



# **NOVASOIL**

INNOVATIVE BUSINESS MODELS FOR SOIL HEALTH

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## **PIL District of the Sands**



## Project Consortium

N°	Participant organisation name	Country
1	EVENOR TECH SLU	ES
2	LEIBNIZ-ZENTRUM FUER AGRARLANDSCHAFTSFORSCHUNG	GE
3	ZEMNIEKU SAEIMA	LV
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8	ASSEMBLEE DES REGIONS EUROPEENNES FRUITIERES LEGUMIERES ET HORTICOLES	FR
9	ISTITUTO DELTA ECOLOGIA APPLICATA SRL	IT
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15	ASOCIACION AGRARIA JOVENES AGRICULTORES DE SEVILLA	ES
16	UNIVERSITY OF LEEDS	GB



# 1 Background, focal question and needs

The case study DISTRICT OF THE SANDS is set in the north-west of Italy, region of Emilia Romagna; for its characteristics this territory is considered part of the so-called *internal areas*<sup>1</sup> and comprises the municipalities of Codigoro, Copparo, Goro, Jolanda di Savoia, Mesola, Riva del Po and Tresignana (figure 1).

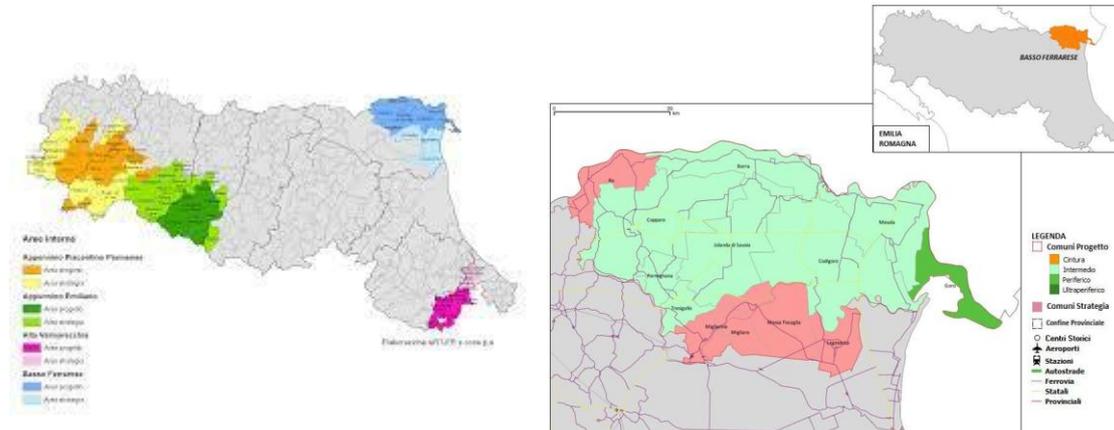


Figure 1: source regioneER and agenzia per la coesione territoriale

Agriculture plays an important role for the area but is also facing serious environmental issues related to soil health that have impact on the productivity.

The area is interested by several climate and human driven challenges that directly affect agricultural productivity. High levels of salinity, due to the proximity to the sea causing salt-water intrusion, and more frequent droughts both impact on water availability and make water management a critical issue. Furthermore, loss of soil organic matter is quite common in intensively cultivated sandy soils and poor soil biodiversity is sure likely to be found there. Finally, subsidence is decreasing land availability.

Horticulture and plant nursery under conventional farming methods are local productions that are highly remunerative, but land prices are also among the highest in Italy and contractual solutions tend to prefer land leasing. Furthermore, generational renewal rate is low, elder landowners tend to rent land to companies that intensively farm for a short time and leave depleted soils behind. Some farmers are worried about the long-term perspective of agriculture in the area and feel the climatic and societal pressure on their activity.

Sustainable farming practices start to be implemented, but uptake remains rather low. Where precision agriculture is in place water and nutrients use is reduced and enables access to new markets thanks to certification schemes,

<sup>1</sup> Internal areas – aree interne – are defined as such because of their significant distance from essential services (education, health, mobility), richness in environmental and cultural services and highly diverse due to secular processes of anthropization.



both recognized at national (organic, SQNPI) and international (GLOBALGAP) level. Economic incentives exist and include pillar I and pillar II subsidies of the CAP (agri-environmental climatic schemes and Rural Development Plan), recovery and resilience funds (PNRR)... however they are mostly distributed at single farm level. Coordination of farmers and other supply chain actors in groups (i.e. sustainability districts) could enhance collaboration and lobbying towards regional and national incentives.

New business models are needed to guarantee a long-term viability of agriculture in the area, in particular how to guarantee that short-term gains don't outweigh long-term benefits of restoring and maintaining soil health. Highlighting the shared and complex issues that are affecting all producers of the sandy district is key to enable uptake of sustainable farming practices contextual to the area. To reach and enlarge new business models for the Sand district case study is needed: a) territorial organization of farmers, b) interaction with local administrators and institutions, c) local governance for regulations and incentives with shared objectives.

FOCAL QUESTION: Given the shared local threats caused by climate change and soil degradation, how to promote interaction and coordination among local institutions to support farmers with long term objectives for sustainable production.

## 2 Policy mix

### Abbreviations

- **AES:** agro-environmental schemes
- **CAP:** Common Agricultural Policy
- **ES:** ecosystem services
- **PUG:** Piano Urbanistico Generale, general urban plan
- **RDP:** Regional Development Plan

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>2</sup>	Q <sup>3</sup>

<sup>2</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>3</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



<b>0.Awareness and understanding</b>	Definition of soil health	<p>No unique definition of soil health.</p> <p>In focus remains fertility, and consequently water storage, nutrients' cycles and SOC (2-3%), well structured, permeable, well managed, with reduced use of tillage and chemical inputs (fertilizers and pesticides). Furthermore:</p> <ul style="list-style-type: none"> <li>- vital, good soil biodiversity is defined as balanced edaphic ecosystem</li> <li>- free from threats (erosion, drought, contamination, compaction)</li> <li>- protected from hydrogeological risk (planning against it)</li> <li>- recognized as an international matter.</li> </ul>	2	4
<b>1.Policy concern</b>	Soils as policy priority	<p>Soils are not a national priority, no regulations or observatory over soils exists and responsibility is mostly delegated to single regions. In the past higher attention, now fragmented knowledge and competencies in institutions and soils are subject to personal and everchanging political interest. In terms of research, priority is given to agricultural soils, focus of CREA, soil sealing, focus of ISPRA, and hydrogeological risk.</p> <p>At regional level concrete efforts are showed i) in the agricultural sector, i.e. concern over organic matter loss and valorisation of "agricultural excellence" ii) law against soil sealing (LR 24/2017); iii) objectives of DG environment is to protect soils from hydrogeological risk.</p>	2	1
<b>2.Policy agenda on soils</b>	Political commitment towards soil health, non-binding targets	<p>Low presence of soils in Italian policy agenda, unlikely to reach objectives of Agenda 2030 or Soil Health Strategy to 2030.</p> <p>CAP measures addressing soil health are mainly non-binding instruments and voluntary ones are included in the RDP measure. In ER past regional RDP with AES aimed at protecting from erosion and hydrogeological risk (M10) and organic matter increase with organic and conservative agriculture (M11). Priority on mountain and hilly areas with high risk, Po</p>	2	2



		<p>plain area remained left out. Still low budget and small uptake.</p> <p>Current regional RDP finances organic and integrated farming with environmental conditionality as binding baseline. Interesting for soil health are BCAA5, minimum tillage, BCAA6, soil cover during 60 days, and further 4% set-aside, biodiversity, crop rotation. Moreover specific measures (SH01 and SH02) for education and consultancy (on machinery, conservative agriculture, tillage,...).</p> <p>Some positive examples can be found in:</p> <p>Information instrument is the regional webGIS <i>Catalogo dei suoli</i> tells about soil management and nutrients, every 3 or 4 years, plan to guarantee continuity. Regional project of integrated supply projects (PIF) and Groups of operational innovation (GOI) in improving soils, e.g. in mountain areas of Parmigiano Reggiano.</p> <p>Future national project for integrated monitoring system (SIM) also about soil hydrogeological risk and contamination.</p>		
<b>3.Institutional environment</b>	Binding national regulations on soil	<p>Few binding regulations are currently available to ensure soil health and depend on EU norms. Recent examples include the new nitrates directive (2023/2108), the Zero pollution action plan (COM/2021/400) and the CAP's conditionality, even though fulfillment remains voluntary.</p> <p>At national level, there are a couple of instruments that define the responsibility of the state towards protection of natural resources, the Italian constitution states in Art. 9 that the State is in charge of protecting environment, biodiversity and ecosystems, also in the interest of future generations AND in Art. 41 that economic activities, in form of private entrepreneurship, need to consider the environment that shall not be harmed. Furthermore, law 132/2016 was issued to constitute SNPA, national system to protect the environment, and to ensure monitoring of soil sealing and respect of national target. Yet, attempts for a national</p>	2	3



		<p>law against soil sealing and a soil framework law failed for now.</p> <p>Interesting soils at regional level, there is the regional law 24/2017 to contain soil sealing, and the regional decree (delibera assembleare 125/2023), stating that no more than 10% of farm surface can be devoted to solar panels; successively national decree to limit solar panel installation on agricultural soils.</p> <p>At the local level, municipalities need to issue a PUG, general urban plan, that is legally binding and concerns soils in terms of urban development.</p> <p>Concerning the Soil monitoring law, hope is to pressure Member States to guarantee and finance a uniform and continuous soil monitoring, concerns relate to indicators' applicability (e.g. SOC) and bureaucratization due to soil districts.</p>		
<p><b>4.Policy integration</b></p>	<p>Interactions between and within policy sectors</p>	<p>Low integration between policies in agriculture (focus on <b>soil productivity</b>) and environment (focus on <b>soil contamination and hydrogeological risk</b>). Increasing land take over by energy sector, i.e. solar panels on agricultural land, is additional policy sector to be integrated. Joint effort on policies to reduce hydrogeological risk.</p> <p>Uncoordinated and unequal distribution of efforts across Italian regions. For instance, soil monitoring is conducted, if at all, through different public or private institutions, without receiving inputs on priorities or baseline from national level. Only exception monitoring of <b>soil sealing</b> at regional level, feeds national research centre on environmental protection (ISPRA). Discrete technical-scientific coordination between agricultural (CREA) and environmental (ISPRA) research centres at national level, e.g. activated for feedback on proposal for EU Soil Monitoring law (concerns on some indicators' applicability on mediterranean soils, e.g. SOC and erosion).</p> <p>At regional level discrete integration between DG environment and DG</p>	<p>3</p>	<p>3</p>



		<p>agriculture, feeding analysis over effects of agricultural policies promoting sustainable soil management, e.g. increase in SOC. Yet bad integration of data produced by DG environment by local administrators e.g. on soil hydrogeological risk, that could have been informative to possibly prevent damages resulting from heavy rainfall that occurred in 2023.</p> <p>Wish for a common national structure of soil monitoring allowing adaptation to regional peculiarities (soil pedoclimatic zones). Need for coordination along regions, or interested areas e.g. River basin, to tackle common problems (soil pollution).</p>		
<b>5.Governance structures</b>	Levels of governance involved, roles and functions	<p><b>National:</b> ministry of agriculture (MASAF) and of the environment (MASE) incorporate EU directives, outline priorities and strategies and transfer them to territorial level, supported by research centres CREA and ISPRA. Yet soils have historically been responsibility of regional administrations, resulting in different approaches to monitoring and soil protection.</p> <p><b>Regional:</b> soil is concern for two DGs. <u>DG_envi</u> (DG cura del territorio e dell'ambiente): "to promote security and resilience of the territory. To improve and safeguard air, water and soil". They produce cartographies, work on hydrogeological risk, environmental monitoring (soil contamination), urban planning and agricultural development. Collaborate in EU (LIFE) projects, i.e. effect of conservative agriculture, mapping ES. <u>DG_agri</u> focus on agricultural soils' production, management and valorisation; set priorities for CAP measures' and monitor actual expenditure; participate to rural development projects; assist farmers in recovery from extreme weather events; active role in promoting legislations (e.g. solar panels). <u>River Basin Consortium</u>, in charge of water management for the Ferrara plain contribute with irrigation, thus soil salinity reduction.</p> <p><b>Local:</b> Strong role of municipalities in terms of soil use by PUG adoption to plan</p>	2	4



		urban development but gap between 21 regional directories and ca 8000 local administration (once there were the provinces) capable of adapting to local needs the general guidelines.		
<b>6.Contracts</b>	Property rights enforcement , land tenure agreements	Private property of most soils determines a difficult regulation of soils when it comes to use and agricultural management. During the past 20 years a change has occurred in regional farm average size (from 6 – 10 ha to 20 ha) with increase share of rented in land. Preference for synthetic fertilizers, deep and mechanical soil tillage and increasing temperatures have caused a progressive decrease in soil organic matter in regional soils during the past 40 years, worries about tipping points being reached. Land tenure ship allow for very short contacts (e.g. 6 months for tomato cultivation), or for overexploitation of soils especially in most productive soils (i.e. two crops per year). On the other hand, long term contract might result from use for energy production, leaving soils artificially covered for up to 30 years, with no organic matter inputs.	2	2
<b>7.Validation and coherence</b>	Mechanisms in place to measure impacts and ensure compliance to targets and limits	<p>Measurement of impacts and effectiveness of policies is absent at national level. Exceptions include i) restrictive regulation about agrivoltaics investments (63/2024), ii) yearly national soil monitoring (ISPRA), coordinated by regional observatory on soils – Emilia Romagna shows an increase in soil sealing rates, despite regional law 24/2017 – and; iii) yearly evaluation of RDP expenditure to fulfil CAP objectives and plan of evaluation and monitoring at the end of the CAP period, only agricultural soils.</p> <p>Regional cartographies provide information on few soil indicators (SOC, salinity, NPK) but other are lacking, first of all biodiversity.</p> <p>Research projects contribute to punctual monitoring, e.g. regional RDP measures to increase SOC for organic, conservative, integrated farming, compared to conventional.</p>	2	1



		General feeling that the policy targets (e.g. stop soil sealing, restore contaminated soils) cannot be respected under current conditions, also due to lack of indicators and data and difficulty of soil monitoring following JRC requirements.		
<b>8.Non-governmental actors</b>	Role of different actors and multi-stakeholder coordination	<p><b>ISPRA</b>, institute for environmental protection and research, contains a national working group of 60 people for soil sealing monitoring.</p> <p><b>CREA</b>, council for agricultural research and agricultural economics, research groups collaborate in projects and soil monitoring.</p> <p><b>EJP soil</b>: working group across CREA, ISPRA and other institutions. Collecting and systematizing know-how on soil with various national and EU projects. E.g. regional soil sealing monitoring; environmental, social and economic sustainability of food supply chains.</p> <p><b>ARPAE</b>, regional agency for environmental prevention and energy, was assigned from Emilia Romagna to conduct soil monitoring.</p> <p>Other research institutions: <b>CRPA</b> (animals' husbandry) and <b>CRPV</b> (vegetal production).</p> <p><b>Farmers' associations</b>: technical and administrative assistance and update to farmers intending to apply for CAP fundings, i.e. new agro-environmental measures. Sustainable soil management is starting to become a topic.</p> <p><b>Dinamica</b>: educational institution for farmers including sustainable soil management.</p> <p><b>River basin</b>: in particular Consorzio di Bonifica Pianura Ferrarese, indirect influence on soils, yet lack of relatedness and missing coordination. <b>Parks</b>, in particular Parco Regionale Delta del Po, host farms subject to particular management rules (Natura2000) and participate to GOI projects, e.g. communication of importance of soil mgmt. <b>GOI</b>: operational innovation groups,</p>	3	3



		<p>regional project to enhance coordination of different stakeholders (e.g. regional and national parks, farmers, research centers) on innovation topics. <b>Environmental organizations:</b> i.e. Legambiente, collaborate in LIFE projects with agricultural associations, e.g. monitoring use of pesticides on farms.</p>		
<p><b>9.Allocation of resources and sources of finance</b></p>	<p>Available budget for soil health and blended finance</p>	<p>Resources are few and (new) priorities need to be established. <u>EU funds</u> are main support to sustainable soil management through CAP. Also, source of finance for LIFE projects (sos4life, life agriCOLture), HORIZON, GOI and EJP soil group for research. Environmental funds mostly related to soil sealing (contrast and monitoring) and energy production, while agricultural funds deal with conservative farming and SOC increase. Rather few national resources are allocated for soil health, starting from national funds to contrast soil sealing, i.e. renaturalization. National PNRR projects for i) monitoring of erosion and soil organic matter, ii) integrated national soil data system, iii) solar panels installation.</p> <p>Region ER: yearly payments to ARPAE for soil monitoring service, CAP fundings for i) AES (11), e.g. conservative agriculture (increasing request but still low budget, small uptake and preference for marginal areas), ii) promoting education and consultancy, iii) past monitoring projects over SOC in soils. Lower regional autonomy will be given in new CAP. Emergency funds (27 millions) to repair hydrogeological damage and landslides, underutilized will be re-distributed to RDP on conservative agriculture.</p> <p>ISPRA invests institutional funds for soil sealing monitoring, CREA for several research projects.</p> <p>Future soil monitoring law might ensure that some national expenditure is dedicated to continuous and consistent monitoring.</p> <p>Carbon farming: interesting as new market form, more for forestry sector and</p>	<p>2</p>	<p>2</p>



		<p>opportunity for marginal areas, but effort to management adaptation (i.e. machinery, techniques, ...) and still unclear regulations are hindering factors. Increasing interest of private companies for soil health, e.g. N fixation from bacteria.</p>		
<p><b>10. Policy consistency with soil health</b></p>	<p>Synergies and trade-offs between policy sectors and towards soil ES</p>	<p>General feeling of low prevention of soil degradation processes, e.g. loss of SOC, increasing erosion and hydrogeological risk, thus higher expenditures on repairing damages than preventing. Agricultural sector needs long term programming improve soil conditions (15-20 years) meanwhile directing fundings of current CAP to guarantee continuity with past work, while also reaching EU targets e.g. 25% of organic cultivated land by 2030. Energy sector is a national priority but trade-off with agricultural and forestry production.</p> <p>On regional level, DG_envi maps several soil indicators but low deployment of information from other actors e.g. local administrations.</p>	3	3
<p><b>11. Contextual factors</b></p>	<p>Enabling and disabling conditions</p>	<p>Few conditions mentioned as enabling and dependent on actors' perception over soils' importance. Some local administrators sensitive to the topic have invested funds in assessing soil ES in face of urbanization, but most lack competences, awareness or willingness to deploy data related to soils, especially if non-agricultural ("cultural problem").</p> <p>Role of education and multidisciplinary approaches could prove key within public administrations as well as university courses, that should include soil sciences not only for agricultural and environmental curricula, but also for urban development, architecture and engineering. Soil health needs communication of degradation processes toward civil society.</p> <p>As for the agricultural sector, this has recently undergone a dramatic change, shifting from farming structure based on family farming, that valued soils as basis for production and subsistence, to new land tenures. Nowadays increasing farm</p>	2	4



		<p>dimensions and use of farm contracting (<i>controterzismo</i>) might be hindering sustainable soil management. Recently also multinational corporations operating in agriculture have started to promote sustainable soil management system, including cover crops with legumes to reduce the use of chemical fertilizer.</p> <p>Conversely, farmers with tighter contact to their fields tend to better know and manage soils. Recent territorial experiences of small farms joining LIFE projects or forming a consortium to share challenges, efforts and access to CAP fundings provide examples of enabling conditions. Despite some diffidence and still low numbers (0,1%), farmers in the region seem open towards innovation, in particular in the case of conservative agriculture (and related fundings) in mountain and hilly areas. Young farmers perceived as more sensitive to the topic, also in a future perspective of livelihood. However, technical advice especially for sustainable soil management are poorly developed in the region, and farmers' association often lack expertise to support farmers on these practices. Only few producers' cooperatives are developing some sort of support and technical advice focusing on soil health.</p>		
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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 is 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
Economic instruments		<b>AEC MEASURES</b>	
Regulations			<b>CARBON CREDITS</b>
Information			<b>SUSTAINABILITY DISTRICTS</b>
<b>Description</b>	<p><b>AEC measures</b> are subsidies given to farmers that comply with voluntary standards. They fulfil CAP strategic objectives (SO4, SO5, SO6). Soil coverage, crop rotation and minimum tillage directly improve soil health (increased SOC, water retention, biodiversity), being continuous application of AEC measures over medium or long periods especially beneficial.</p> <p>In the event of non-compliance farmer would not receive the supposed payments, thus not be compensated for increased costs or incentivised for beneficial results. Farmers have the opportunity to correct non-compliant practices but face administrative penalties for serious or repeated violations.</p> <p>Effect: medium</p> <p><b>Carbon credits</b> could constitute an incentive to sustainable soil management for single farmers and landowners and could contribute to store CO<sub>2</sub>, producing credits to be sold on the market. Regulatory framework is under discussion at EU level, so uncertainty of obligations and sanctions as well as markets prices are for now hindering uptake. Farmers declared to be more interested in carbon credits as additional benefit to other instruments and CAP payments (e.g. carbon farming schemes envisioned). Also, a hybrid contractual model of action based and result based carbon credits generation seem to play a role in risk perception and acceptability of such credit schemes (Raina et al., 2024). Supposed contribution to soil health is directly in form of increased SOC, indirectly in improved soil structure, water retention, biodiversity and nutrients' cycles; yet long term effects of soil carbon storage are rather unsure according to literature (Paul et al. 2023).</p> <p>Effect: low</p> <p><b>Sustainability districts</b>, multiple stakeholders (farmers' landowners, supply chain actors, local administrators, labelling schemes, ...) formally constitute a <i>district</i>, which is a territorial and landscape unit of organization. In this way they collaborate in recognizing common soil threats (low SOC, saltwater intrusion, subsidence) and in finding common solutions. Additionally, participant could gain an increased</p>		



	<p>income based on sustainability/quality label that make the districts' products recognizable (e.g. Distretto delle sabbie).</p> <p>The Soil Monitoring Law currently under discussion envisions the constitution of soil districts, which goes in the same direction, obligation concern a periodic monitoring of soil indicators in order to ensure increased soil health. Sanctions in the event of non-compliance shall be discussed and established among participant to the district, as for the soil monitoring law, sanctions are still unknown.</p> <p>Soil health is directly affected by shared sustainable soil management, and indirectly by knowledge exchange. Products from that area become recognizable for their characteristics, further incorporating cultural ES (local landscape, community, ...)</p> <p>Effect: medium</p>
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*\*Please describe the effect on soil health further considering:*

- *who is the target of this instrument,*
- *does this instrument serve to implement an EU objective,*
- *is this instrument based on obligations of result or of means,*
- *what are the sanctions in the event of non-compliance,*
- *does this instrument directly or indirectly target soil health*

### 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>	<b>Policies and incentives in place</b>	<b>Land tenure and contracts</b>	<b>Management strategies applied</b>	<b>Soil functions interested</b>	<b>Ecosystem services addressed</b>
Soil fertility  Given that current available policies at regional level mostly focus on local fertility.	Policy interventions mostly relate to CAP, AES for improved SOC, conservative agriculture and organic farming.  Farmers are interested in future C credits, if possible, to be	Different arrangements in place, but short-term contracts tend to prevail in high value (horticultural) production and are especially problematic to ensure	Conservative and organic agriculture: minimum tillage, crop rotation, cover crops, organic fertilizers, set-asides and flower strips. Nutrients cycling focus on nitrogen; water cycling focus on	Primary productivity, key to ensure livelihood or rural areas of the Po Delta that highly rely on	YES:1 and 2 YN: 3, 4, 5 NO: 6, 7  In order to reach further ES the Sand district approach to could enable more result towards SH, yet actor coordination



	added to CAP subsidies.	long term soil health.	salinity reduction.	agriculture,	is not granted

## 4 Mapping exercise

The **Policy Innovation Lab workshop** was organized on May 29<sup>th</sup> 2024 at the University of Ferrara. It was participated by 12 stakeholders (see following table) selected among those relevant to the case study and moderated by two researchers of UNIFE and two researchers from IDECO.

	<b>STAKEHOLDER TYPE</b>	<b>Organization / institution</b>
1	Researcher	University of Ferrara
2	Researcher	University of Ferrara
3	Researcher	University of Ferrara
4	Technician	Fondazione Navarra
5	Technician	UNIMA
6	Farmer	Az. Agricola La Sante
7	Farmer	Società Agricola Porto Felloni
8	Farmer	Az. Agricola Mazzoni
9	Farmer	Consorzio Uomini Massenzatica
10	Farmers' association	Confagricoltura
11	Farmers' association	Confederazione Italiana Agricoltori
12	Landscape architect	Metropoli di Paesaggio

### 4.1 Synthesis of the value mapping

*Aim of the value mapping is to understand level of awareness of and purpose towards soil health as framed by the business model (Barth et al, 2015).*

- a. Value proposition



- What are the causes of degradation?
  - loss of SOC, also enhanced by high sand content;
  - increased salinity levels, affecting nutrients' cycles, thus loss of productivity and soil biodiversity;
  - subsidence, physical loss of soil

- What is the socio-technical solutions proposed (BM)?

The business model of a **Sustainability District** seeks to organize local actors, from farmers and landowners, around the shared issues of soil degradation (loss of SOC, salinity and subsidence). The district as a form of actors' coordination can contribute to i) valorize local productions that both deal with difficult soil conditions and apply sustainable soil management; ii) access to public and private fundings not as individuals; iii) exchange knowledge and expertise between actors; iv) create an extension service, possibly related to the university, that precisely conducts research on local soil threats and needs.

- Why do soils matter in the BM?

Agriculture plays a key role in the local economy, therefore protecting soil health and enabling development of business models that valorize actions towards improved soil health in agricultural production may contribute to increased livelihood and wellbeing.

b. Value creation and delivery

- What soil ES are targeted by the business model? (list based on soil strategy)
- What soil ES are not provided / neglected?

SOIL ES	NOTE
<b>Food production (11 yes)</b>	Agriculture and animal husbandry can benefit from soil health with improved fertility, therefore productivity. Primary sector important in the area, increased variability of cultivation.
<b>Biomass (8 yes)</b>	To produce compost and other soil conditioners, also in view of circular economy.
<b>Raw materials (4 yes, 2 no)</b>	
<b>Regulates water and nutrients' cycles (6 yes, 4 no)</b>	Improved water retention capacity and groundwater recharge. Water important element of the territory of the Po Delta, basic resource both in natural park and urbanized areas. However, difficult to measure the contribution of natural cycles, moreover low organic matter content negatively influences nutrients' cycles.



<b>Climate regulation (3 yes, 4 no)</b>	Soil coverage can contribute to it, yet difficult to quantify and not only depending from agriculture but also other activities.
<b>Carbon sink (7 yes, 2 no)</b>	Besides vegetation soils can contribute in absorbing CO <sub>2</sub> . Carbon can be better stored in soils that are far from desertification risk. Furthermore, peatland and humid areas play a key role in CO <sub>2</sub> uptake, therefore are an irreplaceable resource. More soil life can mean higher CO <sub>2</sub> content.
<b>Biodiversity reservoir (7 yes, 3 no)</b>	The territory, given the presence of the Po Delta, can count on a certain biodiversity. Yet, actors believe there is room for improvement and real soil biodiversity, microfauna and microflora is uncertain.
<b>Host human activities (6 yes, 1 no)</b>	Agriculture is the main activity, improved productivity determines improved profitability, thus permanence and livelihood of the area. Tourism is a minor activity that is to be implemented or improved.
<b>Archive of historical and archeological heritage (4 yes, 2 no)</b>	To be safeguarded, the territory is under fast degradation and threat of salt wedge, thus conservation could be negatively influenced.

- Public/private - who can benefit from those values?

Given the agricultural focus of the area, most ES target food and biomass production, therefore benefit private owners and companies. Yet, understanding soils also as carbon reservoirs goes in the direction of public good that might be combined with private benefit, i.e. carbon credits.

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

Low understanding of soils as able to deliver public good, as ES that contribute to human wellbeing, cultural conservation as well as environmental values of climate mitigation and biodiversity preservation.

c. Value capture

- What soil ES are targeted by the incentives?
- How is value distributed along the stakeholders?
- Where do the resources come from (public/private)?

**a. Agro-environmental-climate measures (4 yes, 1 maybe, 1 no)**

Agro-environmental measures could contribute to improved soil health and to farms' income, but improved design, more resources and simplified bureaucracy is needed. One stakeholder felt that increased standardization of such measures is not effective in reaching agro-environmental sustainability objectives.



**b. Collective actions / districts? (e.g. creation of food districts, business networks, Temporary Association of Companies (TAC), associations) (2 yes, 2 maybe, 1 no)**

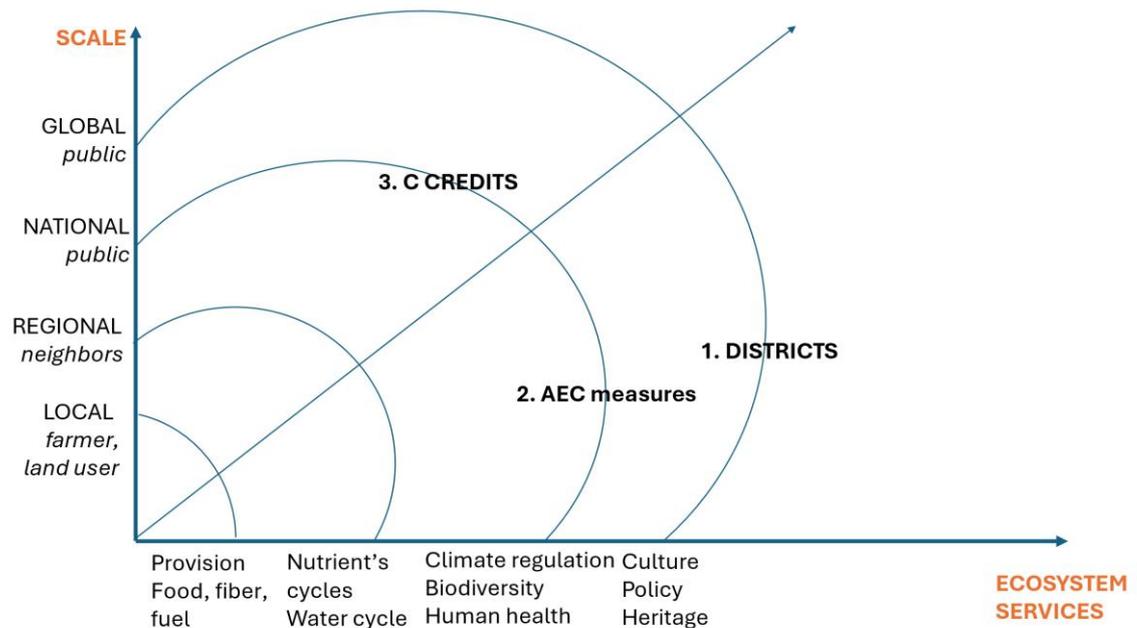
Collective actions could be interesting because of i) the increased bargaining power of producers in order to guarantee better product's price; and ii) promotion of the territory that is characterized by soils with given features. Yet, it is seen more a business model than an incentive per se, and access to market is believed to be difficult, stakeholders suggested to combine it with other benefits i.e. incentives.

**c. Carbon credits (4 maybes)**

Carbon credits could contribute to soil health and to farms' income, but there is the need for a new and clear regulatory framework. Moreover, carbon monitoring should be not based on standardized measurements, in fact threshold values proposed at EU level not always apply to Italian standards. The uncertainty of carbon credits market is also not in favour of this incentive.

In general, the three incentives were perceived as potentially promoting sustainable soil management both from the public and private sector; however, the starting point was seen as missing given that these incentives would base on long term policies which are still lacking from the political agenda. Moreover, stakeholders felt that incentives would also be needed to improve farmers' and technicians' awareness and knowledge over soil health. Finally, urban planning was suggested to better integrate soils by protecting and valorising all forms of landscape, considering also the long-term objective of zero net land take by 2050.

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



Concerning the different business models and incentives discussed, it emerged that:

1. Food districts / collective action as business model could include the largest number of ES, including: identity, landscape and history, in one-word local prosperity. This BM acts mainly on local level but interacts with regional and national level to access fundings and grants.
2. Agri-environmental climatic measures ad hoc can contribute at local level in protecting wetlands and biodiversity, and incentivizing carbon storage.
3. Carbon credits (especially enhanced by use of biochar or zeolite) can contribute in improving production, quality of water and nutrients' availability can be monitored. It is applicable to a restricted territory (local) and can include also supply chains of transformation and distribution. It reaches a national scale when it comes to regulations, i.e. over soil conditioners and future carbon credits.

## 4.2 Solution mapping synthesis

Answer to the following questions is to be found in the table 4 below, where solutions are synthesized and placed in a timeframe of pathways.

- a. What innovations and changes are we looking for?
- b. What regulatory and policy conditions would we need?
  - What regulations (binding or not) and resources (new incentives) are needed?
  - Are there some contradictions between tools and/or policies?



- What could be the effect of the soil monitoring law?
  - What contractual solutions and terms and what kind of guarantees are needed for business model implementation? (e.g. certification)
- c. What resources could facilitate the change?

### 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 emerges also indicate what trends and divers as well as activities and resources might be needed.

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 national regulations on: soil monitoring law; carbon credits; soil sealing.	Review definition of <i>park</i> , combination of agriculture and environment; not only constraint.	<i>District</i> as a legally recognized entity
<b>Incentive instruments</b>	Incentives and investment measures for soils	Review priorities of regional funds	
<b>Contractual solutions</b>		Supply chain contracts.	
<b>Product</b>	Use of soil conditioners and valorisation of local resources (e.g. poultry manure)	Simplify analysis of soil microorganisms and use them to improve fertility and quality	
<b>Services planning</b> /		Spatial approach and centrality of urban plans but promoting peculiarities. Buffer areas around urban areas (not buildable)	



		Ex. VALSAT, new assessment according to "sustainability"	
<b>Technology technical</b>	/	Innovative water and soil management with monitoring systems and soil mapping; survey resources from agricultural activities in relation to soil type.	
<b>Technology farming techniques</b>	/	Conservative agriculture.	Precision farming.
<b>Institutions</b>		Reduce bureaucracy for fundings and deresponsibilization, enhance relatedness to the territory. Collaboration and holistic approach form institutions.	
<b>Actors' configuration</b>		Territorial approach to soil health, e.g. Po river basin Coordination among actors, merging discussion from institutional level with discussion between companies and actors.	Sustainability territorial district
<b>Coordination mechanisms and partnerships</b>		Cooperatives and partnerships for soil management.	
<b>RESOURCES</b>			
		Knowledge transfer, technician training (on integrated agriculture);	Digital systems training for precision farming.



<b>Knowledge and skills</b>	Specialized technical assistance and training of new people in soil management and agri-environmental practices;  Aid and technical assistance even for small farms (service?)	Specialized consulting, e.g., DSG (carbon footprint) balance sheet.	
	Innovative dissemination and skills training systems for technicians and operators, as well as for administrators (ongoing).		
<b>R &amp; D</b>		Data: digitalization, accessibility, management and surveying.	Technical assistance and scientific outreach (e.g., extension service on sand district - UNIFE)
<b>DRIVERS: social habits, economic, environmental</b>		Territorial approach to soil health, e.g. river basin.  Reduce bureaucracy for fundings and deresponsibilization, enhance relatedness to the territory.  Enable coexistence of different farm sizes and priorities.	Sand district open to innovation, possible BM of agriculture and tourism but lack of generational renewal. Understand soils as complex systems and the sand district as an urban-rural territory.

## 5 References



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