



# **NOVASOIL**

INNOVATIVE BUSINESS MODELS FOR SOIL HEALTH

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## **Inter-cropping ZSA**



## Project Consortium

N°	Participant organisation name	Country
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## 1 Background, focal question and needs

The case study "Agroforestry: Inter-cropping," initiated by ZSA (Latvia) as part of the NOVASOIL project funded by Horizon Europe, aims to explore the potential of agroforestry systems on degraded agricultural lands. Agroforestry, the practice of integrating trees and shrubs into crop and livestock systems, offers a multi-dimensional approach to addressing environmental, economic, and social challenges inherent to degraded soils. This system, 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 agroforestry system employed in the case study focuses on agricultural lands that had been ploughed for the final time in 2011, with the dominant soil textures being loam and sandy loam at varying depths. These soils, which are often prone to compaction and nutrient depletion, offered an ideal test bed for agroforestry systems that aim to restore fertility and enhance soil structure. The study employed three distinct fertilization treatments: a control group without fertilization, initial fertilization with wood ash (a mineral-rich byproduct of bioenergy production), and initial fertilization with sewage sludge (an organic fertilizer rich in nitrogen, phosphorus, and carbon). These fertilization strategies were chosen to compare their respective impacts on soil health, nutrient cycling, and crop yields over time, particularly under the unique conditions of an agroforestry system.

Agroforestry is highlighted in the study as a practice capable of providing multiple environmental benefits, particularly in terms of nutrient management, water conservation, biodiversity enhancement, and overall ecosystem resilience. One of the major benefits identified was improved nutrient management, specifically the reduced need for nitrogen fertilization, which not only lowers input costs but also contributes to better water quality by reducing the risk of eutrophication—a critical issue in many agricultural systems. The presence of trees and deep-rooted plants in agroforestry systems enhances water infiltration and retention, making crops more resilient to drought, a vital adaptation in the context of increasing climate variability. Additionally, the agroforestry system significantly improved soil health by increasing organic matter content and promoting better soil structure, thereby reducing erosion and enhancing the soil's capacity to support diverse plant life.

Biodiversity, another key focus of the study, was shown to benefit from the diverse plant species and habitats provided by agroforestry systems. The increased heterogeneity of the landscape supports a broader range of plant and animal species, contributing to a more stable and resilient ecosystem. This increased biodiversity is particularly valuable in the face of climate change and other environmental stresses, as it fosters ecosystem functions that support agricultural productivity, such as pollination and pest control.

Despite these environmental benefits, the study also outlined several significant challenges that agroforestry systems face, particularly in terms of management complexity and economic viability. The diverse crop systems in agroforestry require more intricate and labor-intensive management practices compared to conventional monocropping systems. This increased complexity translates into higher labor costs, which may deter some farmers



from adopting agroforestry practices despite their long-term benefits. Furthermore, economic considerations are a central challenge. The products from diversified agroforestry systems, while often of higher quality, may be more expensive to produce and market. This can create difficulty in finding consumers willing to pay the premium prices necessary to make these systems economically viable. Additionally, the initial costs of establishing agroforestry systems, such as the purchase and planting of trees, can be prohibitively high, especially for farmers with limited financial resources. These economic barriers represent a significant obstacle to the widespread adoption of agroforestry and highlight the need for targeted policy interventions and financial incentives.

The central question guiding this case study is how landowners engaged in agroforestry and multi-purpose farming can be compensated for the ecological services they provide while promoting sustainable land management practices. This focal question underscores the need to bridge the gap between environmental stewardship and economic sustainability. Agroforestry, while offering clear ecological advantages, does not always yield immediate financial returns, particularly in the early years when trees are still establishing and crop yields may be lower than in conventional systems. Therefore, finding mechanisms to compensate farmers for their investment in sustainable land management—whether through government subsidies, carbon credits, or payments for ecosystem services—will be crucial for the long-term success of agroforestry systems.

Moreover, specific needs that remain unaddressed include compensating farmers for the additional management complexities and higher labor costs inherent to agroforestry systems, as well as finding ways to cover the significant initial costs associated with tree planting and the establishment of diversified farming systems. Additionally, there is a critical need to address the market gap caused by consumers' unwillingness to pay premium prices for agroforestry products. Solutions to these challenges may include the development of niche markets, consumer education campaigns highlighting the benefits of sustainably produced agroforestry products, and stronger policy support to promote market access and financial compensation mechanisms for ecosystem services.

In conclusion, the NOVASOIL case study on agroforestry highlights both the immense potential and the considerable challenges associated with implementing agroforestry systems on degraded agricultural land. By restoring soil health, improving water management, and enhancing biodiversity, agroforestry presents a sustainable solution to many of the pressing environmental issues facing agriculture today. However, the success of these systems will depend on addressing the economic and management challenges that currently limit their adoption. Thus, further research and policy innovation are needed to develop business models and compensation mechanisms that make agroforestry a viable option for farmers while ensuring the long-term sustainability of agricultural ecosystems.

## 2 Policy mix

Table 1 Key elements of national **policy mix and institutional framework around soils**, based on and adapted from Rogge and Reichardt, 2016; Williamson, 2000.



Domains	Elements to consider	Description	Lickert (1-5)	
			P <sup>1</sup>	Q <sup>2</sup>
<b>0.Awareness and understanding</b>	Definition of soil health	Soil health is broadly defined by the respondents as a set of optimal conditions necessary to support various ecosystem functions, agricultural productivity, and environmental services. While some emphasize the agrochemical properties that contribute to high crop yields, others focus on a more holistic definition that includes soil's ability to support biodiversity, water filtration, and absence of harmful chemical residues. There is a general consensus that soil health represents a balance between ecosystem services, economic benefits, and societal needs.	4	2
<b>1.Policy concern</b>	Soils as policy priority	All respondents agree that soil health is considered a high policy priority. However, there is a perceived need for elevating its priority further to better address the growing environmental and agricultural challenges. The implementation of numerous measures and requirements indicates its current significance in policy, but respondents believe that more robust and targeted actions are required to make soil health a top-tier priority across all relevant sectors.	4	2
<b>2.Policy agenda on soils</b>	Political commitment towards soil health, non-binding targets	Most respondents are aware of a wide range of binding and non-binding targets aimed at promoting soil health, both at the national and regional levels. While some express concern about the potentially excessive number of regulations, others acknowledge the commitment these targets signify. The awareness and impact of these targets vary among respondents, with some being unaware of specific	3	3

<sup>1</sup> P=priority. Please rank accordingly to 5 point-Likert scale based on how these elements are currently considered in your case study: 1 no priority; 2 low priority; 3 neutral; 4 moderate priority 5 high priority

<sup>2</sup> Q=quality. Please rank accordingly to 5 point-Likert scale based on the current quality of the political process in your case study: 1 very poor -2 poor; 3 acceptable; 4 good 5 very good



		commitments or believing that current measures are insufficient.		
<b>3.Institutional environment</b>	Binding national regulations on soil	Respondents demonstrate varying levels of awareness regarding binding national regulations affecting soil health. Some are familiar with a broad range of regulations, including cover crops, fertilization rates, and maintaining high organic matter. Others have a more general understanding or lack detailed knowledge of specific regulations. A common theme is the belief that while standards are generally high, they may not be adequately targeted to address all soil health issues.	3	3
<b>4.Policy integration</b>	Interactions between and within policy sectors	There is a shared perception of a lack of effective interaction between different ministries and policy sectors when it comes to soil health. While some respondents point to poor inter-ministerial coordination, others highlight the limited but existing cooperation between ministries and municipalities. The integration of soil health into the national development plan is acknowledged, but overall, stronger and more coherent cross-sectoral cooperation is deemed necessary.	4	1
<b>5.Governance structures</b>	Levels of governance involved, roles and functions	The majority of respondents indicate that governance related to soil health is primarily managed at the national level, with national agencies playing key roles. There is also recognition of the involvement of EU-level directives that shape national policies. Some respondents mention the role of municipalities in regulating local soil health factors through their legislation, but the national level is seen as the main driver of governance in this area.	3	4
<b>6.Contracts</b>	Property rights enforcement , land tenure agreements	The contractual arrangements related to soil health are predominantly voluntary in nature. These agreements typically involve landowners collaborating with state authorities to adopt soil-friendly practices, such as through eco-schemes and other support mechanisms. In addition, voluntary agreements between landowners and private entities, including cooperatives and businesses, often focus on initiatives like carbon credit schemes aimed at promoting sustainable land management. The only	2	3



		mandatory obligation is for landowners to maintain basic land standards to prevent degradation, failure of which may result in increased property taxes or other penalties.		
<b>7.Validation and coherence</b>	Mechanisms in place to measure impacts and ensure compliance to targets and limits	The current system for validating soil health involves a partnership between state authorities and private landowners. Farmers are required to conduct regular soil testing, particularly in nitrate-vulnerable zones where testing occurs every five years, and every seven years in other areas. These results are monitored by state authorities, who also assess water quality, soil pollution, and other environmental factors. Despite these measures, there is a recognized lack of targeted soil health monitoring and effective inter-ministerial cooperation. Additionally, soil testing in forestry is less frequent due to the slower cycle of forestry operations compared to agriculture.	4	4
<b>8.Non-governmental actors</b>	Role of different actors and multi-stakeholder coordination	Non-governmental stakeholders, including landowners, farmers, the forestry sector, environmental NGOs, and academic institutions, play a significant role in promoting soil health. While governmental actors provide the regulatory framework, the active participation of these stakeholders is essential for effective implementation of soil health initiatives. However, there is limited engagement from local authorities and broader civil society. Coordination among stakeholders is mainly facilitated through working groups and advisory boards established by the Ministry of Agriculture and the Ministry of Environment. Despite these efforts, there are ongoing challenges in fostering collaboration between environmental actors and landowners, which is crucial for comprehensive soil health management.	4	2
<b>9.Allocation of resources and sources of finance</b>	Available budget for soil health and blended finance	The respondents are generally aware of the substantial financial resources allocated to soil health improvement, primarily from the European Common Agricultural Policy. Over 100 million euros have been dedicated to eco-schemes in Latvia, which support practices such as reduced tillage, cover cropping, and crop diversification.	5	5



		Nevertheless, there is ambiguity regarding the categorization of agroforestry within these measures. Although financial incentives are clear for traditional agricultural and forestry practices, it is less evident how agroforestry fits into the existing support structures. This lack of clarity may hinder the adoption of agroforestry practices that could significantly enhance soil health on degraded lands.		
<b>10. Policy consistency with soil health</b>	Synergies and trade-offs between policy sectors and towards soil ES	While Latvia's soil health policies demonstrate a general alignment with ecosystem services, there is still considerable potential for enhancement. Current policies are effectively supporting food production, biomass growth, and raw material generation, yet there is room to better utilize soil's role as a carbon sink by increasing organic matter content. Cultural ecosystem services are also well supported, with policies facilitating public access to private lands for recreational activities like camping and mushroom foraging. However, achieving the full potential of soil health policies will require improved implementation, more sustainable land management practices, and greater investment in research to unlock further ecosystem benefits.	3	3
<b>11. Contextual factors</b>	Enabling and disabling conditions	A key obstacle to effective soil health policy implementation is the general lack of public awareness regarding the essential ecosystem services that soil provides. While interest from private landowners and the availability of external funding have been positive factors, several challenges remain. Insufficient financial resources for implementing soil health measures, particularly for landowners with limited means, and the lack of a clear definition of "agroforestry" within national legislation complicate the inclusion of these practices in existing support schemes. Despite these challenges, agroforestry holds promise as a long-term economic strategy for rehabilitating degraded lands, offering potentially higher profitability compared to	4	3



		conventional forestry or agriculture in certain regions.		
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### 3 Policy directionality

*Aim of this section is to assess how existing instruments (regulatory and economic) put in place by the national policy mix are able to support business models for soil health. Policy instruments constitute the concrete tools to achieve overarching objectives and are usually associated with specific goals, i.e. the intended effect of instruments on the medium-long term. Furthermore, policy narrative are defined as the key words and concepts that express the political understanding of a problem, i.e. soil health.*

#### 3.1 Instruments

Table 3 Assessment of **policy instruments** (adapted from Rogge and Reichardt, 2016)

PRIMARY TYPE	PURPOSE TYPE		
	Supply	Demand pull	Systemic
<b>Economic instruments</b>	RD&D* grants and loans, tax incentives, state equity assistance	Subsidies, feed-in tariffs, trading systems, taxes, levies, deposit-refund-systems, public procurement, export credit guarantees	Tax and subsidy reforms, infrastructure provision, cooperative RD&D grants
<b>Regulations</b>	Patent law, property rights; land tenure;	Technology/performance labels and standards, prohibition of products/practices, application constraints; public procurement	Market design, grid access guarantee, priority feed-in, environmental liability law Information
<b>Information</b>	Professional training and qualification, entrepreneurship training, vocational training, advisory	labelling programs, public information campaigns; consumers organizations	Education system, thematic meetings, public debates, cooperative programs, clusters

PRIMARY TYPE	PURPOSE TYPE
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	Supply	Demand pull	Systemic
<b>Economic instruments</b>	RD grants, product-label grants,	Subsidy (Eco-scheme) for agroforestry, Carbon Removal Certification Framework (CRCF), initial investment in establishing woods in farmland	
<b>Regulations</b>			National legislation increasing property tax for degraded farmland
<b>Information</b>	Support for knowledge transfer through CAP network advisory services	Product and practice branding campaign financing under CAP Rural Development	
<b>Description*</b>	<p><b>Eco-scheme ” Establishing tree groups or strips in arable land”:</b></p> <ul style="list-style-type: none"> <li>• <b>Target group:</b> This instrument is designed for farmers or private land owners interested in establishing agroforestry practices such as tree groups or tree strips in arable land.</li> <li>• <b>Purpose and implementation:</b> Purpose of this eco-scheme is to boost establishment of such ecosystem services as carbon sinking, nutrient catching and overall bio-diversity increasing.</li> <li>• <b>Nature of this instrument:</b> Annual voluntary subsidy payment for newly established tree groups or strips in arable land based on hectares or meters.</li> <li>• <b>Compliance Mechanism:</b> State payment authorities evaluate the compliance with rules laid out in eco-scheme. In case of non-compliance, the subsidy is not paid out.</li> <li>• <b>Impact on Soil Health:</b> This eco-scheme directly contributes to soil health by helping with preventing nutrient leakage, preventing soil erosion, carbon sequestration.</li> </ul> <p><b>Knowledge Transfer Support under CAP Network Advisory Services:</b></p>		



- **Target Group:** The primary beneficiaries of this instrument are farmers. It is administered with advisory agencies functioning as intermediaries.
- **Purpose and Implementation:** This instrument does not directly align with EU policy objectives beyond facilitating knowledge dissemination. However, it has the potential to educate landowners on sustainable soil management practices.
- **Nature of the Instrument:** The approach is capacity-building and knowledge-based.
- **Compliance Mechanism:** There are no penalties for landowners who opt not to utilize this resource.
- **Impact on Soil Health:** Although not its primary focus, this instrument can indirectly benefit soil health by promoting knowledge transfer related to sustainable land management practices.

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

- **Target Group:** This instrument is designed for both private and public stakeholders interested in establishing a certification process for carbon credit trading.
- **Purpose and Implementation:** It indirectly supports EU objectives related to carbon sequestration and reduction of greenhouse gases.
- **Nature of the Instrument:** It is based on a results-oriented obligation.
- **Compliance Mechanism:** Non-compliance with the standardized certification framework could result in exclusion from carbon trading markets.
- **Impact on Soil Health:** While the primary aim is carbon sequestration, it could positively affect soil health through practices that enhance carbon storage.

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

- **Target Group:** Beneficiaries include cooperatives, research institutions, end-users, and non-governmental organizations (NGOs).
- **Purpose and Implementation:** This instrument does not have a direct link to EU objectives, but its outcomes may contribute to them depending on the focus of the research conducted.
- **Nature of the Instrument:** It requires compliance with results-based obligations.
- **Compliance Mechanism:** Non-compliance with grant conditions may lead to reimbursement of funds.
- **Impact on Soil Health:** While not directly aimed at soil health, research and development funded under this instrument could potentially focus on innovations that enhance soil quality.



### **National Legislation on Increased Property Tax for Degraded Farmland:**

- **Target Group:** The primary target of this legislation is landowners.
- **Purpose and Implementation:** Although not directly related to EU policy objectives, this measure aims to reduce the extent of land degradation.
- **Nature of the Instrument:** It is results-oriented, aiming for a tangible reduction in degraded land.
- **Compliance Mechanism:** Non-compliance results in the doubling of property taxes for landowners.
- **Impact on Soil Health:** This instrument is explicitly designed to promote soil conservation and reduce land degradation.

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

- **Target Group:** Beneficiaries include producer organizations, NGOs, cooperatives, and processors.
- **Purpose and Implementation:** This instrument is not directly linked to implementing EU objectives.
- **Nature of the Instrument:** It is results-oriented, focusing on achieving specific branding outcomes.
- **Compliance Mechanism:** In cases of non-compliance, recipients may be denied co-financing for branding initiatives.
- **Impact on Soil Health:** While not inherently focused on soil health, branding efforts that highlight soil-friendly products or practices could contribute to increased awareness and adoption of sustainable practices.

## **3.2 Policy narrative**

Table 3 Description of the policy narrative (based on Lehmann et al, 2020)

<b>Policy narrative (and scale of action)</b>	Effective management of soil resources is crucial, as it not only ensures the preservation of soil health and ecosystems but also supports the productive and profitable use of land. Despite its significance, soil health has traditionally been overlooked in the political realm. However, recent years have seen a shift, with many countries now implementing comprehensive strategies and legislative frameworks to tackle this issue. The European Union, in particular, has significantly increased its commitment to soil health by providing substantial funding for voluntary programs that encourage agricultural practices beneficial to soil preservation. In the context of this case study, the adoption of agroforestry techniques, such as inter-cropping on
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	<p>degraded agricultural land, represents a critical step towards a more integrated approach to soil management. Historically, Latvia's forestry sector has addressed soil health challenges more robustly and systematically than its agricultural sector. The proposed scale of action for this initiative is nationwide, as the Ministry of Agriculture in Latvia plans to introduce a new eco-scheme that will promote agroforestry practices to farmers across the country, thereby contributing to a holistic enhancement of soil health.</p>
<b>Policies and incentives in place</b>	<ol style="list-style-type: none"><li>1) Common Agricultural Policy Strategic Plan of Latvia<ul style="list-style-type: none"><li>• Eco scheme 8 " Establishing tree groups or strips in arable land" (Planned to be introduced in early 2025, as a result of Novasoil)</li><li>• Investment in material assets "investment in climate friendly soil harvesting machinery" (<i>especially important to tackle harvesting challenges in agro-forestry</i>)</li><li>• Advisory services</li></ul></li><li>2) National legislation on integrated crop growing<ul style="list-style-type: none"><li>• Mandatory soil analysis every 5 or 7 years</li><li>• Maximum fertilization rates that cannot be exceeded</li><li>• Crop rotation requirement</li></ul></li></ol>
<b>Land tenure and contracts</b>	<p>At present, there are no compulsory land contracts specifically supporting this case study. However, several voluntary initiatives exist that promote the integration of agroforestry practices. The private sector currently offers 10-year contracts aimed at establishing tree strips on cultivated land to sequester CO<sub>2</sub> and facilitate the acquisition of carbon credits. It is anticipated that, starting in early 2025, a new voluntary eco-scheme will be introduced, providing farmers with the option to enter into one-year agreements with the Ministry of Agriculture to implement agroforestry practices on arable land.</p>
<b>Management strategies applied</b>	<p>All existing policies and incentives related to agroforestry are managed by national authorities, including the Ministry of Agriculture and its affiliated agencies. Participation in these voluntary support schemes remains at the discretion of the landowners. Applications for these programs are typically submitted by the end of May, followed by the implementation of the required practices. Approval is generally granted by the end of October, provided that all stipulated conditions are met. Although the control mechanisms and administrative processes for the proposed agroforestry eco-scheme have not yet been finalized, current legislative drafts suggest that both the application procedures and the management of the scheme will be overseen by the Ministry of Agriculture and its related agencies.</p>



<b>Soil functions interested</b>	Nutrient cycling, Water cycling, Carbon sequestration mainly, Primary production secondly
<b>Ecosystem services addressed</b>	Water quality, Biodiversity, Climate control, Economic viability,

## 4 Mapping exercise

### 4.1 Synthesis of the value mapping

#### a. Value proposition (look at pentagonal problem)

- **What are the causes of degradation?**

Soil degradation is primarily driven by several factors in this context. One of the key issues is the loss of nutrients, particularly when traditional agricultural practices are applied to already degraded soils. In such conditions, nutrients like nitrate ( $\text{NO}_3$ ), potassium oxide ( $\text{K}_2\text{O}$ ), and phosphorus pentoxide ( $\text{P}_2\text{O}_5$ ) are susceptible to runoff due to the low biomass yield, which is unable to absorb these nutrients effectively, leading to their loss from the soil. Another significant factor is the decline in organic matter content. The limited biomass production on degraded lands results in insufficient organic matter being added back to the soil, reducing its overall fertility. If intensive tillage is applied, it can further exacerbate the situation by increasing soil aeration, which accelerates the decomposition of organic material, potentially leading to a negative organic matter balance. Additionally, water cycling is disrupted by traditional agricultural techniques, especially monocropping. Crops with shallow root systems are unable to effectively retain water, increasing the risk of drought in degraded soils. Although the participants of the PIL consensus indicated that the extent of degraded soils in Latvia is relatively low, these are considered the primary factors contributing to further degradation.

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

The proposed business model focuses on implementing agro-forestry intercropping practices on degraded agricultural lands. This approach is designed to enhance the long-term profitability for landowners by allowing the simultaneous harvesting of both forestry biomass and agricultural crops under improved soil conditions. Additionally, this model aims to significantly enhance the ecosystem services provided by degraded soils. By carefully selecting synergistic tree and crop species, the model seeks to improve several ecosystem services, such as water quality, biodiversity, and carbon



sequestration, compared to conventional agricultural practices on degraded lands.

- **Why do soils matter in the BM?**

Soils, particularly degraded ones, are central to this business model because traditional agricultural activities are both economically and environmentally unsustainable on such lands. The degraded condition of the soil underpins the need for this model, as conventional agricultural practices do not offer sufficient economic justification for agro-forestry on non-degraded soils. Therefore, addressing soil degradation is crucial for the feasibility and success of this business model.

**b. Value creation and delivery**

- **What soil ES are targeted by the business model? (list based on soil strategy)**

The business model directly targets several key ecosystem services, including water quality, biodiversity, climate regulation, and economic viability. These services are essential for restoring and maintaining the health and productivity of degraded soils.

- **What soil ES are not provided / neglected?**

While the business model does not primarily focus on ecosystem services related to recreation, cultural value, plant production, and human health, these aspects are not entirely overlooked. Instead, they are indirectly supported through the broader benefits of improved soil health and agro-forestry practices. The model's main focus is on enhancing soil health and its immediate ecosystem functions, but it also contributes to the wider benefits of other ecosystem services.

- **Public/private - who can benefit from that values?**

The benefits generated by this business model extend to both private and public stakeholders. On the private side, landowners gain from improved conditions for crop production in the short term and from forestry biomass in the long term. Financial incentives, such as eco-scheme support expected to be introduced in early 2025, provide additional private benefits. Public goods are also enhanced, as the ecosystem services promoted by this model, such as reduced greenhouse gas emissions, improved water quality, and increased biodiversity, contribute to the overall environmental well-being and benefit society at large.

- **What trade-offs emerge? Are the causes addressed?**

Several short-term trade-offs are associated with the implementation of agro-forestry practices, such as the initial costs for establishing tree strips, investing in appropriate machinery, and potential alterations to traditional farming practices. These challenges are expected to be mitigated over time as soil health improves and the benefits become more apparent. Another critical trade-off is the potential reduction in market-based income from crop production due to higher production costs associated with agro-forestry.



While subsidies and grants can help offset these costs, there is a need to establish a market-based premium for crops produced under agro-forestry practices to make the system financially viable.

### c. Value capture

- **What soil ES are targeted by the incentives?**

The incentives are primarily aimed at improving water quality, enhancing biodiversity, regulating climate, and ensuring the economic viability of degraded lands. These are key ecosystem services that the business model seeks to promote through various financial and policy measures.

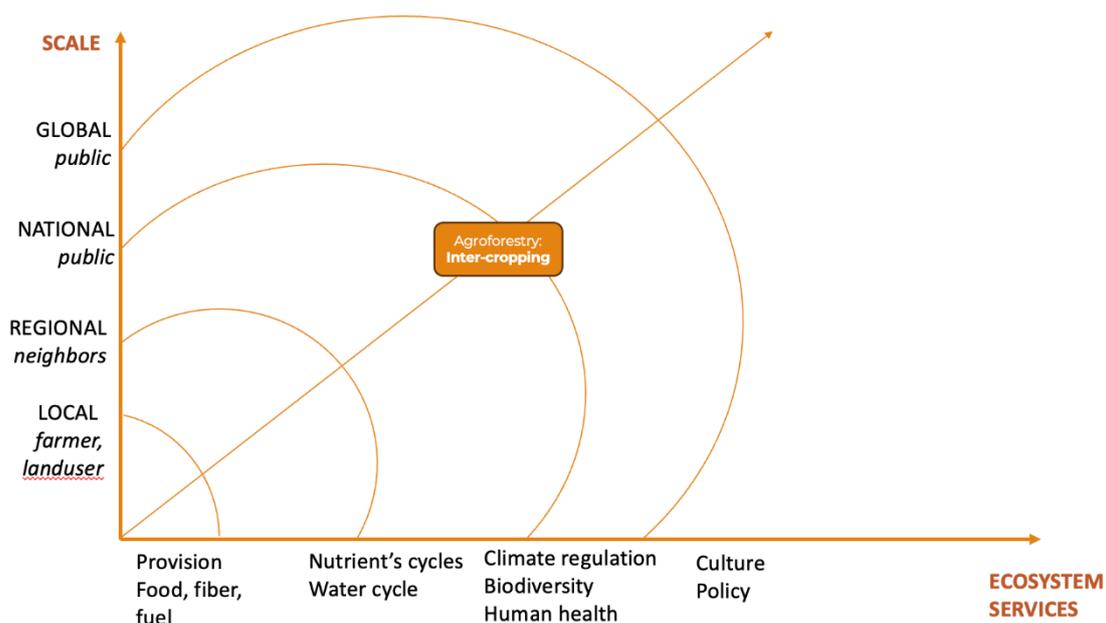
- **How is value distributed along the stakeholders?**

The distribution of value is relatively balanced, with farmers being the primary beneficiaries. They stand to gain from the increased economic viability of their land. Local and state authorities benefit from the improved environmental outcomes, such as reduced greenhouse gas emissions and enhanced biodiversity, which help meet climate and environmental targets. Advisory services also gain from the increased demand for specialized knowledge on agro-forestry practices.

- **Where do the resources come from (public/private)?**

The majority of resources are expected to come from private investments by landowners. However, public resources, such as grants, subsidies, or tax reliefs provided by state or municipal authorities, may also play a role in supporting these private investments and facilitating the broader adoption of agro-forestry practices.

- **How is soil health described and framed by the business model? (place in the picture)**





## 4.2 Solution mapping synthesis

*Finally, participants to the workshop are asked to discuss the needs changes for the development of soil health BM and frame them on a temporal scale.*

- a. What innovations and changes are we looking for?

Participants emphasized the need for innovative approaches to marketing both crop and wood products, aiming to secure a premium price compared to those produced through conventional methods. One proposed solution is the development of certification schemes and labeling initiatives using existing mechanisms to distinguish these products. Additionally, there is consensus that further research into agro-forestry practices is necessary, particularly those that explore unconventional and novel crop and wood species. Current field trials tend to focus on traditional varieties, but there is potential to create new market opportunities by introducing more innovative types.

- b. What regulatory and policy conditions would we need?

- What regulations (binding or not) and resources (new incentives) are needed?

Participants raised concerns about the lack of a comprehensive EU-wide framework for carbon certification, which makes it difficult for landowners adopting agro-forestry practices to verify whether their operations qualify for carbon credits. It was agreed that alongside existing grants for establishing agro-forestry, an additional financial incentive in the form of a subsidy would significantly enhance adoption rates. This could be facilitated through the introduction of a new eco-scheme subsidy, currently under development by the Ministry of Agriculture, following the insights gained from the PIL workshop.

- Is there some contradictions between tools and/or policies?

While no direct conflicts between existing tools or policies were identified, it is critical to establish a clear definition of agro-forestry within national legislation. This definition should delineate the specific regulations governing land used for agro-forestry practices, as there are distinct rules for agricultural and forestry lands in Latvia. Since agro-forestry intersects both categories, a new legislative framework is necessary to clarify its governance

- What could be the effect of the soil monitoring law?

The proposed soil monitoring law is expected to bring significant changes to the agricultural landscape across Europe. Primarily, it would create a unified baseline for soil analysis, ensuring consistent definitions and methodologies among farmers throughout the EU. This harmonization would enable more accurate cross-border comparisons of soil health data, facilitating better



assessments of soil conditions at a European level. Furthermore, the law would offer a structured approach to evaluating the effects of various agricultural practices on soil health, thereby providing more robust conclusions about the benefits of different methods. It would also help establish key indicators and criteria for defining soil health, contributing to a clearer understanding of what constitutes a healthy soil ecosystem. However, the law is still in development, and several uncertainties remain, particularly regarding how well the EU-wide framework will account for the diverse national and natural variations in soil types across member states. Addressing these disparities is crucial to ensuring the law's applicability and effectiveness across diverse agricultural contexts.

- What contractual solutions and terms and what kind of guarantees are needed for business model implementation? (e.g. certification)

Stakeholders agreed that the current short-term subsidy mechanism (eco-scheme), which is based on one-year contracts with the ministry, is not sustainable for the long-term promotion of agro-forestry. Although annual contracts offer flexibility for both policymakers and landowners, agro-forestry requires a much longer commitment, ideally spanning at least 20 years, to fully realize the benefits of tree and crop inter-cropping. Without such long-term contracts, landowners are likely to be reluctant to engage in this business model, as the continuity of support is not assured.

- c. What resources could facilitate the change?

Facilitating this transition would require a financial commitment, either through public funding, such as long-term contractual agreements for ongoing support, or through private financing, potentially involving long-term contracts with food retailers under private labels. The implementation of these changes would depend on proactive steps taken by both landowners and policymakers.

### 4.3 Pathways mapping

#### **- CHANGES: what is needed in terms of regulations and institutions; social habits; products and technologies, services and infrastructure?**

The term Agro-forestry has to be defined in national legislation, common framework for carbon certification on EU level has to be established, a certification of agro-forestry products and product label has to be established.

#### **- TRENDS/DRIVERS: what is the influence of the social, economical and environmental context?**

Social trend towards more sustainable products is already beneficial. In addition to this, the economic benefits for land owners from adopting these practices would further increase the adoption of this business model.

#### **- ACTIVITIES/RESOURCES: what skills, knowledge, partners are needed?**



There has to be additional research carried out to experiment with crop and tree varieties that are not traditional to Latvia. This could lead to innovative products. Additionally, general knowledge about Agro-forestry has to be exchanged among land owners.

Table 4 Pathways mapping

	<b>Short term (up to 3 years)</b>	<b>Medium (3 - 7 years)</b>	<b>Long term (after 7 years)</b>
<b>INNOVATIONS</b>			
<b>Regulations and binding policies</b>	Clear definition of agro-forestry.	Clear framework for carbon certification	
<b>Incentive instruments</b>	Eco-scheme support, Grants	Long term support measures, Grants for establishing	Long term support measures, Grants for establishing
<b>Contractual solutions</b>		Long-term contractual agreement about support from public or private actors	Long-term contractual agreement about support from public or private actors
<b>Infrastructure</b>	n/a	n/a	n/a
<b>Product</b>	Establishing certification scheme/ private label	n/a	n/a
<b>Services</b>	n/a	n/a	n/a
<b>Technology</b>	n/a	n/a	n/a
<b>Institutions</b>	n/a	n/a	n/a
<b>Actors' configuration</b>	n/a	n/a	n/a
<b>Coordination mechanisms and partnerships</b>	Contracts with policy-makers, potential contracts with retailers	Contracts with policy-makers, potential contracts with retailers	Contracts with policy-makers, potential contracts with retailers
<b>RESOURCES</b>			
	New research in less-typical crop	New research in less-typical crop	New research in less-typical crop



<b>skills, knowledge, R&amp;D</b>	synergies in agro-forestry; Knowledge transfer about agro-forestry	synergies in agro-forestry; Knowledge transfer about agro-forestry	synergies in agro-forestry; Knowledge transfer about agro-forestry
<b>DRIVERS: social habits, economic, environmental</b>	Increase of economic output of degraded land, awareness of soil ES	Increase of economic output of degraded land, awareness of soil ES	Increase of economic output of degraded land, awareness of soil ES

## 5 References

Barth, H., Ulvenblad, O., & Ulvenblad, P. (n.d.). Towards a Conceptual Framework of Sustainable Business Model Innovation in the Agri-Food Sector: A Systematic Literature Review. <https://doi.org/10.3390/su9091620>

Lehmann, J., Bossio, D. A., Kögel-Knabner, I., & Rillig, M. C. (2020). The concept and future prospects of soil health. In *Nature Reviews Earth and Environment* (Vol. 1, Issue 10, pp. 544–553). Springer Nature. <https://doi.org/10.1038/s43017-020-0080-8>

Rogge, K. S., & Reichardt, K. (2016). Policy mixes for sustainability transitions: An extended concept and framework for analysis. *Research Policy*, 45(8), 1620–1635. <https://doi.org/10.1016/j.respol.2016.04.004>

Shanahan, E. A., Jones, M. D., & Mcbeth, M. K. (2011). Policy Narratives and Policy Processesp sj\_420 535..562.