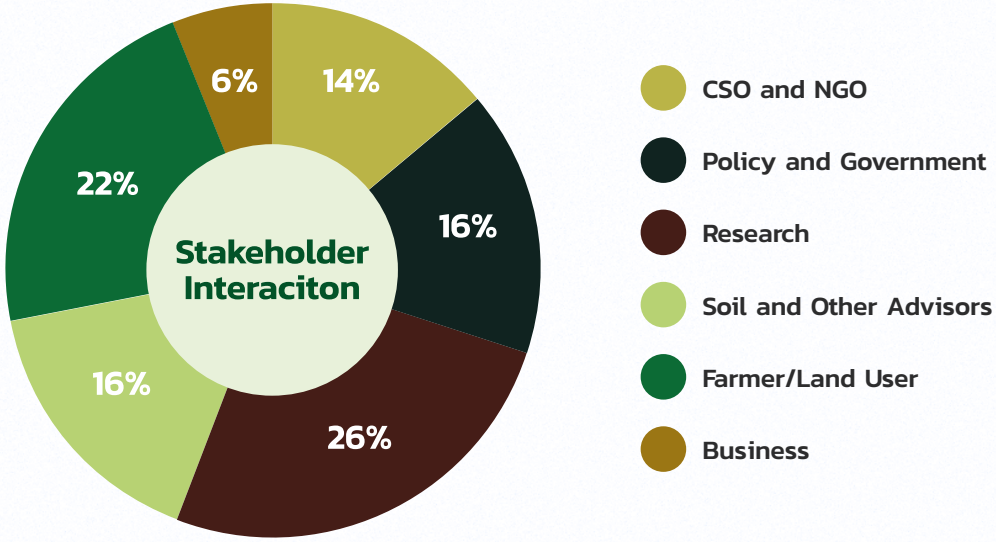

***Figure 3**: Stakeholder participated in all the regional soil needs assessment*

Agriculture

Agriculture

Cow Dairy Farming

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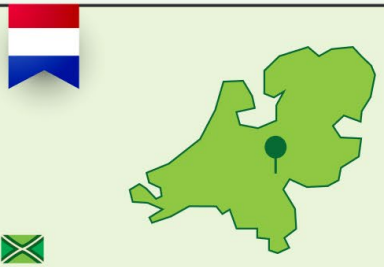

Gelderland (The Netherlands)

REGIONAL INFORMATION

The region was characterized by small-scale farmers, mixed farming systems, incorporating both crops and different Livestock. The landscape was dominated by hedges and thickets, dividing the property of different farmers.

Dominant land use	Dairy Farming
Secondary land use	Arable Farming
Climatic Zone	Cfb = Temperate oceanic climate
Soil WRB classification	Podzol, Fluvisol, Anthrosol
Soil type	Podzol, Fluvisol, Anthrosol
Dominant topsoil texture	Sand (in the higher regions) , Clay (in the valleys)
Soil threat(s)	Too dry (Podzol, Anthrosol), Too wet (Fluvisol), Soil compaction (everywhere)
Representative for regions	areas with intensive dairy farming like Fladers, Northwest Germany and Denmark, but also regions where intensive agriculture is taking place close to Natura2000 areas.

SOIL NEEDS ASSESSMENT

Drivers

- Climate change: extreme droughts, and extreme rainfall events. Mainly sandy soils
- Dutch water system is designed to drain surface water as quickly as possible by ditches and canalized rivers.
- Land consolidation, intensification and specialisation important for the farm profitability
- Policies and conditionality of the CAP (2023 – 2027); crop harvesting dates, fertilizer applications, mono-culture practices,
- Focus on more industry, housing, increased attention for nature areas

Pressures

- Droughts and extreme rainfall cause soil compaction or soil sealing.
- Decreased water quality due to manure surpluses, as water quality should meet the (inter)national standards.
- Increased use of heavy machinery on agricultural land and increase of monoculture, and the practice to let fields lay barren for a while to decrease the chance of pests and
- diseases related to mono-culture cropping.
- Increase of water demand (of agriculture but also due to urbanisation)

State

- Soil compaction, soil sealing, and soil that is too dry or too wet Insufficient water retention capacity
- Changes in water quality and quantity
- Sensors and monitoring programs should create awareness of the soil issues, but the sense of urgency is still not generally seen by landowners/users

Impact

- Decrease in the organic carbon matter in the upper soil, and increasing soil compaction
- The decrease of organic matter in the soil disrupts soil life, causing soil sealing, which leads to run-off of (applied) nutrients.
- The excessive use of fertilisers and pesticides has negatively affected the water quality. Yields became more insecure, especially in monocultures.

Response

- Small-scale initiatives to stimulate sustainable agriculture such as the decrease in use of heavy machinery, crop diversity, animal manure instead of synthetic fertilizers,
- nature inclusive farming on the boundary of nature areas.
- The measures (except carbon sequestration) are currently still based on voluntary actions. Rewards for ecosystem services can stimulate sustainable land use. Subsidies and policies should reward
- farmers for all measures that enhance ecosystem services, and not only a single element as is currently often done.
- Creation of short value chain towards a more sustainable region with a cautious approach of choice and quantity of products.

KEY MESSAGE

- Intensive agriculture, dairy farming and arable agriculture dominant land use, mostly on sandy soils.
- Climate change impacts water availability and soil health: soil compaction in the subsoil of sandy soils and in the topsoil in clay soils. Soil sealing in clayey soils.
- For resilient landscape many small-scale initiatives on extensive, nature-inclusive management are needed.
- Political landscape in the Netherlands and (inter)national regulations makes farming an uncertain business.
- The future of agricultural transition (livestock) is uncertain.
- The transitions towards sustainable soil management is long way.

STAKEHOLDERS INTERACTION

25 April 2023,
Giesbeek (The Netherlands)

- 2 Policy and government
- 3 Soil and Other Advisors
- 9 Business
- 12 Research community
- 5 Farmer/land Owner
- 5 CSOs and NGOs

Relevant Soil Mission Objectives

- 3. Stop soil sealing and increase re-use of urban soils
- 4. Reduce soil pollution and enhance restoration
- 5. Prevent erosion
- 6. Improve soil structure to enhance soil biodiversity

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Agriculture

Sheep Agrosilvopastoral Farming

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REGIONAL INFORMATION

This study area is the upper part of the Tirso Valley watershed, located in Central Sardinia and characterized by acidic soils derived from granitic rocks.

Dominant land use	Less than one third of the Tirso valley (104,536 ha) is characterized by silvopastoral land uses, mainly based on dairy sheep farming systems, with a gradient of heterogeneous land use ranging from forest (73,745 ha) to arable lands in the low valley, (more than 75,700 ha).
Secondary land use	Shrublands characterized by Mediterranean maquis, permanent pastures, urban areas.
Climatic Zone	Mediterranean, with a 3 months drought in Summer and rainfall in Autumn and Spring.
Soil WRB classification	Mainly ROCK OUTCROP, LITHIC XERORTHENTS.
Soil type	1. Clay accumulation, shallow water table and salt accumulation; 2. Shallow, moderately fertile and with relatively high amounts of organic matter; 3. Poor fertility, high erosion risk (slope), characterized by stoniness and rockiness; 4. Shallow and acidic soils.
Dominant topsoil texture	Mainly from sandy to sandy-argillaceous soils. Erosion (water), desertification.
Soil threat(s)	Erosion (water), desertification. The region grapples with land abandonment and fire risk.
Representative for regions	ES61 (Andalusia), ES42 (Castilla la Mancha), ES43 (Extremadura) / EL65 (Peloponnese), EL43 (Crete), EL62 (Ionian Islands) / ITF4 (Apulia), ITF6 (Calabria), ITF2 (Molise) / CY (Cyprus). Other agrosilvopastoral Mediterranean regions.

SOIL NEEDS ASSESSMENT

Drivers
The past conversion from woodland to pasture lands, followed more recently by intensification of the sheep farming system and current land abandonment; Climate change leads to increased aridity, prolonged drought periods and extreme precipitation events. The combination of increased drought and extreme precipitation often leads to increased soil erosion.

Pressures
Overgrazing and over-exploitation of the soil (fodder cultivation with intensive techniques) in the past but still visible; High flock density correlated with imbalance in the feed supply chain and lower farm's feed self-sufficiency; The frequency of megafires and extreme wildfires, that are soil erosion multipliers, is increasing with climate change.

State
Low fertility and production potential limit arable crops, implying lower feed-sufficiency level. Natural pasture directly consumed by sheep grazing are dominant. Human activities have shaped the landscape promoting Quercus suber for cork production and lowering the tree density (agroforestry). Land abandonment has cascading effects on gamma biodiversity and fire risk.

Impact
Permanent grasslands provide high soil carbon sequestration potential but the soils' pressures determine: loss of i) soil (5 cm lost since 1980), ii) carbon stocks and iii) biodiversity; decline in water quality (downstream); fire risk increase; reduction in fodder production.

Response
Maintaining pastoralism with site-specific development policies is crucial for maintaining soil and landscape qualitative traits. Encouraging the regrowth and development of potential vegetation in unsuitable soils for grazing (high slopes). To enhance the role of the forest components in the performance of agro-livestock farms and the provision of ecosystem services.

KEY MESSAGE

To promote the improvement and conservation of agrosilvopastoral soils, as well as boosting awareness concerning Soil Health and its proper management at local level represent a strategic objectives. On the other hand, depopulation and abandonment are the main bottleneck for implementing effective solutions for the survival and attractiveness of these areas.





STAKEHOLDERS INTERACTION

23 June 2023,
Ollolai, Sardenha (Italy)

- 7 Policy and government
- 4 Soil and Other Advisors
- 1 Business
- 17 Research community
- 6 Farmer/land Owner
- 2 CSOs and NGOs

Relevant Soil Mission Objectives

1. Reduce desertification
2. Conserve soil organic carbon stocks
6. Improve soil structure to enhance soil biodiversity

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PREP SOIL Regions SOIL Needs Assessment

Agriculture

Irrigated Arable Farming

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Comunitat Valencia (Spain)

REGIONAL INFORMATION

In the Valencia region, the traditional flood irrigation was fed with natural karstic springs, as in many regions around the Mediterranean where limestones are widely-distributed rocks. In the La Ribera district, the river Xúquer allowed a large flood irrigation system that is millennia old. This sustainable system is recently being changed into drip-irrigated areas . The landscape in terms of cultural heritage and attractiveness for agri-tourism deteriorates.

Dominant land use	Irrigated agriculture, adjacent drylands cropping.
Secondary land use	Peri-urban, nature. Rangelands and forest of Pinus halepensis.
Climatic Zone	Mediterranean, 3 months drought in Summer, rainfall in Autum/ Spring
Soil WRB classification	Aridisoles and Entisoles
Soil type	Calcareous silts with low carbon content.
Dominant topsoil texture	loamy clays and sandy clays (depending on geology type)
Soil threat(s)	Soil erosion, soil pollution.
Representative for regions	Irrigated agricultural areas across the Mediterranean in Italy, Greece, Slovenia, Cyprus, France, Turkey, Croatia, Malta, Albania

SOIL NEEDS ASSESSMENT

Drivers

- Climate change-induced droughts and erratic rainfall events with high-intensity rainfall.
- Availability of better-paid work at the coast in the tourism sector.
- Availability of chemical products (since 60's) and drip irrigation (since 80's) for intensive farming.
- Availability of subsidies from the European Union for the implementation of drip irrigation.
- Low prices of agricultural products making intensification necessary.

Pressures

- According to technicians, scientists, and policymakers: Soil erosion and soil compaction and land abandonment
- According to farmers: Aging, the lack of succession, and low income, low prices for products and soil erosion.

State

Soils are considered fertile, but due to millennia-old abuse of tillage, and since 60's herbicides: the soil system and its services: poor condition of natural resources such as biodiversity, quality of water, quality of soil, and damage to the traditional landscape.

Impact

- Water quality and quantity: Chemical agriculture polluted the aquifer. Drying springs due to aquifer depletion.
- Flooding: more flows due to the use of herbicides and the removal of the agriculture terraces.
- Droughts: due to climate change
- Rural development: Irrigation and mechanization are the key factors. Organic farming can be the solution but most of the farmers doubt that without chemicals they can survive within competitive agriculture.
- The yield of crops: Increased.
- Biodiversity: Decreased.

Response

- Encourage young people to participate in the new agriculture, healthier agriculture.
- Reduce soil losses with the use of chopped pruned branches and other mulches.
- Reduce the use of pesticides.
- Increase prices of agricultural products.
- Recover the use of manure, and for this, we need organic farms.
- However, farmers in general are claiming for a chemical agriculture and fair prices and salaries.

KEY MESSAGE

- Organic farmers (5%) and conventional farmers (95%) have contrasting views on the future of agriculture; organic farmers see options for sustainable farming, the conventional farmers have a negative vision for the future.
- All Farmers are claiming for a chemical agriculture and fair prices and salaries.
- All Farmers agree that the damage in nature is high.
- Some soil health restoring methods are acceptable to all farmers (chipped pruned branches) while others are rejected by conventional farmers (remove the use of herbicides, catch crops, or avoid the use of pesticides).

STAKEHOLDERS INTERACTION

14 January 2023,
Xàtiva (Spain)

- 7 Policy and government
- 8 Research
- 6 Soil and Other Advisors
- 23 Farmer/ land Owner
- 5 Business
- 1 CSOs and NGOs

Relevant Soil Mission Objectives

- 1. Reduce desertification
- 5. Prevent erosion

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Agriculture

Olive Tree Cultivation

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Andalucia (Spain)

REGIONAL INFORMATION

In Europe, almost 5 million ha are dedicated to olive tree (*Olea europaea* L.) cultivation. Jaén (Spain) was selected as a representative area where olive groves dominate, forming Mediterranean socio-ecological landscapes.

Dominant land use	Agriculture (traditional olive, rain-fed cultivation- 78% of the agriculture land).
Secondary land use	Natural/forestry, urban (rural).
Climatic Zone	Mediterranean: mean annual T 7-18 °C, mean annual precipitation of 400-570 mm; Occasional summer droughts.
Soil WRB classification	Cambisol, regosol.
Soil type	Carbonated materials (marls, limestones and dolostones). High calcium carbonate content and high pH (6-8). Low nutrients content.
Dominant topsoil texture	Mainly coarse texture, high stone content; Loam to clay in some areas.
Soil threat(s)	Water erosion, desertification, salinization, pollution, compaction.
Representative for regions	Andalusia,Castilla la Mancha, Extremadura, Peloponnese,Crete, Ionian Islands, Apulia,Calabria,Molise, Cyprus, Other olive-growing Mediterranean regions in Italy, Greece, Cyprus, Croatia, etc.

SOIL NEEDS ASSESSMENT

Drivers

The main biophysical driver threatening the soil health in olive orchards is the **climate change** (increase of temperatures and decrease of rainfalls). At socioeconomic level, drivers such as the **decreased economic viability**, the **application of traditional deleterious practices** or certain political measures were also identified.

Pressures

Currently, main pressures derive from the **transition of the olive-oil productive sector from traditional model to intensive and super-intensive models**. Intensification practices (mainly the **use of heavy machinery, increase in the use of fertilizers/pesticides and recurrent tillage**) are accelerating soil degradation processes. **CAP-subsidies system** is causing positive and negative pressures.

State

Deterioration of soil health in olive groves has been reported at different levels:
1.**Erosion**: major threat to the sustainability of this crop. 2.**Compaction/degradation of soil structure**: mainly caused by the use of heavy-machinery. Soil water storage capacity is reduced. 3.**SOC depletion**
4.**Decrease in soil biodiversity** 5.**High dependence on EU subsidies.**

Impact

1.**Crop productivity**. 2.**Water regulation:** critical in rainfed olive orchards. 3.**Carbon sequestration and climate change mitigation**. 4.**Regulation of drought, flood and fire risks**: higher frequency and damages caused by these events. 5.**Degradation/contamination of soil and water resources**: affecting their human leisure/economic potential. 6.**Soil biodiversity resources**: reducing beneficial effects on soil resilience/fertility.

Response

Main responses/strategies are: 1.**Societal-political measures**: e.g. policy reforms on soil governance and subsidies-based programs. 2.**Soil literacy – Stakeholders awareness**: e.g. capacity-building/education initiatives, living labs establishment. 3.**Adoption of sustainable/regenerative soil management practices**: e.g. use of vegetable ground covers, soil amendment application, no-tillage, controlling pests and managing water and nutrients efficiently, olive-tree variety optimal selection.

KEY MESSAGE

The massive soil erosion and the lack of water caused by climate change seem to be the main threats for the medium/long-term sustainability of this important economic sector. The adoption of management models promoting olive groves resilience in face of these determining factors seems essential to ensure their socio-economic viability and environmental sustainability.

STAKEHOLDERS INTERACTION

17 March 2023,
Jaén (Spain)

- 5 Policy and government
- 14 Soil and Other Advisors
- 2 Business
- 14 Research community
- – Farmer/land Owner
- 1 CSOs and NGOs

Relevant Soil Mission Objectives

1. Reduce desertification
2. Conserve soil organic carbon stocks
4. Reduce soil pollution and enhance restoration
6. Improve soil structure to enhance soil biodiversity
8. Improve soil literacy in society

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PREP SOIL Regions SOIL Needs Assessment

Agriculture

Annual Cropping Central Europe

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Brandenburg (Germany)

REGIONAL INFORMATION

The study area Brandenburg located in north-eastern Germany andcovers 29.640 km2. It is an excellent case study to represent modernagriculture in Europe, because it is an agricultural state characterized byintensive use; approximately 45% of its area is dedicated to intensive agriculturalland use. Compared to other German states, Brandenburg shows a relatively highshare of organic agriculture (12% of the agricultural area), and this share iscontinuously increasing. Brandenburg is representative for very large-scale high technology andindustrialized agriculture. Farm sizes are among the largest in Europe (242 ha).

Dominant land use	High Tech Agriculture
Secondary land use	Forestry; metropolitan region Berlin is spreading into Brandenburg
Climatic Zone	Continental
Soil WRB classification	Luvisols
Soil type	Dominantly loamy sand, sandy loam; 4% organic soils
Dominant topsoil texture	Loamy sand and sandy loam
Soil threat(s)	SOC decline, compaction, biodiversity decline, soil erosion (water, wind, tillage); decreasing water retention capacities
Representative for regions	Regions in Europe with large scale, large field sizes, highly industrialized, similar to Po Valley, Veneto, Emilia-Romagna, Lombardy, and Normandy, in Eastern Europe as they share a common heritage of eastern block association.

SOIL NEEDS ASSESSMENT

Drivers

- Climate change-induced droughts, erratic rainfall.
- Unfavourable topographical features- poor soils, poor accessibility, low fertility
- Large-scalehigh technology and industrialized agriculture, large farm sizes (242 ha), narrow crop rotation (maize, wheat, rey)
- Farmers attributes (education, age,know-how, political attitudes)
- Lack of adequate extension servicesand research transfer to farmers
- Policies and conditionality of the CAP (2023 – 2027); Mono-croppingpolicies
- Increased demand from regional products, animal products, biomass for energy, food waste,increase industrial use of biomass

Pressures

- Precision farming and an uptake of autonomous machineries
- Context adapted agricultural practices (conditions in soil and weather when choosingcrops)
- Flexiblesite adapted soil management
- Soilas a crop location factor
- No-till practices
- Bio-char
- Agri phtovoltaic practices.

State

- The state of Brandenburg soils in terms of soil health for agricultural production is determined by:
- Waterretention capacity in root zone depth
- Insufficient water retention capacity
- Generally lowand medium levels of soil organic matter
- State of the organiccarbon stock at 0,3 m.

Impact

- Ever-increasing **economic vulnerability** of farm finances and **climate change and extreme weather events**.
- **Price shocks** from trade, **dependency on cap payments** impacts onsocio-economic viability of the farming. Unforeseeable dynamics of the **CAP**'s expansion of the second pillarand the changes, worried many participants as their planning capacity isseverally impacted, leading them to consider moving out of the farming sector.
- Eco-system services, soil organic matter and soil fertility arenegatively impacted.

Response

- Soil management practices (no-till, improve soil structures) shouldbe adapted to increase the water retention capacity of soils, by implementing.
- A diversified product portfolio may offer an adaptation strategy, which can also meet changing societal consumption preferences and diets, protectagainst price shocks.
- Reconnecting the urban-rural linkages is of special relevance inthis regard for Brandenburg as Berlin is in its centre.
- Digitalization, assigning new roles to advisors, such asfacilitator and intermediaries and the role of digitalization in agriculture
- In response to the increasing land prices the parliament ofBrandenburg introduced the agricultural structure act, which aims at limitinginvestment coming from real estate companies
- To strengthen the family owned farms, protect the rural farmingheritage, maintain the agricultural landscape has recreational value.
- A major influence for farmers was their desire forself-determination to not be overly regulated and carrying burdens ofbureaucracy for their activities.

KEY MESSAGE

- The farming is effected by a strong pathdependency, large farm sizes limiting the management decisions, especiallyspatial organisation.
- The farming system in Brandenburg and its focuson efficient production will increasingly rely on digitalisation and robotics.
- Innovation activities should focus on theknowledge transfer system, changing spatial patterns, alternative incomesources, and establishment of regional value chains.
- Adaptation measures to limit erosion (no-till practices or agroforestry) to climate change should move to the forefront.

STAKEHOLDERS INTERACTION

26 May 2023,
Brandenburg (Germany)

- 2 Policy and government
- 2 Soil and Other Advisors
- 2 Business
- 5 Research community
- 9 Farmer/land Owner
- 2 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 5. Prevent erosion
- 6. Improve soil structure to enhance soil biodiversity

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Agriculture

Wine Farming

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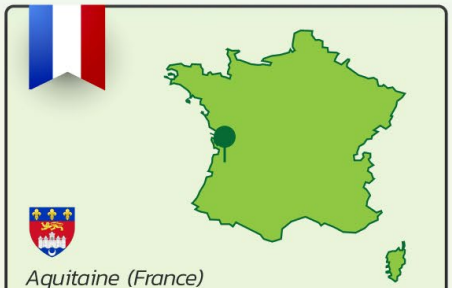

Aquitaine (France)

REGIONAL INFORMATION

Bordeaux vineyard is a well-known vineyard with many different terroirs, related to various pedo-climatic context, facing climate change and a difficult socio-economic context.

Dominant land use	Agriculture: wine, cereals, grassland, fodder
Secondary land use	Urban and peri-urban
Climatic Zone	Oceanic climate
Soil WRB classification	Mainly ROCK OUTCROP, LITHIC XERORTHENTS.
Soil type	Limestone and clay bedrock, sandy loam soil, silt-clay soils and graves (gravel and pebbles, often mixed with sand and clay),
Dominant topsoil texture	Mainly from sandy to sandy-argillaceous soils. Erosion (water), desertification.
Soil threat(s)	Mainly Sandy loam, silt-clay, graves
Representative for regions	Based on its climate, can be representative of other vineyards near the Atlantic coast and some regions in the north of Spain and north of Portugal.

SOIL NEEDS ASSESSMENT

Drivers
Climate change is the main biophysical driver identified during the evaluation process. The growing demography of the region, a growing societal demand for a healthy environment and sustainable agriculture, and the decline of wine consumption on the domestic market are the main socio-economic drivers identified.

Pressures
Rising in temperatures, changes in rainfall patterns and droughts that can lead to water scarcity, and increase in frequency and intensity of extreme events and climatic accidents (late frost, hail, drought).
Societal demand for reduction of pesticide use, urban sprawl leading to artificialisation, and financial challenges faced by winegrowers.

State
Land artificialisation of 0.9%/year in Gironde between 2008 and 2018. Significant variability in soil types and states within the vineyard. Main changes in soil states identified as a concern for the future are the loss of soil biodiversity and organic matter, soil compaction and the potential accumulation of pesticides.

Impact
Impact on soil capacity to supply water (and minerals) to the vines is the main concern in the context of climate change. Soil states also impacts yield and quality of grape production, carbon sequestration and storage capacity, and plays a role in the unique cultural identity of the vineyard.

Response
Several initiatives exist at the national and regional level to foster the adoption of sustainable practices in the vineyard (81% of the vineyard was under permanent grass cover in 2019). Efforts in research and in fostering interaction between researchers, advisors and winegrowers are also made and need to be strengthen.

KEY MESSAGE

Main levers identified are: research and development in real conditions (data and references, operational tools), co-creation approaches and demonstration sites (fostering dissemination and peer-to-peer exchange), economic support (public policies, label specifications, role of retail sector), a strong technical support (requires human resources) and more internal expertise on soil within organisations.

STAKEHOLDERS INTERACTION

26 April 2023,
Bordeaux (France)

- 3 Policy and government
- 6 Soil and Other Advisors
- – Business
- 11 Research community
- 3 Farmer/land Owner
- 4 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 4. Reduce soil pollution and enhance restoration
- 5. Prevent erosion
- 6. Improve soil structure to enhance soil biodiversity
- 8. Improve soil literacy in society

Funded by the European Union

Agriculture

Annual Cropping North

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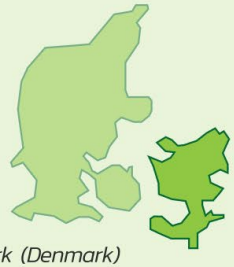


Eastern Denmark (Denmark)

REGIONAL INFORMATION

East Denmark is characterized by loamy soils, and a warmer, drier climate than the rest of the country. Approx. 60% of the land area is agricultural, dominated by large single-owner farms focused on cereals like winter wheat and barley.

Dominant land use	Arable agriculture (59% land area), primarily grains/cereals.
Secondary land use	Urban, Managed forest
Climatic Zone	Atlantic North, Continental.
Soil WRB classification	Luvisols, Cambisols, Regosols.
Soil type	Post-glacial moraine.
Dominant topsoil texture	Loams, loamy sands and sandy loams.
Soil threat(s)	Soil organic carbon loss, nutrient loss, compaction (topsoil and subsoil), water erosion, reduced water retention capacity, reduced soil fertility.
Representative for regions	Regions with similar soil and climate characteristic, where annual cropping is also a dominant land use, e.g. Scania (Sweden), Southern Finland, Northern Germany, Northern France, Poland.

SOIL NEEDS ASSESSMENT

Drivers

- Intensification of agriculture after the 1950's, with wide-scale mechanization and consolidation into large farms focused on high-yield annuals.
- Nutrient pollution in vulnerable aquatic ecosystems which led to strict nutrient regulations after the 1980's
- Climate change (milder winters, drier growing seasons)

Pressures

- Excessive tillage and heavy machine traffic (negative)
- Minimal or zero tillage, e.g., as part of Conservation Agriculture (positive)
- Excessive use of mineral and carbon-poor fertilizers (negative)
- Organic management and principles (positive)
- Low crop diversity (negative)
- Periods of grass cultivation, including for grass seed production (positive)

State

- Low SOC content
- Nutrient depletion
- Soil compaction
- Reduced water holding capacity
- Erosion risks from water and tillage.

Impact

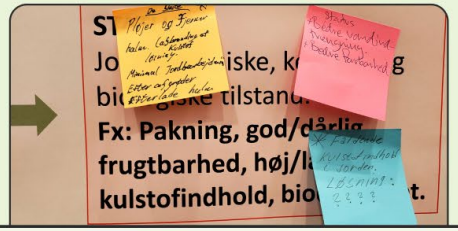
- Reduced fertility and yield stability affect provision of cultivated plants (for nutrition, materials and energy)
- Nutrient pollution affects general provision of surface and groundwater.
- Low crop and soil biodiversity affect pest and disease control (in crops).
- Soil carbon loss and GHG emissions affect the chemical composition of the atmosphere.

Response

- Continued increase in farm sizes and intensive practices.
- New investments towards improving soil health (e.g., Conservation or Precision agriculture).
- Faster change in large corporate farms and with younger farmers.
- Increased policy focus on soil health and climate goals.
- Novel forms of research (e.g., Living Labs).

KEY MESSAGE

Research and innovation in East Denmark should prioritize the scientific and practical validation of emerging agricultural practices (Regenerative practices, Conservation Agriculture, Precision Agriculture, etc.). Policy makers, advisory services and farmer's schools should be involved in the research along with researchers and farmers to help guide Denmark's comprehensive regulations.



STAKEHOLDERS INTERACTION

13 April 2023,
Flakkebjerg (Denmark)

- 2 Policy and government
- 5 Soil and Other Advisors
- – Business
- – Research community
- 8 Farmer/land Owner
- 3 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 5. Prevent erosion
- 6. Improve soil structure to enhance soil biodiversity
- 7. Reduce the EU global footprint on soils
- 8. Improve soil literacy in society

Funded by the European Union

Agriculture

Large Scale Annual Cropping

Authors
Re Soil Foundation

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REGIONAL INFORMATION

The most fertile arable land of Italy, extending over the provinces of Emilia-Romagna, surrounded by the Adriatic Sea, the Appennines and the Po river.

Dominant land use	Agriculture, croplands
Secondary land use	Urban/industrial
Climatic Zone	Temperate subcontinental
Soil WRB classification	Cambisols
Soil type	More than 210 identified: mainly alluvial origin
Dominant topsoil texture	Variable texture, predominantly medium to fine, with a high fraction of alterable minerals and carbonates
Soil threat(s)	Soil sealing; soil organic matter loss; drought; flood; soil erosion; soil pollution; soil salinity; functional soil biodiversity deterioration
Representative for regions	-

SOIL NEEDS ASSESSMENT

Drivers

The extreme climatic events have accentuated:

- Rainfall is concentrating in shorter periods, resulting in longer droughts and higher flooding hazards. Overall reduction of snowfalls;
- Temperature: the medium annual temperature and the minimum temperature have increased.
- Urbanisation keeps consuming soil for infrastructures;
- Shift toward industrial production system.

Pressures

Building activity and infrastructures expansion; overall division of animal farming and agricultural production together with misalignment in animal manure cycling; landscape elements renewal (hedgerows and buffer zones); mechanization, technologies and land management.

State

High rate of soil sealing (net soil consumption of +658 ha); low soil organic matter content (0,98-2,26 %) which keeps decreasing.

Impact

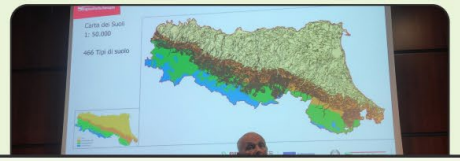
Reduction of water retention capacity and availability, soil stability and structure which are represented by the numerous lanslides and floodings occurred; Overall, the quality of the soil's structure is lowering and the nutrients mineralization is faster.

Response

The Regional law L.R. 24/2017, taking effect by 1.1.2024, introduced a maximum of 3% of consumable land, consequently reducing regional land potentially by 70% the hectares of transformable land. In the strategic plan for CAP 23-27 of Emilia-Romagna are listed specific measure to incentivize the use of conservative practices for soil.

KEY MESSAGE

Identified needs include: further research on conservative agricultural practices and surrogates of manure; establishment of MRV (Measurement, Reporting, and Verification) methodologies for monitoring and results verification; development of Carbon Farming schemes



STAKEHOLDERS INTERACTION

24 May 2023,
Rimini (Italy)

- 4 Policy and government
- 7 Soil and Other Advisors
- 7 Business
- 3 Research community
- 10 Farmer/land Owner
- 22 CSOs and NGOs

Relevant Soil Mission Objectives

- 3. Stop soil sealing and increase re-use of urban soils
- 4. Reduce soil pollution and enhance restoration
- 5. Prevent erosion

Funded by the European Union

Agriculture

Mixed Farming East

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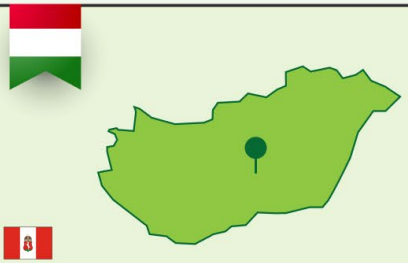

Del-Alföld (Hungary)

REGIONAL INFORMATION

The selected, Dong creek region is a part of the Sand Ridge that stretches across the Hungarian Great Plain in the Danube-Tisza Interfluve.

Dominant land use	cropland, field crop production
Secondary land use	grassland with extensive livestock farming, fruit and vine
Climatic Zone	IPPC climatic zone: Warm Temperate Dry
Soil WRB classification	Arenosols, Cambisols
Soil type	quicksand, humus sand
Dominant topsoil texture	sand, loamy sand
Soil threat(s)	Wind erosion and desertification due to climate change and historical change in water management.
Representative for regions	Sandy part of Szabolcs-Szatmár Bereg in Hungary, Regions having drought issue on sandy soils.

SOIL NEEDS ASSESSMENT

Drivers

The main problem is climate change (warming and decrease precipitation and change in precipitation pattern) followed by change in water management (draining water away from the region) and changes in land use (intensive crop production, afforestation).

Pressures

As a result of changes in water management and land use, territory of arable land has increased, but the natural water reservoirs region has been dried up. Drought further increases water use, which further lowers groundwater level. Farming practices use intensive tillage with ploughing and disking that deteriorate soil structure, soil organic matter and biodiversity.

State

Increasing number of serious wind erosion events damaging crops and infrastructure has been reported.

Impact

Effect of water shortage can be seen on the vegetation and dried up saline lakes, but it also has a great impact on the agricultural production. Yield stability decreased due to extreme weather events and longer dry periods.

Response

Most people agree that keeping precipitation in place would be one of the most important measures. A local initiative consisting of local farmers has already started a small water retention project as pilot. **Workshop participants appreciate the efforts of agricultural policy to promote the change, but the ways of communication and implementation has to be improved.**

KEY MESSAGE

Farmers have to apply soil conservation techniques adapted to the region and sandy soils to restore soil structure, increasing biodiversity and organic matter. Restoration of hedge rows and trees is also important for example controlling wind speed and providing habitats for wildlife and biodiversity. It has to be accompanied with changes in water management retaining water in the landscape.

STAKEHOLDERS INTERACTION

24 May 2023,
Kecskemét (Hungary)

- 4 Policy and government
- 5 Soil and Other Advisors
- – Business
- 13 Research community
- 8 Farmer/land Owner
- 3 CSOs and NGOs

Relevant Soil Mission Objectives

1. Reduce desertification
2. Conserve soil organic carbon stocks
5. Prevent erosion
6. Improve soil structure to enhance soil biodiversity

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Agriculture

Mixed Farming North

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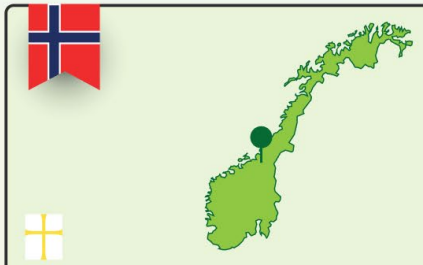


Trondelag (Norway)

REGIONAL INFORMATION

Agricultural soils cover only three percent of the total land area in Norway, and of that, only a third [KB1] is suitable for producing food grains. The total area of the Trøndelag region is 42 190 km2, and between four and five percent of this area is used for agricultural purposes (Area barometer, NIBIO (2022)). Trøndelag has a population of around 446 000 residents and is one of Norway's largest agricultural regions and the northernmost grain county (Knutsen et al. 2017). Intensive land use and poor drainage represent typical soil pressures in Trøndelag, while less intensive agricultural methods (e.g., no-till, reduced tillage) and measures (e.g., cover crops) can be hard to establish due to the cold climate and short growth season.

Dominant land use	Commercial forestry and Agriculture (mixture of pastures and cropland)
Secondary land use	Natural/forestry, mountains
Climatic Zone	Alpine north/atlantic north
Soil WRB classification	Stagnosol (dominant WRB), Gleysol, Cambisol, Arenosol, Histosol, Podzol, Leptosol, Regosol, Phaeozem, Fluvisol, Planosol, Umbrisol
Soil type	Agricultural soil
Dominant topsoil texture	Silty loam/clay loam
Soil threat(s)	High precipitation rates, poor drainage, soil compaction (saturated soil during harvest), soil erosion, soil sealing. Part time farming, intensive agriculture, limited time to spend on farm work, sometimes lacking/to small economic incentives, high pressure on agricultural land.
Representative for regions	Regions in Europe with Cereal production and mixed farming at high latitudes.

SOIL NEEDS ASSESSMENT

Drivers
- Political decisions, affecting pricing and agricultural agreements/settlement, Canalization policy, levelling of soils, production subsidy measures are not practical oriented, poor agriculture infrastructure.
- Distance between decision-makers and farmers, poor link between theory and practice
- Climate change- short growing season, unpredictable rain.
- Land use change from agriculture to other, expensive heavy machinery.
- Farming is part time occupation, shift towards mixed farming (livestock and grain)

Pressures
- Decreased mixed farming (removal of livestock)
- Increase in the lease land, lack of knowledge and prioritization for soil health
- Absence of crop rotation and crop biodiversity
- Poorly maintained drainage
- Warmer and dry seasons has positive pressure with more time for farming activities
- Investments in the biogas industries

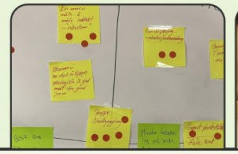
State
- Slowly decreasing soil organic carbon, reduced soil fertility
- Reduced biodiversity
- The workability of the soil was also decreasing, requiring more horsepower and effort to till the soil
- Soil compaction, Soil sealing and permeant loss of fertile soil, land abandonment

Impact
- Soil fertility, functioning and resilience (to floods and droughts), plant root growth, soil gas exchange capacity, microorganisms' access to "food" (as straw is heavily degradable and often removed).
- Reduced water infiltration, storage capacity, increasing surface runoff, the risk of nutrient leaching, water eutrophication affecting wild salmon.

Response
- Diversity, cover crops and crop rotations (with e.g. wheat, peas, beans and oilseed rape), "green soil cover", permanent grassland, organic inputs
- Knowledge demand on soil health improving measures- cover crops in high altitudes, bio-manure applications, biochar application, farm equipment and about the status of soil health.
- Organic residues from the biogas facilities, is possibly easier to transport than manure, creating new opportunities.
- Good links between farmers, extension services, decision makers and researchers
- Regulations related to subsidies need to be flexible.

KEY MESSAGE

- Agriculture in Trøndelag is diverse with dairy and meet, grain (barley), and vegetables. Soil health is affected with low organic carbons, soil compaction from heavier machinery, poorly drained fields, increase in leased land.
- The regional policies need to adopt to local farmer demands
- Raising awareness amongst politicians, consumers and producers is key to get soil health. Establishing farmer engagement, and co-op farming, A labeling scheme for soil health on products.



STAKEHOLDERS INTERACTION

27-28 March 2023,
Trøndelag (Norway)

- 2 Policy and government
- 11 Soil and Other Advisors
- 5 Business
- 4 Research community
- 8 Farmer/land Owner
- 5 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 5. Prevent erosion

Funded by the European Union


Mixed

Mixed

Agro-Forestry in DEHESA

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Foundation FUNDECYT SCIENTIFIC AND TECHNOLOGICAL PARK OF EXTREMADURA (FUNDECYT-PCTEX)

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Extremadura (Spain)

REGIONAL INFORMATION

The DEHESA is a centennial land system composed by scattered oak trees and annual native pastures extensively grazed by autochthonous livestock, being part of the cultural legacy of Extremadura region.

Dominant land use	Extensive grazing
Secondary land use	Self-consumption agriculture
Climatic Zone	Mediterranean
Soil WRB classification	Leptosol, Cambisol and Regosol
Soil type	Shallow, sandy-loam textured, slightly acidic and relatively poor in nutrients
Dominant topsoil texture	Sandy-loam
Soil threat(s)	Erosion, compaction, lack of fertility
Representative for regions	Extremadura (ES), Andalusia (ES), Alentejo (PT), Castilla-La Mancha (ES), Castilla y León (ES)

SOIL NEEDS ASSESSMENT

Drivers

Regarding environmental drivers in Extremadura, most of them are consequence of climate change: drought risk, flood risk, fire risk, frequency of extreme weather, etc., with much longer dry periods. On the other hand, as Socioeconomic driver, **low farm profitability** and **lack of generational replacement** have been also identified.

Pressures

The need of cultivation. The low profitability of many farms forces their farmers to cultivate their soils to avoid buying external feed. The Dehesa soil (shallow and relatively poor in nutrients and organic matter) is not suitable for being cropped regularly. Even the occasional crops can cause significant loss of soil, nutrients and organic carbon

State

The current state of Dehesas is not satisfactory yet because they are overcoming former processes of land use intensification in parallel with current livestock mismanagement in many farms. Although their normal edaphic conditions are not so exigent, the optimum conditions could be only reached when every farm has a reasonable tree density.

Impact

The impacts suffered by the Dehesa system are a consequence of socio-economic drivers happened overall during the 20th century and in the recent decades: reduction of biomass production, soil erosion, less water quality and availability, loss of biodiversity, increase of the external dependence of the farms and loss of reputation.

Response

- **Zero tillage**.
- **Smart grazing.** Farmers must be trained in an intelligent, sustainable and regenerative grazing.
- **Soil protection**. In degraded areas it is suggested the construction of check-dams to avoid soil losses during torrential events.
- **Tree regeneration.** It is necessary to implement regeneration and afforestation techniques with support irrigation.

KEY MESSAGE

Dehesa system must overcome land mismanagement practices that provoke soil degradation and bad reputation as well as new threats induced by the effects of climate change and loss of rural population that threaten the current scenario. The use of new technologies and the co-design of solutions seem to be essential for the sustainability of this ancestral land system.

STAKEHOLDERS INTERACTION

13 April 2023,
Badajoz (Spain)

- 3 Policy and government
- – Soil and Other Advisors
- 3 Business
- 6 Research community
- 2 Farmer/land Owner
- 1 CSOs and NGOs

Relevant Soil Mission Objectives

1. Reduce desertification
2. Conserve soil organic carbon stocks
5. Prevent erosion
6. Improve soil structure to enhance soil biodiversity
8. Improve soil literacy in society

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Mixed

Alpine Tourism

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Rhône-Alpes (France)

REGIONAL INFORMATION

The Lautaret-Oisans region is located in the French Alps (mainly the Northern Alps). Snow-related tourism is a major economic driver, threatened by climate change.

Dominant land use	Natural, agriculture (pastoral)
Secondary land use	Recreative (skiing, biking, etc.)
Climatic Zone	Mountain climate / continental
Soil WRB classification	(Dystric) Cambisols, Colluvic Regosols, Hyperskeletic Leptosols
Soil type	Variable. Limestone, silt, shallow, acidic soils with calcareous stones; glaciers
Dominant topsoil texture	Variable. Silt loam, silty clay, silty clay loam, with stones
Soil threat(s)	Climate change (erosion, changes in the cryosphere and water resources, increase in climatic hazards and risks in the high mountains, increase and elevation of wooded areas, artificialization of valley bottoms, greening) Mass tourism (urbanisation, biodiversity degradation, erosion)
Representative for regions	(North) alpine regions, other mountain regions with snow-related tourist activities

SOIL NEEDS ASSESSMENT

Drivers
Climate change and its consequences (reduced snow cover, greening phenomenon, ...) is the main biophysical driver identified. The importance of tourism to the region's economy, the decline in the local population and the high number of tourists requiring short-stay accommodation are the main socio-economic drivers identified.

Pressures
Tourism's response to climate change currently includes artificial snowmaking or the development of alternative activities (e.g., hiking) that can lead to high tourist flows in sensitive areas (natural, forest, or pastoral). Drivers also led to conflicts over the use of water resources (domestic, agricultural, and pastoral use, hydroelectric production, tourism).

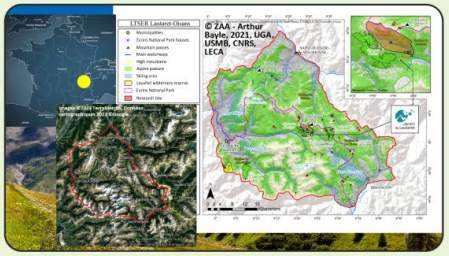
State
Melting of permafrost affect soil stability. Soil sealing rate is 1.29% in mountain resorts, 1.05% in mountain municipalities. Some impacts on soil compaction, pollution, biodiversity and salinisation need to be further studied. Expansion of vegetation partly explains a reduction in soil loss and improvement in soil characteristics in some areas.

Impact
Soil degradation:
- affect fodder production in the area;
- reduces the capacity of ecosystems to control erosion and natural hazards (tourism infrastructures and activities)
- reduces the cultural and recreational services with potential economic impact on local communities (e.g., closure of a shelter due to destabilisation of the bedrock)

Response
While soil preservation may not be the first priority in the area, several solutions (such as nature-based solutions) were mentioned by the stakeholders. Several initiatives have already been implemented, such as soil restauration with local seeds, territorial planning with citizen involvement to reduce artificialisation, or awareness raising actions.

KEY MESSAGE

- Collecting data and developing knowledge at the local level.
- Raising public awareness (on how and why preserve soil) using strategies designed for different target audiences, including local political decision-makers.
- Involving citizen in local governance
- Technical and economic support to adopt new practices.



STAKEHOLDERS INTERACTION

10 May 2023,
Grenoble (France)

- 2 Policy and government
- 2 Soil and Other Advisors
- – Business
- 4 Research community
- 5 Farmer/land Owner
- 3 CSOs and NGOs

Relevant Soil Mission Objectives

2. Conserve soil organic carbon stocks
3. Stop soil sealing and increase re-use of urban soils
4. Reduce soil pollution and enhance restoration
5. Prevent erosion
6. Improve soil structure to enhance soil biodiversity
8. Improve soil literacy in society

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Mixed

Peatlands

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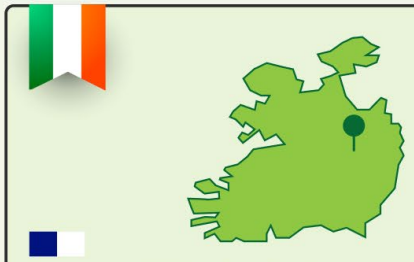

Eastern and Midland (Ireland)

REGIONAL INFORMATION

Ireland has transitioned away from the use of peat. Realigning policy through mediation will help to mitigate and reverse damaging activities on peatland habitats.

Dominant land use	Agriculture, forestry
Secondary land use	Previously energy peat production
Climatic Zone	Temperate
Soil WRB classification	Histosols
Soil type	Peat
Dominant topsoil texture	Peat; often highly decomposed
Soil threat(s)	Drainage of peatlands led to peat shrinkage, compaction, subsidence, erosion and greenhouse gas emissions
Representative for regions	Midlands North West Region

SOIL NEEDS ASSESSMENT

Drivers
Overgrazing, agricultural drainage, commercial forestry plantation and domestic and commercial turf cutting affect Irish blanket bogs and associated peatlands. Those land use activities result in biodiversity loss, soil erosion, decline in water quality, reduction in carbon sequestration and increased rate of carbon emissions.

Pressures
Farmers spent their lives extracting peat and now they rewet. This should be seen as a benefit for the community. Regarding the communication around rewetting and restoration, many farmers fear what it means for their farm and highlight the importance of getting the correct information from the right people. There is many miscommunication, which is creating fear.

State
Today, the status of Ireland's blanket bogs is considered 'bad' in terms of condition. This indicates that many blanket bogs are losing important species, releasing carbon to the environment, and providing sub-optimal water quality. Many farmers want to rewet their drained peatlands but lacking knowledge and communication.

Impact
A lot of income in this region comes from intensive farming. Peatland rewetting would reduce farming intensity but also income in the beginning before new economic valuable land uses on wet peatlands have been installed. There are many farmers whose rewetting will impact neighbouring farms who are not involved in rewetting programs. They need to be informed.

Response
To conserve and improve peatlands is to work with farmers and local communities by developing measures, such as base line site surveys, ecological assessments, training for conservation actions, fire prevention and water management. The role of climate officers and effective communication with farmers was emphasized, along with the need for realistic and less bureaucratic approaches.

KEY MESSAGE

The Irish Climate Action Plan set targets and measures to reducing agricultural production on peatlands under grassland and promote their rehabilitation through establishment of local support groups, developing and implementing community knowledge exchange programmes, administering community outreach activities, developing a schools education programme, supporting communities to develop and manage tourism and recreational activities and develop appropriate infrastructure.

STAKEHOLDERS INTERACTION

28 June 2023,
Tullamore (Ireland)

- 2 Policy and government
- 11 Soil and Other Advisors
- – Business
- 9 Research community
- 4 Farmer/land Owner
- 7 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 4. Reduce soil pollution and enhance restoration
- 6. Improve soil structure to enhance soil biodiversity

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Mixed

Reforestation

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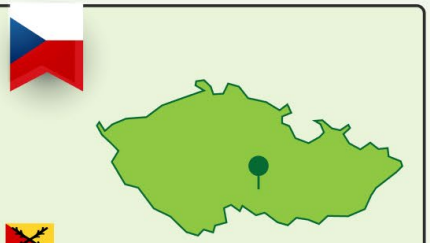

Jihovychod (Czech Republic)

REGIONAL INFORMATION

The Vysočina "Highlands Region", of the Czech Republic, is located partly in the southeastern part of the historical region of Bohemia and partly in the southwest of the historical region of Moravia (https://www.kr-vysocina.cz/).

Dominant land use	Agriculture (61%)
Secondary land use	Woodland (30%)
Climatic Zone	Moderate Continental
Soil WRB classification	Dystric Cambisol, Gleyic Luvisol.
Soil type	Medium
Dominant topsoil texture	Medium
Soil threat(s)	Erosion, Acidification
Representative for regions	Jihlava

SOIL NEEDS ASSESSMENT

Drivers

Climate change is a significant biophysical driver affecting agriculture. It involves changes in temperature, floods, droughts, and wind storms. Vysocina being a highland region, water erosion is recognized as a serious problem. **Bark Beetle Calamity** started in 2017, which was mainly influenced by large monocultures of spruce and partly influenced by climatic changes.

Pressures

The physical environment of Vysočina has witnessed notable shifts in recent years, mainly due to multifaceted pressures arising from biophysical and socioeconomic drivers. **Climate Change and Soil Management Practices; Erosion and Land Use; Socioeconomic Impacts and Soil Management Evolution.** For Vysočina, the future envisions a landscape where the pressures of 2050 are preemptively addressed.

State

The changes in the state of soils in the region changed from "healthy" towards "moderately healthy."
Biophysical Situation: Soil has transformed over the years; **Soil Organic Matter**: The prevalence of spruce monocultures, the impacts of the bark beetle calamity, have caused a decline in organic matter input; **Soil Erosion**: The region's susceptibility to water erosion has been exacerbated by climate change; **Soil Nutrient Retention**: The dominance of certain crops, often backed by subsidies, has impacted the soil's nutrient balance; **Soil Biodiversity**: Both crop composition in agriculture and forestry practices have implications for soil biodiversity.

Impact

The main impacts are: **Provision of Food, Fibre, and Biomass**: Impaired soil health negatively affects crop growth and productivity; **Water Purification and Soil Contaminant Reduction**: Reduced soil health hinder its natural ability to filter and purify water; **Water Flows Regulation**: Eroded soils with compromised structures may not efficiently regulate water flows, leading to increased flooding risks; **Drinking Water Resources**: Nutrient imbalances and potential leaching can risk contaminating drinking water sources; Carbon Storage and Climate Regulation: Decreased organic matter content can impact the soil's ability to store carbon; **Support for Biodiversity and Nature**: The shift towards monocultures and the impacts of erosion have had detrimental effects on soil biodiversity.

Response

Envisioning a sustainable Vysočina, stakeholders aim to cultivate a landscape characterized by thriving agriculture, sustainable forestry, and balanced ecosystems. By 2043, the region should be a beacon of innovation where traditional values merge with contemporary sustainable practices. Farmers and forest owners would employ cutting-edge techniques that bolster soil health while ensuring productivity. Policymakers would enact adaptable regulations that prioritize the environment and the local economy. Moreover, a collaborative spirit would be the region's hallmark, with knowledge-sharing and cooperative efforts at the core of all activities. The region aims to foster increased awareness, promote the adoption of sustainable soil management practices, and prioritize collaboration across sectors.

KEY MESSAGE

For an optimal soil health framework and a robust socio-economic fabric in Vysočina, a dedicated thrust on research and innovation is indispensable. The recent workshop threw light on pivotal areas like precision farming, Earth observation, and sensor measurements, intertwined with the enriching potential of citizen science. A novel concept discussed was the quantification of the allure of fields or forest sections, which holds the promise to revolutionize decision-making for farmers and forest proprietors.

STAKEHOLDERS INTERACTION

19 May 2023,
Žďár nad Sázavou (Czech Republic)

- 3 Policy and government
- 9 Soil and Other Advisors
- 1 Business
- 2 Research community
- – Farmer/land Owner
- 2 CSOs and NGOs

Relevant Soil Mission Objectives

- 4. Reduce soil pollution and enhance restoration
- 6. Improve soil structure to enhance soil biodiversity

Funded by the European Union

Urban-Industrial

PREP SOIL Regions SOIL Needs Assessment

Urban - Industrial

Post-Mining

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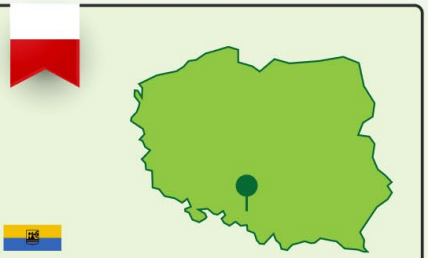

Slaskie (Poland)

REGIONAL INFORMATION

Upper Silesia is a region with mosaic of post-industrial sites and deposits, arable lands, hobby gardens, settlements. Part of the land has been contaminated with trace metals by smelter emissions

Dominant land use	Industry
Secondary land use	Urban/arable
Climatic Zone	IPCC - cool temperate moist
Soil WRB classification	Cambisols, luvisols, podzols
Soil type	Mineral, loamy soils
Dominant topsoil texture	Silt loam, sandy loam
Soil threat(s)	Contamination, soil sealing, land abandonment
Representative for regions	Post industrial areas in Eastern Europe

SOIL NEEDS ASSESSMENT

Drivers

Soil contamination from industries, waste management, and climate change is identified as the major factors affecting soil conditions in the region. There are still insufficient awareness of the ecosystem services provided by soils, especially in the urban environment of larger agglomerations. Legal regulations and financial mechanisms, such as EU strategies for soil protection and national funds, play a role in supporting soil regeneration efforts.

Pressures

The main pressures identified include urbanization, prolonged droughts, limited interest in soil management by local authorities, the absence of regulations on cultivating soils with increased contaminants and limited competence in urban greening practices. Climate change exacerbates these pressures by causing droughts, storms with intense rainfall, and snowless winters.

State

The main soil degradation process identified is the presence of pollutants in some areas.
Soil sealing has been intensive in agglomerations that were economically developing.
Wind erosion has intensified in urbanized areas. Overall biodiversity was recognised as low.

Impact

Current soil management in the region is not optimal. Agricultural production and hobby gardening on soils with elevated metals causes their transfer to crops. The current condition of soils supports cultural and landscape services but reduces carbon sequestration and water retention. Accelerated wind erosion induces air quality problems in urban areas.

Response

There needs to be focus on soil restoration. Experts recommend implementing initiatives and legislative changes to promote land reuse and increase in green areas in cities. The key changes required include better cooperation among stakeholders, raising public awareness, interdisciplinarity in spatial planning. Education of citizens and dissemination of scientific soil research is one of most important expected responses.

KEY MESSAGE

Soil Mission measures are of great importance to the region. This includes increasing soil literacy and co-creation processes or harmonized soil monitoring program. There is a need for more systematized, updated and available soil information. Research should also focus on: green and blue solutions in populated areas; soil regeneration; cycling of contaminants; microplastic pollution; transition in agriculture without hampering economic situation of farmers; combining spatial planning and soil management into one concept.

STAKEHOLDERS INTERACTION

23 June 2023,
Katowice (Poland)

- 1 Policy and government
- 2 Soil and Other Advisors
- 3 Business
- 11 Research community
- 2 Farmer/land Owner
- 4 CSOs and NGOs

Relevant Soil Mission Objectives

- 3. Stop soil sealing and increase re-use of urban soils
- 4. Reduce soil pollution and enhance restoration
- 8. Improve soil literacy in society

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Urban - Industrial

Dense Urbanism

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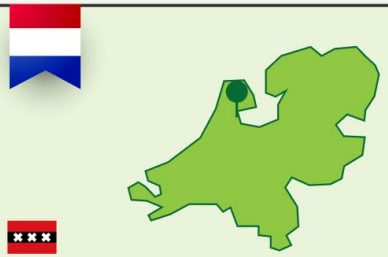

Noord (The Netherlands)

REGIONAL INFORMATION

Amsterdam is the densely populated and built-up Capital of the Netherlands, built on soft soils. Both today and in the past, it has had a high urbanization rate due to the city's progressive industrialization and economic prosperity.

Dominant land use	Artificial land
Secondary land use	• Artificial built-up area – (inner city, housing no garden, offices, schools) • Artificial industrial built-up area – (industrial area, harbour..) • Artificial non built-up area (sealed) (parking lots, infrastructures, roads, rails) • Urban brownfield (-land in transition to more beneficial use) • Road and railway berms • Private gardens with green potential (office gardens, housing) • Leisure (events, sport fields, playgrounds) • Urban agriculture • Agricultural area outside the city • Nature and recreational areas outside the city (incl water & peatland) • Subsurface space
Climatic Zone	Moderate Maritime (or oceanic) climate
Soil WRB classification	Gleysols and Histosols (but mainly technosols)
Soil type	Anthroposols, peat, sea clay
Dominant topsoil texture	NA (in many urban areas fill sand is used, in parks / gardens /etc garden soil can be applied)
Soil threat(s)	Sealing, contamination, loss of biodiversity, loss of organic matter (peat), land subsidence, soil degradation due to disturbance, compaction, and –in parts (external)– salinization (through Noordzeekanaal)
Representative for regions	Highly urbanized areas all over Europe. Especially in same climatic regions / delta areas (soft soils).

SOIL NEEDS ASSESSMENT

Drivers

Climate change is the main biophysical driver in Amsterdam. The average temperature in 2050 could be 1–2.3°C higher than the 1981–2010 average, and maximum summer temperatures are also expected to increase. Under the socioeconomic drivers in Amsterdam, urbanization and the digital & energy transition play an important role, as well as the positive, greening transition.

Pressures

The main physical pressures identified for Amsterdam are soil sealing, soil compaction and soil disruption including soil contamination, all largely caused by urbanization related activities. Further, the growing spatial pressure in the subsurface plays an important role, which is partly caused by urbanization but also by the digital & energy transition.

State

Amsterdam has a soft peat subsurface making it susceptible to damage to constructions and building foundations. Further, the chemical soil quality is poor in Amsterdam. For example, diffuse lead contamination and emerging contaminants such as PFAS. Lastly, the subsurface is literally full with assets such as cables, pipes and other underground structures and a lot of damage occurs every year when performing activities in the subsurface.

Impact

The main impacts are soil degradation and compaction, loss of biodiversity, a decreasing chemical soil quality, a decreasing water storage capacity and infrastructural damage caused by land subsidence, making soils less suitable for the urban land uses.

Response

Define urban soil health, where a distinction is made between specific urban land uses. Support the transition to urban soil health by clearly defined frameworks and policies. Build awareness and create a shared vision together with citizens, landowners and governments in which soil is presented as a valuable asset. Invest in urban LLs: they can increase knowledge and improve soil health.

KEY MESSAGE

Defining what soil health is and what it can bring to the different urban land uses is crucial. It is important to recognize the unique characteristics and requirements of urban soils which differ from the more homogenous agriculture, nature and forest soil ecosystems. In urban areas, an integrated approach, cocreated with relevant actors is necessary for dividing the limited space for the many demands and improving soil health. This includes multifunctional land use.

STAKEHOLDERS INTERACTION

20 April 2023,
Amsterdam (The Netherlands)

- 11 Policy and government
- 2 Soil and Other Advisors
- – Business
- 8 Research community
- – Farmer/land Owner
- – CSOs and NGOs

Relevant Soil Mission Objectives

- 3. Stop soil sealing and increase re-use of urban soils
- 4. Reduce soil pollution and enhance restoration
- 6. Improve soil structure to enhance soil biodiversity
- 8. Improve soil literacy in society

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Urban - Industrial

Post-Mining

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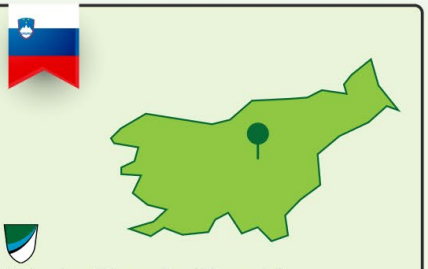

Vzhodna Slovenija (Slovenia)

REGIONAL INFORMATION

The Zasavje region is located in the central part of Slovenia, between the capital city of Ljubljana and Celje (the 3rd largest city). The region can be classified as a post-industrial region, more specifically, a post-mining region.

Dominant land use	Forest (67.5%)
Secondary land use	Grassland (21.0%)
Climatic Zone	Cfb, Temperate oceanic climate, without dry season and warm summer (Temperate continental, central Slovenia)
Soil WRB classification	Cambisols and Leptosols
Soil type	Cambisols: Eutric, Dytric or Chromic. Leptosols: Mollic, Rendzic or Dystric
Dominant topsoil texture	Different Loamy textures (loam, silt loam)
Soil threat(s)	1. Soil erosion 2. Soil contamination 3. Soil acidification 4. Urban sprawl and urbanization 5. Invasive organisms
Representative for regions	Post-mining region, Central European region

SOIL NEEDS ASSESSMENT

Drivers
The most important biophysical drivers are the parent material and topography, water erosion and vegetation cover (protects against erosion processes). Further the (lack of) national and local politics is an important socioeconomic driver as well as the mining activity and accompanying industry.

Pressures
The five most pronounced pressures are: 1) soil erosion and other negative slope processes (landslides), 2) soil and water contamination, 3) soil acidification (induced by past Trbovlje thermal power plant acid exhausts), 4) urban sprawl and industrialization and 5) invasive organisms.

State
The region is characterised by two types of landscapes: the mountainous part and the valley part. The state of the mountainous part is largely affected by natural factors (steep and rugged topography, hard and consolidated rocks, rapid runoff of precipitation water and watercourses), while the state of the soil in the valley largely reflects human activities (flat topography, softer and unconsolidated rocks, industrialized area).

Impact
In the mountainous part, the steep and rugged topography makes the soil less stable and shallow and, in combination with heavy rainfall, the soil is subject to landslides. In the valley, the past industrial long term pollution results in excessive concentration of heavy metals in soils, plants and water. Further, underground mining and surface extraction of rock material lead to soil subsidence.

Response
Regarding the policy sector, adequate soil legislation should be adopted at EU level, but municipalities should also manage space strategically through multi-year programmes. Further, a clear soil monitoring program should be established and performed yearly. Lastly soil health awareness should be raised at all levels: municipal officials, higher education, primary education etc.

KEY MESSAGE

There is a lack of knowledge about soil and soil management. Therefore, it is essential to establish a monitoring program, especially in severely degraded areas, to understand the scope of the problem and to inform the population on an annual basis. Then, stricter criteria on soil management need to be formed, especially on pollution, and more participation and networking of stakeholders (farmers, decision-makers) is needed.

STAKEHOLDERS INTERACTION

17 May 2023,
Zasavje (Slovenia)

- 10 Policy and government
- 1 Soil and Other Advisors
- – Business
- – Research community
- 1 Farmer/land Owner
- – CSOs and NGOs

Relevant Soil Mission Objectives

- 3. Stop soil sealing and increase re-use of urban soils
- 4. Reduce soil pollution and enhance restoration
- 5. Prevent erosion

Funded by the European Union

Forestry

PREP SOIL Regions SOIL Needs Assessment

Forestry

Forest North

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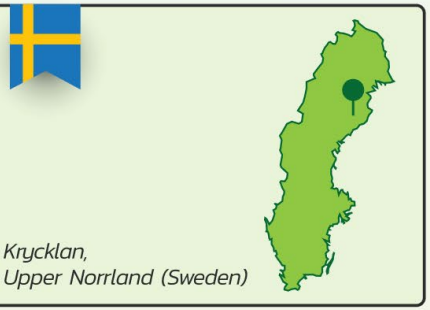

Krycklan, Upper Norrland (Sweden)

REGIONAL INFORMATION

The challenges within the typical boreal forest catchment area Krycklan are to maintain natural soil ecosystem services in combination with sustainable forest management.

Dominant land use	Forest (87 %): Scots pine (Pinus sylvestris L., 63 %), Norway spruce (Picea abies (L.) H. Karst., 26 %) mixed with deciduous trees (Betula spp., Alnus incana (L.) Moench., and Populus tremula L., 11 %)
Secondary land use	Mires (9 %), lakes (1 %), agricultural lands (2 %), and rock outcrops (1 %)
Climatic Zone	Subarctic with a 30-year (1991–2020) mean annual precipitation of 638 ± 40 mm and a mean annual air temperature of 2.4 ± 0.3°C
Soil WRB classification	Podsols, Regosols, Histosols, Gleysols, Leptosols and Arenosols
Soil type	Poor mineral soils (mostly podsols) and peatlands
Dominant topsoil texture	Silt, sand, fibric and decomposed peat
Soil threat(s)	Climate change: Droughts and extreme weather, bark beetle outbreaks, browning of freshwater Forestry operations: Soil damage and compaction; ditching affecting soil health, water quality, carbon sequestration and storage below and above ground, and biodiversity
Representative for regions	Fennoscandia, Canada, Baltics

SOIL NEEDS ASSESSMENT

Drivers

Climate change with higher temperatures and extreme weather can affect browning of freshwater, outbreaks of bark beetle, forest fires and natural forest carbon pools above and below ground. Industrial forestry can lead to soil damage resulting in decreased biodiversity and carbon sequestration in drained peatlands while increasing the timber production.

Pressures

Forest conversion with replacement of coniferous monostands would be a desired pressure. This may result in financial penalties for the forest owners. Rewetting of drained peatlands as a climate-smart mitigating measure can release toxic metals and phosphorus and offsets the environmental objective of 'zero eutrophication'.

State

High-latitude regions have the largest standing soil carbon stocks and are sensitive to warming and change in soil moisture regimes inducing carbon losses. Reduced forest rotation time and increased forest density stimulate productivity. Fire-fighting systems are highly developed and forest fires are no problem. New ditching is forbidden (maintenance only), affecting forest productivity.

Impact

Climate and forestry directly impact e.g. the soil's climate regulation by carbon sequestration, the provision of food, fibre and biomass for energy and material production, the support for biodiversity and nature. They are coupled to each other and must be taken into consideration together when judging over a single one.

Response

Private and governmental forest organisations waking people's awareness for the sustainable use of our soils through informative material (e.g. short movies, maps, flyers, seminars). This will lead to an enhanced soil literacy.

KEY MESSAGE

How do we manage our productive forests soil-smart? Forestry on nutrient-poor soils and on rocky morainic material is without concurrence to any other land uses. The long-term issue of securing water and carbon storage in soils (and above ground) and to reduce potential negative impacts such as soil damage need more responsive forest management strategies.

STAKEHOLDERS INTERACTION

29 May 2023,
Uppsala (Sweden)

- 4 Policy and government
- 4 Soil and Other Advisors
- – Business
- 9 Research community
- 3 Farmer/land Owner
- 1 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 4. Reduce soil pollution and enhance restoration

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Forestry

Forest Peatland Northeast

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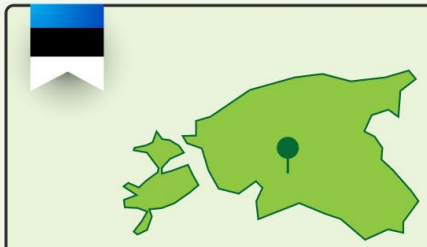

Soomaa, Estonia

REGIONAL INFORMATION

Soomaa is characterized by low population, wilderness and tourism. The dominating land-uses in the area are pristine bogs, forestry on peatlands, and semi-natural meadows.

Dominant land use	Forestry on fens and transitional peatlands, and on the edges of the bogs
Secondary land use	Nature protection (bog area with pools, forest habitats, semi-natural meadows, and birds)
Climatic Zone	Temperate
Soil WRB classification	Histosols, Gleysols, Fluvisols, Histic gleysols, Gleyic albeluvisols
Soil type	Mainly Histosols: bogs in natural state but also heavily drained fen peat and transitional peat
Dominant topsoil texture	Highly decomposed peat
Soil threat(s)	Peatland drainage for forestry; tracks from harvesters
Representative for regions	Forestry on peat soils mainly in Scandinavia and Baltic states (Northern Europe)

SOIL NEEDS ASSESSMENT

Drivers
The main biophysical driver in the region has been the **periodic spring flooding** related to snowmelt ("fifth season"). With climate change, in addition to the spring flooding also **winter flooding or the "sixth season"** has occurred during the recent years, but also **warmer summers with extreme drought periods**.

Pressures
Wet peatland soils and their management with heavy machinery. This is also combined with very short forest management periods, planting of spruce and pine **monocultures**, and **restoration of peatlands and semi-natural habitats** on former forest land.

State
The state of the soils is generally **good inside of the protected areas** whereas it is expected to be lower outside of it. The soil state is affected mainly by drainage of peat soils (incl. reconstruction of ditches) and management with heavy machinery during times when the soil is unfrozen.

Impact
The area is important for **water buffering, carbon accumulation, and recreation**. The drainage systems reduce the water retention time after the floodings but also drain the peat soils leading to carbon release from the soil layer and increase in wood production. With drainage, open bog landscapes are replaced with forests.

Response
The stakeholders had following **visions for the Soomaa area**: wilderness area, balanced and homogenous development, forest management for own use of farmers and stricter approach to forest management, natural succession, improvement of tourist infrastructure, increase the area of the national park and less drastic differences between the national park and outside areas.

KEY MESSAGE

Soomaa is an area with low number of inhabitants and regular floodings. Although the Soomaa area has been managed, these actions and their results are mainly not monitored. In addition, the impact of tourism in Soomaa has not been studied in detail so far.

STAKEHOLDERS INTERACTION

3 May 2023,
Soomaa National Park (Estonia)

- 2 Policy and government
- 1 Soil and Other Advisors
- – Business
- 3 Research community
- 6 Farmer/land Owner
- 8 CSOs and NGOs

Relevant Soil Mission Objectives

- 2. Conserve soil organic carbon stocks
- 6. Improve soil structure to enhance soil biodiversity

Funded by the European Union

PREP SOIL Regions SOIL Needs Assessment

Forestry

Forest Tourism South East

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Antalya (Turkey)

REGIONAL INFORMATION

Köprülü Canyon NP, located in Antalya, has various forests, cultural areas and ecotourism activities. However, forest fires and climate change pose risks to soil health.

Dominant land use	Protected area, Extensive Tourism & Recreation
Secondary land use	Forestry, Semi natural areas, Agriculture (Rural)
Climatic Zone	Mediterranean climate (Csa) with hot and dry summers
Soil WRB classification	1-Order: Entisol, Sub-order: Orthent 2-Order: Alfisol, Sub-order: Xeralfs 3-Order: Inceptisol, Sub-order: Xerepts
Soil type	Terra Rosa
Dominant topsoil texture	ClayLoam
Soil threat(s)	water erosion, organic matter decline, desertification
Representative for regions	Mediterranean Europe forest regions with tourism, fringing agriculture and are susceptible for wild fires: Spain, Portugal, southern France, Italy, Greece, coastal parts of Balkan and Israel.

SOIL NEEDS ASSESSMENT

Drivers
Climate change, soil fertility, and wildfires are the main biophysical drivers in Köprülü Canyon National Park. These drivers are expected to continue impacting the region in the future, affecting agriculture, tourism, and overall livelihoods. Collaboration is needed for sustainable solutions.

Pressures
The intertwining of residential, forest, protected, and tourism areas creates management problems. Reduced water availability and quality due to climate change and water misuse impact agriculture and tourism. Forest fragmentation increases disease occurrence. Tourism activities and expanded road networks negatively effect soil health.

State
Soil fertility and water availability have decreased in Köprülü Canyon NP, leading to suboptimal crop yields. Reliance on artificial fertilizers has increased, causing nutrient run-off and affecting ecosystems and human health in the region. The porous rock composition of the area further complicates water management.

Impact
Tourism activities in Köprülü Canyon National Park negatively affect soil functions by causing soil erosion and fragmentation of forests. Farmers are aware of the importance of healthy soil, but economic constraints affect land use changes. The decrease in soil functions has increased the risk of disease on forest tree species.

Response
Collaboration among stakeholders is crucial for sustainable forest and soil management. Policy changes and incentives can encourage conservation efforts. Public awareness of healthy soil and organic fertilizers in tourism development is important. Adaptation strategies and monitoring systems are needed to manage changing environmental conditions.

KEY MESSAGE

Stakeholders must establish a shared vision for sustainable forest and soil management. Eco-tourism can increase livelihoods, but technology and infrastructure impact tourism. The strict protection status of the national park may need to be modified. Organic fertilizers should be promoted, and climate change impact studies conducted.

STAKEHOLDERS INTERACTION

26 April 2023,
Antalia (Turkey)

- 9 Policy and government
- – Soil and Other Advisors
- – Business
- 14 Research community
- 25 Farmer/land Owner
- 1 CSOs and NGOs

Relevant Soil Mission Objectives

1. Reduce desertification
2. Conserve soil organic carbon stocks
5. Prevent erosion
7. Reduce the EU global footprint on soils

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