



# NOVASOIL

INNOVATIVE BUSINESS MODELS FOR SOIL HEALTH

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## D4.2 Policy and Innovation Roadmap

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## Table of contents

### Summary

1	Executive Summary	7
2	Objective	8
3	Policy innovation lab	9
	3.1 Overall approach	9
	3.2 Main methodological aspects	10
	▪ Policy narratives	10
	▪ Policy coherence and institutional gaps	10
	▪ Co-Creation Processes	11
	3.3 Implemented PIL: countries, business models and stakeholders engaged.	11
4	Policy Coherence and Legal Aspects	15
	4.1 Policy coherence	15
	▪ Literature Review	15
	▪ Results	16
	4.2 Legal Aspects	25
5	Institutional analysis and institutional gaps	32
	5.1 Literature background	32
	5.2 Results: Institutions for Soil Governance	35
	▪ ITALY	36
	▪ SPAIN	37
	▪ ESTONIA	37
	▪ BULGARIA	38
	▪ LATVIA	38
	▪ NETHERLANDS	39
	▪ GERMANY	40
	▪ OVERALL CONSIDERATIONS	41
6	Pathways towards sustainable business models for soil health	42
	6.1 Baseline: Current Challenges and Systemic Barriers	42
	6.2 Socio-Technical Roadmaps Toward 2050	43
	6.3 Milestones	48
7	Policy implications	51
8	Synthesis	54
9	Appendix I - Case studies' incentives	57



10	Appendix II Workshop guidelines
11	Appendix III - Institutions involved

61
73



## 1 Executive Summary

The deliverable outlines the development and implementation of a Policy Innovation Lab to accelerate sustainable soil management across Europe. The document presents a structured approach to translating scientific evidence, stakeholder insights, and systemic analysis into actionable policy pathways that support soil health, climate resilience, and sustainable land use.

The roadmap is built on a multi-stage policy innovation framework that integrates foresight, co-creation, piloting, and impact monitoring. It emphasises the need to overcome fragmentation in soil governance by fostering coordination across EU, national, and regional levels, while aligning soil policy objectives with broader Green Deal targets, including climate mitigation, biodiversity protection, and sustainable agriculture.

A central contribution of the report is the establishment of a Policy innovation lab in each case study. This lab functions as a collaborative platform where policymakers, scientists, farmers, industry representatives, and civil society jointly design, test, and refine policy solutions. Through iterative experimentation, the PIL supports evidence-based policymaking and reduces the risk associated with regulatory innovation.

The deliverable identifies key policy leverage points, including financial incentives, regulatory instruments, data governance, and capacity-building mechanisms. It also highlights persistent barriers, including limited soil-monitoring data, misaligned economic incentives, institutional silos, and uneven stakeholder engagement. To address these challenges, the roadmap proposes targeted interventions, including enhanced soil monitoring systems, the integration of soil metrics into agri-environmental schemes, strengthened advisory services, and innovative financing tools.

Furthermore, the document sets out a clear implementation pathway, including milestones, governance structures, and mechanisms for scaling successful policy experiments. Impact assessment is embedded throughout the process, ensuring that policy outcomes are measurable with respect to environmental performance, socioeconomic benefits, and long-term sustainability.

Overall, the deliverable provides a strategic, operational, and replicable framework for advancing soil policy innovation in Europe. It demonstrates how participatory governance, scientific evidence, and adaptive policy design can jointly support transformative change in soil management and land-use systems.



## 2 Objective

Based on D.o.W., task 4.2 (M10-24) “Policy Innovation Lab”, the deliverable contains a synthesis of individual policy and innovation lab reports (WD4.1, provided at month 20) and the identification of the policy and innovation roadmaps. in month 24 and will provide the list of promising incentives and business models to be tested in task 4.3.” The document synthesises the individual Policy Innovation Lab (PIL) reports, which are available online, and includes a brief description of the case studies in Appendix I.

The report is organised into 8 sections; the first one gives an overview of the country's case studies and related business models participating in NOVASOIL PILs. Please note that two case studies originally in the project were not able to deliver the final report, i.e. University of Leeds and LEIBNIZ-ZENTRUM FUER AGRARLANDSCHAFTSFORSCHUNG, either due to low person-months numbers or internal availability issues during the timeframe of this task.

Section 3 offers an overview of the methodology applied.

Section 4 offers an overview of the interview results of the policy mix concerning soil health on an overall EU level, as well as the broader context of legal aspects concerning (upcoming) soil regulations.

Section 5 goes more into detail of the institutional framework and specific business models in the different country case studies, to provide insights into soil governance modes.

Section 6 outlines pathways to soil-health business models envisioned by participants in the individual PIL, including the drivers, changes, and solutions required.

Section 7 examines policy implications relevant to facilitating the implementation of sustainable business models for soil health.

Section 8 summarises the main policy implications.



## 3 Policy innovation lab

### 3.1 Overall approach

The Policy Innovation Lab approach is grounded in interdisciplinary scholarship spanning environmental policy analysis, institutional economics, innovation systems theory, and sustainability governance. It integrates theoretical insights with applied policy design to support transformative change in soil management. The primary objective of the Policy Innovation Lab is to bridge scientific knowledge, institutional analysis, and stakeholder co-creation to generate feasible, scalable, and policy-relevant innovations. The PIL supports policy learning, strengthens coherence across multi-level governance, and enhances alignment among environmental sustainability objectives, agricultural productivity, and socio-economic resilience (Bartolini et al., 2022).

One PIL is built in each NOVASOIL Case Study, and PIL integrates policy analysis, empirical case studies, participatory engagement, and institutional diagnostics. It is intended to function as a reflexive environment in which alternative policy mixes and governance mechanisms can be tested, refined, and translated into implementable recommendations.

According to the methodology published in D4.1, the PIL follows a sequential iterative approach consisting of the following core phases:

1. Policy and Institutional Review – Systematic mapping of existing regulatory frameworks, institutional arrangements, and policy instruments affecting soil health and land management.
2. Problem Framing and Diagnostic Analysis – Application of structured analytical tools to identify systemic constraints, policy failures, market barriers, and governance gaps.
3. Stakeholder Identification and Mapping – Classification of actors based on influence, interest, and expertise in soil-related policy domains.
4. Key Informant Interviews – Collection of qualitative insights from policymakers, practitioners, industry actors, and civil society organisations.
5. Participatory Workshops – Co-design of policy innovations through deliberative and multi-actor engagement processes with development of three main participatory activities: value mapping, solution mapping and pathways mapping.
6. Synthesis and Reporting – Development of Policy Innovation Lab outputs that translate empirical findings into policy-relevant recommendations into a comparable document. The PIL report template is available in D4.1



## 3.2 Main methodological aspects

This section summarises the main methodological aspects:

### • Policy narratives

The first exercise requires conceptualising soil health within policy narratives. The conceptual model recognises that policy development is shaped by dominant narratives and framing processes. Historically, soil governance emphasised agricultural productivity and fertility; contemporary policy increasingly adopts a broader narrative centred on soil health, ecosystem services, climate mitigation, biodiversity conservation, and long-term resilience. By situating the PIL within the context of the European Green Deal and the EU Soil Strategy, the framework conceptualises soil as a strategic environmental asset essential for food security, climate neutrality, water regulation, and sustainable rural livelihoods. This narrative orientation supports prioritising long-term ecological integrity over short-term productivity gains. The policy narrative is elaborated during the participatory workshop and summarised in the common template for PIL.

### • Policy coherence and institutional gaps

The PIL applies a multi-level institutional framework to analyse how formal regulations, informal norms, governance structures, and market incentives interact to shape soil-related outcomes. This approach facilitates the identification of:

- Legal and regulatory gaps affecting soil protection
- Property-right constraints influencing land management decisions
- Governance fragmentation across administrative levels
- Misaligned economic incentives and market failures
- Enforcement, monitoring, and compliance challenges

By diagnosing institutional bottlenecks, the PIL supports the design of policy instruments that are both legally viable and operationally implementable, increasing the likelihood of sustained policy impact.

The PIL is informed by policy mix theory, which emphasises that effective sustainability transitions require coherent combinations of regulatory, economic, informational, and voluntary instruments rather than isolated interventions. The framework evaluates coherence across:

- Environmental, agricultural, climate, and rural development policies
- Local, national, and supranational governance levels
- Public, private, and hybrid regulatory mechanisms

This activity involved collecting information from experts and summarising it into a common template.



## ▪ Co-Creation Processes

A Participatory workshop is the core activity expected in each PIL. In each pilot, a participatory workshop will facilitate joint problem diagnosis and prioritisation, as well as co-design of policy instruments, incentives, and governance arrangements. PIL workshop is designed as a structured, participatory process to validate soil-health business models, gather stakeholder insights, and co-develop policy and innovation pathways. The workshop follows a multi-phase methodology that integrates presentation, deliberation, collaborative mapping, and pathway planning, ensuring both analytical rigour and stakeholder inclusiveness

The workshop begins with an introductory session in which participants receive a clear explanation of the objectives, roles, ethical consent procedures, and engagement rules. Stakeholders are assigned distinct symbols or colours to ensure traceability of responses by actor group, supporting systematic data analysis and balanced representation.

The first core activity focuses on value mapping and business model validation. Participants review findings on soil health challenges, drivers of soil degradation, ecosystem services, and proposed socio-technical solutions. Using guided discussion and colour-coded post-its, stakeholders evaluate ecosystem service relevance, incentive structures, and trade-offs, contributing to a shared framing of how soil health is addressed within the business model.

A second phase applies the World Café method to map solutions and innovations. Stakeholders work in small, rotating groups to identify needed innovations, support regulations, and enable policy conditions, with facilitators ensuring inclusive dialogue, thematic focus, and structured documentation.

The final phase involves pathway mapping, in which participants organise proposed actions, resources, and policy changes across short-, medium-, and long-term timelines. This exercise supports strategic planning aligned with future agricultural and policy cycles.

Overall, the workshop is guided by facilitator-led moderation, participatory equity, evidence capture, and iterative reflection, generating structured inputs for PIL solution mapping, governance recommendations, and policy pathway development.

Appendix II provides the workshop guidelines.

### **3.3 Implemented PIL: countries, business models and stakeholders engaged.**

Given the diversity of business models (BMs) analysed in the project, we present them here in the order used in the subsequent sections. Therefore, the BMs range from highly public, subsidised forms to supply chains and hybrid contracts to certification schemes and private funds. Below is a summary of the main implemented PIL. Each PIL involved the key stakeholders mapped in a previous project phase (see D4.1) as well as

11



additional individuals deemed relevant to or interested in the case study. Participants ranged between 10 and 15 and included the following categories:

- Public Sector Actors: local and regional administrators, general directories;
- Private Sector and supply chain actors: farmers and landowners, seed and machinery companies, processors, cooperatives, foundations and banks?
- Knowledge, Advisory, and Civil Society Actors: researchers, technicians, agronomists, NGOs, citizens

1. ITALY **Long-term experiments (LTEs)** carried out on large plots/at field scales at the Centre for Agri-environmental Research "Enrico Avanzi" of the University of Pisa. Two field experiments focus on applying conservation agriculture techniques (i.e., reduced or no-tillage, cover cropping), whereas the third compares organic and conventional farming systems. Using the standard field plot size, soil fertility, crop yield, rheological quality, weed abundance and composition, energy-use efficiency, and economic balance are regularly assessed.

The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (3); Private Sector and supply chain actors (7); Knowledge, Advisory, and Civil Society Actors (4)

2. SPAIN **Integrated production in olive groves** seeks to balance agricultural production with the protection of the environment and human health, applying practices that improve the sustainability and efficiency of cultivation and improve soil structure and fertility. Integrated production also focuses on the biological control of pests and diseases, thereby reducing the need for chemical pesticides and minimising negative impacts on soil microbiota. By reducing the use of chemicals and encouraging the presence of beneficial organisms in the soil, integrated production techniques also promote biodiversity, which can contribute to the overall stability and health of the agricultural ecosystem

The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (4); Private Sector and supply chain actors (9); Knowledge, Advisory, and Civil Society Actors (4)

3. ESTONIA **Certified seed** producers are a BM that requires farmers to improve management techniques that contribute to soil health, compared to those who use uncertified seed on a wider area. Practices include less pesticide, improved nutrient uptake from the soil and carbon and nitrogen compounds from the air.

The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (3); Private Sector and supply chain actors (5); Knowledge, Advisory, and Civil Society Actors (8)

4. BULGARIA **Vertical integration of local, regional and traditional wine sector** farmers adopting conservative agricultural practices (hedges or



rows of trees, terraces; non-productive crops and waste biomass; buffer strips; mulching with pruning leftovers) to reduce soil erosion. Moreover, they are participating in the program on local and regional traditional products, aiming to revitalise and support the regional economy.

The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (3); Private Sector and supply chain actors (6); Knowledge, Advisory, and Civil Society Actors (7)

5. LATVIA **Digital map, "Digital Showcase"**, serves as an interactive platform where agricultural fields managed with climate-friendly tillage practices are highlighted. These practices include direct seeding, strip tilling, and minimal or reduced tillage using harrows and cultivators. The aim is to raise public awareness, create a societal demand and drive a shift towards more environmentally responsible farming.  
The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (3); Private Sector and supply chain actors (5); Knowledge, Advisory, and Civil Society Actors (6)
6. LATVIA **Agroforestry: Inter-cropping**, implemented in 2011, was specifically designed to investigate whether combining trees with crops on previously degraded farmland could yield significant improvements in soil health, ecosystem services, and economic returns, thus providing a comprehensive, sustainable solution to land degradation.  
The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (2); Private Sector and supply chain actors (8); Knowledge, Advisory, and Civil Society Actors (3)
7. ITALY **Perennial aromatic crops** converting conventional cropping systems based on annual cereal crops to organic cropping systems based in a hilly environment. It focuses on profiting from soil fertility and health data, crop yield and quality, agri-environmental aspects, and landscape valorisation collected at the farm level. It derives from an integrated supply chain project funded in the framework of the EU's Rural Development Policy, which involved research centres, private companies, farmers, and public administrations in driving force of rural sustainable development through new cropping systems and management innovations.  
The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (2); Private Sector and supply chain actors (7); Knowledge, Advisory, and Civil Society Actors (6)
8. SPAIN **Tamarguillo Park**. Sustainable and resilient urban green area, improving local citizens' well-being, reducing heat islands and improving water reservoirs and drainage for potential floods. Community gardens to enhance citizens' involvement; facilities provided by green areas can positively impact local commerce, enriching the neighbourhood's economic value.



The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (7); Private Sector and supply chain actors (2); Knowledge, Advisory, and Civil Society Actors (6)

9. ITALY **Sand district** PIL seeks to guarantee long term viability of agriculture in the area, establishing local governance with shared objectives. To reach and enlarge participation, it seeks to enhance the territorial organization of farmers, adopt shared regulations, access to shared incentives and interact with local administrators and institutions. Set in Italy, as in the previous two case studies, beyond CAP instruments, this initiative seeks to rely on further territorial and private incentives. The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (6); Private Sector and supply chain actors (5); Knowledge, Advisory, and Civil Society Actors (4)
10. NETHERLANDS **Rabo Carbon Bank**, is a carbon credit trade that allow the remuneration of extensification practices and creating public goods is important to allow such business models to become self-sustained. Research shows that current financial incentives may not be sufficient to induce farmers to enter into carbon credit trading contracts, particularly when they require long-term (>10 years) commitments. The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (1); Private Sector and supply chain actors (7); Knowledge, Advisory, and Civil Society Actors (3)
11. GERMANY **The Soil Fertility Fund of the Swiss Organic Farming Foundation (BFF)** was established to counteract soil degradation and help to ensure that as much fertile soil as possible can be passed on to future generations. It provides financial support to create “degrees of freedom” for farmers to implement appropriate measures and to maintain soil fertility on their farms. The financial support is based on donations and further offers expert advice, financed for the same purpose. The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (1); Private Sector and supply chain actors (4); Knowledge, Advisory, and Civil Society Actors (9)
12. GERMANY The **CO2-Land initiative** aims to make a significant contribution to climate protection by using scientifically proven methods to create CO2 sinks in arable soils. By creating climate certificates, these are offset by farmers who, in return, commit to continuously increasing the organic carbon content of their soils. The gains from the certificates' sale are used to (partially) compensate farmers for their additional efforts. The stakeholders engaged in both interviews and in the workshop belong to the following categories: Public Sector Actors (2); Private Sector and supply chain actors (4); Knowledge, Advisory, and Civil Society Actors (7)





*Table 1. Policy Coherences parameters.*

<b>Pillar of coherence</b>	<b>Elements of coherence</b>	<b>Parameter</b>	<b>Description of parameter</b>
<b>Institutional Mechanisms</b>	political commitment	Awareness and understanding	<b>Definition of soil health</b>
		Policy concern	<b>Soils as policy priority</b>
		Non-governmental actors	<b>Role of different actors and multi-stakeholder coordination</b>
	coordination mechanisms	Institutional environment	<b>Binding national regulations on soil regional if relevant</b>
		Governance structures	<b>Levels of governance involved, roles and functions</b>
		Contracts	<b>Property rights enforcement, land tenure agreements</b>
	monitoring system	Validation and coherence	<b>Mechanisms in place to measure impacts and ensure compliance to targets and limits</b>
	<b>Policy interaction</b>	policy objectives	Policy agenda on soils
policy implementation		Allocation of resources and sources of finance	<b>Available budget for soil health and blended finance</b>
		Policy integration	<b>Interactions between and within (main) policy sectors</b>
		Policy consistency with soil health	<b>Synergies and trade-offs between policy sectors and towards soil ES</b>
Contextual factors		Contextual factors	<b>Enabling and disabling conditions</b>

The table presents a framework for assessing policy coherence in soil health, using two main pillars: Institutional Mechanisms and policy Interaction. The institutional mechanisms outline the framework and priority objectives, typically expressed through political commitments, policy statements, and existing coordination structures. Political commitment is directed towards defining policy objectives and guiding the implementation process. Finally, contextual factors highlight how current conditions can support or hinder these objectives.

### ▪ **Results**

This section summarizes the findings from the coherence analysis (refer to section 2.2 of D4.1) conducted within individual policy innovation labs. The results are derived from interviews with key stakeholders, focusing on the main national-level issues in each country.

Table 2 assesses policy coherence for soil health, analysing the perceived priority and quality of various policy elements. According to D4.1, a five-point Likert scale is suggested for priority and quality (low (high) score reflecting low (high) priority or quality). The data, expressed as means with standard deviations in parentheses, provide insight into the strengths and weaknesses of current soil health policies.



*Table 2. Priority and Quality of policy coherences*

<b>Policy coherence parameters</b>	<b>Priority</b>	<b>Quality</b>
Policy concern	3.23 (0.93)	2.62 (0.87)
Policy agenda on soils	3.54 (1.13)	2.38 (1.26)
Institutional environment	2.54 (1.27)	2.31 (1.11)
Policy integration	2.69 (1.44)	2.15 (0.99)
Governance structures	2.46 (1.51)	2.31 (1.44)
Contracts	2.69 (1.18)	2.62 (1.12)
Validation and coherence	3.38 (1.50)	2.08 (1.04)
Non-governmental actors	3.31 (0.95)	2.46 (0.52)
Allocation of resources and sources of finance	3.85 (1.07)	2.69 (1.25)
Policy consistency with soil health	3.08 (1.12)	2.46 (0.88)
Contextual factors	3.31 (1.11)	2.85 (0.80)

Mean value and (standard deviation)<sup>1</sup>

The high priority assigned to "Policy concern" (3.23) and "Policy agenda on soils" (3.54) suggests a significant recognition of the importance of soil health. However, the quality scores (2.62 and 2.38, respectively) indicate a gap between the desired level of attention and the perceived effectiveness of current policy frameworks. Institutional and Environmental Factors: While the priority given to the "Institutional environment" is relatively high (2.54), its quality score (2.31) mirrors the pattern observed for policy concern and agenda—a need for improvement in effective policy translation to action.

The relatively low priority and quality scores for "Policy integration" (2.69 and 2.15, respectively) and "Governance structures" (2.46 and 2.31, respectively) point to critical areas requiring attention. Effective soil health policy necessitates integration across multiple policy domains, robust governance frameworks, and several institutional gaps (see section 3).

A striking observation is the high priority (3.85) placed on the "Allocation of resources and sources of finance." This indicates the recognition that financial investment is crucial for soil health initiatives. However, the quality score (2.69) reveals challenges in ensuring the effective and efficient allocation of available resources. This necessitates improving transparency and accountability in financial management for soil health projects and creating enabling conditions for implementing sustainable business models addressing soil health.

While the intention to prioritise soil health is apparent, the effectiveness of current policies falls short of expectations (Figure 2 and Figure 3)

<sup>1</sup> The detailed of each PIL's score is available in the each individual policy innovation lab available upon request.

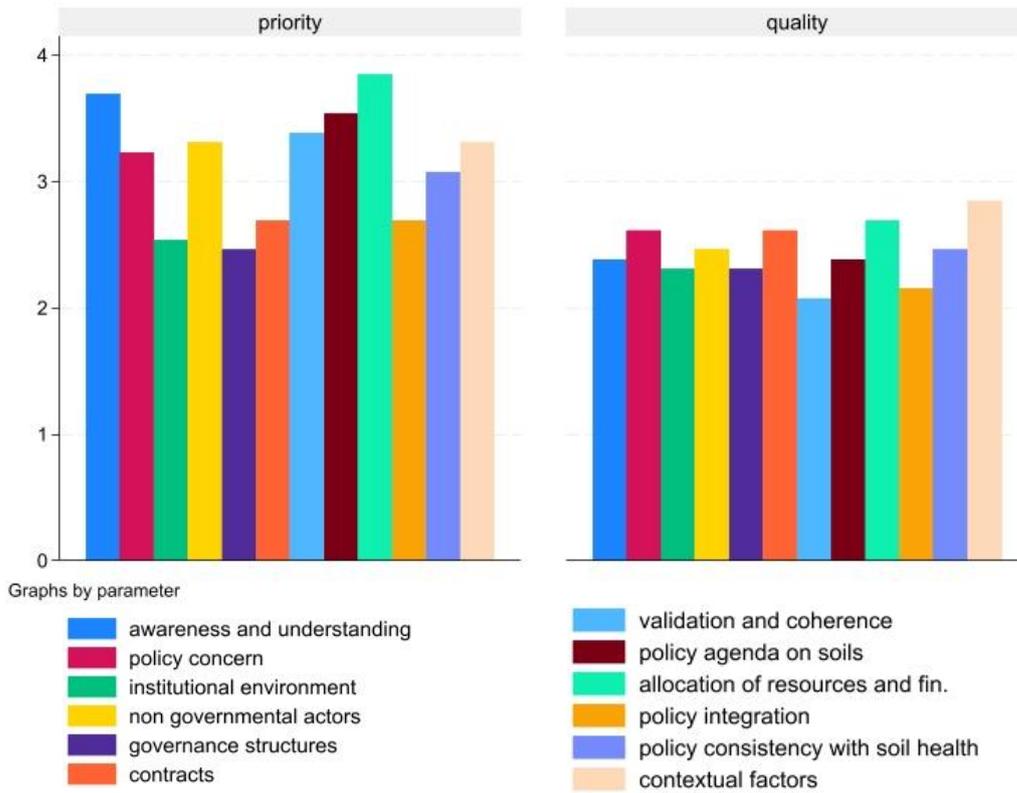


Figure 2. Comparison of priority and quality (average value)

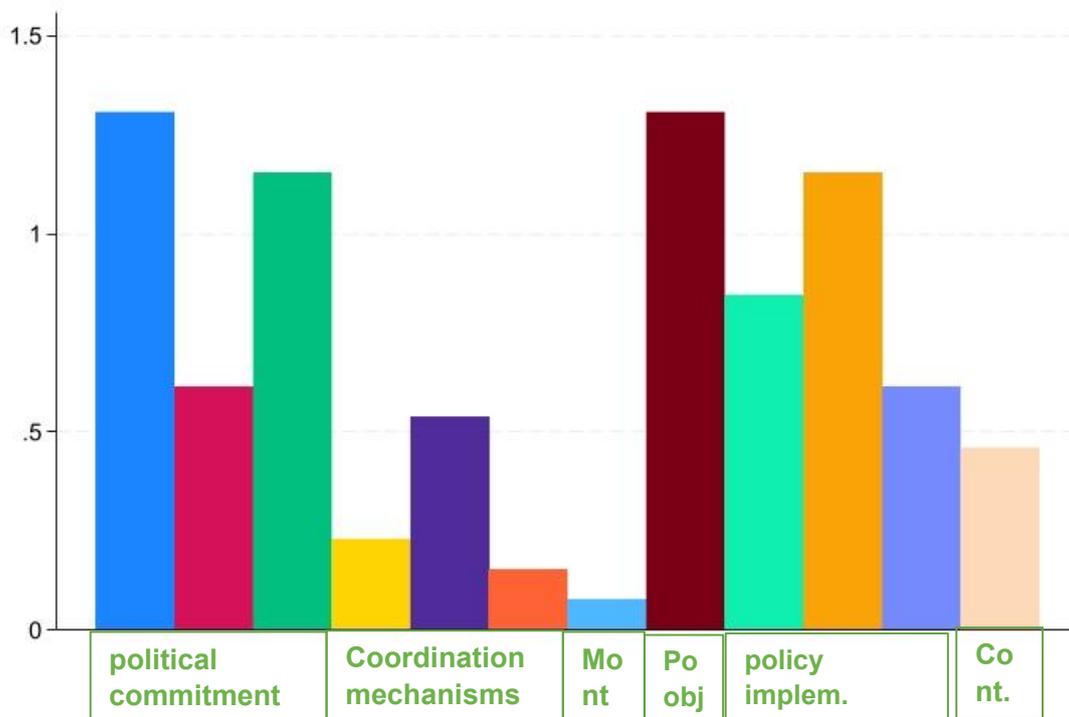


Figure 3. GAP between priority and quality (average value)

Such discrepancy highlights the critical need for targeted interventions and strengthening the implementation process, creating a reflexive space for



fostering collaboration and coordination across different sectors and government levels.

The results also highlight the need to develop a more participative approach to public policy, with the engagement of several categories of stakeholders (e.g., farmers, scientists, policymakers, advisory services and civil society organisations) in developing and implementing soil health policies.

#### ▪ **POLITICAL COMMITMENT**

The results highlight divergencies in how soil health is defined and understood across different regions and stakeholder groups. While there is a consensus that soil health is crucial for agricultural productivity and ecosystem services, the specific metrics and priorities vary considerably. This variance stems from several factors, including differing agricultural practices, environmental concerns, and the influence of national policies.

One striking observation is the tension between a narrowly defined approach focusing solely on agricultural productivity (e.g., high organic matter content, water retention, crop yields) and a more holistic perspective encompassing broader ecosystem services. Some definitions emphasise the soil's ability to support biodiversity, filter water, and mitigate climate change—factors often overlooked in productivity-centric views. Including these ecosystem services is vital for the long-term sustainability and resilience of soils and ecosystems, especially in the face of climate change and environmental degradation.

The case studies result reveal that there is often no universally agreed-upon definition, even within a single country. For example, in Latvia, scientists, advisors, and farmers differ in their understanding of soil health, reflecting different priorities and levels of expertise. This underscores the need for clear communication and a unified understanding among stakeholders, which is crucial for implementing effective soil management strategies. The upcoming EU Soil Monitoring Law mentioned in several case studies exemplifies this tension. The initial proposal's criteria faced resistance, hinting at the challenges of balancing the need for comprehensive soil protection with the practical concerns of farmers and acceptability (Dessart et al., 2019). This highlights the complexities of establishing uniform standards for soil health across diverse geographical areas and agricultural systems. The lack of an accepted definition of soil health presents significant policymaking challenges. Diverse interpretations hinder the establishment of clear policy directionality, which would also affect weak policy processes (i.e. goals targeting, monitoring and regulations). Therefore, it is crucial to move beyond simple definitions towards robust monitoring frameworks, increasing the information value of the monitoring process and aligning it with the policy goals (Pascual et al., 2021, 2015).

The results return a complex and often fragmented landscape of soil health policy concerns across different regions, with a recurring theme about lacking clear prioritisation of soil health as a distinct policy area. In many cases, soil concerns are addressed indirectly through broader agriculture-related policies, environmental protection, or climate change. This lack of focus often



leads to inconsistencies, limited funding, and ineffective implementation. The PIL reports highlight the pervasive influence of the CAP in shaping soil management practices. However, while the CAP includes some measures to improve soil health, there are conflicting views on its ability to address soil health concerns. Some PILs indicate an overly burdensome, while others argue it's insufficient to address the main challenges faced by soils at the territorial level. The complexity and sometimes confusing nature of CAP regulations contribute to the overall lack of clarity regarding soil health as a policy priority. The upcoming Soil Monitoring Law exemplifies the efforts to establish a harmonised approach across member states. However, this initiative faces challenges, with initial proposals meeting resistance from various stakeholder groups. This underscores the difficulty in establishing a common framework that balances the needs of multiple stakeholders (farmers, policymakers, and environmental advocates) with varying priorities and perspectives on the importance and urgency of soil health protection. In addition, some countries have integrated soil health concerns into broader environmental or biodiversity strategies, while others have yet to develop comprehensive national soil policies. This disparity reflects differences in national contexts, existing policy frameworks, and the relative prioritisation of soil health among various policy goals. However, even when policies exist, they translate them into a concrete set of actions. Voluntary measures usually fail to produce substantial impacts, and proactive investments in new technologies are frequently lacking.

The PIL indicates that many non-governmental actors (NGOs) are involved in promoting soil health initiatives. These actors range from research institutions and farmers' organisations to environmental NGOs and consumer groups. Their roles and influence vary significantly depending on the context, highlighting the complexity of multi-stakeholder engagement in soil health management. Farmers, as direct land users, play a central role, directly impacting soil health through their practices. However, their actions are shaped by various factors such as markets, consumer preferences, and government policies. The interplay between farmers' decision process and exogenous factors calls for fine-tuned economic incentives and regulatory frameworks with sustainable soil management objectives, avoiding the creation of distortive mechanisms pushing for poor soil health practices. This is, for example, the case of isolated farmers' practice without a valorisation of ecosystem services provided through the market or through direct/indirect payment from the society. Some case studies emphasise that research centres, service providers, and cooperatives play an essential role in supporting the adoption of sustainable practices. In other case studies, consumers increasingly demand sustainably produced products, leading to market pressures that can encourage farmers to adopt more environmentally friendly methods. This demonstrates the potential of consumer activism to create positive market incentives for sustainable soil management.

The comparison across several PILs suggests that while diverse actors contribute to soil health initiatives, there is a lack of interactive and reflexive



space across them, which makes achieving multi-stakeholder coordination very challenging. The coordination efforts are often fragmented, with limited communication and collaboration among various groups. This is particularly apparent in cases where NGOs with differing agendas and priorities interact with governmental agencies and industry stakeholders. A lack of centralised coordination mechanisms hinders the integration of diverse perspectives and resources, ultimately compromising the effectiveness of soil health initiatives. In fact, while various organisations operate at the local, regional, and national levels, their contributions are often isolated and not effectively leveraged for a collective impact. This, perhaps, is also a consequence of conflicting SDG objectives that are pursued over space and time (Doran, 2002). The challenges of securing funding, building capacity, and engaging a broad range of stakeholders can hinder NGO effectiveness in promoting the widespread adoption of sustainable soil management practices.

### ▪ COORDINATION MECHANISMS

Governance structures exhibit weak coordination mechanisms across almost all case studies. A lack of central authority or designated agency to oversee soil health issues results in insufficient oversight and strategic planning. The absence of effective coordination among agencies and stakeholders often leads to a lack of alignment between policy goals and coherent activities at local level. Experts indicated that the involvement of multiple levels (EU, national, regional, local) further exacerbates the problem. The differing priorities and capabilities of actors operating at different levels often create conflicts, delays, and a lack of consistency in policy implementation. This is exemplified by the uneven application of policies and programs across various regions, highlighting a critical lack of harmonisation and a failure to tailor policy approaches to diverse local contexts. This points towards a substantial need for a clearer system of accountability and the development of a more streamlined approach to soil health policy that incorporates input and coordination between different levels of governance.

Contractual arrangements related to landowners and farmers often lack clear stipulations regarding soil health. Reliance on voluntary agreements and eco-schemes fails to ensure the widespread adoption of soil-friendly practices. While some contracts (e.g., carbon credit schemes) include provisions for specific soil health outcomes, these are often limited in scope and do not address the broader range of soil health challenges. This means a deeper focus is needed on contractual mechanisms that explicitly address soil health protection.

Finally, the lack of comprehensive soil monitoring and systematic data collection for soil health avoids a proper assessment of soil health status and a measure of policy effectiveness (Winkler et al., 2025). Without accurate and readily accessible data, tracking progress towards soil health goals, identifying areas of concern, and implementing targeted interventions is difficult. A systematic approach is therefore required to ensure consistent monitoring and standardised data collection, which could provide a more reliable basis for evidence-based decision-making.



## ▪ MONITORING SYSTEM

The results highlight significant inconsistencies and limitations in mechanisms for measuring impacts and ensuring compliance with soil health targets and limits across the examined case studies. While some regions implement *ad hoc* monitoring programs (e.g., Germany's long-standing soil sampling program), others lack robust systems for tracking soil health indicators, relying instead on indirect measures or voluntary compliance. These differences highlight a critical need for harmonised approaches and improved data collection and analysis.

Some case studies report the potential benefit of employing remote sensing technologies, like satellite imagery, for monitoring but still require a methodology to calibrate and validate findings. This highlights the need for a more integrated approach that combines advanced technologies with traditional methods for a more complete picture. The requirement of physical soil samples for assessing specific indicators (e.g., organic matter) adds another layer of complexity, potentially hindering the efficiency and cost-effectiveness of broader-scale monitoring efforts. The lack of consistency in the availability and use of specific indicators (e.g., biodiversity, soil compaction) across the case studies further underscores the challenge of comparing outcomes and establishing benchmarks for evaluating soil health. The absence of clearly defined metrics and standardized measurement protocols makes it difficult to effectively assess the impact of policies and practices.

This is even exacerbated by the prevalence of non-binding targets and voluntary compliance mechanisms for soil health. While incentive-based approaches can be valuable, they often fail to produce widespread adoption of soil-friendly practices. The lack of stringent regulations and enforcement mechanisms weakens the effectiveness of soil health initiatives, particularly in cases where the absence of robust monitoring tools exacerbates the situation. Several case studies note that despite existing guidelines, the commitment to soil health remains too weak, especially when designed at local and decentralised levels. The absence of sufficient dedicated funding and personnel for soil monitoring is a common theme, hampering the potential to make substantial improvements. Additionally, the significant variation across regions in institutional capacity and resources further compounds the challenges of achieving harmonized soil health standards and consistent implementation of effective policies. A concerted effort is needed to improve data collection, strengthen monitoring mechanisms, harmonize indicators, and ensure adequate resources are committed to achieving consistent progress towards achieving soil health targets across all regions.

## ▪ POLICY OBJECTIVES

The results highlight the significant influence of the Common Agricultural Policy (CAP) on soil health policies across the examined regions. For instance, the objective of soil conservation is enshrined in Article 6 of Regulation 2021/2115, and it is further stated in Article 47, lett. a of the same regulation, among the priorities supported under the CAP sectoral intervention envelope. However, its effectiveness is often debated. The reliance on non-binding



measures, such as agri-environmental schemes and eco-schemes, is a recurring theme. In fact, voluntary measures often fail to achieve widespread adoption due to their non-mandatory nature (Abadi et al., 2020; Barreiro-Hurle et al., 2023). Farmers' participation is influenced by economic factors and the perceived benefits compared to the potential costs of adopting more environmentally friendly practices. This indicates the need for a more targeted policy to ensure the widespread adoption of soil-friendly agricultural practices (Raggi et al., 2015). The recent approval of a nature restoration law aiming, among other goals, at increasing the stock of organic carbon in cropland mineral soils, is a good example of well-targeted policies.

Overall, the results emphasise the fact that soil health is often addressed only indirectly, as a part of broader policies addressing biodiversity, climate change, and water management. This indirect approach frequently results in fragmented and less effective measures than a dedicated soil health policy. While integrating soil health into multiple policy areas is a clear policy direction, it leads to a diffusion of responsibilities and diluted efforts across several DGs and stakeholders. This highlights the limitations of relying solely on non-binding targets and suggests the need for targeted policies and programs that prioritise soil health directly (Winkler et al., 2025). The lack of clear soil health targets beyond the overarching goals of the CAP further reinforces this observation.

#### ▪ **POLICY IMPLEMENTATION**

Our results confirm that while various funding sources exist (e.g., CAP subsidies, national and regional programs, and private investments), their allocation often lacks strategic focus and coordination, leading to fragmented efforts and weak outcomes. While providing significant funding, CAP subsidies are often criticised for their indirect approach and insufficient support for targeted soil health interventions. In most cases, the funding specifically allocated for soil health initiatives remains unclear and difficult to track. Even when figures are available, they often lack sufficient granularity, making it difficult to understand how resources are distributed to tackle the different sources of land degradation (Panagos et al., 2022). This lack of transparency makes it challenging to assess the effectiveness of funding allocation and to identify areas for improvement.

Private-sector involvement in funding soil health initiatives is limited in most case studies, despite potential synergies between private interests and sustainable soil management, including carbon farming. The absence of robust mechanisms to attract private investment in soil health hampers the potential for innovation and the wider adoption of sustainable practices. Wark consumer awareness for soil health and their willingness to support soil-friendly practices seem insufficient to generate substantial involvement and coordination across the food supply chains.

The lack of policy consistency across sectors poses a major challenge to effective implementation of soil health policies. In several case studies, soil health is addressed indirectly, often fragmented across various agriculture-



related policies, environmental protection, climate change, and water management. This lack of a holistic approach frequently results in conflicts, overlaps, and inefficiencies, ultimately hindering the implementation of effective soil conservation measures. The absence of a central authority responsible for coordinating policies and actions related to soil health significantly contributes to fragmented implementation. The lack of integrated strategies and clear lines of responsibility across policy sectors (e.g., agriculture, environment) hampers the implementation of comprehensive soil health initiatives, as insufficient oversight and planning often hinder progress. While some case studies show efforts to integrate soil health concerns into broader policies (e.g., CAP eco-schemes), there is limited evidence of synergies between different policy sectors. Despite the acknowledged importance of linking soil health with biodiversity, climate change, and water resource management, there is a need for better coordination and harmonisation of policies across these areas to maximise the effectiveness of soil health interventions.

Synergies between different sectors and stakeholders are essential for successful soil health implementation. The limited attention to fostering such cooperation leads to missed opportunities to leverage resources, knowledge, and initiatives across various sectors, ultimately hindering the collective efforts to improve soil health. This reinforces the need for stronger inter-ministerial collaboration, coordinated multi-sectoral strategies, and public-private partnerships.

#### ▪ **CONTEXTUAL FACTORS**

The comparison across case studies highlights a complex interplay of enabling and disabling conditions influencing soil health initiatives. A prominent theme concerns on the lack of awareness and knowledge among farmers regarding soil health management practices. Bridging this knowledge gap requires effective training, education, and outreach programs tailored to the specific needs and contexts of the various farming communities.

Another recurring challenge is the incentives, or lack thereof, for adopting soil-friendly practices. While subsidies and eco-schemes offer some financial support, they are often insufficient to fully compensate for the additional costs associated with sustainable farming methods, particularly in the face of market pressures and economic uncertainties. The inconsistent and sometimes misleading policy frameworks, including frequent changes in regulations and funding mechanisms, further undermine the long-term strategy of soil health initiatives. In fact, under an unstable and unpredictable policy environment, the associated uncertainty about future conditions can postpone the soil health investment decision (Di Corato and Zormpas, 2022)

Other disabling factors include bureaucratic hurdles excessive regulations, and the limited integration of soil health concerns into policies. In fact, the fragmented nature of policy initiatives, often addressing soil health indirectly through other policies (e.g., environmental protection, biodiversity



conservation), hinders the development and implementation of comprehensive and effective soil health strategies.

On the other hand, enabling factors include a growing awareness among consumers of the importance of sustainably produced food, increasing demand for organically farmed products, and the emergence of carbon markets. These factors offer both economic incentives and market-driven pressures for promoting soil health, helping to align consumer preferences with sustainable practices. The development of innovative business models that integrate soil health into existing agricultural systems, as well as successful multi-stakeholder collaborations, also represent other enabling factors.

## 4.2 Legal Aspects

The currently available European legal framework for soil health is based on 3 points:

1. the dependence on soil. Human beings and our ecosystems depend on soil as a source of food, clean water and habitat. It is also the planet's largest terrestrial carbon reservoir. "Too few of us realise that our future lies beneath our feet. Soils and the multitude of organisms they support are our source of food, biomass, fibres and raw materials; they regulate the cycle of water, carbon and nutrients and make life on earth possible. It takes several thousand years to form a few centimetres of this magical mantle" (COM (2021) 699 of 17 November 2021, p. 1).
2. a reminder of the limited, non-renewable nature of this resource. Soil Strategy, p. 10 - "Land and soil are fragile and their limited resources are subject to an ever-increasing thirst for space: urban sprawl and soil sealing are depleting nature and turning precious ecosystems into concrete deserts. This process often affects the most fertile soils and undermines the ability of farmers and foresters to earn a decent living<sup>2</sup>

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<sup>2</sup> The agricultural land lost between 1990 and 2006 due to soil sealing in EU countries had a production capacity equivalent to 6 million tonnes of wheat per year [Gardi et al (2014)].

<sup>3</sup> Scientific Advisory Board of the European Academies (2018), Opportunities for soil sustainability in Europe.

<sup>4</sup> The impact of overall EU consumption on deforestation is estimated at over 9 million hectares (ha) lost between 1990 and 2008 to meet the demand for imports of agricultural and livestock products into the EU. Source: [Consumption Impact Study - Forests - Environment](#).



3. an emphasis on the degraded state of the soil. More than 60% of EU soil is not in good condition. More specifically, "It is estimated that around 60-70% of soil in the European Union is in poor health (European Commission (2020), Caring for soil is caring for life)" (COM 2021, 699, p. 1).

While this factual framework has always remained the same, justifying an urgent legal response to preserve soil, this response has evolved. While offering a single legal response to soil is still at the heart of European discussions, the way in which this is achieved has varied (I). What is more, the content of the latest legislative version of the Soil Directive, which includes the general guidelines of 17 June 2024, pending the final reading by the European Parliament, strikes a subtle balance between setting common requirements for all EU Member States and leaving Member States considerable flexibility in this area, both in terms of assessing soil condition and in terms of sustainable soil management (II).

**A unique legal response dedicated to soils: entrepreneurial approach and focused on monitoring (two new features - "soil health" and "soil management").**

Interest in soil legislation is not new. A soil strategy in 2006, followed by a legislative proposal on soil, signalled the desire to fill a legal vacuum, which ended with the withdrawal of this proposal in 2013.

This failed attempt at framework legislation on soil was driven by the same general ambition as the current legislative proposal (the 2022 legislative proposal). As pointed out in the European Union Strategy for Soil Protection 2030 - Harvesting the fruits of healthy soil for people, food, nature and climate of 17 November 2021<sup>5</sup> and announcing this legislative proposal, "the lack of specific European legislation in this area has been highlighted by many<sup>6</sup> as being largely responsible for the alarming state of our soils"<sup>[6]</sup>. This strategy stems from the 2030 Biodiversity Strategy of 20 May 2020, itself an offshoot of the Green Deal. However, the legislative framework currently being developed falls short of what was hoped for (1.1). Furthermore, while the existence of a single piece of legislation for soil is an approach shared with the previous legislation, it differs in that it focuses on the good health of the soil. In this way, it creates a link between soil health and the production of ecosystem services, and conveys a message of strategic investment to ensure good soil health (1.2). Insofar as the aim was to compensate for the lack of European legislation dedicated to an environmental component, and in relation to other existing legislation, it was expected that the level of legal protection would be

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<sup>5</sup> COM (2021) 699.

<sup>6</sup> The European Parliament, the European Court of Auditors, the Committee of the Regions, the EEA in its report "Europe's environment: state and prospects 2020" and the citizens and stakeholders who responded to the public consultation; see SWD(2021) xxx for more details.



equivalent to that of other legislation. The latest version of the proposal for a Directive of the European Parliament and of the Council on the monitoring and resilience of soil, dated 17 June 2024, confirms that this is not the case (1.1.1) and, more importantly, that the relevant legislation likely to take over this protection is either no longer in place or has failed to materialise (1.1.2).

**Key point: A legal framework for soil protection is not equivalent to that of other natural ecosystems**

The issue behind the development of legislation dedicated to soil has always been explicit. As the 2021 European Soil Strategy points out, "Apart from certain existing EU legal provisions on soil protection<sup>7</sup> and the actions undertaken as part of the 2006 Thematic Strategy for Soil Protection<sup>8</sup>, the EU has so far been unable to provide itself with an adequate legal framework giving soil the same level of protection as that afforded to water, the marine environment and air". In view of the stated motivation, it was therefore legitimate to expect the introduction of legal protection for soil at least equivalent to that for other ecosystems, particularly given the urgency and importance of protecting it. To this end, the 2021 strategy points out that "knowledge of soil and recognition of its value have evolved considerably in recent years"<sup>9,10</sup>, justifying immediate legal consideration.

However, Article 1st paragraph 1 (version of 17 June 2024, bold characters are those added by the Council in the general guidelines) states that "The Directive aims to establish a robust and coherent monitoring framework for all soils in the Union [...], to promote continuous improvement of soil health, to maintain soil in a good state of health and to combat all aspects of soil degradation with a view to achieving a good state of soil health by 2050, [...so that they can deliver different ecosystem services on a sufficient scale to meet environmental, societal and economic needs, prevent and mitigate the effects of climate change and biodiversity loss, increase resilience to natural disasters and food security, and to reduce soil contamination to levels no longer considered harmful to human health and the environment".

Article 1(2) of this proposal for a directive provides the establishment of "a framework and measures for: a) the monitoring and evaluation of soil health; b) the sustainable management of soil; c) the management of contaminated sites". While the boundary between protection and management is particularly porous, the progressive nature of sustainable soil management means that it cannot be assumed that soil protection is and will be effective

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<sup>7</sup>Requirements relating to specific aspects of soil protection under, for example, the Sewage Sludge Directive, the Industrial Emissions Directive, the Common Agricultural Policy, the Environmental Liability Directive, the Waste Framework Directive and the LULUCF Regulation.

<sup>8</sup> Thematic Strategy for Soil Protection, COM(2006)231.

<sup>9</sup> COM (2021), 699, p. 5

<sup>10</sup> COM 2021 699, p. 4.



in a relatively short space of time, even though the state of degradation is being denounced and the urgent need for action is constantly being reiterated.

According to article 3-9 of the proposed directive in its version of 17 June 2024, "soil health assessment" is "an assessment of soil health based on a measurement or estimation of descriptors". The General Guideline includes additional flexibilities for Member States with regard to soil measurements, including the possibility of using existing data and monitoring systems. It also lays down minimum quality requirements for laboratories analysing soil samples in order to ensure the comparability of soil measurements.

The fact that the proposed directive on soil is less ambitious than had been hoped is in no way offset by other legislation applicable to soil, whether it be the legislation currently structuring the new Common Agricultural Policy, whose environmental ambitions have been revised downwards, or the recent legislation on nature restoration, which falls short of its environmental ambitions.

**Key point: The failure to compensate for this shortfall by other relay legislation applicable to land**

Insofar as agricultural land covers more than 38% of European territory, the influence of the Common Agricultural Policy on the land concerned is undeniable. In its reformed version, the new Common Agricultural Policy has strengthened cross-compliance, i.e. the minimum conditions to be met in order to qualify for Common Agricultural Policy support. The 2021 soil strategy was clearly counting on this support to create a synergy of actions and support for soil. In fact, it states that "in the new CAP11, reinforced cross-compliance has been introduced for environmental protection. Cross-compliance defines the minimum requirements for more ambitious and sustainable agricultural policies, including environmentally and climate-friendly cultivation practices as part of ecological projects and support for rural development"<sup>12</sup>. The components of cross-compliance include statutory management requirements and the Good Agricultural and Environmental Conditions (GAEC) that farmers must respect for the areas, animals and elements under their control. There are a number of good agricultural and environmental conditions, some of which are new and particularly relevant to soil. These include, for example, GAEC 1 on the obligation to maintain permanent grassland, GAEC 5 on the management of ploughing to reduce the risk of soil degradation, GAEC 6 on the ban on bare soil during sensitive periods, and GAEC9 on the ban on converting or ploughing permanent grassland in Natura 2000 sites.

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<sup>11</sup> [https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance\\_fr](https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_fr).

<sup>12</sup> COM 2021 699, p. 17.



However, the recent revision of the CAP<sup>13</sup> in response to the reactions of the farming sector in Europe in early 2024 affects precisely this minimum environmental base. Good agricultural and environmental conditions in particular were at the heart of the recent review of the CAP. The review amends the rules relating to six of the existing nine Good Agricultural and Environmental Conditions<sup>14</sup> and affects in particular those relating to soil. A careful reading of the changes made raises questions, as they run counter to urgent climatic and environmental requirements, insofar as they water down this recently strengthened minimum, even though environmental arguments and the fact that they are limited to "certain situations" or "exceptional situations"<sup>15</sup> have been put forward to justify many of these changes<sup>16</sup> (Langlais 2026). For example, the first GAEC relating to the obligation to maintain permanent grassland has been reconsidered in order to take into account the impact of the reduction in livestock numbers on this

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<sup>13</sup> Regulation (EU) 2024/1468 of the EP and of the Council of 14 May 2024 amending Regulations (EU) 2021/2115 and (EU) 2021/2116 as regards standards for good agricultural and environmental condition, climate, environment and animal welfare programmes, amendment of CAP strategic plans, review of CAP strategic plans and exemptions from controls and penalties, OJ L, 2024/1468, 24.05.2024.

<sup>14</sup> Exemptions from GAEC 1 and 8 had already been granted prior to this review.

<sup>15</sup> Cons. 5, aforementioned regulation 2024/1468.

<sup>16</sup> See in particular Cons. 5 of the above-mentioned regulation 2024/1468 "The general objectives of soil protection and soil quality pursued by GAEC standards 5, 6 and 7 are influenced by many factors, such as soil type, choice of crops, weather and climate conditions, past and present land use and farming systems, such as organic farming, which require a different approach to certain operations. Experience shows that, in certain situations, the imposition of various requirements without due consideration of these factors, such as restrictions on tillage or the obligation to sow during a given period, can have negative effects on certain soils or crops and may even run counter to the objective of soil protection. GAEC standard 9 prohibits the conversion or ploughing of permanent grassland designated as ecologically sensitive permanent grassland on Natura 2000 sites. Experience has shown, however, that exceptional situations may arise in which these ecologically sensitive permanent grasslands are damaged, for example by wild animals or invasive species, and appropriate measures to remedy these situations, including exceptions to the ban on ploughing the areas concerned in order to restore these permanent grasslands, may be necessary in order to ensure that the requirements of GAEC standard 9 contribute to the protection of habitats and species", see also cons. 7 of the said regulation, "Climatic conditions and the resulting impact on the conditions of agricultural land may prevent farmers and other beneficiaries from complying with the requirements of GAEC standards, such as the deadlines and periods for carrying out certain operations, in a given year. In order to avoid a situation in which farmers faced with such requirements are obliged, for example, to sow crops before a specific date when climatic conditions in a given year do not allow the necessary operations to be carried out, or only with serious negative effects on the soil, such as soil compaction (...)".



obligation, with a view to not penalising farmers who change their activities by turning to arable farming. Under GAEC 5, which is dedicated to combating soil erosion through appropriate practices, the review of this GAEC gives Member States greater flexibility in managing ploughing. Furthermore, GAEC 6, which is designed to protect soils through rules on minimum cover, has been reviewed. The definition of "sensitive periods" during which farmers are required to cover the soil on their plots is now variable, as are the practices to be implemented, taking into account local considerations and the variability of climatic conditions. GAEC 7, on maintaining soil organic matter and requiring crop rotation, has also been made more flexible, as it is replaced by crop diversification, which is deemed simpler to implement. GAEC 9 concerning sensitive permanent grasslands on Natura 2000 sites now allows ploughing on at least part of the permanent grasslands on Natura 2000 sites following significant damage caused by predators or invasive species. Lastly, with regard to GAEC 8, the obligation to devote a minimum proportion of arable land to non-productive areas has been abolished in favour of a new approach: farmers now have the choice of planting hedges or trees or certain catch crops or nitrogen-fixing crops and benefiting from the eco-regime programme, i.e. receiving aid for this purpose.

Mitigating land artificialization will preserve land availability (2.2.1), defining sustainable management practices will help to maintain or improve soil health (2.2.2). Each of these issues is guided by principles, either mitigation principles in land use planning, or guiding principles for sustainable soil management that help Member States to define sustainable soil management practices no later than five years after the directive comes into force. Combating soil sealing and soil destruction are the most visible, effective and easily monitored aspects of land artificialization. It should, however, respect Member States' spatial planning decisions. As for sustainable soil management practices, they will have to take full account of the land rights applicable in the various Member States.

Another long-awaited piece of legislation to help preserve the soil was the Nature Restoration law of 24 June 2024. This European regulation, adopted at the last minute, is one of the pillars of the Green Pact for Europe and provides for the restoration of at least 20% of the land and sea in the European Union (EU) by 2030 and of all degraded ecosystems by 2050. Here too, the 2021 soil strategy envisaged a strong connection with European legislation on nature restoration, and in particular the need to give full legislative existence to soil as an ecosystem. Indeed, it states that "the Commission's forthcoming proposal for legislation on nature restoration aims to restore ecosystems by 2050. However, to achieve this objective, given the absence of an EU soil policy, a number of important policy gaps will remain and need to be filled. This Communication addresses these gaps through different strands"<sup>17</sup>. More generally, the complementarity between the two texts stems from the fact that soils are covered by both: as degraded ecosystems targeted for restoration and as soils, since the proposal for a directive on soil monitoring

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<sup>17</sup> COM 2021, 699, p. 5.



and resilience<sup>18</sup> concerns all soils (art. 2). Regarding agricultural soils, European legislation on nature restoration is not as protective as expected. Initially stripped of all its obligations relating to terrestrial agricultural ecosystems, they were then reintroduced in a more flexible manner. In particular, it will be possible to adopt the planned measures if food safety is threatened. In addition, Member States will only have to achieve an upward trend in two of the following three indicators: the grassland butterfly index; the proportion of farmland with high-diversity topographical features; and the organic carbon stock in cultivated mineral soils.

While the establishment of a single legal framework for soil is less ambitious than initially envisaged, it still stands out in terms of the objective it seeks to achieve: good soil health.

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<sup>18</sup> Proposal for an EP and Council Directive on soil monitoring and soil resilience (Soil Monitoring Directive) of 5 July 2023, COM/2023/416 final



## 5 Institutional analysis and institutional gaps

### 5.1 Literature background

Natural resource governance is complex and multifaceted, and soil governance constitutes an interesting case in Europe, as a common framework does not yet regulate it, but rather relies on single member states' regulations and relates to different policy sectors. It is not only what institutions exist, but how they perform governance that shapes how natural resources management is able, or not, to pursue objectives, increasingly ambitious and urgent in the age of the climate crisis.

Institutions play a key role in shaping how natural resource governance is pursued and, in particular, two levels are relevant: the institutional environment and the governance. The first one defines the “formal rules of the game”, governments perform it in the form of executive, legislative, judicial and bureaucratic functions to define and enforce property rights and contract laws (Williamson, 2000). Beyond formal ones, informal institutions also exist and perform customary rules and habits that often lack official codification but can play a relevant role in natural resource management (Rahman et al., 2017).

The second level, governance, shows “how the game is played”, namely what kind of contracts and arrangements are found between parties. According to Kiser and Ostrom, (1982) actions as pursued by the actors of the game include three layers of “rules-in-use”:

- constitutional, based on rules for governing authorized actions (e.g. laws)
- non-constitutional
  - collective, decisions to enforce, continue, and change authorized actions within institutional arrangements (e.g. tech. offices, organizations, NGOs)
  - operational, individual day-to-day actions without prior arrangement with other individuals (e.g. farmers)

Governance is relevant to soils because varied combinations of actors' institutions and motivations can constitute different arrangements of more public or private-driven forms of governance (Vatn, 2018) . This can result in the delivery of different soil ecosystem services that, in turn, relate to more private (e.g. food, biomass) or public (water filtration, climate mitigation, biodiversity) services (Bartkowski et al., 2022). These two levels interact with each other and are subject to change; however, while the governance can adjust within a decade, the institutional environment is slow to change, from decades to centuries (Williamson, 2000).



So, if institutions perform governance, what lies between institutional levels and the dynamics, or lack of it, can constitute useful lenses for analysis. Meso-institutions, as defined by Ménard, (2017) , provide the social infrastructure to the actual organisation of services, ranging from public bureaus and regional agencies to sector regulators and private certifiers, are in charge of interpreting, implementing and monitoring the issue at stake. This was applied to the case of drinking water but could also be used to think about soil quality monitoring, for instance. Moreover, looking at the dynamics between formal and informal levels, the so-called ‘inter-institutional gap’ (IIG) can be highlighted. IIG are plural, can coexist at the same time and “occur when there is an absence of agreed upon ‘rules of the game’ between autonomous institutional regimes in a social-ecological system” (Rahman et al., 2017).

Drafting from this definition, we apply the IIG framework (overall presented in figure 4) to the case of soil governance and soil users (farmers, landowners, ...). Limitation: the ones presented by (Rahman et al., 2017) are all case studies of *common property* resources (e.g. forest, fisheries).

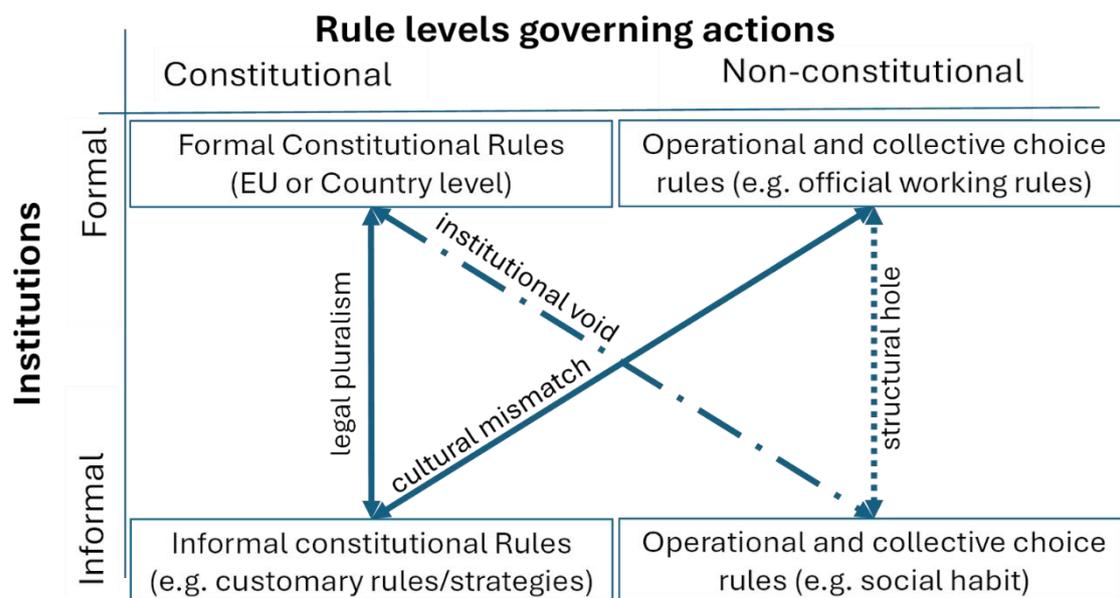


Figure 4: IIG framework: institutional levels and gaps based on Rahman et al. (2017).

The dynamics are showing how different level and institutions interact, or not, and are defined by Rahman et al. (2017) as follows:

- Legal pluralism: “recognizes the interplay at the constitutional-choice rule level by addressing the co-existence of multiple sets of legal systems, or constitutional choice rules (between formal, codified, and informal, historically and culturally evolved institutions).” Newborn laws



don't recognize already existing, and in-use rules and overlaps with sometimes conflicting aims.

- Institutional void: “explains the absence or lack of recognition of collective action initiated by informal actors (e.g. community members) by constitutional choice rules of formal institutions.” In face of self-governed systems, where individuals apply operational rules, this might not match with constitutional rules from formal government. E.g. Forest or land management
- Structural hole: “identifies the role of networks or structural social capital (i.e. connectedness of actors) in shaping ideas, and influencing information, communication and material resource flows at the operational level” Bureaucrats applying formal constitutional laws and local actors pursuing informal social habits need mediating roles, or the flow of information, knowledge, material resources, might be hindered resulting in conflictual resource use and lack of purposeful interaction.
- Cultural mismatch: “Explains the lack of recognition by formal institutions of informal constitutional rules associated with ethnically diverse groups in post-colonial societies (e.g. with distinct cultural practices- resource, ownership, cultivation pattern, and sharing of resources and outputs)”. Lack of common understanding of rights of use and exclusion between constitutional informal social habits of locally embedded rural communities or resource users and formal laws applied by government officials.



## 5.2 Results: Institutions for Soil Governance

Our results reveal a significant lack of coordination among various levels of governance and institutions, which hinders the development and implementation of effective measures to tackle soil degradation. The institutional environment often lacks clear mandates, with responsibilities diffused across multiple national, regional, and local agencies. This diffusion leads to conflicting priorities, overlaps in jurisdiction, and, ultimately, ineffective action. In many cases, soil health is addressed indirectly through broader policies concerning environmental protection, agriculture, or water management rather than as a distinct policy area with clearly defined goals and targets. This means there is a lack of consolidated effort towards a cohesive approach to soil health. Based on that, we have adapted the IIG gap analysis to the topic of soil governance, which can be understood as follows.

(country)	CONSTITUTIONAL ACTORIS & ACTIONS	NON-CONSTITUTIONAL ACTORS & ACTIONS
FORMAL INSTITUTIONS	Ministries and departments Local institutions Regulations over soil, agriculture and land management. [laws, regulations, ...]	Public offices, advisory and consultancy National research centres & universities e.g. forestry officials mediation of public agents and leaders <i>Financial institutions and private sector – mostly intermediary function</i>
INFORMAL INSTITUTIONS	Customary rules cooperatives, associations, groups e.g. farmers' groups	Individual rules: social habits understanding of land use and property by Farmers, farm contractors, resource users, citizens

A description of soil governance relevant to the countries in the projects' case studies follows. Detail of formal and informal institutions for every country PIL can be found in Appendix III.



## • ITALY

The case studies set in Italy highlight the presence of a quite great deal of formal institutions relating to soil, in particular at the regional level, and of public institutions devoted to environmental monitoring, to a small extent also related to soils. Yet, no specific national strategy or priority refers to soil, with the exception of the Hydrogeological risk protection agency (*protezione civile*) that is in charge of acting in emergency situations. All the policies currently addressing soil health are integrated within the larger frameworks (CAP, chemicals use regulations, regional decrees, etc.) and are subordinate to these, which complicates any coordinated action to address the issue.

Therefore, the law application level (top right), has no clear rules to enforce and is failing to provide successful guidelines to informal institutions, such as farmers trade associations or groups, that might or not be committed to soil health. A proliferation of actors and institutions with conflicting priorities and understanding has not enabled a fruitful context for soil health business models proliferation and valorisation, even where potential for tourism or consumers' centred initiatives would be there.

The low political priority of soil health and the little availability of political instruments to address it is reflected in IIG highlighted is both an b) institutional void and c) structural hole, where missing clear regulations and priorities over soil health in Italy and lacking mediating actors are capable of transferring indications from formal institutions. For instance, regional agencies and agricultural extension to farmers and land users in order to ensure greater awareness and commitment to soil health. The role of boundary organizations, or in this case the adoption of clear soil related priorities from the already established institutions (e.g. ARPA) could possibly advise and guide in the process of regulation adoption and enforcement, also ensuring adequate advisory services to committed producers' groups. Local communities, being affected by soil degradation in both the Po Delta and the hilly marginal Tuscany are highly involved, attempts to organize in face of this challenge, such as in the case of the bio districts, might call for stronger informal institutions pursuing soil health. The agricultural, industrial, and urban sectors are interconnected when implementing political land-use decisions and regulations, indirectly impacting soil health. An excellent example is the new urban-rural housing and infrastructure development and the associated policy steps. Since these are mainly managed at lower administrative level (i.e. municipality) still not commonly grounded in sustainable land management planning (i.e. at territorial scale based on an overall), they burden the landscape and the human communities (especially the farmers) with additional threats and costs (e.g., poorly managed waste management, extensive land use leading to the decrease of landscape resilience against the impact of events related to climate change: land floods, droughts, and landslides).



## ▪ SPAIN

The case studies set in Spain shows an overall presence of institutions and regulations on a national level (mostly connected to farming sector and CAP) that separately deal with soil governance, yet very low uptake and commitment to soil health at local and regional levels is detected. If some urban planning departments are starting to develop green urban planning where soils are indirectly included, urban expansion and soil sealing still remain concrete trade-offs. Sustainable farming practices, both integrated and organic, mostly rely on the willingness of individual farmers to adopt such practices, and on the availability of subsidies to support uptake.

Therefore, the resulting framework highlights an institutional void with the absence of formal institutions, in particular at the regional level, that regulate soil protection and guarantee support mechanisms for pursuing objectives of soil regeneration. The urban park PIL highlights the diverging perspectives between neighbourhood organizations and NGOs on one hand, and the city council on the other. Initially designated green spaces, highly sought after by citizens, are often destined to urban expansion. Moreover, a low presence of both informal institutions – with the exclusion of few committed producers' associations (e.g. Riscal) or urban community gardens – and of public agencies and advisory services committed to soil health is preventing soil management practices and data from being understood and accessible to both the farming community and city administration, therefore evidencing a structural hole.

To balance the overall institutional framework, stronger involvement and prioritization of soil health from city administration, regional authorities, and supply chain actors, as well as building and supporting a tailored advisory service and raising consumers' and citizens' awareness, are required.

## ▪ ESTONIA

The Estonian PIL shows a quite strong environment of formal institutions, with a number of legislative instruments, extension services and knowledge institutions engaged with soil related topics.

Estonian farmers are increasingly committing to sustainable farming practices, with a particular focus on soil health. Soil is vital for agricultural productivity and environmental sustainability, and Estonian farmers are adopting methods to improve soil quality, increase biodiversity, and reduce the environmental impact of farming. This commitment reflects both ecological concerns and the recognition that healthy soil is key to long-term farming success. While bureaucratic frameworks can provide incentives for improving soil health, they can also create barriers that hinder the adoption of sustainable practices. Farmers in Estonia, especially those operating on a smaller scale or with fewer resources, may struggle to meet the administrative demands while also tackling soil degradation. This might result in a structural hole between expectations of formal institutions and farmers' livelihoods, e.g. capacity to access to incentive programs from small scale farmers.



On the other hand, the SoilHub, newly born in 2024, can be understood as a boundary organization, in charge of bringing communication and coordination between different levels, in particular policy making and research with farmers and land users, thus filling the institutional void occurring between governmental requirements and farmers capacities and willingness to implement healthy soil management.

#### • BULGARIA

The PIL in Bulgaria identifies several ministries related to soil governance, and a National Program for the Conservation, Sustainable Use, and Restoration of Soils is in place. Yet, implementation is largely focused on EU regulations and is believed to provide insufficient protection of soil. This highlights an institutional void between formal rules and farmers' implementation, with low integration among formal institutions and some coordination occurring thanks to the advisory board, that follows implementation of conservation, sustainable use and restoration of soils. The business model is highly concerned with the supply chain, in fact a number of informal institutions, i.e. producers and processors cooperatives, are to be found. Their role might prove pivotal in deciding to prioritize and support farmers' action towards soil health conservation, if not, main responsibility lies in the advisory board's capacity.

Stronger involvement and prioritization of soil health from regional authorities and supply chain actors, as well as building and supporting a tailored advisory service, together with consumers' and citizens awareness could contribute in balancing the overall institutional framework.

#### • LATVIA

The case studies set in Latvia show a quite strong presence of formal institutions partly concerned with soils but poorly coordinating across ministries. Furthermore, a number of regulations on the topic exist, worth noticing are the **National Legislation Ban of Soil Ploughing in Certain Areas**, targeting farmers with arable land or permanent grasslands to reduce GHG emissions and maintain soil organic matter, imposing sanctions that reduce direct payments for non-compliance; and the **national Legislation Increasing Property Tax for Degraded Farmland**, targeting landowners to reduce degraded land, imposing doubled property taxes for non-compliance, and directly supports soil health. Yet the existing legislations don't seem to be sufficiently effective to ensure soil health, and they do not always appeal to farmers and land users' needs, as shown by the lack of targeted incentives for agroforestry. This highlights an **institutional void**: on the one hand stakeholders are asked to do regular soil testing, on the other missing mechanisms to respond to their needs result for now in a low uptake of agroforestry. Targeted incentives from CAP have allowed some practices to be adopted, e.g. reduced tillage, but this relies rather on individuals' capacity than on the support of public offices, showing a further **structural hole** occurring between formal and informal levels. The digital mapping initiative, together with tailored advice in soil management techniques and bureaucratic



support, might act as boundary initiative to help bridge this gap and improve farmers' livelihood

## • NETHERLANDS

The Netherlands demonstrates a complex interplay of formal and informal institutions and regulations. A study by Kik et al., (2021) identifies all relevant actors, analyses their objectives, and determines their power dynamics. During NOVASOIL's interviews, informal rules were described as highly heterogeneous. For example, some pro-environmental farmers prioritize soil health in their farm management decisions, while others focus on profit maximization, making it more challenging to motivate them to adopt soil health measures. Formal rules are often shaped by EU regulations.

The Dutch PIL focuses on the business model of carbon credit trading, which remunerates soil health measures if they lead to quantifiable, long-term carbon sequestration. Trials of this business model are currently being organized by rural banking institutions and farmers' associations, highlighting the prominent role of the private sector in the PIL. Within the theoretical framework, the private sector serves a mediating role and is categorized as a non-constitutional actor. This role may or may not ensure that the interests of all stakeholders are adequately represented. Specifically, private actors might prioritize their objectives (e.g., profit maximization) while considering public interests, such as ecosystem services like biodiversity, only to a limited extent.

Regarding the broader context of carbon credit trading, farmers' associations and certification bodies, alongside rural financial institutions, are considered boundary organizations. These actors enhance the legitimacy of claimed CO<sub>2</sub> reductions and improve the business model's functionality. Similarly, research institutions and soil sensing providers play a critical mediating role. These actors help address structural holes—gaps in the network of actors involved. In the early trials of carbon credit trading, a **structural hole** was evident. These trials arose due to increasing interest from private buyers (e.g., those pursuing climate neutrality) and individual farmers, despite significant uncertainties. These included unclear legislative frameworks and questions about the long-term carbon storage potential of soils.

Early trials mistakenly assumed that measures complying with existing formal requirements, such as GAEC (Good Agricultural and Environmental Conditions) and other CAP (Common Agricultural Policy) obligations, could qualify for carbon credits. However, draft regulation 2018/841 clarified that carbon credits can only be generated through measures exceeding standard farm management and regulatory requirements. This misalignment between early trials and the stricter legislative framework highlighted inefficiencies stemming from the structural hole. Improved communication and coordination could have better utilized resources. To address these challenges, rural banking institutions and other boundary organizations now advise on measures that meet regulation 2018/841 requirements, aligning



with the more ambitious framework. Certification bodies ensure the reliability of carbon credits, potentially boosting demand. Additionally, advancements in sensor technologies could lower certification costs (e.g., for soil sampling) and further increase the reliability of quantified carbon sequestration.

Interviews and the above example highlight weak past interactions between the formal constitutional level and the informal level. In contrast, better coordination is evident in institutions like independent regional water boards. These boards manage water levels and quality, with most members elected by citizens, while certain seats are reserved for specific stakeholders (e.g., farmers, environmental organizations, and industry representatives). Water boards facilitate resource flows, information sharing, and actor representation. However, past overrepresentation of farmers and other groups compared to their societal share posed challenges, such as the risk of **institutional voids**. Institutional voids—characterized by inadequate institutional frameworks—can limit certain actors' access to resources. Recent adjustments to water board compositions aim to improve societal representation and address these risks. Ensuring balanced representation is crucial, as actors may differ in their environmental quality priorities.

In conclusion, fostering a shared understanding of new business models (e.g., carbon farming), their benefits, and the ways to reliably meet legislative requirements can support the development of early trials that align with enforced regulations. This approach is necessary to maintain farmers' motivation and prevent frustration when early efforts fail to meet regulatory standards.

## • GERMANY

The case studies are mainly set in Germany – CO<sub>2</sub> land (DE) and Soil Fertility Fund (DE, AT, CH) – and both concern organic matter build-up and carbon sequestration to generate carbon credit certificates. Even if soil health is among governmental interests, the private sector is for now playing a prominent role. Besides the formal institutions showing medium interest in soil health, at least in terms of agricultural policies and EU guidelines uptake, there is a degree of governmental commitment in the form of funding research projects and supporting initiatives such as the HumusClimateNet whose objective is to demonstrate soil health practices and connect farmers. Yet, low interaction and knowledge flows, with the exclusion of federal agricultural offices, is directed towards farmers. This latent institutional void could worsen if governmental priorities shift against soils, or if the application of the Carbon Removal Certification Framework proves too rigid for farmer uptake. To ensure an enabling institutional environment for forthcoming regulations on soil monitoring and carbon sequestration, regional and national authorities may need to update state agencies and offices to support farmers in changing practices. Moreover, the reliance on private funding and donations for carbon sequestration rewards poses risks of discontinuous or unreliable resource flows and of increased bargaining power for financial institutions. This evidences a structural hole between farmers, agricultural



extensions and advisory services, and calls for improved function of boundary organizations, and possibly research institutions, to increase networking and ensure that soil health principles are respected in an encompassing way, that goes beyond carbon sequestration and guarantees farming livelihood.

#### ▪ **OVERALL CONSIDERATIONS**

The analysis of the case studies across Italy, Spain, Estonia, Bulgaria, Latvia, and the Netherlands collectively reveals widespread institutional gaps, a lack of political priority, and poor coordination between formal and informal institutions as the primary barriers to effective soil health management. Successful models emphasise the role of boundary organisations in bridging gaps, the importance of incentive programs in motivating farmers, and the need for stronger advisory services to ensure that soil health practices are accessible and sustainable. Additionally, the urban-rural divide and land-use conflicts further complicate soil protection efforts, underscoring the need for integrated policy frameworks that prioritise soil health across all sectors.



## 6 Pathways towards sustainable business models for soil health

### 6.1 Baseline: Current Challenges and Systemic Barriers

The transition toward sustainable business models (SBMs) for soil health begins from a fragmented and misaligned baseline. Across case studies, the prevailing starting conditions are characterised by soil degradation pressures, weak incentive alignment, regulatory uncertainty, limited market demand for soil-positive products, and insufficient technological and advisory capacity

From an economic perspective, current subsidy frameworks under the Common Agricultural Policy (CAP) tend to reward compliance rather than performance and fail to reflect farmers' real costs, risks, and long-term investment needs. Payments for soil-friendly practices are widely perceived as too low, short-term, and administratively burdensome, discouraging meaningful adoption. Funding application processes remain complex and time-intensive, creating additional barriers to participation.

From a regulatory and institutional standpoint, stakeholders expressed concern over frequent policy changes, legal uncertainty, and fragmented governance, which reduce farmers' willingness to commit to long-term sustainable transitions. While interest in emerging frameworks such as carbon farming and soil carbon certification is high, the absence of harmonised EU-wide standards undermines trust, scalability, and investment security.

On the market side, weak demand signals persist for soil-positive products, despite growing sustainability awareness. Certification and labelling schemes are emerging, but they often impose disproportionate administrative burdens on farmers and supply chain actors, and supply chain actors do not yet consistently share the costs or benefits of compliance.

Finally, technological and knowledge gaps constrain transition pathways. While monitoring technologies, precision farming tools, and digital platforms show strong potential, their costs, complexity, and uneven access limit adoption. Advisory systems remain under-resourced, and long-term applied research on soil health outcomes is insufficiently funded.

This starting point defines the baseline condition: a system in which soil health is widely recognised as essential, but institutional, economic, and socio-technical structures remain misaligned with long-term sustainability goals.



## 6.2 Socio-Technical Roadmaps Toward 2050

Socio-technical roadmaps are a method for addressing complex problems, such as soil degradation, that entail long-term goals, such as restoring soil health by 2050, and a high degree of uncertainty throughout the process. They may help generate future innovation pathways based on chains of change and identify opportunities and risks across markets, technologies, and social environments. To navigate the complexity and uncertainty of soil restoration goals—particularly the ambition to restore soil health by 2050—the project adopts a socio-technical roadmap approach. The roadmaps (figure 5) entail three interlinked levels:

### **Level A — Macro Trends and Drivers (Contextual Forces)**

These include climate change, environmental degradation, global food security pressures, EU sustainability policies, urbanization, and evolving consumer preferences. While not directly controllable, these forces shape the strategic environment and create both risks and opportunities for soil-focused innovation.

### **Level B — Meso-Level System Changes (Structural Transformation)**

This level encompasses institutional reform, infrastructure development, legal innovation, market restructuring, and social norm shifts. Key transformation priorities are: a) Redesigning incentive systems toward performance-based and outcome-oriented payments; b) Creating stable but flexible regulatory frameworks; c) Scaling carbon markets and ecosystem service mechanisms; d) Strengthening advisory systems and digital infrastructure

### **Level C — Micro-Level Resources and Activities (Actionable Levers)**

At the operational level, stakeholders pursue concrete actions, such as:

- Adopting regenerative practices (e.g., cover cropping, reduced tillage, agroforestry)
- Investing in monitoring technologies and soil data systems
- Establishing supply chain contracts and certification schemes
- Participating in training, innovation networks, and community-based initiatives

Together, these three levels form a coherent pathway linking high-level drivers to actionable transition strategies.

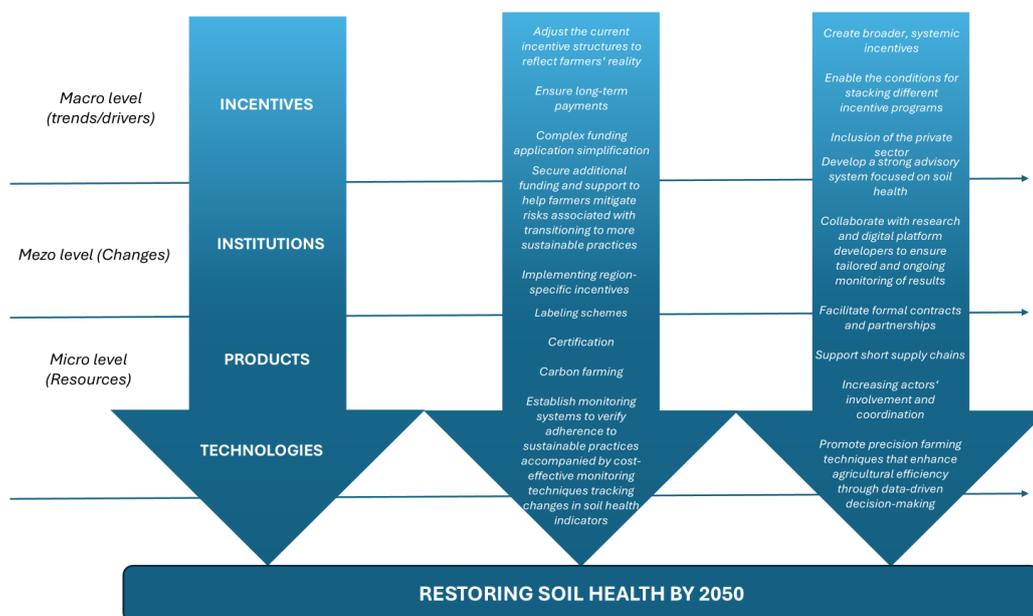


Figure 5. Pathways for restoring soil health by 2050

Hereafter, we summarise the main outcomes of what actors across different case studies individuated to be possible pathways and dynamics towards increased soil health BM. As **economic drivers and constraints** were mostly mentioned across all case studies, we'll start by outlining them. Concerning current **incentive structures**, it was found that subsidies and funding frameworks in the pursuit of soil health do not align with farmers' real needs, often incentivising compliance rather than sustainable practices that are locally adapted and relevant. Furthermore, farmers need guarantees of attractive **long-term payments** for sustainable practices, as current payments are often viewed as too low to justify the effort. Finally, **complex funding application** processes can deter farmers from seeking financial support for sustainable transitions, necessitating a simplification of bureaucratic procedures.

Solutions proposed to improve incentive mechanisms for soil health include creating broader, systemic incentives considering multiple environmental policies in agriculture and promoting integrated approaches to sustainable land management. Enhance payments from both agri-environmental schemes and subsidies for practices (e.g. crop rotation, reduced tillage and cover cropping) that specifically aim to improve soil health and Payments for Ecosystem Services (PES) (e.g., biodiversity and carbon sequestration). To increase attractiveness, **ensure long-term contracts**, which are key for the case of agroforestry; ensure fair remuneration for various ecosystem services; and allow for the **stacking of different incentive programs**. Introduce financial guarantees to protect farmers from economic risks associated with transitioning to sustainable practices and research funding for long-term trials. This might, for instance, motivate the adoption of carbon sequestration techniques, as current payments are often viewed as too low to motivate



significant changes in practices. Sources of finance include municipal or state authorities, as the centrality of CAP subsidies continues to prove, but it shall also further **include the private sector** and community funds that might finance soil-friendly practices, as the “soil fertility fund” shows. These findings underscore the necessity for a diverse and integrated set of financial incentives to promote soil health in various agricultural and urban contexts effectively.

While discussion on incentives has opened a broad range of solutions, when it comes to regulatory frameworks, contradictory feelings emerged when considering additional regulations. Overall advocated was a stable legal framework with less frequent changes while allowing flexibility in regulations to support farmers in developing sustainable practices. The most discussed PIL was one of **carbon credits**, calling to support research and development of scalable business models for carbon sequestration - and considering the long-term nature of carbon sequestration assessments – while establishing a clear EU-wide framework for certification with transparent and uniform standards for measuring changes in soil carbon content across initiatives to ensure consistency and reliability. Further soil-friendly regulations were found to be possible through mandatory practices of catch and cover crops and reduced tillage and agro-forestry; nevertheless, several case studies addressed the potential conflicts between those practices and EU goals for reducing plant protection products. Last but not least, incorporating green areas, urban and rural, in city development plans and limiting soil sealing were reported as still lacking regulatory instruments, possibly enhancing biodiversity and providing social and educational benefits.

Introducing a mix of support measures tailored to stimulate sustainable agriculture and foster collaboration among institutions could enhance the overall effectiveness of initiatives to improve soil health. In that sense, the **role of institutions** should contribute in: a). secure additional funding and support to help farmers mitigate risks associated with transitioning to more sustainable practices; b). implementing region-specific incentives that consider the unique characteristics and environmental needs of the different regions, c). develop a strong advisory system focused on soil health, providing farmers with guidance and support in bureaucratic processes, d). collaborate with research and digital platform developers to ensure tailored and ongoing monitoring of results and accurate representation of on-ground practices in agricultural data. Establishing soil health as a priority, that is, enhancing policies that foster sustainable practices and protecting agricultural land from being converted to non-agricultural uses, e.g. urbanisation or energy production, was also frequently mentioned.

Coming to **products** related to soil health SBM, there was a great focus on (new) certification and **labelling schemes** to distinguish soil health-enhancing products, from carbon farming to soil-district labels aiming at tailoring agricultural practices to local soil needs, as in the case of the sandy soils of the Po Delta. Although certification may be viewed as a burden, it serves as a critical tool for ensuring compliance with sustainability and quality



standards in production processes. The case of carbon farming best exemplifies this, as positive measures can help reduce greenhouse gas emissions while providing additional income to farmers. To ensure that consumers can identify and support sustainable options, thus addressing the market need of greater demand, foster awareness supported by information campaigns to educate consumers on agricultural practices and product quality is still a niche to expand in most cases but could contribute to advocating for fair pricing that reflects the actual input costs of products. On the supply side, encouraging the formation of supply chain contracts that involve all actors, e.g. retailers and certification companies, ensures sustainable practices through labelling adherence to environmental standards, which could help distribute the burden of certification not only on farmers.

Concerning the need for technological support and advancement, three main directions were found:

- Establish monitoring systems to verify adherence to sustainable practices should be accompanied by monitoring techniques that are cost-effective in tracking changes in soil health indicators, soil carbon content being the most mentioned one. To ensure complete and transparent information on carbon removal processes and the credibility of carbon sequestration claims, including consistent measurement protocols. Invest in new measurement technologies such as remote sensing, can improve accuracy and reduce sampling expenses.
- Promote precision farming techniques that enhance agricultural efficiency through data-driven decision-making. For example, moisture and nutrient sensor technologies and innovative equipment, such as drones for targeted applications, were presented as hopeful solutions in the intensive olive sector and vineyards.
- Digital platforms and maps to exchange knowledge and information on soil health and best practices, fostering actors' engagement both in urban areas, as for the case of community gardens, and rural areas, as for the digital showcase.

While technological solutions constitute starting points, research and development also showed different directions, seeking, on the one hand, investment in new soil health technologies, conservation agriculture techniques and access to analytical tools (maps and data) combined with enhanced and specialised training for technical advisors in soil management. On the other, foster **partnerships** between researchers, farmers, and community members to guarantee long-term studies, establish networks for sharing best practices, enhance knowledge application and promote sustainable practices and implement programs to raise public awareness about soil health.

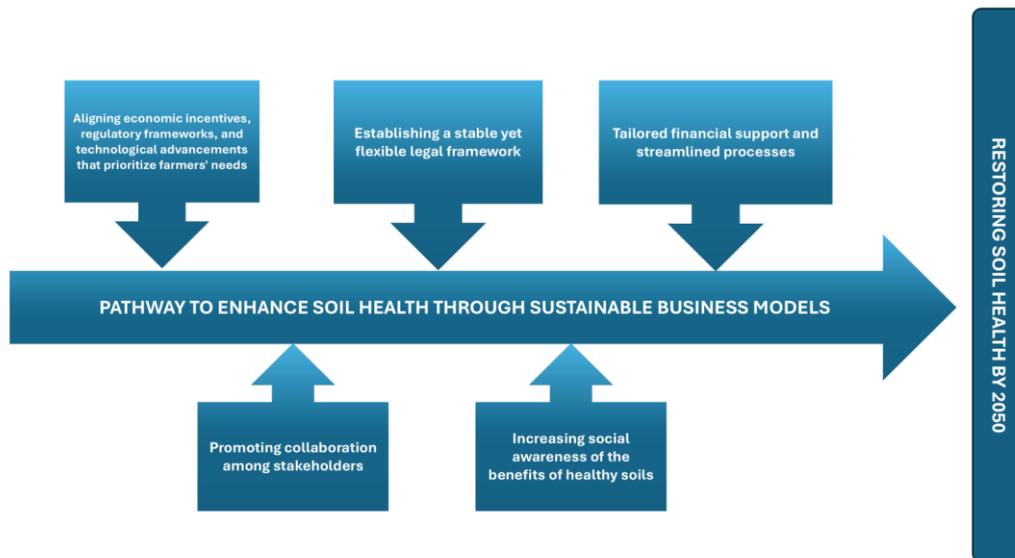
This result is quite in line with the underlined **social drivers**, where the overarching theme was to encourage a shift in social habits and perceptions



around sustainability, promoting the idea that healthy soils can lead to higher profitability through reduced input costs. To do that, it is key to increase social awareness of the ecosystem services provided by healthy soils, emphasising their importance for long-term agricultural viability and local livelihood. Ultimately, this requires balancing the economic benefits possibly derived from SBM for healthy soil with community needs, ensuring that local economic interests align with sustainable practices.

Increasing **actor involvement and coordination** is crucial to accompany transition pathways. In this regard, farmers remain central actors, so to ensure that farmers' realities and needs are considered in decision-making processes, addressing doubts and scepticism, and include them in discussions about regulations and sustainability efforts, bridging the gap between government, NGOs, and the agricultural community, remains pivotal. As shown by the recent case of the Farm to Fork strategy, or the future scenario of an EU certification scheme for carbon credits, fostering better cooperation and reducing bureaucratic burdens might raise farmers' willingness to adopt certain practices, and establishing a robust agricultural advisory system focused on soil health to provide guidance and resources might prove conducive. Furthermore, coordination mechanisms were suggested for contracts, partnerships, and supply chains. **Facilitate formal contracts and partnerships** between stakeholders (e.g., farmers, state agencies, research institutions, and technology providers) to drive innovation in sustainable practices and products, ensuring the effective integration of agricultural data and practices, promoting adherence to sustainable methods and possibly strengthening collaboration and sharing best practices. This includes the case of carbon credit generation, local supply chains and the adoption of sustainable practices. **Support short supply chains** that connect producers directly with consumers, enhancing recognition of sustainable practices and improving market dynamics. This includes educating consumers about the value of sustainable products, addressing misconceptions about pricing and encouraging support for ethically produced goods. In the case of urban gardens, this might also enhance community ownership and participation, creating a stronger sense of belonging.

In conclusion, as depicted in figure 6, the pathways to enhancing soil health through sustainable business models rely on aligning economic incentives, regulatory frameworks, and technological advancements that prioritize farmers' needs. Establishing a stable yet flexible legal framework, tailored financial support, and streamlined processes is essential for fostering sustainable agricultural practices. Ultimately, promoting collaboration among stakeholders and increasing social awareness of the benefits of healthy soils can drive the necessary shifts in both agricultural practices and community engagement.



*Figure 6. Pathways for sustainable business models*

### 6.3 Milestones

Overall, the pathway toward sustainable soil health business models represents a multi-decade socio-technical transition. We begin with fragmented incentives and governance, proceed through targeted pilots and system scaling, and aim to reach a mature ecosystem in which soil health is fully embedded in markets, policies, and societal values.

By aligning economic incentives, regulatory frameworks, technological innovation, and social awareness, the roadmap provides a credible, phased, and measurable pathway toward restoring soil health by 2050 and establishing durable, scalable, and impact-oriented sustainable business models.

To ensure the pathway is operational, measurable, and time-bound, milestones are structured across short-, medium-, and long-term horizons.

#### **Short-Term Milestones (1–3 Years): Enabling Conditions**

**Goal:** Reduce barriers and create immediate incentives for adoption. At this stage, the priority is to reduce administrative burdens for SH investment, build trust, and generate early adopters.

Key milestones include:

- Simplification of funding procedures and subsidy access
- Introduction of pilot Payments for Ecosystem Services (PES) schemes
- Initial rollout of soil carbon monitoring and verification systems
- Expansion of farmer advisory services specialised in soil health



- Launch of consumer awareness campaigns on soil-positive products
- Establishment of pilot contracts across supply chains

- **Medium-Term Milestones (3–7 Years): Systemic Scaling**

Goal: Embed soil health into mainstream markets, policies, and business models. This phase represents the transition from pilots to system-wide adoption, where soil health becomes economically viable, institutionally supported, and socially normalised.

Expected milestones include:

- Adoption of EU-wide SH standards
- Expansion of long-term PES contracts and stacked incentive schemes
- Integration of the monitor systems (soil sampling) with advanced one (i.e. remote sensing technologies)
- Growth of certified soil-health product markets
- Institutionalisation of regional soil health advisory hubs
- Strengthening of formal partnerships among farmers, researchers, technology firms, and policymakers

- **Long-Term Milestones (Beyond 7 Years, Toward 2050): System Transformation**

Goal: Achieve resilient, self-sustaining soil health business ecosystems. At this stage, sustainable soil business models are expected to be financially self-reinforcing, technologically supported, socially valued, and environmentally effective.

Key long-term milestones include:

- Full integration of **soil health performance metrics** into CAP and national policies
- Mature **carbon and ecosystem service markets** delivering stable income streams
- Widespread adoption of **regenerative and climate-smart farming systems**
- Fully operational **digital soil monitoring platforms** supporting evidence-based policy
- Strong **consumer demand and price premiums** for soil-positive products
- Institutionalisation of **soil health as a public-good priority**





## 7 Policy implications

Results indicate that implementation gaps significantly hamper the effectiveness of soil health policies. Many regions, even those with existing policies, face challenges in translating policy goals into concrete actions. This points to weaknesses in enforcement, monitoring, and evaluation mechanisms. Funding levels for soil health initiatives often remain insufficient, limiting the scope and impact of conservation efforts. The lack of coordinated efforts among stakeholders, including farmers, researchers, and government agencies, negatively affects the implementation. Even when targets are set, as is evident in certain cases, like the Netherlands' 2030 sustainable soil management goal, the lack of concrete action and insufficiently defined goals demonstrate a significant gap between commitment and implementation.

On the EU level, a lack of common legal framework to ensure soil protection and the shortcomings of upcoming regulations have been highlighted. The 2021 European Soil Strategy and the proposed Directive on Soil Monitoring aim to establish a coherent, standardized framework for tracking soil health. Moreover, the Nature Restoration law falls short of offering strong protection for agricultural soils and needs a comprehensive approach originally envisioned, leaving critical policy gaps for soil health. The legislation has been made more flexible and introducing exceptions, such as allowing flexibility if food security is at risk. This loophole may weaken the legal authority needed to push farmers toward sustainable practices consistently.

On the other hand, ensuring better soil management practices across the EU remains poorly tackled by the CAP. If the new GAECs include regulations to protect soil, such as maintaining permanent grassland and limiting soil degradation, recent changes to the CAP have weakened some of these protections, reducing their effectiveness in addressing environmental challenges. The legal complexities embedded in the CAP rules constrain the policy implication of simplifying financial application processes and providing risk guarantees. The GAEC conditions in their current form still require farmers to meet specific soil-related criteria (e.g., soil cover during sensitive periods), but the new flexibility under CAP might result in farmers seeing these requirements as less binding, weakening the economic incentives for them to make the transition to more sustainable practices. Additionally, the financial incentives (e.g., PES and carbon sequestration payments) are highlighted as insufficient in the policy text. Legal mechanisms like the EU's soil monitoring framework and carbon farming credits could theoretically provide additional financial incentives. However, the current legal shortcomings in enforceable standards and the lack of long-term guarantees for farmers make these incentives less attractive in practice. National-level variations in policy approaches highlight the challenges of establishing uniform standards and effective enforcement. Different regions' diverse agricultural systems, environmental conditions, and socio-economic contexts require tailored solutions. Yet, a lack of harmonised methodologies and coordinated data



collection makes assessing progress and sharing best practices challenging. Furthermore, the fragmented nature of soil health policies and lack of clarity on who is responsible for implementation often leads to a situation where no one takes ownership and accountability for results.

Our results confirm the need for stronger political commitment, which includes setting clear national targets, providing dedicated funding, and implementing robust enforcement mechanisms. This highlights the importance of addressing the needs identified in the soil monitoring law and a further harmonisation process within the EU soil health regulation. Prioritising soil health as a distinct policy area, rather than addressing it indirectly through other broader policies, is necessary to ensure adequate attention and resources are dedicated to its preservation. Collaboration among stakeholders, coupled with effective monitoring and evaluation frameworks, is key to bridging the implementation gap and realising the goals of sustainable soil management.

Soil health depends on the effective coordination of multiple actors, including farmers, NGOs, government agencies, and businesses. A proactive, collaborative approach, focusing on shared goals, transparent communication, and efficient resource allocation, is needed to enhance the collective impact of these diverse actors in promoting sustainable business models.

Overall, successful implementation of soil health initiatives requires a multifaceted approach that addresses the enabling and disabling conditions identified in the case studies. This involves providing adequate financial incentives and technical support, enhancing awareness, improving stakeholder coordination, and creating a supportive and predictable policy environment that fosters sustainable land management practices.

A coherent approach to dealing with health policy strategy would require tackling the following aspects:

- **Directionality** - *Clear mandates and responsibilities.* Agrees on an inclusive definition of soil based on shared value and long-term goals. Establish a central agency or authority responsible for soil health management, with clearly defined roles and responsibilities at all governance levels. Identify clear roles and responsibilities, ensuring effective collaboration between different levels of government and policy sectors. Develop comprehensive soil health policies addressing various issues coherently with agreed definitions.
- **Coherence:** *Harmonized policies and programs.* Develop and implement national soil health policies that align with EU directives and effectively address regional and local contexts. Soil health concerns should be seamlessly integrated into broader agriculture, environmental protection, and climate change policies. This goal should be achieved by enhancing the collaboration among stakeholders, including farmers, scientists, policymakers, and the



public, which is essential to build a shared understanding and consensus on soil health goals and strategies.

- **Implementation:** *funding allocation and incentive.* Encourage collaboration between different sectors to leverage available opportunities and resources. Develop tailored contractual mechanisms and financial incentives encouraging farmers and landowners to adopt sustainable soil management practices. Ensure dedicated funding for soil health initiatives and enhance transparency in resource allocation.
- **Mechanisms:** *Enhanced synergies: Implementation and monitoring:* To bridge the implementation gap, ongoing monitoring systems and targeted interventions are necessary. This includes investment in education, capacity building, and technological innovation. Ex-post monitoring and evaluation of policy effectiveness are crucial to ensure accountability and identify areas for improvement.

Given these implications and considering the pathways that emerged from discussions with stakeholders of case studies and business models, practical actions undertaken by the policy sector to effectively promote soil health concerns four main areas.

Firstly, aligning incentives with farmers' needs and sustainability goals. This includes improving subsidies and funding frameworks to offer long-term, attractive payments that align with farmers' realities. Policies should promote integration of environmental objectives, such as carbon sequestration and biodiversity, into payment schemes (e.g., PES), and allow for the stacking of incentives across different environmental programs. Additionally, simplifying bureaucratic processes and ensuring that financial support is easily accessible will encourage more farmers to transition to sustainable practices. To maximise impact, policies should also provide risk guarantees to protect farmers from the financial uncertainty of shifting to new practices.

Secondly, in the face of upcoming regulatory frameworks and standards, policy should prioritise the creation of a stable yet flexible legal framework that can accommodate the diverse environmental needs of different agricultural contexts. This includes supporting the development of transparent and standardised EU-wide frameworks for initiatives like carbon credits and soil carbon measurement. Regulation should encourage soil-friendly practices such as cover crops, reduced tillage, and agroforestry while also addressing potential conflicts with other EU goals, such as reducing plant protection products. A clear regulatory mandate to reduce soil sealing in urban areas, alongside urban-rural policy integration, could further enhance biodiversity and ecosystem services, ensuring that soil health is prioritized in both agricultural and urban planning policies.

Thirdly, fostering collaboration and knowledge exchange, since successful implementation of soil health initiatives relies on strong, coordinated efforts among diverse stakeholders—farmers, researchers, NGOs, government agencies, and businesses. Policy should promote mechanisms that facilitate



collaboration across sectors and at different governance levels. This includes supporting the formation of formal partnerships, such as supply chain contracts that ensure adherence to sustainable practices, and encouraging knowledge-sharing networks between farmers, researchers, and advisors. Additionally, fostering community-level engagement and establishing advisory systems focused on soil health can support farmers through the technical and bureaucratic challenges of adopting new practices. Creating digital platforms to exchange best practices and integrate data on soil health will enhance both the reach and impact of these initiatives.

Finally, given the long-time commitment needed for soil regeneration and the evidence of political discontinuity and ever changing targets, to secure dedicated funding and ensuring effective monitoring. To bridge the existing gaps in implementation, it is critical that the policy sector secures dedicated funding for soil health initiatives and ensures it is effectively allocated. Policymakers must prioritise soil health as a standalone policy area and ensure that funding is sufficient, transparent, and directed toward initiatives that make measurable impacts on soil health. This should include supporting long-term research and pilot projects and investing in monitoring systems that track progress and ensure accountability. Policies should also establish clear roles and responsibilities for all stakeholders, with effective monitoring and evaluation frameworks to assess policy effectiveness and provide feedback for continuous improvement. Enhancing synergies between national and local policy frameworks, along with collaboration across sectors, will help to ensure that policies are effectively implemented and achieve their intended outcomes.

## 8 Synthesis

Ensuring the goal of achieving good soil health by 2050 requires a long-term perspective, acknowledging the need for dedicated funding and long-term monitoring and research. The Soil Monitoring Directive partly shares this long-term vision; however, recent changes to the CAP and Nature Restoration regulations reflect a short-term political reality in which flexibility and exceptions to environmental rules are often justified by immediate concerns such as food security or farmers' resistance. This tension between the long-term policy vision for soil health and the short-term legal compromises made under political and economic pressures is an ongoing challenge for ensuring that environmental policies align with the Green Deal's vision. Effective implementation may require overcoming resistance from sectors that prioritise short-term economic gains.

A more coordinated and prioritised approach is necessary to address these gaps in soil health governance. Key recommendations include recognising soil health as a national and regional priority with dedicated budgets and governance structures. Enhanced collaboration among stakeholders, such as farmers, scientists, and policymakers, is essential to building consensus on



goals and strategies. Soil health should be seamlessly integrated into broader agriculture, environmental protection, and climate change policies. Effective monitoring systems, capacity building, and investments in education and technology are critical to fostering proactive soil management and encouraging sustainable practices.

Additionally, establishing a central authority to oversee soil health, with clear definitions and mandates at all governance levels, would strengthen accountability. National policies should be aligned with the EU soil health definition and tailored to regional needs, while dedicated funding for soil health initiatives would ensure consistent support. Financial incentives should encourage sustainable practices among landowners and farmers, with regular monitoring and evaluation to track progress and adjust policies as needed. Enhanced coordination between government levels and sectors and harmonised policies can further support a cohesive and effective soil health strategy.

Individual Policy Innovation Labs can be found here: <https://zenodo.org/communities/novasoil>

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## 9 Appendix I - Case studies' incentives

### 1. CiRAA Long term experiments – UNIPI

Incentives that relate to the experiments conducted and that could be adopted by farmers are based on the CAP, namely:

- **Organic Farming Practices**, promotes adoption or maintenance of organic farming to mitigate climate change, enhance biodiversity, and improve ecosystem services. It aims to reduce chemical dependency and produce sustainable food while improving animal welfare.
- **SRA29 Reduced Tillage Techniques**, encourages farmers to adopt reduced tillage methods to mitigate climate change and promote efficient natural resource management.
- **SRA03-ACA3 Cover Crops**, promotes the use of cover crops to mitigate climate change and enhance resource management, including soil and water. It aims to improve carbon sequestration while reducing chemical use. Non-compliance results in the loss of financial contributions, directly benefiting soil health.

### 2. SPAIN - Olive groves - ASAJA

Key instruments for integrated production up to now only rely on CAP eco-schemes, specifically:

**Eco-scheme: P6.** Practice of spontaneous or planted vegetation covers

**Eco-scheme: P7.** Practice of inert covers of pruning remains in woody crops

Those encourage farmers to implement spontaneous or planted vegetation covers and inert covers of pruning remains, aiming to enhance economic, environmental, and social sustainability but impose strict compliance requirements; failure to adhere to the guidelines results in the loss of financial contributions, directly impacting soil health and overall agricultural sustainability.

### 3. ESTONIA – Sustainable seed production - ETKI

Incentives important to the BM are based on CAP, namely:

- **Basic income support payment**
- **“Environment friendly production eco plan”**: crop rotation and cultivation of leguminous crops; use of certified seed (15% cereal seed); glyphosate restriction; winter vegetation (30% of eligible land); soil samples and fertilization plan; grass strips (flowering strips) and promoting pollinators; education; additional water protection (50% winter vegetation); promoting field birds (not mowing permanent grassland)



- **Support for land melioration**, to develop and maintain agricultural and forestry infrastructure. A strong agricultural advisory system needs to be built up, which also attaches importance to soil health.

#### 4. **BULGARIA Vineyards – NBU**

Main incentives for the BM rely on the CAP strategic plan 2023 – 2027, namely:

Intervention for encouraging cooperation for short supply chains

Investments in the viticulture sector

Eco-scheme for perennial crops

Eco-scheme for developing ecological infrastructure

Implementation of cooperation activities that aim at strengthening of regional potential and local product

#### 5. **LATVIA Digital mapping and Agroforestry – ZSA**

Both case studies are set in Latvia and currently, there are several incentives interesting to the BM, relying on both CAP, supply chain and private initiatives.

##### **CAP Eco scheme “Reduced Soil Tillage Practices”**

This instrument targets arable farmers to reduce GHG emissions and enhance soil health through non-ploughing practices, with non-compliance leading to loss of hectare-based support.

##### **CAP Knowledge Transfer Support under CAP Network Advisory Services**

Aimed at all farmers, this advisory service facilitates education on soil-friendly practices without sanctions for non-use, indirectly promoting soil health through knowledge transfer.

##### **CRCF Carbon Removal Framework**

This framework targets any entity willing to certify carbon credits, indirectly supporting EU carbon sinking objectives while risking exclusion from markets for non-compliance with certification standards.

##### **Investment in Cooperative and R&D Grants**

Targeting cooperatives and research institutions, this funding is based on result obligations, with potential payback sanctions, and may enhance soil health if research focuses on this area.

##### **Product and Practice Branding Campaigns**

This initiative targets producers and NGOs to promote branding without directly implementing EU objectives, with non-compliance resulting in lost co-financing, potentially benefiting soil health through related campaigns.

#### 6. **Perennial aromatic plants UNIPI**

Existing incentive to the BM is **Eco Scheme 5 - Specific Measures for Pollinators**. This scheme targets farmers to enhance biodiversity and food security by promoting pollinator-friendly land management. It aims to



prevent biodiversity loss, improve ecosystem services, and ensure sustainable food production.

Further incentives might be:

- **Soil Health Certification Standards**, targeting farmers, this instrument focuses on improving soil health and efficient natural resource management while reducing chemical dependency. It promotes the biological quality of soil and aligns with various EU objectives. Financial contributions are forfeited for non-compliance, directly impacting soil health.
- **European Charter for Sustainable Tourism and Sustainable Tourism Fund**, this initiative involves farmers, locals, and the public to promote sustainable development and resource management while protecting biodiversity and landscapes.

#### 7. **SPAIN - Tamarguillo park - EVENOR**

Main economic incentives useful to the business model are:

- Local subsidies to incentivize the creation and maintenance of sustainable urban gardens and the use of practices that improve soil health.
- Payments for ecosystem services (PES), rewarding garden managers who adopt sustainable practices that contribute to biodiversity, water retention, and carbon capture.

#### 8. **ITALY - Sandy soils - IDECO**

**AEC Measures** provide subsidies to farmers meeting voluntary standards that enhance soil health through practices like soil coverage and crop rotation. The medium-term application of these measures significantly improves soil organic carbon, water retention, and biodiversity.

- **Carbon credits** incentivize sustainable soil management by allowing farmers to earn and sell credits for carbon sequestration, though uncertainty around regulations and market prices limits their uptake. Farmers view these credits as a supplementary benefit to existing CAP payments, with a preference for hybrid models that balance action and results.
- **Sustainability Districts** unite various stakeholders to address common soil threats and develop collaborative solutions, potentially enhancing income through recognizable sustainability labels.

#### 9. **Rabo Carbon Bank - WUR**

Main instruments to support development of such BM are carbon credits, yet they tightly relate to other incentives.

**Carbon Credit Trade:** certification process is still under discussion. Might be effective to promote more sustainable farm practices as it allows financial



renumeration but there seems to be a need for further research (whether soil health practices can lead to long-term carbon sequestration).

**Payments over the CAP** (Agri-environmental schemes for more advanced environmental goals and Eco-schemes for less ambitious environmental goals). Received by all farmers that comply with the enhanced conditionality. Doubts to additional measures' compliance to generate carbon credits.

**Investment support** might promote the adoption of carbon farming practices such as conservation tillage, but do not target soil health.

Additional incentives might be: **labelling programs** (to generate additional payments for farmers on top of income from the sales of carbon credits); **research and development grants** (to improve C certification processes); **training and qualification** (soil health promoting farming)

## 10. GERMANY Soil fertility funds and CO2 lands - TUM

Both BM are placed in Germany, those rely on the same three key instruments:

- **Minimum Soil Coverage Standards (GAEC):** This measure requires farmers to maintain soil coverage during sensitive periods to reduce erosion and enhance soil health. Compliance with these standards is essential for receiving direct payments under the Common Agricultural Policy (CAP), with penalties for non-compliance.
- **DÜV - Fertiliser Ordinance:** This regulation governs the application of fertilizers and soil additives to protect soil health and reduce nitrate leaching into groundwater. It sets strict nitrogen application limits (max 170 kg N/ha) and imposes significant fines for violations, emphasizing sustainable nutrient management.
- **Impact Funds:** These funds support initiatives aimed at improving soil health by providing financial assistance for sustainable practices and facilitating knowledge transfer among farmers. They aim to promote both direct and indirect benefits for soil health through education and resource allocation



## 10 Appendix II Workshop guidelines

### Part 1: Introduction (collect informed consent while registering participants)

# INTRODUCTION

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1. Introduce the team: names, researchers, expertise
2. Explain the roles:  
Facilitators: “navigate the discussion”  
be neutral, not forcing to say
3. Explain some guidelines
  - How to participate / intervene / timing
  - How to distinguish stakeholder categories’

#### The aim of this part is to:

1. Introduce the whole workshop process. This is important so the participants understand why they are there and what will happen during the workshop.
2. Explain the roles of each team member. This is important so the participants understand who is holding the workshop.
3. Explain the guidelines. This is important so people understand their roles and how they will be executed.
  1. Note: We need to know which group of stakeholders gave us which answers. Therefore, based on the list of accepted invitations, each team will prepare a symbol for a group/actor (e.g., farmers will be represented by a circle, tree, or a specific colour,...you can be creative on this 😊). In the beginning, the stakeholders will be told that these groups have assigned this simple symbol, and they have to use it when they give us an answer for something (draw it on a Post-it, or they can be given a pen of a specific colour to write with the whole workshop). The facilitator will be responsible for checking out that these are given while answering the questions).



In general, this part should not take more than 10-15 minutes (the lesser the better, but stay clear, and provide all the information needed).

**Exercise 1: Value mapping (see PIL template report: part 4.1 for more information)**

## PART A – VALUE MAPPING

- Presentation of soil threats and business model (aka value capture) 30 mins  
 1 -2 slides, based on pentagonal problem  
 are there major concerns / integrations? Why do soils matter in the BM?
  
- Discussion on business models (aka value creation and delivery) 45 mins
  - Individuals compile post its (different colors) on guiding questions
  - Individuals place post-its in the flipchart (divided in 2 sections)
  - The group discusses about findings
  - The moderators place in the picture the business modes

1:15 hours

Part	exercise	PIL report section
A	Presentation	Value proposition (4.1 a)

### **I.PRESENTATION:**

This part serves us to:

1. Present our findings so far;
2. See if we are on the same page with the participants regarding the definition of soil health. After the presentation, we will discuss the business model presented to the participants.
3. The areas enrolled in the presentation should address these questions (see PIL template, 4.1 a):
  1. Value proposition (look at pentagonal problem)

i.What are the causes of degradation?

ii.What are the socio-technical solutions proposed (BM)?

iii.Why do soils matter in the BM?

### **II. DISCUSSION ON BUSINESS MODEL GUIDELINES:**

1. Guiding questions:

Part	exercise	PIL report section
A	Presentation	Value proposition (4.1 a)
A	Post-its and discussion	Value capture and delivery (4.2 b & c)



The guiding questions will be:

## PART A – VALUE MAPPING

Discussion on business models – guiding questions

1. Are the following **ecosystem services** provided by the BM? (list of ES based on EU soil strategy)

- If yes, how? (green post it)
- If no, why? (red post it)

who benefits from them? What trade offs emerge?

2. Are the following **incentives** targeting soil health? (list of incentives based on D3.2)

- What soil ES are targeted by the incentives?
- Where do the resources come from (public/private)?

### For question 1, we need:

1. a pre-prepared flipchart with listed ES (list based on soil strategy);
2. Post-its of two different colours (green + red for yes and no);
3. Enough pens and markers.

The idea is to ask participants to take a post-it of a specific colour (representing a yes/no answer) and their justification for the yes/no answer and then place it on the flipchart. Once they finish this part (10 mins), they discuss the trade-offs (10 mins).

### For question 2, we need:

1. A pre-prepared flipchart with a list of incentives (based on your list for WP3);
2. Post-its of two different colours (green + red for yes and no);
3. Regular yellow post-its;
4. Enough pens and markers.

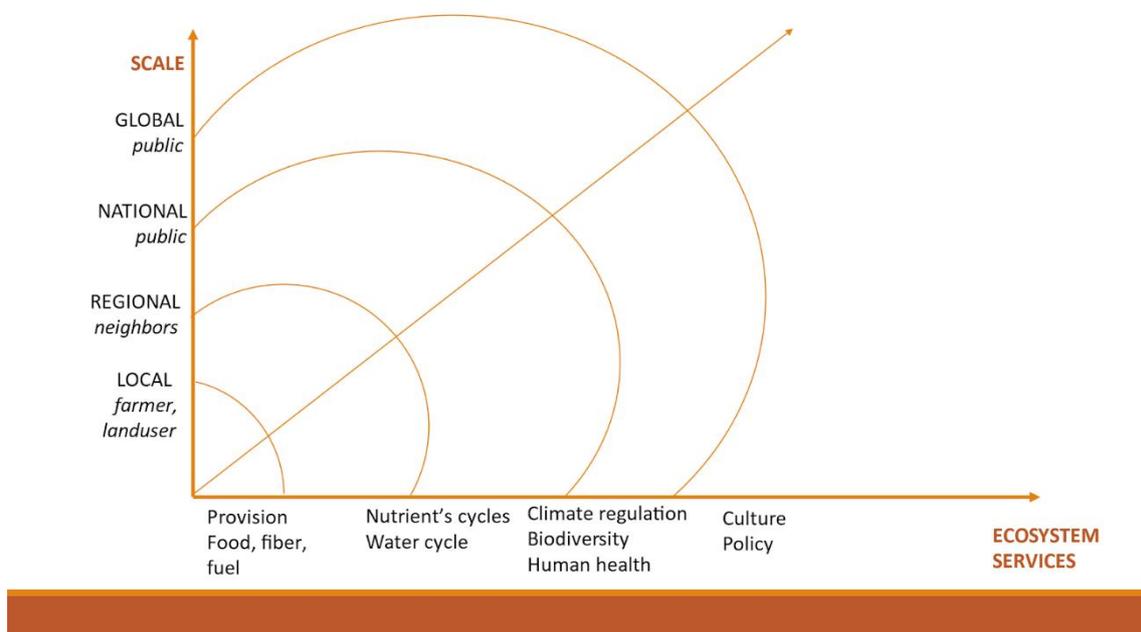
Participants are asked to add their yes/no post-its to the various incentives and writing on them the ES linked (10 mins). They are also invited to take the yellow post-its and write on them if the source of incentive is public or private (5 mins).



### Part 3: DISCUSSION OF HOW IS SOIL HEALTH FRAMED BY THE BM? (15 mins)

A pre-printed image (see next page for template, orange graph) is needed for this part. The flipcharts are discussed with participants, and moderators place the business model within the graph, considering the answers to the discussion. More than one placement might result, there is no right or wrong answer. (if time is not enough, this can still be done after the workshop).

The x axes helps to relate to what ES are actually targeted by the business model, the y axes refers to the scale of action.



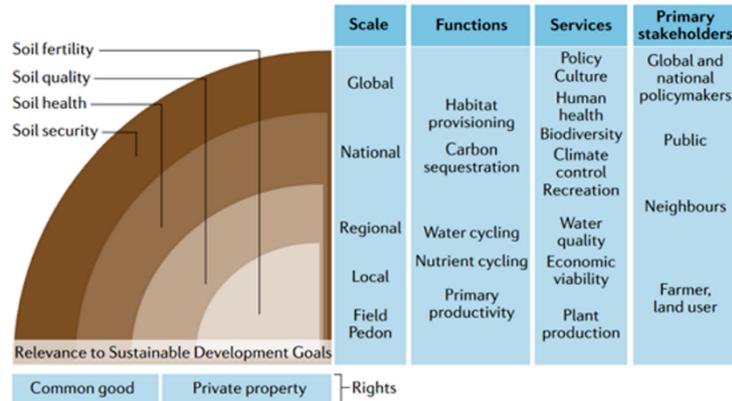
Template for placing the business model (see pp to adapt it in local national language)



# PART A – VALUE MAPPING

HOW IS SOIL HEALTH FRAMED BY THE BUSINESS MODEL?

Discuss findings and place in the picture



*Theoretical reference behind the template (Lehmann et al., 2020)*

### III. First coffee break:

This part is crucial since it provides the research team time to reflect on the process that just happened and come up with some more ideas if anything did not work in the way it needed to.

### IV. PART B: SOLUTION AND PATHWAYS MAPPING

Part	exercise	PIL report section
A	Presentation	Value proposition (4.1 a)
A	Post-its and discussion	Value capture and delivery (4.2 b & c)
A	Place in the picture	Policy narrative (3.2, table 3)
B	Question 1 and 2 (summary)	Solution mapping (4.2)
B	Question 1 and 2 (summary)	Solution mapping (4.2)
B	Place in the timescale	Pathways mapping (4.3, table 4)

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This part will feed 4.2 PIL report template parts.

## PART B – SOLUTION & PATHWAYS MAPPING

World café - how it works

45 mins

- Two smaller groups (5 – 7)
- Two tables with two flipcharts and guiding question
- One moderator and recorder / table

Temporal diagram

30 mins

One big flipchart hanging with timeframe (short – medium – long)

total 1:15 hours

For this part, you will need to apply the world café method. Keep on mind:

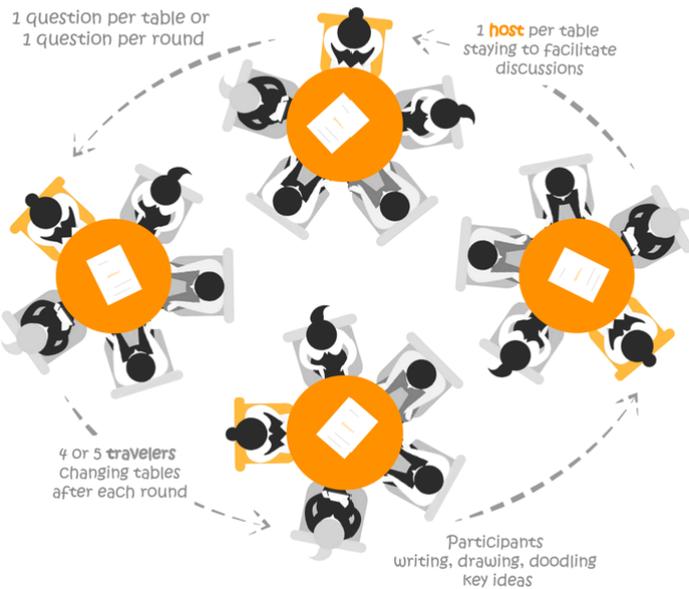
1. For the bigger groups (6-10 people), break them into two;
2. For smaller groups (2-5 people): keep the group together.

The idea behind the world café method (explanation):



## WORLD CAFE METHOD

3 or more rounds of conversation,  
approximately 20 minutes each



*General picture to how a world café looks like.*

### **Initially, the ideas behind the world café are:**

1. Get feedback from multiple stakeholders: When we break a bigger group into a smaller one, we ensure that even the quieter stakeholders get to speak. This gives us a deeper insight into the research program.
2. We move people around the room so we energize them and keep their attention;
3. We get greater feedback from stakeholders.

### **Cons (what to pay attention to):**

1. You need more tables (one table for each group);
2. Each table needs a facilitator;
3. Need for a bigger space: so each group has its own space, therefore they do not disturb each other.

### **What do you need for this exercise:**

1. Two tables;



2. 4 flipcharts (two for each table; each flipchart has a guiding question written on it);
3. Markers, pens, post-its;
4. Recorders, notebooks, things for taking notes...
5. Cameras and mobiles for taking pictures.

**This exercise is supposed to feed the 4.2 Solution mapping part of the PIL template.**

**Specifically, the guiding questions for parts 1 and 2 of this exercise are:**

## PART B – SOLUTION MAPPING

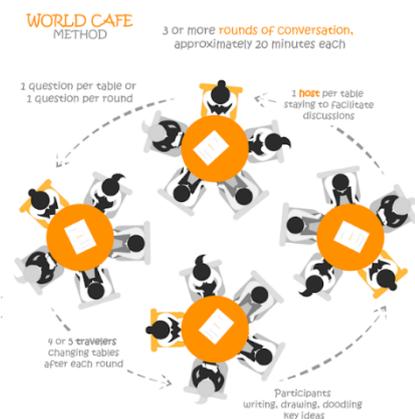
World café – guiding questions (20 min / question)

Question 1: INNOVATIONS

- What innovations are needed (e.g. products, technologies, services, infrastructure, social habits)
- How innovative is the socio-economical context?

Question 2: REGULATIONS

- What institutional instruments (e.g. binding regulations, non-binding strategies, new incentives and contractual solutions)
- What resources (skills, knowledge, partners) are missing?



**Guidelines for this exercise:**

### 1. You need to pre-prepare each table:

1. Each table has a flipchart with written questions on innovations (for part 1) and another one (which you introduce later, or it can be written on the other side of the paper) on regulations for part 2.
2. Each table has enough pens, post-its and papers for notes.
3. Each table has its facilitator to moderate the discussion.



2. You explain the to the participant the meaning of this exercise. That is, what innovations are needed, and what regulations are needed to make these innovations happen? You also explain to the participant the process of the world café.
3. You split the group and introduce them to the tables.
4. You explain the role of facilitators (they will moderate the discussion).
5. At table:
  1. You explain to participants that they will search for innovations and list them on the paper (brainstorming: they can use post-its or write them down directly on the flipchart). The time is 20 mins.
  2. After this, they search for regulations to enable these innovations (20 mins)

Note: there are several ways to link the regulations/innovations together. You can use one huge flipchart and create a mental map: use Post-its and write the innovations on them, place them on a flipchart, and then use Post-its again with regulations that you join with the original ones addressing the innovations. Or you can split the flipchart into two parts, write innovations directly on one part of it, and then reserve the second part for regulations. And then draw lines between them.

Finally, you give participants time to reflect on the missing resources that we need to make these happen (5-10 mins).

The role of the facilitator in this is:

1. To make sure that participants speak about the topic addressing the questions;
2. To keep the discussion going;
3. To explain the exercise (but be careful, we so not want to make participants to answer “what the facilitator wants to hear”): it is important to explain the participants that there are no right or wrong answers;
4. To make sure that everybody talks/participates;
5. To observe the group dynamics;
6. To take notes/record what is going on and said;
7. To take pictures of the flipcharts;



8. To ensure we can later identify the stakeholder answers (by checking out if they use the proper colour for answers/draw symbols assigned to their group...).

## V. PART B: PATHWAYS MAPPING

Part	exercise	PIL report section
A	Presentation	Value proposition (4.1 a)
A	Post-its and discussion	Value capture and delivery (4.2 b & c)
A	Place in the picture	Policy narrative (3.2, table 3)
B	Question 1 and 2 (summary)	Solution mapping (4.2)
B	Question 1 and 2 (summary)	Solution mapping (4.2)
B	Place in the timescale	Pathways mapping (4.3, table 4)

**This exercise is supposed to feed section 4.3 of the PIL report, specifically table 4.**

During the workshop, by means of a guided discussion, post-its resulted from previous exercise should be placed in the flipchart, structured as follows

## PART B - PATHWAYS MAPPING

Topic / timescale	SHORT TERM (1 – 3 years)	MEDIUM TERM (3 – 7 years)	LONG TERM (> 7 years, new CAP)	Desired vision: Business models for healthier soils
DRIVERS				
INNOVATIONS				
REGULATIONS				
RESOURCES				

*Template for flipchart of pathways mapping*

The discussion should be wrapped around three main areas:



### 4.3 Pathways mapping

Based on what discussed above, complete the table below (i.e. not all categories might be applicable, in case not please write n.a.). If relevant point emerge also indicate what trends and drivers as well as activities and resources might be needed.

- CHANGES: what is needed in terms of regulations and institutions; social habits; products and technologies, services and infrastructure?
- TRENDS/DRIVERS: what is the influence of the social, economical and environmental context?
- ACTIVITIES/RESOURCES: what skills, knowledge, partners are needed?

## PART B - PATHWAYS MAPPING

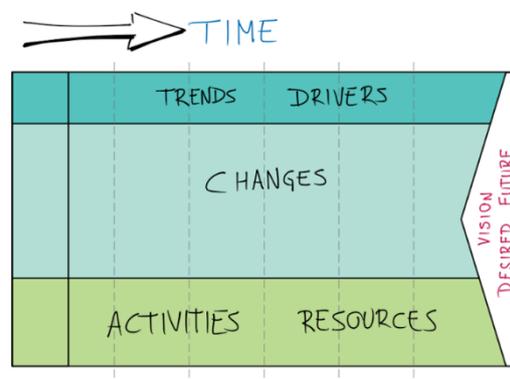
Wrap up

30 mins

- Discuss main findings and
- Place in the timescale (short – medium – long)

Presentation of results by (depends on group dynamics)

1. moderators
2. group participants



### Guidelines for this part:

1. We will again need two groups and two pre-printed tables (see picture above) with a time scale. This time scale should include three time "sections":

Short (1 -3 years), medium (3 – 7 years) , and long (> 7 years, next CAP).

2. We need Post-its and pens.
3. Each group has a facilitator, but this time, we can either place the chart on the table or on the wall so people can walk around and discuss it.
4. We ask people to think about all the categories enrolled in the above-seen picture (changes, drivers, activities) and write them on post-its. Then, they place them on the scale in the assigned section ("activities", "resources..."). We give them 15 minutes to do this.
5. After they are finished, we give them space to present the results to the other group and to discuss their ideas.



**Notes:**

More on World café method:

<https://www.involve.org.uk/resource/world-cafe#:~:text=The%20World%20Cafe%20is,open%20conversations%20to%20take%20place.>

<https://theworldcafe.com/key-concepts-resources/world-cafe-method/>

More on facilitation:

<https://www.indeed.com/career-advice/career-development/facilitation-tips>



## 11 Appendix III - Institutions involved

ITALY	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
<p>FORMAL INSTITUTIONS</p>	<p>Ministry of Agriculture, Food sovereignty and Forestry MASAF;</p> <p>Ministry of Environment and Energy Transition MASE</p> <p>CS1: Regional DG Agriculture and DG Environment, River basin consortium (weak), Regional park</p> <p>CS2: Agrobusiness industry (Flora srl)</p> <p>CS3: Regional authorities of Tuscany and Emilia-Romagna (strong)</p> <p>Local administrations (weak) [General urban plan]</p> <p>Public administration (Comunità della Pratica Agricoltura di Precisione)</p>	<p>Research centers: ISPRA, CREA, IRPET</p> <p>ARPA [environmental monitoring]</p> <p>Hydrogeological risk protection agency</p> <p>Operational innovation groups (GOI)</p> <p>Farmers Association training bureau</p> <p>CS1: Regional educational extensions</p> <p>CS3: CiRAA, technical advisors, organic certifiers</p>
<p>INFORMAL INSTITUTIONS</p>	<p>Farmers' trade associations</p> <p>Environmental organizations</p> <p>CS2: designation of origin groups (PDO, PGI, TSG), bio-districts</p> <p>CS3: The Garfagnana food and agro-biodiversity community</p>	<p>FARMERS</p> <p>Farm contractors</p> <p>CS1: (few) civil society and tourists</p> <p>CS2: (agri)tourists, local citizens, agricultural entrepreneurs</p>

CS1: District of the sands in the Po Delta

CS2: Aromatic perennials

CS3: Long term-experiment



<b>ESTONIA</b>	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
FORMAL INSTITUTIONS	Ministry of Regional Affairs and Agriculture Ministry of Climate Agricultural Registers and Information Board Agriculture and Food Board [Water Act, Plant protection act, CAP, environmentally sound mgmt eco-plan]	Extension services Educational and research centers Estonian Soil Science Society, Plant Protection Society Seed center (state owned enterprise) SoilHUB
INFORMAL INSTITUTIONS	Organic farming organizations Estonian nature conservation fund (NGO) Initiatives: Northern Roots, NGO Estonian Permaculture Association, Organic Club	FARMERS [environmentally sound mgmt eco-plan: soil analysis/5 years by beneficiaries of]

<b>LATVIA</b>	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
FORMAL INSTITUTIONS	Ministry of Agriculture Ministry of Climate Ministry of Environment National agencies with regional branches [CAP (nitrogen reduction, soil cover), tax for abandoned or degraded land.]	Advisory services Universities and Private research institutes
INFORMAL INSTITUTIONS	NGOs for environmental protection Agricultural cooperatives	FARMERS Landowners Forestry sector

CS1: digital map

CS2: agroforestry



NETHERLANDS	CONSTITUTIONAL ACTORS & ACTIONS	NON-CONSTITUTIONAL ACTORS & ACTIONS
<p>FORMAL INSTITUTIONS</p>	<p><b>ACTORS</b></p> <p>European Union, Regional and local governments (Ministry of climate, Ministry of agriculture, nature and food quality, Ministry of finances, Provinces, Waterboards)</p> <p><b>EXAMPLES OF ACTIONS:</b></p> <p>Development and enforcement of Dutch legislation such as the Dutch Fertilizer Ordinance, and others. These enforce CAP policies and strategies</p>	<p><b>ACTORS</b></p> <p>Advisors and certification bodies Knowledge institutions <i>Financial institutions suppliers (technology, feed, input), crop insurance providers, real estate and land agents</i> NGOs <i>soil sensing providers.</i></p> <p><b>ACTIONS</b></p> <p>Provision of learning materials on soil quality, demonstrations on the topic etc.</p>
<p>INFORMAL INSTITUTIONS</p>	<p><b>ACTORS</b></p> <p>Farmers' organisations (Farmers' collectives, Farmers' associations) Agricultural communities</p> <p><b>ACTIONS</b></p> <p>Farmer collective organize the nature protection activities within the Netherlands, some of them focus on soil quality.</p>	<p><b>ACTORS</b></p> <p>FARMERS: dairy and arable; intensive livestock without farmland, other (non-agricultural) landowners, water users and nature managers, <i>agricultural purchasers, distributors and retailers, contractors, rural banking institutes (financial institutes), residents</i></p> <p><b>ACTIONS</b></p> <p>Farm managers and other land users have a heterogenous opinion on how to farm best  (informal rules are heterogenous)</p>



		Rural banking institutes set up early trials for carbon credit trade
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<b>GERMANY</b>	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
FORMAL INSTITUTIONS	Ministry of Agriculture Ministry of the Environment Federal agricultural offices [CAP – AEM, Federal soil protection act]	State research center for agriculture Soil and biodiversity advisory <i>Climate humus network</i> <i>Private initiatives, foundations, NGOs</i>
INFORMAL INSTITUTIONS	Associations' projects (IG Healthy Soil, Down-to-Earth Project, and Bioland Foundation) Organic farming association	FARMERS CS1: citizens, (researchers) CS2: private donors

CS1: CO2 land (DE)

CS2: Soil Fertility Fund (DE, AT, CH)

<b>BULGARIA</b>	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
FORMAL INSTITUTIONS	Ministry of Agriculture and Food Ministry of Environment and Water Ministry of Regional Development and Public Works Regional offices Municipalities [National program for conservation, sustainable use and restoration of soils]	Advisory board Universities Advisory services and consultants
INFORMAL	Wine growing cooperative	FARMERS



INSTITUTIONS	Association of wine growers Agricultural Credit Cooperative "Solidarnost"	Local actors
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SPAIN	CONSTITUTIONAL ACTIONS	NON-CONSTITUTIONAL ACTIONS
FORMAL INSTITUTIONS	Ministry of Agriculture, Livestock, Fisheries, and Sustainable Development  Ministry for the Ecological Transition and the Demographic Challenge  State Agency for Air Safety  Autonomous communities (regional)  CS1: Urban planning department [CAP, "Green urban"]	Universities  Research centers  CS1: parks and gardens services  CS2: (few) advisory services  CS3: organic farming consultants
INFORMAL INSTITUTIONS	CS1: Neighborhood association, social gardens, NGOs [round tables]  CS2: farmers' organizations, olive growers' cooperatives  CS3: Riscal winery	CS1: CITIZENS  CS2 and CS3: FARMERS

CS1: Tamarguillo Park

CS2: Olives' integrated production

CS3: La Rueda organic vineyards