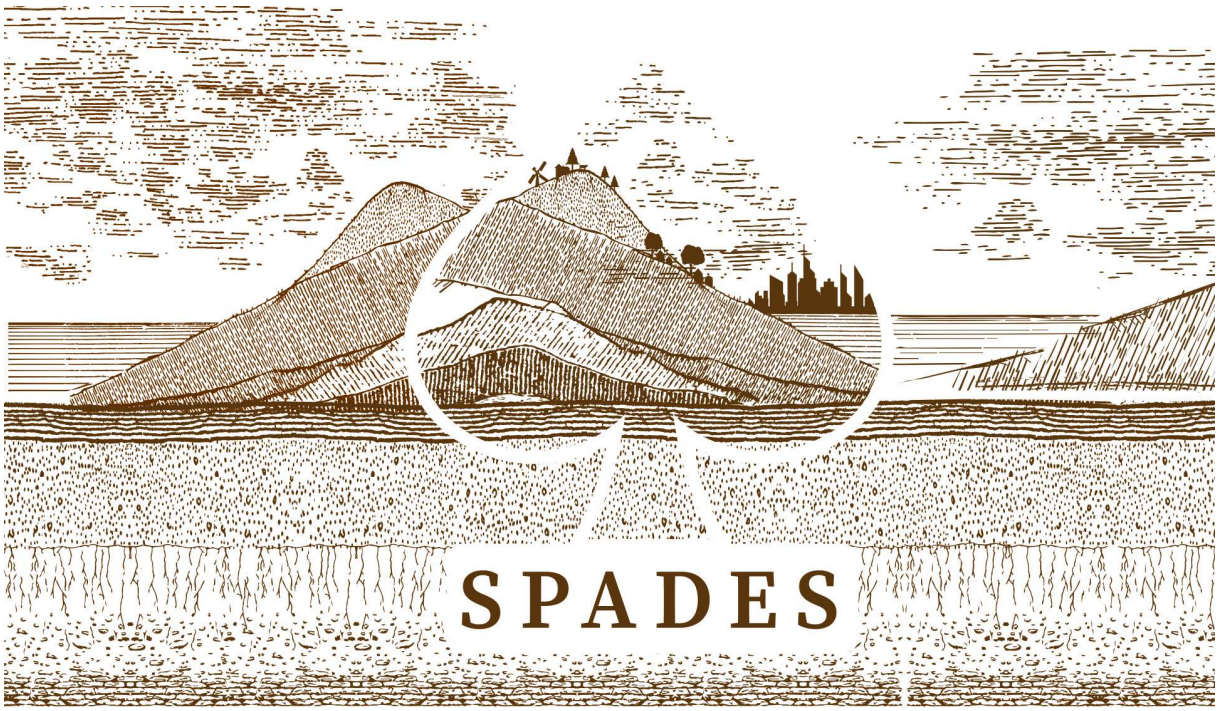
SPADES PILOTS: INTEGRATION OF SOILS IN SPATIAL PLANNING PRACTICES

Deliverable 3.1



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ABBREVIATIONS AND ACRONYMS

D	Deliverable
EC	European Commission
EU	European Union
M	Month
NA	Not applicable
NGO	Non-Governmental Organization
WIM	Walk-in Meeting
T	Task
WP	Work Package

CONTENTS

SPADES PROJECT AND CONSORTIUM

SPADES' mission is to develop, test and implement soil-inclusive spatial planning strategies to support the transition towards soil health in Europe. Soil health is highly under pressure and the soil's ability to perform essential ecosystem services should be improved to cope with pressures such as climate change and need such as a healthy (living) environment. Spatial planning and design are practices that, when enriched by soil care, can enhance the current status of soils and support societal challenges and needs, while avoiding unwanted trade-offs towards other areas, generations or functions. SPADES will therefor provide a comprehensive state of the art on both planning and design practices, as on soil instruments. To be able to make a transition in spatial planning and design towards healthy soils a fundamental understanding of the current mechanisms is key. SPADES will develop integrative instruments and improve the information basis and brokerage to bring the spatial planning and design field and soil sector together. This will contribute to the methodological basis.

1. INTRODUCTION

1.1. Presentation of the role of pilots in SPADES

SPADES includes research and innovation activities in 17 pilots in 10 member states (Figure 1), covering a broad range of land uses (urban, peri-urban and rural areas), time and spatial scales, and soil and planning challenges. This is done in WP3 "Pilots: Cocreation of soil-inclusive spatial strategies", together with local practitioners and policy makers to develop fit-for-purpose soil-inclusive spatial strategies to support different goals such as land degradation neutrality and no net land take.

WP3 objectives are the following:

- Understand if and how soils are currently integrated in spatial planning strategies, in relation to other resources (such as water), in a diversity of pilots, representing a wide array of planning systems and soils challenges.
- Co-create spatial planning strategies at diverse territorial scales to better integrate soils and a diversity of societal demands on soils (and land), e.g., urban development, climate change adaptation/mitigation, water management, biodiversity conservation, food planning.
- Implement innovative strategies and test instruments in a selected number of pilots.
- Evaluate progress in each pilot and identify solutions, required trade-offs, levers and bottlenecks for adoption, implementation, and dissemination of soil-planning innovations.

The 17 SPADES pilots are divided into 3 pilot families, that are working in tasks which focus on different scales (regional strategies in T3.1., urban/peri-urban in T3.2. and rural/peri-urban areas in T3.3), involving different planning instruments in response to complementary societal demands.

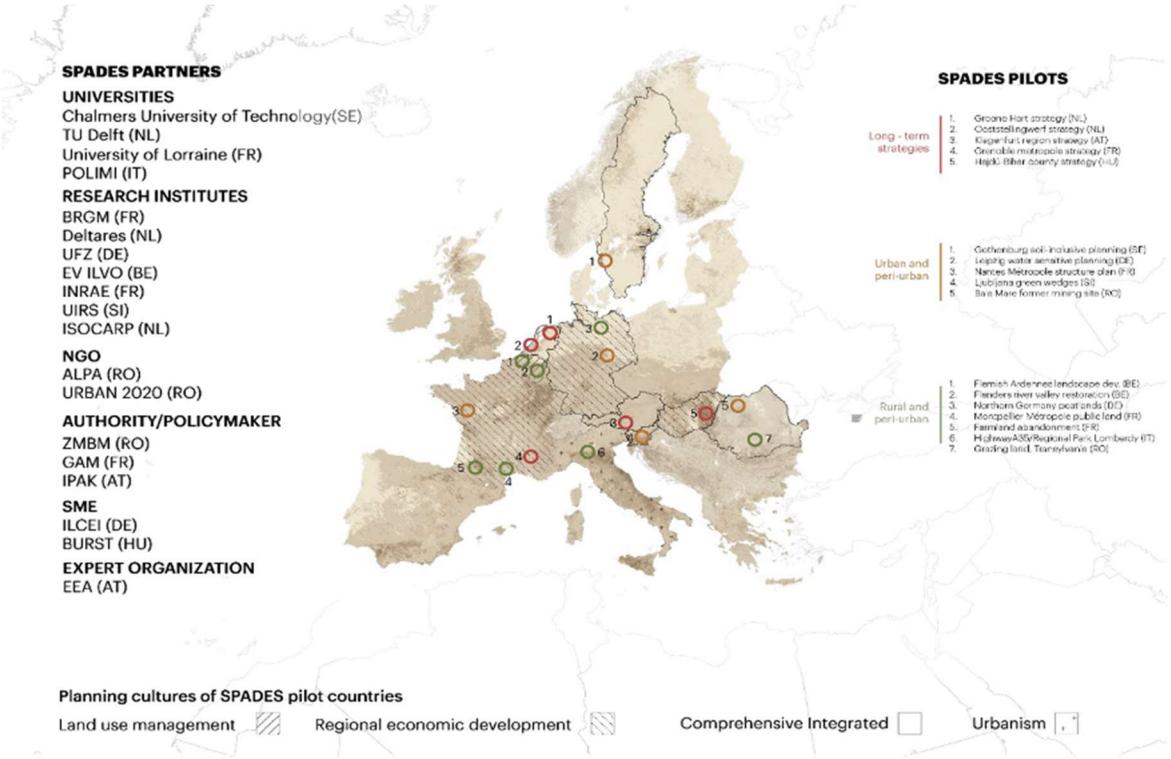


FIGURE 1: MAP OF SPADES PARTNERS AND PILOTS

The pilots go through 4 phases (Figure 2): diagnosis, co-creation, implementation and evaluation. The aim of the diagnosis phase was to have a common and specific understanding of what the pilots are willing to achieve in the SPADES project, what their own challenges and opportunities are.

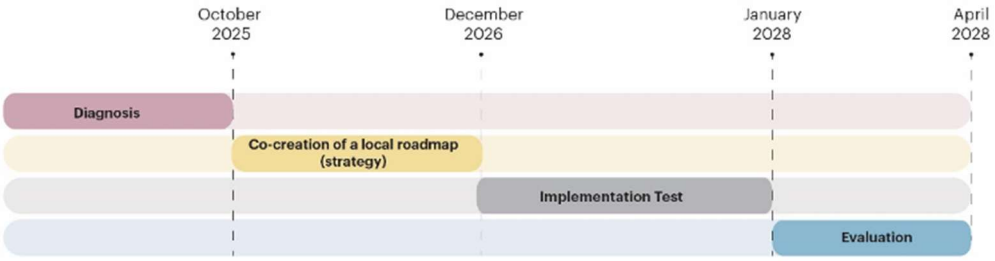


FIGURE 2: TIMELINE OF WORK IN SPADES PILOTS

1.2. Aim of this report: synthesis of the diagnosis conducted in the pilots

The D3.1 deliverable report presents the synthesis of the 17 diagnoses that were conducted in 2026 (M6-M16 links to the first WP3 objective). In each pilot, the researchers together with the pilot partners have refined local soil and planning challenges, explored the current state of integration of soil in the local spatial planning system, identified the local instruments, tools, and data currently used in practice, and the specific levers, barriers, bottlenecks or boundaries that need to be spanned, to better integrate soils into spatial planning. This included social, economic, and cultural factors, mapping power dynamics (among actors and policies at different levels) and highlighting trade-offs, controversies, conflicts, and existing arrangements.

Methods for such diagnostics included public policy documents analysis, stakeholders mapping, qualitative interviews (with local government departments' staff, their partners, and other local stakeholders), and the organisation of a first in-person local multi-stakeholders' workshop in each pilot (List of all local workshops/events organised in Appendix).

Each pilot delivered in October 2026 a report by filling in the diagnosis workbook, which gave a common analytical framework. Each pilot presented in an online cross-fertilisation workshop on 16–17 October 2025 the key findings of their local diagnosis of the current integration of soil in the local spatial planning system, and of the first local multi-stakeholders' workshop. These presentations provided a unique opportunity to better understand what the pilots aim to achieve within SPADES — from their policy objectives and planning approaches to the specific challenges and opportunities they face at local level. Beyond sharing individual progress, the workshop also served as the first collective step toward cross-learning among the pilots, helping to identify common themes, shared challenges, and emerging needs, offering valuable insights into how the SPADES consortium can provide targeted support and foster mutual learning.

The results of this phase are presented in various formats: 17 diagnostic workbooks (60-100 pages each), 17 PowerPoint presentations, 17 posters, 17 short videos[1] extracted from the cross-fertilisation workshop.

This rich material was analysed by the SPADES researchers. The D3.1. deliverable report aims to present the synthetic results of this transversal analysis.

1.3. Use of this document

This D3.1. deliverable report is structured as follows:

- Chapter 2, written by WP3 WP and task leads, gives an overview of the results of SPADES diagnosis phase at the level of the 3 families (or clusters) of pilots: the long-term strategy pilots (section 2.1, by Mark Niesten), urban and peri-urban pilots (section 2.2, by Jenny Norrman), rural and peri-urban pilots (section 2.3, by Jeroen De Waegemaeker), plus a final section on common challenges (section 2.4, by Coline Perrin).
- Chapter 3 brings transversal results across the 17 pilots, with thematic entries on policies, good practices, instruments, and needs. Each section is the result of the transversal analysis of the 17 diagnoses conducted by WP1 “Soil in spatial planning systems, design concepts and strategies” and WP2 “The potential of soil in spatial strategies” researchers (sections’ contributors: 3.1: Marcin Dabrowski, Boštjan Cotič, Liljana Jankovič Grobelšek, Robi Koščak; 3.2: Roger Roca, Hsoc Mathai; 3.3: Tannya Pico, Yoann Clouet; 3.4: Teodora Todoric Vekic; 3.5: Sophia Arbara).
- The Appendix presents a one-page overview and summary of each of the 17 pilots, prepared by WP3 task leaders, and reviewed by each pilot partner, as well as the list of all local workshops/events organised by the SPADES project in pilots, mentioning the number of participants/ the audience.

[1] https://www.youtube.com/playlist?list=PL5F--Fcau3RxWpzjDbdhHN2C2h0Q1hJGE

2. PRESENTATION OF THE PILOTS' AMBITIONS AND BARRIERS IN INTEGRATING SOIL IN SPATIAL PLANNING PRACTICES

In this chapter, the first three sections (2.1–2.3) examine each pilot family in turn. They highlight key features, shared soil and planning challenges, barriers, boundary-spanning needs, and common ambitions in SPADES. Section 2.4 discusses transversal challenges across these 3 families of pilots and proposes next steps for handling these common challenges in SPADES in 2026.

2.1 Long-term strategy pilots

Distinctive features

The five long-term strategy pilots (Figure 3) collectively demonstrate how long-term strategies can be developed in a way that is spatially inclusive, multilevel, and action oriented. Each pilot covers rural, peri-urban, and urban areas, which naturally introduces a wide spectrum of planning and soil related challenges. By spanning this full territorial gradient, the pilots reveal how spatial development strategies can respond to highly diverse landscape dynamics, land use pressures, and environmental conditions.

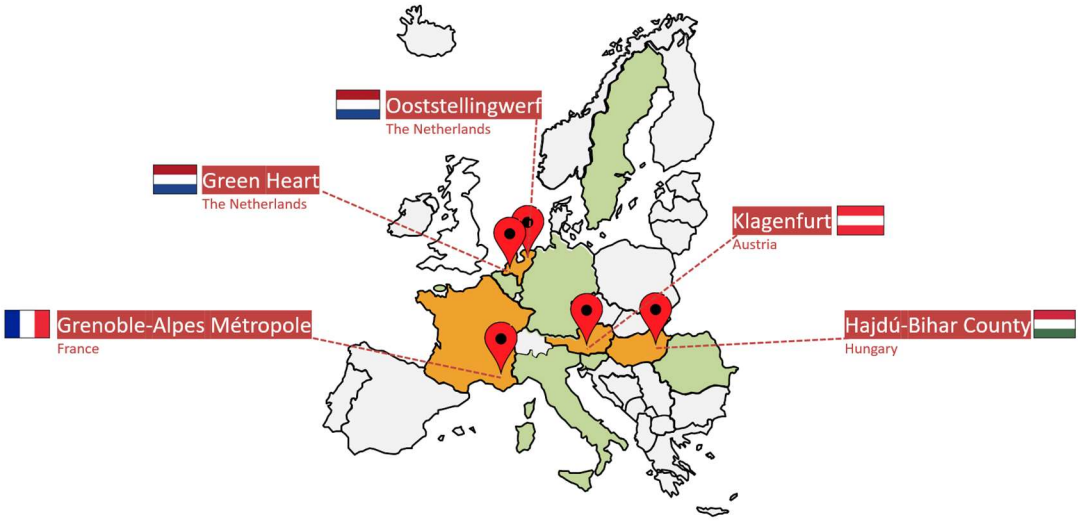


FIGURE 3: OVERVIEW LOCATIONS OF LONG-TERM STRATEGY PILOTS

A second defining feature of these pilots is their multiscale character. They mostly operate simultaneously at regional, subregional, and local levels, requiring the alignment of distinct systems such as ecological networks, governance structures, infrastructural frameworks, and socioeconomic processes. Working across scales highlights the interconnections — sometimes synergies, sometimes tensions — between strategic regional ambitions and concrete local realities. This approach supports more integrated decision making, helping stakeholders understand how interventions at one level influence outcomes at another.

These pilots also show the importance of linking long-term planning with short-term interventions. Strategic visions and long-range development pathways are translated into practical operational steps, management measures, and early actions. These early interventions often serve as catalysts that test ideas, build momentum, and provide tangible results while maintaining a coherent direction toward long-term objectives for spatial development considering soil resources. In this way, these pilots operate not just as conceptual exercises but as frameworks that can guide and inspire more detailed, place-specific projects.

Finally, each of the long-term strategy pilots integrates a broad range of societal challenges. Rather than focusing on a single sector, they adopt cross-sectoral approaches that connect natural, social, and economic issues. This includes addressing climate adaptation, biodiversity, soil protection, liveability, accessibility, housing, and economic vitality in relation to one another. By doing so, the pilots exemplify how long-term strategies can become powerful tools for balancing multiple public interests and guiding sustainable, resilient spatial development.

Common soil and planning challenges

In the diagnostic phase and during the 2025 General assembly (Figure 4), the following shared challenges in this group of pilots have been identified:

- Land Take & Urban Expansion: All pilots in this family face to some extent the challenge of urban expansion. From regional scale (Groene Hart, Hajdú-Bihar) to local scale (Grenoble, Klagenfurt), there is tension between planned urban development and protection of unbuild areas.
- Climate Adaptation: Regional adaptation to climate change is present in all pilots but in different ways. Some pilots encounter increased challenges of flooding (Klagenfurt, Grenoble, Ooststellingwerf), erosion and drought (Hajdú-Bihar), or salinisation due to sea level rise (Groene Hart).
- Agriculture – Nature Interface: The pilots that include large agricultural areas (Groene Hart, Ooststellingwerf, Hajdú-Bihar) in the vicinity of natural areas such a Nature 2000 share the challenge to combine both functions. Not only because they compete for the same space and soils, but their spatial and functional co-existence is difficult (e.g. deposition of nitrate from dairy farming to sensitive natural environments).
- Regional Economic Development: Several pilots deal with a regional transformation that implies multiple sectors (Groene Hart, Hajdú-Bihar) and requires a new regional perspective on land use and soil management, which results in a need for new business models. For example, for dairy farmers who need new economic models when the old model (dairy farming) is possible anymore due to increasing attention to biodiversity goals. These new models often include not only the previous agro-economic aspects but are more comprehensive (and include tourism, commercial activities, etc).

FIGURE 4: WORK SESSION TO ASSESS AND PRIORITIZE SHARED CHALLENGES BETWEEN THE LONG-TERM STRATEGY PILOTS DURING THE GENERAL ASSEMBLY IN LEIPZIG, NOVEMBER 13, 2025.

Common barriers and boundary spanning needs

This family of pilots shares barriers and several similar needs for boundary spanning to integrate soils and spatial planning.

- Positioning 'soft' soil in 'hard' economic short-term driven context: The pilots experience that decisions on spatial development are often based on profit-driven arguments in a high dynamic financial-driven context. There is a clear need to better position soil in this context, for example by linking soil performance to achieving societal challenges (climate adaptation, energy transition, greening, housing, etc.).

- Cooperation and Coalition Building: Several pilots (Grenoble, Hajdú-Bihar, Klagenfurt, Ooststellingwerf) indicate the need for integrated cooperation between domains of soils and spatial planning. Some pilots struggle with organising cooperation and coalition building between sectors (e.g. spatial planning, soil, water, environmental, governance), and between a large variety of stakeholders with various interests.

- Awareness Raising and Capacity Building on Soil: There is limited internal expertise on soil available in planning departments / small administrations in charge of planning. The relevance and importance of healthy soils in spatial planning is rather low. Awareness building is needed on this topic.

- Need for Monitoring Indicators: All pilots expressed the importance of monitoring to assist and assess the progress of integrating soils into spatial planning. For example, KPI sets for permeable surfaces added, brownfield hectares recycled can be beneficial.

- Data Availability and Accessibility: Useful data on soils are often limited or unavailable due to fragmented investigation / storage / hosting and limited knowledge on the right interpretation of the soil data exists (Hajdú-Bihar, Ooststellingwerf).

Common ambitions

The long-term strategy pilots have shared ambitions on the integration of soil in their spatial planning.

- Integrate Soil in Regulatory Spatial Frameworks: All pilots have the ambition to better integrate soil in their spatial frameworks. Some pilots aim at positioning soil in legally binding frameworks such as building codes (Klagenfurt, Ooststellingwerf, Hajdú-Bihar) and other have not yet defined the legal / juridical spatial instrument of their focus (Groene Hart, Grenoble).

- Shift from Reactive to Proactive Approach: A common factor of all the pilots is that they have the ambition to shift from an approach where soil is involved late in the planning cycle (current status) to an earlier involvement in which soil can be taken up from the start of planning processes. It is believed that this will result in more efficient and effective spatial planning in regard to available soil resources.

- Embedding Soil across all Scales of Planning: Several pilots indicated their aim to embed soil at different scale levels of spatial planning; from national and regional visions and strategies to the local implementation of projects (Groene Hart, Ooststellingwerf, Hajdú-Bihar).

Reflections at task level

Because this family of pilots includes rural, peri-urban and urban areas, the diagnosis revealed a broad spectrum of challenges, needs and ambitions related to better integrating soil in the pilot's spatial planning. This resulted in a wide array of insights that is useful for the next phases of the project; from regional to local aspects, and from long-term to short term interventions. The interaction between the pilots created a shared understanding of Europe-wide shared challenges but revealed also substantial differences in approaches to soil and spatial planning. In these long-term strategic pilots' different soil functions often compete. For example, the water-retention capacity of soils and their food-producing capacity go hand in hand to a certain extent, but conflict at a certain point. This competition can be considered a boundary spanning that needs to be addressed in the projects next phases. Table 1 gives a snapshot of the challenges in the 5 long-term strategy pilots. For more details on each pilot, see Appendix A.

TABLE 1: SNAPSHOT TABLE OF LONG-TERM STRATEGY PILOTS

	Klagenfurt (AU)	Grenoble (FR)	Hajdú-Bihar (HU)	Groene Hart (NL)	Ooststellingwerf (NL)
Drivers of soil issues / degradation	Population growth, land per capita increase, abundant building land, inefficient land use	Rapidly urbanising alpine valley / urban pressure, No net land take policy, preservation of agricultural land	Pressure of human economic / urban development, urban sprawl, greenfield investments on most fertile soils, impact highway constructions, land grabbing, greenfield investments,	Urban pressure, maintaining low water levels for agriculture, nitrogen emissions from cattle,	Interface between nature and agriculture (dairy), linkage to regional (ground)water system
Types of soil issues / degradation	Priority: Land take Secondary: urban heat and flooding in sealed areas, wetlands preservation	Intensive soil sealing in valleys. Legacy contamination from river-adjacent industrial platforms and logistics estates burdens soil quality and constrains redevelopment. Ambition to preserve and restore soil functions,	Degradation of agriculture soils; by wind and water erosion, artificial fertilizers, soil compaction. Soil pollution by nitrate contamination. Desertification and aridification. Decline of organic matter due to intensive farming. Ambition to reduce soil compaction, soil pollution and enhance restoration. Improve soil structure and habitat quality for (soil) biodiversity.	Peat oxidation, soil subsidence, decreasing fresh water availability, decrease water quality	Nitrogen deposition from dairy farming to sensitive Nature 2000 areas. Drought sensitivity of these Nature 2000 areas. Soil with low infiltration capacity (clay loam)
Negative Consequences of soil issues	Land take, urban heat islands in sealed areas, increased flooding, decrease of agricultural land	Reduced water infiltration, flood management, biodiversity, and carbon storage. Sealing on hydromorphic alluvial soils amplify runoff, flood risk and heat-island effects while weakening natural (in)filtration. Erosion and shallow landslide risk threaten infrastructure, agricultural plots and ecological corridors, especially under more intense rainfall	Natural environment including soil is under pressure. Degradation of agriculture soils; by wind and water erosion, artificial fertilizers, soil compaction. Exacerbating to desertification and aridification by climate change.	Soil subsidence, infra damage. Increasing flood protection challenges on long term, increasing salination of (ground) water, poor (ground and surface) water quality. Current and increasing CO2 emissions due to peat oxidation	Decrease nature and ecology in specifically Nature 2000 areas., Flood risk near streams, flood risks linked to existing clay loam layers, stagnating spatial development
Sustainable soil management Soil practices (to promote to address such issues)	Guideline for Soil Function Assessment in Carinthia, which provides a map-based tool to evaluate soil fulfilment levels.	Testing for circular soil recycling, cooperation with applied sciences intitutions		"Klei in veen" (clay in peat), an initiative that applies dredged clay to slow peat decomposition. "Valuta voor Veen" carbon credit system, which rewards farmers for raising water tables.	Ambition for agroecological transition for farmers located near protected nature sites
Planning practices, instruments (to promote to address such issues)	New Urban Development Concept (STEK 2025) and Klagenfurt's commitment to the EU Mission "100 climate-neutral and Smart Cities by 2030", NutOpIA project, which aims to reduce land take by identifying potential in vacancies and underutilized sites. Moor4Klagenfurt initiative (renaturation and rewetting of degraded wetlands to restore their function as CO_2 sinks). "sponge city" principles in urban redesigns	"Plan Canopée," which aims to increase canopy coverage to 40% by 2050. "Voyage en systémie" approach, which fosters horizontal collaboration within the metropolitan administration.	Protective forest strips to combat wind erosion and deflation around Debrecen. Region is witnessing a rise in agroecological practices like no-till farming.	Provincial, regional, municipal and local planning practices and instruments in place.	Municipal environmental vision (NL: Omgevingsvisie) in place. More concrete municipal environmental plan to be made (Omgevingsplan).

	Klagenfurt (AU)	Grenoble (FR)	Hajdú-Bihar (HU)	Groene Hart (NL)	Ooststellingwerf (NL)
Boundary spanning, already in place	Establishment of regular capacity-building and training for soil protection	Cooperation with applied reasearch institutions (https://frichescrisalid.fr/)		Collaboration with 3 Provinces, 5 Water Authorities and 41 Municipalities involved through Bestuurlijk Platform Groene Hart. Many regional and thematic initiaves on (parts of) the Green Heart.	Knowledge centre 'Bodem' (Soil Learning Centre) as a boundary-spanning facilitator that connects farmers, researchers, and policymakers. the "Regiodeal Zuidoost Friesland," a cross-institutional funding and cooperation structure that enables integrated projects focused on brook valley restoration and biodiversity-friendly farming.
Boundary spanning needs challenges, barriers to overcome	Current low priority soil protection in zoning decisions, there is no dedicated local authority for soil protection, technical expertise regarding soil centralized at state and federal levels	Lack of functional soil indicators. Lack of specific monitoring indicators and operational measures to prevent degradation in daily practice	Soil data is often fragmented across institutions and outdated, and local municipalities frequently lack the technical staff to interpret it.	How to position 'soft' soil in 'hard' economic and short term driven context? How to transition from old to new (regional) systems? Multi functional landscape (energy, water storage, recreation), besides agriculture / nature requires cooperation other sectors. Interest in rewetting.	Limited "in-house" soil expertise within the small municipal administration. How to deal with Agriculture – Nature interface ?
Other local related challenges	Resources and willingness to change existing processes/regulations, Political decisions might be required, Identify relevant stakeholders, risk that the process becomes larger than it needs to be	Connecting and cooperating with all (separate) already existing initiatives. Data fragmentation and a lack of coordination.		Maintaining characteristics openness of iconic landscape. New agriculture perspectives. + Improve recreational use of the landscape	
Ambitions in SPADES	Integrate soil protection directly into city planning by developing a green infrastructure index to be included in the binding regulatory framework of the municipal building plan. Binding soil conservation at construction sites (plus training) Continue reuse of vacant and underused buildings.	Shift from follow-up remediation to preventive soil protection by integrating soil functional parameters into the Metropolitan Urban Plan (PLUi) and the Climate-Air-Energy Plan (PCAET)	Integrate soil health into long-term strategic spatial planning to mitigate the negative effects. Within the SPADES project, the team aims to adapt innovative methodologies—such as ecosystem service assessments—for the upcoming 2028-2034 planning period.	Develop a regional "Soil Vision" that identifies soil potential and informs spatial planning at provincial, regional, and local levels.	Integrate soil and water building blocks into the upcoming mandatory Municipal Environmental Plan (Omgevingsplan).

2.2 Urban and peri-urban pilots

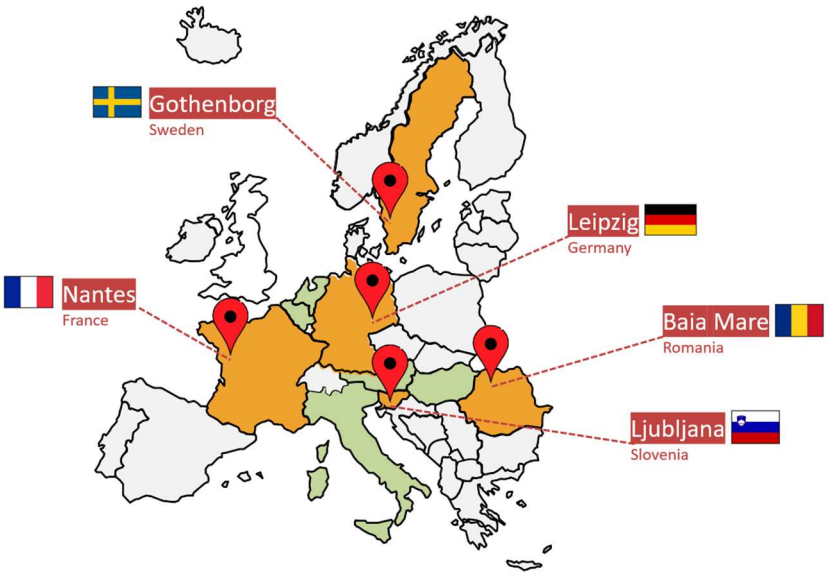


FIGURE 5: OVERVIEW LOCATIONS OF URBAN AND PERI-URBAN PILOTS

Distinctive features

System complexity and interdependence: the five urban and peri-urban pilots (Figure 5) collectively demonstrate how soil plays a foundational role in shaping urban development. Although their contexts differ, they share a dense web of interdependencies between soil conditions, land use pressures, ecological systems, and governance structures. These complexities arise because soil is not merely a surface but a layered physical and ecological system that interacts with water, climate, infrastructure, the historical development and economic processes.

> *In Baia Mare, mining and metallurgical activities have left a legacy of heavy metal contamination that restricts land use and requires substantial, long-term remediation efforts. Gothenburg sits on deep marine clays and extensive areas of historical fill that complicate land stability, contamination management, and the reuse of excavated soils. In Ljubljana, although the preservation of the green wedge and the protection of groundwater are established elements of planning and environmental policy, maintaining the wedges is often challenging due to conflicting stakeholders' interests and weak implementation of existing planning regulations. Leipzig, one of Germany's fastest-growing cities, faces mounting pressure from soil sealing and brownfield contamination within a context shaped by rapid densification, a tense budgetary situation, and limited political momentum for soil protection. Nantes, despite its environmental ambitions, contends with persistent soil sealing, brownfield pollution, and incomplete soil data, such as the pedogeochemical baseline.*

Across these cases, soil connects directly to water management, mitigation of heat islands, biodiversity, and long-term land-use decisions. The pilots highlight a mismatch between complex, slow-changing soil systems and the planning institutions, which typically operate in linear, sectoral ways. This misalignment is one of the defining shared features of the pilot family. Table 2 below shows a summary of common themes and challenges in the urban and peri-urban pilots.

TABLE 2: SUMMARY OF COMMON THEMES AND CHALLENGES OF THE URBAN AND PERI-URBAN PILOTS REPORTED IN THE WORKBOOKS.

Common themes and challenges	Description & examples
Urban sprawl, land take, soil sealing, soil degradation	Urban expansion, infrastructure, and industrial growth leading to loss of green areas (nature, agricultural and forest areas), soil degradation and increasing challenges in stormwater management (focus in Nantes, Leipzig, and Ljubljana, but also an issue in Baia Mare and Gothenburg)
Climate adaptation & green space/nature preservation	Soil's role in flood regulation, cooling, water retention, green infrastructure and nature-based solutions (Leipzig, Ljubljana, Baia Mare, Nantes, Gothenburg,)
Contamination & legacy issues	Soil pollution and brownfields, e.g. due to industrial and mining legacy, and urban activities in general (focus in Baia Mare and Gothenburg, but also a prominent issue in Leipzig, Nantes and Ljubljana)
Handling of excavated soil	Non-circular practices (focus in Gothenburg), sometimes contaminating practices (issue in Ljubljana), not strategically/systematically handled (issue in Leipzig and Baia Mare, Nantes)
Integration into planning	Soil health issues are not systematically or strategically included in spatial plans. (e.g. remediation: site-to-site basis) (common issue for all 3.2 pilots)
Stakeholder complexity	Multi-level governance, fragmented responsibilities, and a need for better coordination and engagement (common issue for all 3.2 pilots)
Data & information gaps	Fragmented, outdated, inaccessible or non-existing urban soil data; need for centralised, GIS-based soil information (common issue for all pilots, but the data and information systems are more or less developed)
Policy & regulatory gaps	EU directives are influential (e.g. NNLT) for all 3.2 pilots, but national/local implementation and specific policies vary

Common soil and planning challenges

- Legacy Contamination: Contamination from past industrial and mining activities is widespread. Baia Mare and Gothenburg face large-scale contaminated areas that influence metropolitan planning decisions, while Leipzig, Nantes, and Ljubljana grapple with brownfield sites and pollution in industrial strips or informal gardens. These conditions elevate health risks, complicate redevelopment, and require costly remediation efforts.

- Soil Sealing, Densification, and Heat Stress: Across the pilots, soil sealing is a significant concern, often linked to urban densification. Leipzig and Nantes face escalating pressures from housing demand, while the inner part of the green wedge in Ljubljana's shows high sealing and minimal canopy coverage (31% unsealed area, 24% canopy cover, 3% tree canopy). These conditions intensify heat islands, reduce infiltration, and strain drainage systems.

- Late Soil Consideration: In all pilots, soil assessments and remediation planning occur late in the development process, reducing opportunities for preventive action and contributing to costly project delays. This pattern reflects institutional culture and organisation (habits) rather than technical limitations.

- Fragmented and Missing Soil Data: The pilots consistently report gaps in site-level soil parameters such as infiltration rates, bulk density, soil organic matter (SOM)/soil organic carbon (SOC) levels, and horizon profiles. Nantes requires additional resource capacity to advance soil mapping even further than today and integrate data across planning domains. Ljubljana lacks a comprehensive monitoring repository, while Gothenburg highlights fragmented data across departments.

- Climate Vulnerability: Local flooding, landslide risks, erosion, and urban heat islands underscore the need for soil-based solutions. However, current planning tools often fail to integrate soil performance into climate adaptation strategies.

Barriers and boundary-spanning needs

- Governance Fragmentation: Sectoral and administrative fragmentation is a pervasive barrier. Baia Mare's metropolitan coordination challenges, Nantes' intercommunal planning structure, Leipzig's divide between soil and water governance, Ljubljana's tensions between public and private interests, and Gothenburg's cross-departmental misalignments all illustrate this issue with regard to soil.

- Gaps Between Policy and Practice: National and EU soil ambitions (NNLT, zero degradation) are strong, but operational implementation tools are often lacking. Baia Mare must secure financing and long-term institutional adoption of soil regeneration strategies beyond the project timeframe, while other pilots lack codified routines or enforcement mechanisms.

- Misaligned Stakeholder Incentives: Conflicts between municipal objectives and private investors, particularly visible in Ljubljana, present obstacles to soil-inclusive planning. Nantes must coordinate diverse interests across developers, landowners, and agricultural actors.

- Soil Literacy and Professional Cultures: Differences in how disciplines understand and value soil create barriers to integrated planning. Soil scientists, planners, ecologists, and engineers often speak in different conceptual languages. In urban areas, soil may also encompass other parts of the subsurface than the fertile topsoil (land and ground): the urban development also impacts and interacts with the deeper subsurface in terms of, e.g. construction and soil stability, the use of the subsurface to host and protect infrastructure, groundwater, energy extraction, and archaeological remains.

Common ambitions

- Integrating Soil into Planning Instruments and Planning Processes: All pilots seek to embed soil considerations into spatial planning. Nantes aims to incorporate soil multifunctionality and de-sealing strategy, including soil refunctionalisation and remediation, into the PLUi. Some actors in Leipzig intend to formalise and strengthen preventive soil protection. Baia Mare aims to move from isolated remediation efforts toward a more systemic and integrated approach to soil-inclusive planning. Ljubljana aims to test soil-inclusive detailed planning for the green wedge. Gothenburg aims to contribute to the thematic addition on contaminated land and revise its workflow for early soil assessment, also considering more circular management of excavated soil.

- Advancing EU Soil Objectives: All pilots aspire to align with the no net land take and land degradation neutrality goals. Nantes and Baia Mare explicitly connect their ambitions to national and EU policy frameworks.

- Strengthening Soil Literacy and Capacity: Capacity-building efforts are central. The Leipzig pilot aims to support intra- and inter-agency soil literacy. Nantes hopes to produce guidance transferable across France and Europe. Baia Mare aims to strengthen soil literacy by improving understanding of contaminated land, building municipal capacity to interpret soil diagnostics, and fostering collaboration between planners, environmental experts, and academic partners. Ljubljana seeks to raise planners' awareness and embed new standards in municipal amendments. Gothenburg is refining its internal governance of contaminated sites and excavated soil management.

- Circular Soil and Mass Handling, including Circular Land Management appears as a shared ambition, particularly in Gothenburg, Ljubljana, and Nantes. Strategies include preserving soil horizons, rebuilding topsoil, limiting compaction, and reusing excavated material under controlled conditions. Brownfield regeneration is also an important aspect of circular land management, and as such, achieving the goals of no net land take.

- Developing Replicable Planning Models: Several pilots aspire to create approaches that can be transferred beyond their regions. Baia Mare aims to become a national reference for post-industrial soil regeneration, while Nantes seeks to develop soil integration practices and guidance that are transferable across France and Europe.

Reflections at task level

Signifying urban and peri-urban areas is that they function as gravitational centres – current global challenges intensify where there are so many competing interests, all with distinctive local character. We can also see this in this pilot family: the urban and peri-urban pilots all face the combination of multiple challenges (such as soil sealing, climate adaptation, stormwater management, brownfield redevelopment, and net land take reduction, Table 3 below) and system complexity: the interdependence between the natural subsurface system (including soil) and the constructed system. Because the metropolitan areas and cities are large, the organisational structure is divided into departments with distinct roles, responsibilities, budgets, and working processes, which may also compete with one another. The organisational structure is not necessarily in line with the natural boundaries and the interconnectedness of the system.

Figure 6 below illustrates a simplified conceptualisation of how urban development processes interact with natural systems. The conditions of urban soils and the subsurface influence the impacts of planning decisions on the system as a whole, and because these interactions are tightly coupled, policies, strategies, and plans cannot be developed in isolation. System responses are highly site-specific, depending on geological (both natural and anthropogenic) and geographical contexts.

Across the pilots, soil conditions interact closely with water management, climate adaptation, urban development, and environmental legacy issues, shaping both risks and opportunities for cities. While approaches such as water-sensitive urban planning have gained traction, soil is still rarely treated as a central planning variable. For more details on each urban pilot, see Appendix B.

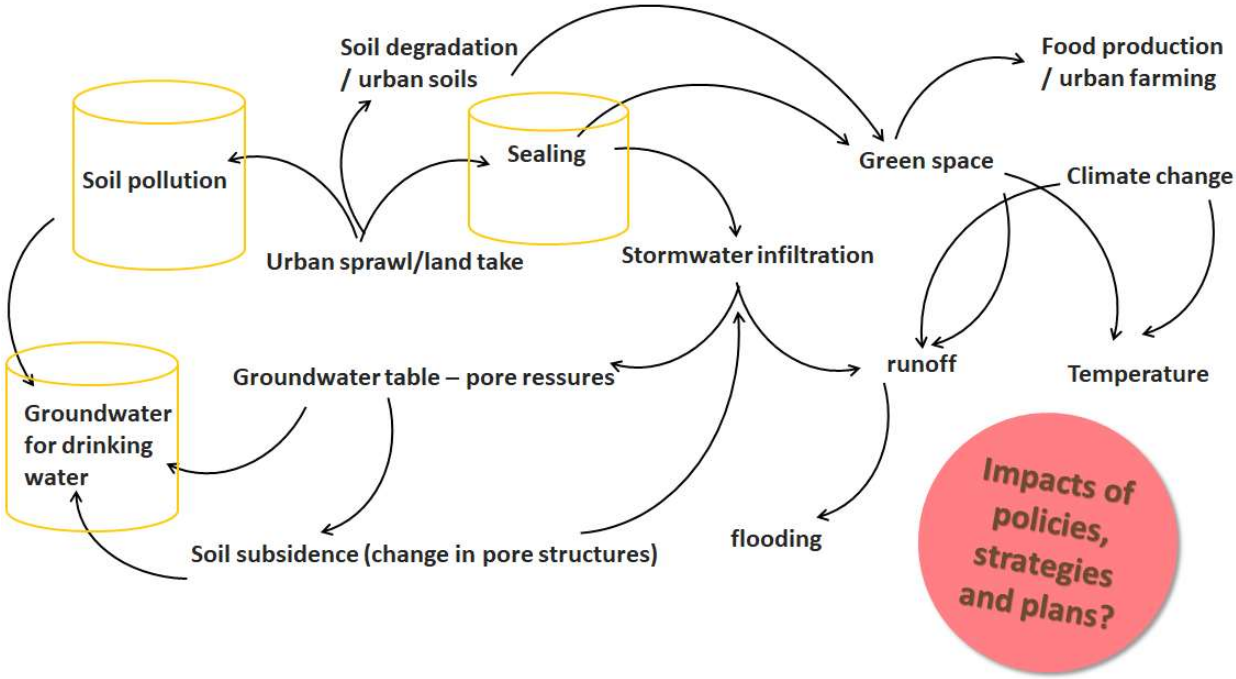


FIGURE 6: SIMPLIFIED CONCEPTUALISATION OF HOW THE URBAN DEVELOPMENT PROCESS INTERACTS WITH NATURAL PROCESSES, WHERE THE CONDITIONS OF THE URBAN SOIL AND SUBSURFACE WILL INFLUENCE THE IMPACTS ON THE SYSTEM AS A WHOLE. SINCE THE SYSTEM IS INTERCONNECTED IN VARIOUS WAYS, POLICIES, STRATEGIES AND PLANS CANNOT BE DEVELOPED IN SILOS BUT NEED TO CONSIDER NOT ONLY EXTERNAL FACTORS SUCH AS CLIMATE CHANGE, BUT ALSO THE DOWNSTREAM EFFECTS OF INTERVENTIONS. HOW THE SYSTEM RESPONDS TO INTERVENTIONS WILL BE SITE-SPECIFIC, DEPENDING ON THE GEOLOGICAL (BOTH NATURAL AND ANTHROPOGENIC) AND GEOGRAPHICAL CONTEXT.

TABLE 3: SNAPSHOT TABLE OF URBAN AND PERI-URBAN PILOTS

T3.2	Leipzig (DE)	Nantes (FR)	Baia Mare (RO)	Ljubljana (SI)	Gothenburg (SE)
DRIVERS of soil issues / soil degradation	Rapid population growth (Top 5 growing cities; +25% since 2010–2024) and densification; industrial legacy; tense economic/budgetary situation; weak political standing of soil	Historic urban sprawl and ongoing housing demand; climate and land-use policies driving densification; revision of planning documents (PLUi).	Mining & metallurgical legacy; metropolitan expansion; need to reconcile post-industrial landscapes with environmental preservation/regeneration.	Development pressure in inner wedge; weak enforcement of policy of preserving wedges; strong groundwater protection regime in peri-urban wedge supplying city drinking water.	Urban (re)development in central waterfront land. Top-down requirements to improve the process for handling contaminated sites in the urban development process, + ambitious goal for circular handling of excavated soil.
TYPES of soil issues/ soil degradation	High degree of soil sealing; contamination on former industrial/brownfield lands.	Soil sealing; brownfield pollution; knowledge gaps: urban soil maps and pedo-geochemical background.	Widespread heavy-metal contamination (lead, cadmium, arsenic, and zinc); urban soil sealing; forest–pollution interfaces in the metropolitan area.	Inner wedge: high sealing, low canopy rate (urban strip ≈ 31% unsealed, 24% canopy, 3% tree canopy); site-level data gaps (Ksat, bulk density, Soil Organic Matter, Soil Organic Carbon); contamination risk (industrial strip, informal gardens).	Contaminated fillings along the riverfront and old industry legacy; unstable clay subsoil, legal framework complicating reuse of excavated soil.
NEGATIVE CONSEQUENCES of soil issues	Climate stress (local flooding and urban heat islands); health/environmental risks; reactive handling slows redevelopment; loss of rich soils	Loss of ecosystem services due to soil degradation (flood regulation, biodiversity, carbon sequestration); risks to climate adaptation/resilience/quality of life; polluted soils threaten water and health.	Urban heat island/runoff; unsafe land for agriculture and housing; public-health risks; environmental stigma due to the former mining; need to protect Natura 2000 edible chestnut reserve.	Pluvial flood & heat stress in inner wedge (~+5 °C summer urban heat island effect); biodiversity loss; drinking-water protection constraints (≈ 2/3 of city supply) limit inputs/infiltration siting.	Infrastructure risk (stability/subsidence, flooding); costly delays when contamination is addressed late; non-circular handling of excavated soil.
SUSTAINABLE SOIL MANAGEMENT SOIL PRACTICES to promote to address such issues	Water-sensitive urban design (green/blue infrastructure); risk-based remediation; shift to preventive soil protection.	No net land take/land degradation neutrality; concrete de-sealing projects (e.g., former parking lots in central Nantes); future development zones of urban plan revision guided by soil multifunctionality mapping (MUSE) (increased protection of soil).	Phytoremediation and ecological restoration; brownfield reclamation to reduce land take; NBS in forest–pollution interfaces and runoff control.	Three bundles: (1) De-sealing + source-control flood regulation + selective land-use change to create vegetated bands; (2) Circular soil management at worksites/brownfields (preserve horizons, limit compaction, rebuild topsoil, interim living cover, targeted testing/remediation); (3) Agroecology (organic-only) under groundwater protection with testing/advisory.	Circular use of excavated masses; gentle remediation (phytoremediation/bio-based where feasible); early soil assessments; explore digital tracking/governance for masses.

T3.2	Leipzig (DE)	Nantes (FR)	Baia Mare (RO)	Ljubljana (SI)	Gothenburg (SE)
PLANNING PRACTICES, INSTRUMENTS to promote to address such issues	Promote (existing) municipal soil protection strategy; embed soil–water measures via Water-Sensitive Planning (WSP) network; formalise preventive routines.	Integrate soils and soil functions into PLUi revision (maps of functions/constraints; restoration targets); consider de-sealing regulation/compensation; incentives for brownfield reuse.	Update plans to prioritise brownfields; align with Law 246/2020; anticipate EU Soil Monitoring Law to formalise sealing/land-take; build GIS atlas and scenario/suitability tools to steer remediation/reuse.	Strengthen spatial regulations to protect wedge (e.g., minimum permeable area/green-factor); prepare soil-inclusive detailed plan; feed solutions into municipal spatial plan amendments.	Contribute to the Comprehensive Plan thematic addition on contaminated land; require early soil investigations and mass-reuse plans.
BOUNDARY SPANNING already in place	Water-Sensitive planning (WSP) working group linking planners, water utility and environmental departments.	Inter-municipal coordination across 24 communes.		"Mission 100 initiative for climate-neutral and smart cities"	
BOUNDARY SPANNING NEEDS challenges, barriers to overcome	Secure political momentum for soil protection; institute inter-department routines for preventive soil protection; foster coordination capacities; proper scientific arguments to connect water to soil	Align incentives across developers/landowners/farmers/community; balance housing, climate, agriculture; resource capacity for urban soil mapping and data integration.	Translate science to policy; coordinate uneven municipal capacities; ensure adoption beyond project; secure financing for remediation/sustainable reuse.	Bridge public objectives vs. private interests; integrate planners with environmental regulators also regarding soil issues; collect site-level soil performance data and build monitoring repository.	Break departmental silos; align planning timelines with environmental assessments
OTHER LOCAL RELATED CHALLENGES	Manage climate resilience while maintaining affordable housing; upskill staff; adapt administrative routines to achieve proactive approach.	Deliver large housing targets within existing footprint; coordinate 24 communes; low-lying river/estuary context requires integrated water–soil planning.	Peripheral location and socio-economic disparities; overcome post-industrial stigma; address derelict mining infrastructure; attract investment with green regeneration.	Inner wedge: noise/pollution (industry/traffic), scarce green space, need to improve/connect green system in this part of the city; outer wedge: informal structures/urban gardens and enforcement; balance housing demands with wedge preservation.	Complex waterfront redevelopment: soil stability, flooding
AMBITIONS IN SPADES	Coalition building by linking the topic of soil protection to water-sensitive urban development; Capacity building for preventive soil protection (inter- & intra-agency; knowledge, networks, etc.); Strengthening the political momentum for soil protection (e.g., via the existing but politically ignored soil protection strategy)	Embed soil practices and maps in PLUi (local comprehensive binding zoning plan); demonstrate de-sealing and progress toward no net land take; produce guidance transferable across France/EU.	Deliver roadmap for soil regeneration with planning provisions, remediation investments, stakeholder agreements; become a national reference for post-industrial recovery; deploy GIS atlas & decision tools.	Raise awareness; prepare an action list; prepare professional basis for a soil-inclusive detailed spatial plan in the wedge; institutionalize measures via next municipal/detailed plan amendments.	Systematic early soil consideration in planning; input to thematic addition on contaminated land; co-create improved working processes (including digital tracking where feasible); potentially share a national blueprint.

2.3 Rural and peri-urban pilots

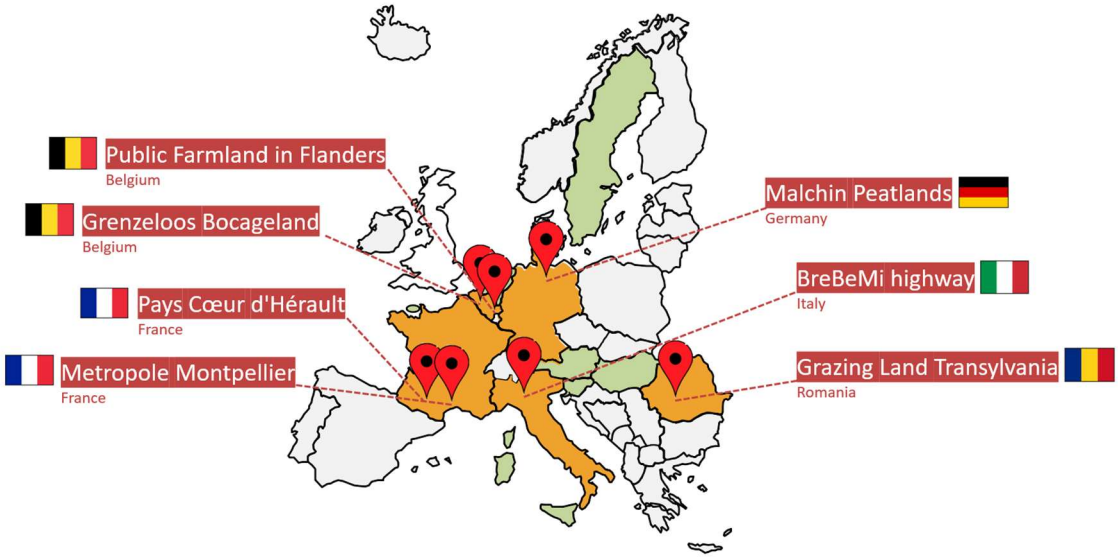


FIGURE 7: OVERVIEW LOCATIONS OF RURAL AND PERI-URBAN PILOTS

Distinctive Features

The 7 rural pilots (Figure 7) are defined by their focus on "open spaces" (Nature, Agriculture, and Forest) and the necessity of looking beyond the "bucolic" to address deeply rooted conflicting interests. A central theme is the **interlaced nature of soil and land.** While these are interrelated, they carry different contexts for different actors. Spatial planning traditionally operates on "land"—a 2D layer of property rights, zoning, and territorial development. Conversely, rural and farming communities holds embodied, 3D knowledge of the soil, treating it as a vital basis of production. While soil serves as a powerful concept for facilitating knowledge exchange and spanning boundaries between farmers and planners, it sits at the heart of a fundamental systemic contradiction: although soil health is essential, it remains economically precarious because current business models and financial incentives fail to support the long-term viability of human stewardship.

Human stewardship — an idea that connects many of the ambitions articulated at the case level — frames soil health not as an inherent property that simply needs protection, but as a dynamic condition that depends on ongoing human engagement. In short, soil health requires continuous, informed care through active management practices, often linked to agricultural systems, to regenerate the living processes that keep soils fertile, productive, and resilient over time. Several soil materialities and soil functions are produced and reproduced through human stewardship, which is a distinctive feature in the rural and peri-urban pilot research.

Common soil and planning challenges

The rural pilots share several cross-regional challenges that bridge physical soil degradation with planning bottlenecks:

- **Soil Performance Degradation (Erosion and Compaction)**: Multiple pilots face soil erosion, compaction, and loss of organic matter. In Transsylvania (RO) and Grenzeloos Bocageland (BE), overgrazing and the conversion of grasslands to arable land have severely impacted the soil's water-holding capacity and structure. Similar erosion risks are noted along the Brebemi Highway (IT) corridor.

- Access to land: Speculative buying and sky-high land prices (averaging €70,000/ha in Flanders) create a significant barrier to sustainable soil stewardship. In Romania and France, this manifests as land grabbing or competition between agricultural users and non-agricultural investors, which pushes farmers toward intensive, soil-depleting practices to remain competitive.
- Land Take: The Brebemi Highway (IT) case, for example, highlights the impact of urban sprawl and massive land take. Infrastructure development physically fragments ecological corridors and consumes high-quality agricultural soils, a trend also noted across the fragmented landscape of Flanders (BE).
- Siloed Institutional Frameworks: A persistent bottleneck is the polarisation between nature conservation and agriculture. Planning is often reactive; zoning landscape features as isolated systems (e.g. the protection of prime biodiversity hot spots via Natura 2000) without accounting for the agricultural business models required to maintain those landscapes.
- "Planning Shadows" and Path Dependency: There is a common difficulty in altering big decisions on land use once rights have been granted. Planning history is known to affect the current planners' debate and practices in the sense that former planning practices, land-use policies, and planning discourses cast 'shadows' on contemporary developments. Path dependency makes it hard to prohibit unsustainable practices once they have been made legally permissible. For that reason, the discipline of planning sometimes intervenes in a very indirect and compensatory manner, whereas a direct tightening of regulations sometimes seems far more appropriate.

Common barriers and boundary spanning needs

The rural pilots have identified several needs to bridge the gap between technical soil knowledge and spatial planning:

- Financial (dis)incentives: Current financial mechanisms, particularly the Common Agricultural Policy (CAP), are primarily land-based rather than soil-based. They reward hectares of land cover rather than sustainable soil management practices. This makes the transition to soil-inclusive practices — e.g. paludiculture (DE) or agroecology (FR, BE, RO) — a high financial risk for farmers.
- Data Accessibility and Scale Gaps: While regional soil maps exist, there is a recurring lack of site-specific data (e.g., soil biodiversity or carbon stocks at the plot scale) to inform precise planning decisions. Furthermore, many organizations and public administrations lack technical staff to interpret complex soil data.
- Power Dynamics in the Rural Community: Inclusion of human stewardship of soil health into the planning process is hindered by power imbalances: landowners vs. tenants, or large-scale farmers vs. small-scale agroecological farmers. Finding a shared language and empowering farm businesses which are tailored to local soil conditions is a key challenge in several SPADES rural pilots.

Common ambitions

The rural pilots seek to move from "dreaming" to "doing" by testing the following innovations:

- Restoring Rural Landscape through Nature-Positive Business Models: Instead of simply "fencing off" nature, pilots in Belgium and France aim to re-integrate landscape elements (hedgerows, nature grasslands) into viable agricultural business models. The aim is to use planning, and the tools at the disposal of planners, to create an environment in which soil-restoring business models and their human stewardship can thrive, rather than to achieve or restore the results of their soil management efforts directly.
- Using Land Tenure as a Strategic Lever: Pilots in Belgium (Public Farmland), France (Montpellier) and Romania (Transylvania) share the ambition to use public land allocation and Land Trusts as tools to enable and reward soil stewardship.

- Co-designing Shared Narratives and Mental Space: There is a collective ambition to build trust and soil literacy. By reframing technical terms into local concepts, e.g., moving from "paludiculture" to "Moorwirtschaft" in Germany, multiple pilots (including Grenzeloos Bocageland, Coeur d'Hérault and Malchin peatlands) seek to create common ground about the territory's future development, a vision adopted as well as adapted by local residents and farmers.
- Integrating Soil Indicators into Binding Plans: Multiple cases (IT, RO, FR) aim to embed soil health indicators (e.g., quality, functionality, organic carbon) directly into local zoning documents, such as Municipal General Urban Plans (PUG) or Strategic Environmental Assessments (SEA).

Reflections at task level

In the context of complex environmental challenges, a planetary approach to urbanisation calls for extending planning beyond cities to include rural hinterlands (Brenner & Schmid, 2015[2]). This perspective recognises that urban systems are deeply interconnected with peripheral regions, particularly through food production and resource flows. The SPADES rural pilots contribute to this discussion by highlighting what the concept of soil-inclusive planning for rural areas entails. Rather than treating soil health as a static condition to be protected, the cases emphasise its dynamic and regenerative character. Soil health is actively shaped by communities of practice — farmers and land stewards — whose knowledge and management practices sustain and restore soil systems. For planners, this underlines the need to support and enable these existing regenerative efforts via the tools and planning instruments that are at their disposal. Table 4 presents a snapshot of the challenges in the 7 rural pilot. For more details on each pilot, see Appendix C.

[2] Brenner, N., & Schmid, C. (2015). Towards a new epistemology of the urban? *City*, *19*(2–3), 151–182. https://doi.org/10.1080/13604813.2015.1014712

TABLE 4: SNAPSHOT TABLE OF RURAL PILOTS

	Pays Coeur d'Hérault (France)	Montpellier (France)	Grazing land Transylvania (Romania)	Malchin peatland (Germany)	Brebemi highway (Italy)	Grenzeloos Bocageland (Belgium)	Public farmland in Flanders (Belgium)
Drivers of soil degradation, soil issues	Farmland abandonment (due to wine monoculture and mechanisation), urban sprawl and 'cabanisation', climate change, renewable energy development pressure	urban sprawl legacy, climate change, industrialisation of agriculture	land grabbing and land speculation, overgrazing, land abandonment (depopulation), industrialised agriculture (use of chemicals)	drained peatland, industrialised agriculture	Construction of a major infrastructure; Secondary urbanisation, logistics and commercial developments; Fragmented spatial planning and limited consideration of cumulative effects in environmental assessments	Land-use change, intensification of agriculture, urbanisation	Unsustainable soil management practices (expensive and uncertain access to farmland in overburdened land market leads to intensive land use and land degradation) further exacerbated by the impact of climate change (drought and flooding).
Types of soil degradation / soil issues	Erosion, sealing, pollution (illegal dumping), landscape closure	soil salinisation, compaction, erosion, loss of soil organic matter, nutrient imbalance, loss of biodiversity	soil erosion, loss of soil organic matter, soil compaction, nutrient imbalance	soil compaction, subsidence, oxidation of organic carbon	Permanent soil sealing and land take; Loss of fertile agricultural soils; Soil compaction and alterations; Soil fragmentation and disruption of soil-water systems; Degradation of soil functions in adjacent areas due to indirect development	soil erosion, degrading soil structure and biodiversity, eutrophication	Low soil organic stocks, soil erosion, compaction, loss of soil biodiversity, nutrient imbalance (e.g. nitrogen) a.o.
Negative Consequences of soil degradation	Increased flood risk & fire risk, invasive species/biodiversity loss (related to landscape closure)	Increased flood risk, deficient water regulation (floods, draughts), increased draught and fire risk, soil fertility loss, biodiversity loss (habitat fragmentation),	climate hazard (e.g. flash floods), biodiversity loss, soil fertility loss, emerging of invasive species	GHG emissions, increased flood risk	Reduction of agricultural land and soil ecosystem services; Increased pressure on peri-urban and rural soils; Hydrological impacts (reduced infiltration, increased runoff); Landscape fragmentation and loss of biodiversity; Limited effectiveness of mitigation and compensation measures	loss of productivity, deficient water management, loss of grassland biodiversity	Loss of soil fertility, impairment of the productive capacity of soils and thus the productivity of agricultural businesses, water shortages and flooding, conflict with social and policy expectations/requirements
Sustainable soil management practices (to promote to address such degradation)	agroecological practices, soil restoration, grazing management	Landscape agro-ecology, based on soil multifunctionality and regenerative hydrology (= soil restoration, landscape re-design to manage superficial water), sustainable grazing management, raise crops diversity/rotation	agroecological practices (like no-till, crop rotation, local varieties, diversity), tailored grazing, water management (regenerative hydrology)	rewetting, paludiculture	Soil protection and soil function preservation in infrastructure projects, including reduction of soil sealing, improved topsoil management, and soil-focused mitigation and compensation measures addressing cumulative impacts.	grazing management, landscape agroecology, circular soil fertility management	Crop diversification including cover crops, reduced soil tillage, organic fertilisation including green manure, sustainable grassland management, protection and management of historical grasslands, restoring land-based character of livestock farming
Planning practices and instruments (to promote to address such degradation)	PAT (Territorial Food Plan) helps assess land suitability + allocate public land to farmers. PLU (local land use plans) revised to protect farmland/integrate soil functions PAEN (open space binding zoning plan + action plan)	Include agroecology in site-level management plans, landscape redesign, public land allocation to farmers	Planning with locals, promoting and putting agroecology in practice	Cooperative paludiculture planning Scoping for 'rewetting discourse landscapes'	Integration of soil into Environmental Impact and Strategic Environmental Assessment (SEA), coordination between infrastructure and spatial planning, and planning instruments addressing direct and indirect land take of major transport infrastructures.	Organise landscape design, development and management based on the principles of agroecology	Focus on the strategic allocation of public land with long-term contracts to facilitate the voluntary adoption of sustainable soil practices.

	Pays Coeur d'Hérault (France)	Montpellier (France)	Grazing land Transylvania (Romania)	Malchin peatland (Germany)	Brebemi highway (Italy)	Grenzeloos bocageland (Belgium)	Public farmland in Flanders (Belgium)
Boundary spanning already in place	Local group for information sharing), Land stewards (Veilleurs de Terres) to break down barriers of knowledge Collective site visits (knowledge sharing) Photo exhibition	Local group for information sharing, collective site visits with famers & planners & ecologists (knowledge sharing)	Workshops on soil and spatial planning in the local context – sharing information, exchanging views and perspectives. Hub in Huedin – a place for exchange and inclusion.	Concertation of landscape actors pursued by local NGO Wasserwerk der Zukunft: effective and openminded exchange of perspectives through outdoor format: 'landscape walks'	Environmental Impact Assessment procedures involving multiple sectors and authorities, and partial coordination between transport infrastructure planning and spatial planning.	The park bureau as a local liaison trying to merge the otherwise conflicting domains (agriculture, nature, industry, etc.)	Renewed public and policy interest public farmland assets / travelling scales plot-farm-landscape level / connecting public land management to topical challenges / recent exhibition
Boundary spanning needs (challenges, barriers to overcome)	How to better articulate agriculture, biodiversity management and renewable energy development? How to promote the recultivation of abandoned farmland at the political level?	Siloed planning among departments (water, biodiversity, agroecology), need to better consider farmers' needs in planning	How to promote the concept of the commons without the association with communism? How to navigate between interests and levels of understanding?	Water, conservation and climate policies and administrative structures are pursued separately – alignment is not top priority	Limited integration between infrastructure, spatial planning and soil governance, insufficient consideration of cumulative and indirect soil impacts	Planning and policy are too siloed and more often hindering transition, rather than facilitating it.	Concretising the utility value of public farmland as a counterbalance to dominant sales value / breaking down policy silos between asset/financial management and soil/open space/agricultural/water policy.
Other land related challenges	fragmented land, high concurrency for "good land", inequalities in access to land for new farmers, difficulties to reach out private landowners, land tenure, coordination between landowners	fragmented land, economically viable farming, diverse visions of farming, competitive land market	Land ownership (sometimes cadastral documents are missing or have never been done), land stewardship, (ALPA is experiencing with the idea behind organisations like Terre de liens), common land	fragmented land, land prices, few voluntary agreements with farmers, coordination between landowners	coordination between planning levels, public and institutional awareness raising	landscape preservation, nature development, ecosystem services payment, flood regulation, economically viable farming, land grabbing	High pressure on farmland market / pressure on public finances / farmland contract regulations...
Ambitions in SPADES	Build a decision-making tool to set guidelines for the reuse of abandoned farmland: -> What are the current regulations that should be considered? -> who are the stakeholders that should be involved and at what stage of the project? -> what diagnoses should be done and at what stage? -> what soil functions should be considered to decide the future use of the land? -> what kind of tools could be used (PAEN, etc.)?	Systematically consider agroecology in public land management plans. -> validate roadmap (political will + budget) -> co-create common tools, processes -> test, adjust tools, processes -> disseminate	Promote agroecology – raise awareness about the risks of soil erosion and possible mitigation practices. Connect local authorities, farmers and spatial planners through workshops, local hubs, events etc. Give farmers the opportunity to express their needs, ambitions and to learn more about soil inclusive practices. Develop a business model for agroecological farmers; experience with and develop the model of the common land.	Co-develop a local cooperative paludiculture business case for peatland rewetting. Understand and refine regional rewetting narratives and localise them in the discourse landscape	Analyse the direct and indirect land take, evaluate environmental compensation, monitore measures and, through a participatory process, increase awareness and capacity among local stakeholders regarding soil.	Understanding the interactions between local dairy farmers and the landscape to: -> uncover the potential for structurally integrating landscape management in their business models, -> and organise landscape planning based on this operation, to create an enabling environment for these human stewards.	Demonstrate that public land management and allocation can be a very effective way for planning disciplines to engage in soil tasks. > Develop a learning network for public farmland in Flanders to support policy development. > Develop and test a strategy to support soil stewardship at farm level through public (farm)land allocation. > Move beyond existing pilot projects towards socio-technical regime shift.

2.4 Common challenges and ambitions across the 3 families of pilots

The diagnosis carried out across the 17 pilots confirmed the coherence of the three families corresponding to the three tasks of WP3. Many challenges are shared by pilots within the same family; these were explained in the preceding sections. Pilots also confirmed their will to keep the 3 families/tasks as a first level of interaction among pilots in SPADES.

However, some challenges cut across more than one family/task. This chapter will present them and discuss opportunities to handle them in SPADES during the next phases of the project.

Tentative mapping of common challenges in SPADES pilots

Mapping common challenges has been an iterative process since the beginning of the SPADES project. It brings interesting results in terms of analysing the impact of inter/transdisciplinarity, and of experience sharing among the 17 pilots. In the Grant Agreement prepared in 2023, a first table mapped common soil and planning challenges across the 17 pilots (Table 5).

TABLE 5: OVERVIEW OF SOIL & PLANNING CHALLENGES IN THE 17 SPADES PILOTS (SOURCE: GRANT AGREEMENT, 2023)

	T3.1 Comprehensive long-term visions					T3.2 Urban and peri-urban soil challenges					T3.3 Rural and peri-urban soil challenges						
CHALLENGES OF MAIN CONCERN	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	6	7
Soil quantity challenges																	
Avoid land take		■	■	■	■	■		■	■		■					■	
Avoid, reduce or compensate soil sealing			■	■	■	■	■	■	■	■				■	■	■	
Re-use of excavated urban soils						■	■	■									
Avoid land grabbing														■			■
Soil quality challenges																	
Soil fertility and soil nutrient cycles	■	■						■				■		■	■		■
Reduce soil pollution and enhance restoration						■	■	■		■	■	■		■			
Reduce desertification					■												■
Reduce soil compaction							■	■				■					■
Prevent soil erosion, landslides				■							■	■				■	■
Soil performance challenges																	
Improve climate buffering incl water regulation, heat stress reduction	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	
Conserve or increase organic carbon stocks / Carbon storage	■	■										■	■		■		
Improve soil structure and habitat quality for (soil) biodiversity		■			■	■	■	■		■	■	■	■	■	■	■	■
Contribute to the energy transition	■														■		
Improve production function for food, fibre and biomass		■						■			■	■	■	■	■		■
Planning challenges																	
Subsurface planning						■	■	■									
Climate change adaptation/mitigation	■	■	■	■	■	■	■	■	■			■	■	■		■	
Biodiversity preservation	■	■		■	■	■	■	■		■	■	■	■	■	■	■	■
Energy transition	■	■		■											■		
Human health and well-being improvement	■	■	■	■	■	■	■	■	■	■							
Densification					■	■			■	■							
Mobility and transport	■		■			■			■	■							
Nature restoration	■	■						■			■	■	■	■	■	■	■
Development of agro-ecological farming		■										■		■	■		■
Economic development of the countryside	■	■									■		■		■	■	■
Reconciling agriculture and nature	■	■									■	■	■	■	■	■	■
Limited planning power at the countryside		■									■		■		■	■	■

PILOTS

Comprehensive long-term strategies

1. Long-term strategy Groene Hart (Green Heart) (NL)
2. Long-term strategy Ooststellingwerf (NL)
3. Long-term strategy Klagenfurt region (AT)
4. Long-term strategy Grenoble metropole (FR)
5. Long-term strategy Hajdú-Bihar County (HU)

Urban and peri-urban soil challenges

1. Soil-inclusive planning in Gothenburg (SE)
2. Water sensitive planning in Leipzig (DE)
3. Structure plan for Nantes Métropole (FR)
4. Green wedges for Ljubljana (SI)
5. Former mining site in Baia Mare (RO)

Rural and peri-urban soil challenges

1. Landscape development in Flemish Ardennes (BE)
2. River valley restoration in Flanders (BE)
3. Peatland restoration in Northern Germany (DE)
4. Public land in Montpellier Métropole (FR)
5. Farmland abandonment in France (FR)
6. HighwayA35/Parco Regionale Adda Nord in Lombardy (IT)
7. Grazing common land in Transylvania (RO)

During the kick-off meeting in 2024, such a table was refined with pilots, showing in table 6 below that pilots could, in fact, “check” many more boxes than what was mentioned in the previous 2023 table.

TABLE 6: OVERVIEW OF SOIL & PLANNING CHALLENGES IN THE TASK 3.1. PILOTS (SOURCE: SPADES KICK-OFF-MEETING, 2024)

SOIL	Soil quantity challenges					Soil quality challenges						Soil performance challenges					
	Avoid land take	Avoid, reduce or compensate soil sealing	Re-use of excavated urban soils	Avoid land grabbing	Other	Soil fertility and soil nutrient cycles	Reduce soil pollution and enhance restoration	Reduce desertification	Reduce soil compaction	Prevent soil erosion, landslides	Other	Improve climate buffering incl water regulation, heat stress reduction	Conserve or increase organic carbon stocks / Carbon storage	Improve soil structure and habitat quality for (soil) biodiversity	Contribute to the energy transition	Improve production function for food, fibre and biomass	Other
City of Klagenfurt, AT																	
Hajdú-Bihar County, HU																	
Grenoble-Alpes Métropole, FR					X (Restore sealed or polluted soil)												
Ooststellingwerf, NL					Need to build suburban properties												
Groene Hart, NL					Soil subsidence												

PLANNING	Planning challenges												
	Subsurface planning	Climate change adaptation/mitigation	Biodiversity preservation	Energy transition	Human health and well-being improvement	Densification	Mobility and transport	Nature restoration	Development of agro-ecological farming	Economic development of the countryside	Reconciling agriculture and nature	Limited planning power at the countryside	Other
City of Klagenfurt, AT													
Hajdú-Bihar County, HU													
Grenoble-Alpes Métropole, FR													
Ooststellingwerf, NL													
Groene Hart, NL													

In 2025, for the purpose of publishing brochures presenting shortly the 17 pilots, each pilot chose a maximum of 3 soil challenges (the Xs in table 7 below). In addition, the yellow cells in this table indicate the major challenges on which each pilot has stated its intention to work more specifically and to place particular emphasis within the framework of the SPADES project, according to the diagnosis results presentation slides and posters in October 2025.

TABLE 7: OVERVIEW OF SOIL CHALLENGES IN THE 17 PILOTS (SOURCE: SPADES BROCHURES & POSTERS, 2025)

Pilots	Long term - strategic					Urban - peri urban					Rural - peri urban						
Soil challenges (on brochures)	Ooststellingwerf	Groene Hart	Grenoble	Hajdu-Bihar	Klagenfurt	Gothenburg	Leipzig	Ljubljana	Nantes	Baia Mare	Lombardy	Flanders	Montpellier	Gr. Bocageland	Mecklenburg-Vorp.	Cœur d'Hérault	Transylvania
Land take & urban expansion		X	X	X	X		X	X	X	X	X	X	X			X	
Soil sealing					X	X	X	X	X		X						
Soil health & degradation			X	X					X	X				X			X
Soil compaction							X	X									
Soil pollution	X			X		X											
Circular soil use						X											
Climate resilience					X								X				
Ecosystem fragmentation			X							X	X	X		X			
Agricultural transition & Pressure	X											X	X	X	X	X	
Peatland & Water-Soil imbalance		X													X		
Land abandonment & governance																X	X

In this most recent table, we see that:

- "Land take and urban expansion" are transversal challenges across the three families of pilots (12 pilots), while only a few pilots mention soil health as a central (6 pilots, 2 per family).
- The division into three families of pilots is still valid, with several challenges being distinctive of one family, such as soil sealing & soil pollution for urban pilots, and agricultural transition for rural pilots.
- Specific challenges, such as peatland rewetting, can be shared by 2-3 pilots from different families.
- Some transversal challenges, such as water-soil imbalances, were mentioned in many diagnosis reports (12 pilots), but do not emerge from these tentative mappings.

This last point, plus the differences between the successive tables, and between the brown Xs and the yellow cells in table 7 above, led us to raise several hypotheses explaining why challenges are moving over time.

First, pilots are local authorities and associations with their own timeline and agenda. Their objectives may change over time due to:

- Local policies development, local agenda, external events (elections, new legislation, etc.)
- A better global understanding of soil issues, partly due to their involvement in the SPADES project (better soil literacy). While a pilot started in 2023 with the will to address soil contamination due to industrial legacy, the same pilot may frame today its objective in terms of soil health, considering soil performance (diverse functions).
- Exchanges among pilots give pilots new ideas. This is a direct outcome of the project. Pilots get inspired by each other. For instance, one pilot, first concerned mainly by land take, is keen to understand better how to operate soil circularity.

Second, pilots may phrase their local challenges in different ways, depending on how researchers ask them. This conclusion invites researchers to be more explicit when they talk/write about "challenges". Are they expecting types of soil degradation or challenges related to planning and governance? By challenges, do they mean obstacles, barriers, bottlenecks, boundaries, needs, or local ambitions, objectives? The snapshot tables added at the end of each section of this chapter aim to clarify these different meanings of "challenges" in pilots. Finally, are the researchers expecting a long list of all challenges at stake in each pilot/territory? Or only the 2-3 challenges on which each pilot wants to focus in SPADES?

> *For example, Montpellier Métropole faces a wide range of soil (and planning) challenges, as all local authorities at that metropolitan/regional scale. This is the case in SPADES for all long-term strategic pilots grouped in the first family/task. However, Montpellier Métropole decided to work within the SPADES project on how to better integrate agroecological practices in public land management plans. This specific objective positions this pilot among the rural/periurban pilots, in relation to common challenges such as agroecological transition, climate resilience, and biodiversity preservation/restoration.*

Third, and finally, the different ways of naming challenges are also due to different perspectives in SPADES, related to interdisciplinarity and transdisciplinarity. Pilots' practitioners are practice-driven; they share a pragmatic, operational perspective. They may, however, have a distinct technical language, according to their professional and national backgrounds. SPADES researchers represent diverse social sciences (planning, political science, geography, sociology) and soil sciences, with diverse theoretical points of view, implying the use of specific concepts, according to the scientific literature in their field. Spending time to discuss terms is then an integral part of the SPADES project.

As a conclusion, following the way the 17 pilots present their challenges will remain an iterative process within SPADES. It will bring further insights on how interdisciplinarity and transdisciplinarity are handled within the project, and on the impact of the SPADES project on the pilots (capacity building, awareness raising, soil literacy).

How to work on common challenges in SPADES?

In a walk-in meeting in January 2026, WP3 facilitated a brainstorming session on the common challenges emerging from the 17 pilots and proposed to handle such common challenges at 3 levels:

1. WP3 task meetings will put on their agenda the challenges that are of common interest for their family of pilots. These topics are listed in sections 2.1, 2.2 and 2.3 of the present chapter. These meetings remain open. All other pilots (as well as all researchers) are welcome to attend WP3 task meetings, according to their interest in the agenda.
2. SPADES monthly walk-in meetings (WIM) have an open agenda. Some will be used to discuss challenges relevant to more than 3 pilots from diverse WP3 tasks. The results of the brainstorming session on common challenges are presented in the first subsection below.
3. Bilateral/trilateral direct exchanges will be facilitated by WP3 on specific topics, gathering few pilots, from diverse tasks. The topics identified are listed in the second section below.

List of common challenges across pilots deserving to be addressed in walk-in meetings (WIM)

- Inspiration for co-creative workshops

Most pilots expressed in their diagnosis workbook the need to get inspiration on how to conduct successful co-creative workshops. In response, the cocreation workbook and the inspiration portfolio (in Notion) bring many examples of tools and methods. WIMs could be used to present some of them, to help pilots understand how to put them concretely into practice.

- Focus on instruments for spanning spatial planning and organisational boundaries

ICLEI and Deltares identified 4 main spatial planning/organisational boundaries that needed to be spanned to better integrate soils into spatial planning and design (see section 3.2 below). These boundaries are common to most pilots, not just to one family of pilots. They all deserve to be discussed in WIMs. They were presented in December 2025. Other WIMs could be dedicated to presenting some of the typical instruments mentioned in the cocreation workbook to help span these boundaries (e.g. joint scenario planning, multi-stakeholder mapping, etc.).

- On policy and planning, pilots & researchers expressed interest in a WIM on the following topics:

- Presentation of EU laws/policies and their relevance for soil-inclusive planning at local levels (including the recent EU soil monitoring law). WIM planned in Spring 2026.
- How to secure a political momentum for soil protection? How to identify present and upcoming windows of opportunity as well as a coalition building
- Water-Soil nexus: What to learn from the integration of soil systems with water systems? How can water-sensitive planning inspire soil-inclusive planning? NBS, etc. (12 pilots interested!)

- Compensation of biodiversity losses: how to build a long-term territorial strategy for compensation of biodiversity losses (in the framework of the no-net-land take strategy)
- Timelines adjustments & business models for soil remediation/sustainable reuse/regeneration. Financial (dis)incentives: transition to soil-inclusive practices may be a high financial risk for private actors. Different time horizons between long-term soil dynamics, medium-term planning, and short-term businesses horizons (challenge raised by T3.1. and T3.3)

- On soil data & tools, pilots & researchers expressed interest to deserve a WIM on the following topics:

- Data: What types of data are available? How to use them in planning? Scale gap (need for site-level data), capacity gap (how to use complex data with limited skills)
- Soil indicators for planning (invite someone from the BENCHMARK project?)
- Tools Examples of interesting tools, explain concretely how tools can support planners in practice
- Good practices/tools/indicators to limit land take and soil sealing
- Frameworks for impact monitoring

Next step: WP3 will interact with the persons identified during the brainstorming session on each topic to confirm their willingness to contribute and identify a leading person. Some topics are related to the capacity building program; some need inputs from other Soils EU Projects.

Cross-family small-group cooperation opportunities

Possible groups for topical exchanges emerge from pilots and researchers (Table 8). WP3 will help to organise bilateral / small-group meetings on those topics, if they are not addressed in WIMs (walk-in meetings).

TABLE 8: TOPICS OF INTEREST FOR PILOTS

Topics	Pilots interested to know more	Inspiring pilots, could give a presentation
Green space index in planning (for land take monitoring)	Brebemi Highway, Hajdu Bihar, Klagenfurt, Ljubljana, Baia Mare	Klagenfurt, Nantes, (Gothenburg)
Landscape fragmentation by new infrastructures	Hajdu Bihar, Brebemi Highway, Ljubljana	
Long-term territorial no net land take strategy including compensation of biodiversity losses	Klagenfurt, Brebemi Highway, Oostellingwerf, Baia Mare	Nantes, Grenoble
Soil circularity	Klagenfurt, (Nantes)	Gothenburg
Operational guidance on tools for planners (how to translate soil knowledge into planning practices)	Baia Mare	Gothenburg, Nantes
Translate complex soil data and multiple perspectives on soil health into actionable planning decisions	Montpellier, Klagenfurt, Brebemi Highway	Grenoble, Nantes, Groene Hart
Multi-level, cross-sectors coordination, indicators	Baia Mare	Hajdu Bihar
Land bank	Klagenfurt	Montpellier, Flanders
Business models (for soils to rest)	Groene Hart, Montpellier, Coeur d'Hérault, Grenzeloos Bocageland	
Relation of soil and water systems with spatial planning	Grenoble, Leipzig, Ljubljana, Nantes, Gothenburg, (Malchin, Grenzeloos Bocageland)	The Netherlands
Peatland restoration, rewetting peat areas (how to use public structures to drive regional rewetting)	Groene Hart, Malchin, Klagenfurt	
Dairy farming vs. nature, similar organisations	Bocageland, Oostellingwerf, Groene Hart, Grenzeloos Bocageland	
Agriculture nature interface	Ljubljana, Hjadu Bihar, Oostellingwerf, Groene Hart, Grenzeloos Bocageland	All T3.3. more rural pilots

3. TRANSVERSAL ANALYSIS OF THE 17 DIAGNOSIS WORKBOOKS

This chapter provides the first results of the transversal analysis of the 17 diagnosis workbooks, conducted by several researchers from WP1 "Soil in spatial planning systems, design concepts and strategies" and WP2 "The potential of soil in spatial strategies". Such intermediary results, coming from the SPADES pilots, will be further elaborated and integrated with external data (e.g. benchmarking, document analysis) into the upcoming WP1 and WP2 deliverable reports, due by August 2026.

3.1 Current state of integration of soils in spatial planning practices in the 17 pilots

In the Diagnosis workbook (in the section "Planning levels and planning documents relevant for the specific case", based on Task 1.1.2 "Spatial planning systems (policy) and soil policy".), pilots were asked to provide information about spatial planning documents, relevant to the pilot areas, that include any direct or indirect mentions or relations to soil. The aim of this input was to identify how documents from different pilots, and on the different levels, include the aspects of soil quality and health, quantity and performance. Out of a total of 17 pilots, data were provided for 15 pilots. A total of 182 spatial planning documents were collected from the pilots that provided potential links related to soils. Various types of documents are included, such as legislation, policy frameworks, implementation and action plans, environmental assessments and instruments. These documents refer to a broader or concrete pilot area. Documents also refer to different scales: from national, regional, provincial, county and metropolitan level to the local level. In the terms of EU statistical unit levels, the following levels are included: NUTS0, NUTS1, NUTS2, NUTS3, LAU1 and LAU2[3].

The data collected was harmonised and aggregated by NUTS and LAU levels (Table 9). Subsequently, we sorted the documents grouped in clusters of pilots (Long-Term Strategy, Urban and Peri-urban and Rural and Peri-urban). Table 9 below shows the essential and recurring themes related to soil quality and health, quantity and performance, emerging from the responses of each pilot.

TABLE 9: KEY FINDINGS ON SOIL-RELATED ISSUES ACROSS PILOTS BY NUTS AND LAU LEVELS

Type of pilot	Pilot	Soil quality and health	Soil quantity	Soil performance
NUTS0 (national level)				
Long-Term Strategy	Groene Hart (NL)	1) soil sealing, erosion, soil degradation and contamination, harmful soil changes, 2) soil health protection, clean water, preservation of biodiversity, sustainable soil management, 3) quality arable land, 4) remediation of contaminated sites, CO_2 storage, 5) evaluation system, planning considerations	1) land use, zoning, 2) soil sealing, protection of soil, arable and productive land, 3) limiting land take and reuse of abandoned areas, 4) habitat preservation, and reducing environmental pollution	1) carbon storage, annual carbon sequestration, 2) water retention, 3) maintaining soil functions, protection of natural soils, ecosystem services 4) reuse of abandoned areas, using land sparingly and carefully, 5) maintaining / restoring soil productivity
	Hajdu-Bihar (HU)			
	Ooststellingwerf (NL)			
Urban and Peri-urban	Baia Mare (RO)			
	Leipzig (DE)			
Rural and Peri-urban	Grazing land – Transylvania (RO)			

[3] Definition of such administrative units here: https://ec.europa.eu/eurostat/web/nuts/local-administrative-units.

Type of pilot	Pilot	Soil quality and health	Soil quantity	Soil performance
NUTS1 (large regions)				
Long-Term Strategy	Groene Hart (NL)	1) erosion, soil sealing, soil as part of the components under pressure, contaminated sites, 2) ecological objectives, ecosystem resilience, 3) avoiding soil compaction, crop rotation 4) preserving agricultural land, land usability and productivity, 5) zoning plans and ordinances settlement expansion to less valuable land	1) preservation of productive land, reduction of land take, soil sealing, reuse of brownfields, 2) strengthening of inner urban development, expansion of settlements on less valuable agricultural land, 3) protection of green areas, forests, farmland consolidation, 4) zoning plans and ordinances, 5) ecological purposes, amount of polluted soil	1) maintaining landscape functions, the material standards of soil protect-ion, food production, land consolidation, 2) conservation of the forests, supporting landscape connectivity, water drainage 3) natural preservation, biodiversity and landscape diversity, ecosystem services, peat oxidation 4) zoning plans and ordinances
	Klagenfurt (AT)			
	Ooststellingwerf (NL)			
Urban and Peri-urban	Gothenburg (SE)			
	Leipzig (DE)			
	Ljubljana (SI)			
Rural and Peri-urban	Farmland abandonment (FR) – Pays Cœur d'Hérault			
	Natural grasslands (BE) – Grenzeloos Bocageland			
	Public Farmland (BE) – Flanders			
NUTS2 (smaller regions, provinces)				
Long-Term Strategy	Grenoble (FR)	1) sustainable and efficient land use, environmental protection, biodiversity assessments, soil preservation, soil sealing, erosion, mandating reuse, 2) habitat function for soil organisms and plant comm-unities, crop rotation, 3) water regulation, water holding capacity, water retention, 4) production function, identifying high-quality soil zones, 5) reducing emissions, preventing contamination and degradation	1) land use and territorial planning, soil preservation, food production, 2) strengthening of land recycling, reduction of unused building land, 3) environmental protection, ecological networks, recreational spaces and future societal needs, 4) mapping land take trends, 5) urban sprawl	1) biodiversity, water regulation, carbon storage, agricultural productivity, 2) soil sealing, soil subsidence, restoring degraded, brownfield sites, 3) maintaining green and blue corridors and infrastructure, green networks, habitat function, 4) ecosystem values and ecosystem services, buffer function, 5) erosion prevention, emission reduction
	Groene Hart (NL)			
	Klagenfurt (AT)			
	Ooststellingwerf (NL)			
Urban and Peri-urban	N/A			
Rural and Peri-urban	Farmland abandonment (FR) – Pays Cœur d'Hérault			
	Brebemi Highway (IT) – Lombardy			
	Natural grasslands (BE) – Grenzeloos Bocageland			
	Public Farmland (BE) – Flanders			
NUTS3 (provinces, counties, départements, districts)				
Long-Term Strategy	Grenoble (FR)	1) environmental protection, carbon storage, land use regulation, soil permeability, ecosystem functions, 2) limitation of urban sprawl, blue-green urban development, protection of soils, risk prevention measures, 3) soil sealing, degradation, artificialisation, 4) the importance of soil for animals, plants, human quality of life, 5) soil assessment, zoning plans and ordinances	1) land-use planning, land artificialisation, urban sprawl, promoting sustainable densification, 2) soil sealing, brownfield redevelopment, 3) preservation of forests and natural areas, productive agricultural land 4) sustainable soil use, the need for space to store floodwaters, 5) zoning plans and ordinances, introducing quotas	1) ecosystem services, biodiversity, environmental, land use, climate and sustainability objectives, 2) soil sealing, 3) land cover, carbon storage, preserving natural / agricultural areas, 4) zoning plans and ordinances, and 5) flood mitigation, water retention, infiltration, flood buffering, natural floodplains
	Hajdu-Bihar (HU)			
	Klagenfurt (AT)			
	Ooststellingwerf (NL)			
Urban and Peri-urban	Baia Mare (RO)			
	Leipzig (DE)			
Rural and Peri-urban	Farmland abandonment (FR) – Pays Cœur d'Hérault			
	Natural grasslands (BE) – Grenzeloos Bocageland			
	Public Farmland (BE) – Flanders			

Type of pilot	Pilot	Soil quality and health	Soil quantity	Soil performance
LAU1 (large municipalities, districts, groups of municipalities)				
Long-Term Strategy	Klagenfurt (AT)	1) degradation, erosion, de-sealing, compaction, depletion, 2) water and agricultural soils pollution, motor vehicle traffic, waste, plant protection products, 3) soils as "surfaces" for renewable energy sources, 4) agricultural fertility, diversification of production, weeding and vineyard irrigation, green and blue corridor, biotopes, 5) action-research about soil carbon sequestration, diagnosis of the environment	1) densification, reduction of land take, de-sealing measures, 2) land consumption, soil artificialisation, urban sprawl, agricultural land conversion, 3) restoring biological, ecological, hydrological qualities, green quota, 4) monitoring the evolution of land artificialisation and flooding phenomena, vulnerability to climate change, clay shrinkage and swelling, 5) the issue of land prices on the land market	1) de-sealing, soil fertility, brown network, 2) biological, environmental, ecologic-al, hydrological, agronomic functions, biodiversity, food production, (3) resilience to climate change, heat sinks, carb-on sequestration, storage capacity, air quality, risk prevention, 4) promotion of agroforestry, agroecology, sustain-able farming practices, 5) heritage, nourishing and recreational function
Urban and Peri-urban	Gothenburg (SE)			
Rural and Peri-urban	Farmland abandonment (FR) – Pays Cœur d'Hérault			
	Montpellier (FR)			
LAU2 (municipalities, settlements)				
Long-Term Strategy	Groene Hart (NL)	1) food supply, ecosystem services, protection of biodiversity, green wedges, thematic areas of parks, preservation and planting of trees, 2) urban expansion, densification, changes in land use, separating removal and return of soil layers, 3) climate change, emissions of pollutants, waste, soil contamination, spread of alien species, 4) terrain stability, bank and embankment management, cultivated terrain, sustainable farming practices, rainwater infiltration, 5) protection of human health in existing kindergartens	1) soil sealing, urban sprawl, pollution, recycling, protecting land, 2) social, sociotopic functions, ecosystem services, cultivated terrain, 3) flood management risks, definition of embankments, banks, basement floors based on soil stability, minimum share of green areas, green space factor, 4) soil movements, earthworks, excavations, arrangement of underpasses, railway corridor, height regulation of the terrain, 5) traffic, construction areas, delimitation of functional units, technical measures	1) contaminated soils, reducing the city's environmental and climate impact of transport, increased circular economy, carbon sequestration, 2) water quality, rain-water infiltration, facilitating runoff, preserving flood storage, expansion, restoration of hydro-melioration systems, 3) food production, maintaining soil fertility, 4) green areas and elements, regulatory, protective, ecological function, 5) biodiversity, rehabilitation of forests, agricultural land, limiting the spread of invasive alien plant species
	Ooststellingwerf (NL)			
Urban and Peri-urban	Gothenburg (SE)			
	Ljubljana (SI)			
Rural and Peri-urban	Farmland abandonment (FR) – Pays Cœur d'Hérault			
	Brebemi Highway (IT) – Lombardy			
	Natural grasslands (BE) – Grenzeloos Bocageland			

Such analysis showed that the NUTS0 and NUTS1 levels are predominantly represented by legislation and strategic documents. On NUTS2 and NUTS3 levels there is a wider variety of document types, with fewer legislation and strategic documents and more planning documents and programmes, than on previous two levels. Similarly, on LAU1 and LAU2 levels, a broad range of documents was identified, with local spatial plans, guidelines, ordinances and building plans being particularly prominent on these two levels.

Some links or connections to soil related issues are present throughout multiple NUTS and LAU levels. For soil quality and health such examples are soil sealing, degradation, erosion, protection, contamination, water related issues and importance of soils for plants. When it comes to soil quantity, such examples are urban sprawl, soil sealing, production function, land recycling and redevelopment of brownfields. In contrast, some of the links or connections recognised on multiple levels for soil performance are production function, soil artificialisation, water related issues, biodiversity, ecosystem services and carbon storage. One of the other noteworthy findings was that zoning plans and ordinances appear mostly on NUTS1 and NUTS3 level. Similarly reuse and brownfield redevelopment are mostly present on NUTS levels,

while connections to climate change and carbon sequestration appear mostly on LAU levels. Spread of alien species appears only on LAU2 level, as well as links to cultivated terrain and terrain stability.

Based on such results, soil aspects — such as soil quality and health, quantity and performance — appear more frequently than might have been expected. It is important to note, that these aspects are not necessarily addressed directly. The results show that in some cases, they are presented indirectly, through other related aspects such as food production, water infiltration and other topics. This highlights the importance of linking soils and soil related issues with other policy areas and sectors.

3.2 Boundaries identified in the 17 pilots

The SPADES project pilots highlight a set of recurring governance and planning challenges that shape how soil management and land-use strategies are co-created across diverse territorial contexts. Drawing on the diagnosis workbook results and the cross-fertilisation workshop outcomes, boundaries were shortlisted based on their relevance to co-creation processes, understood as the interaction and collaboration between institutions, sectors, and stakeholder groups. These boundaries were clustered into four overarching categories.

Multi-Level Coordination

Boundaries under multi-level coordination arise from misalignments across governance levels (local, regional, or national) or between sectors. They are characterised by fragmented policies, inconsistent enforcement, and misaligned strategies. For instance:

- in Hajdú-Bihar (HU), urban and agricultural planning processes operate in parallel without a shared soil monitoring framework, limiting integrated decision-making.
- The Groene Hart (NL) faces similar challenges, where agricultural, water, and climate policies remain poorly aligned across governance levels.
- Grenoble-Alpes Métropole (FR) illustrates how strategic inconsistencies across valley, slope, and mountain areas, combined with fluctuating political support, complicate territorial coherence.
- In Malchin's peatlands (DE), national rewetting objectives struggle to translate into local practice due to fragmented incentives for land managers.
- The Brebemi Highway pilot (IT) further demonstrates the complexity of coordinating soil- and land-related priorities across many municipalities.

Such boundaries point to the need for stronger cross-level coordination mechanisms that align objectives and responsibilities across scales.

Cross-Sector / Cross-Departmental

A second cluster of boundaries concerns the misalignment and silos that exist between sectors, departments, or stakeholder groups. Conflicting priorities and fragmented planning emerge as major obstacles to co-creation. For instance:

- In the Groene Hart (NL), tensions between housing, energy, recreation, and agriculture illustrate how sectoral competition constrains co-creation.
- Grenoble-Alpes Métropole (FR) and Klagenfurt (AT) reveal gaps in integrating soil preservation and ecological compensation into planning instruments dominated by urban or infrastructural priorities.
- Fragmented governance structures in Ooststellingwerf (NL) and Nantes (FR) further slow the operationalisation of soil, water, and land policies within spatial planning.
- Similar dynamics are visible in Leipzig (DE), where soil considerations remain marginal despite increasing urban pressure, and in Montpellier's public land (FR), where agriculture, tourism, biodiversity, and urbanisation are addressed through parallel, uncoordinated processes.
- Public Farmland Flanders (BE) highlights how misalignment between governance frameworks and market incentives hampers sustainable soil stewardship at farm level.

These cases underline the importance of cross-departmental collaboration and shared planning frameworks.

Across the pilots, the tensions identified typically occur between a recurring set of sectors involved in territorial development and land management. The most common sectoral interfaces are presented in table 10 below:

TABLE 10: SECTORAL INVOLVEMENT ON SOIL AND LAND-USE GOVERNANCE

Sector / Department	Typical role in soil and land-use governance	Examples of tensions observed in pilots
Agriculture	Farm management, food production, land stewardship	Conflicts with urban expansion, nature protection measures, or infrastructure development
Housing / Urban Development	Spatial planning, housing supply, urban growth	Pressure on agricultural land and open spaces
Water Management	Flood control, water quality, hydrological systems	Alignment needed with agricultural practices and climate adaptation strategies
Climate & Energy	Renewable energy infrastructure, climate mitigation and adaptation	Land competition with agriculture, nature areas, or landscape preservation
Nature Conservation / Biodiversity	Habitat protection, ecological networks, soil ecological functions	Restrictions affecting agricultural or urban development priorities
Transport & Infrastructure	Roads, mobility corridors, logistics infrastructure	Land take and soil sealing affecting agricultural or ecological land
Recreation & Tourism	Landscape use, leisure infrastructure	Balancing landscape preservation with economic activities

Stakeholder Engagement / Trust

Trust and alignment among stakeholders represent another critical set of boundaries. Weak collaboration, lack of transparency, and conflicting interests undermine co-creation processes. For example,

- In Ljubljana (SI), tensions between municipal planning objectives and investor-driven development, combined with weak legal enforcement, hinder the integration of green wedges into spatial planning.
- In Transylvania (RO), low levels of trust and limited transparency constrain citizen involvement and reduce the legitimacy of soil-inclusive strategies.

These cases demonstrate that co-creation depends not only on institutional alignment but also on sustained trust-building and meaningful stakeholder involvement.

The pilots reveal a wide diversity of stakeholders involved in soil and land-use co-creation processes, which typically include (Table 11):

TABLE 11: STAKEHOLDERS' ROLES

Stakeholder group	Role in Co-creation processes	Relevance in pilots
Municipal Authorities	Local spatial planning, land-use regulation, implementation of policies	Central role in coordinating planning and local stakeholders
Regional / National Authorities	Policy frameworks, funding instruments, regulatory oversight	Influence strategic direction and policy alignment
Farmers and Land Managers	Direct management of agricultural soils and landscapes	Key actors for implementing sustainable soil practices
Private Investors / Developers	Urban development, infrastructure, real estate projects	Often drive land-use change and development pressure
Environmental NGOs	Advocacy for biodiversity, soil protection, ecosystem services	Provide expertise and represent environmental interests
Research Institutions / Experts	Scientific knowledge, monitoring, data analysis	Support evidence-based decision-making
Citizens and Community Groups	Local knowledge, social acceptance, participation in planning	Important for legitimacy and public support of strategies

Implementation & Iterative Learning

Finally, several pilots demonstrate that even when policies exist, translating them into action remains a challenge. This boundary group emphasises the importance of iterative governance, adaptive management, and feedback loops. For example,

- Grenzeloos Bocageland (BE/NL) shows how long-term visions struggle to translate into concrete action without adaptive governance and feedback mechanisms.
- In Gothenburg (SE), contaminated land, soil sealing, and brownfield redevelopment are addressed in isolation, limiting opportunities for learning across initiatives.
- The Pays Coeur d'Hérault farmland abandonment pilot (FR) further illustrates how fragmented actor coordination can ultimately lead to implementation failure.

These cases highlight the need for iterative approaches that enable learning, adjustment, and continuous stakeholder engagement throughout implementation processes.

3.3 Good soil management practices identified in the 17 pilots

SPADES aims to develop a portfolio of best practices to enhance soil-inclusive planning strategies. To that end, T2.2 "Inventory of best practices" is compiling a long list of cases of soil management practices that prioritise soil health, which will be assessed against a specific Evaluation Framework (T2.3) to develop a short list of best practices. The process was structured with a multi-layer approach, blending the Grant Agreement's specifications with supporting documentation and contribution from the project's partners. The task aims for a comprehensive portfolio of best practices tailored to soil-inclusive case studies and their interaction (explicit or not) with spatial planning across various contexts.

To manage the high number of identified cases, T2.2 proposed an analytical framework whereby the cases are clustered by good soil management "Practice Families" (Figure 8).

FIGURE 8: BEST SOIL MANAGEMENT PRACTICE FAMILIES (INCLUDING NAMING REFINEMENT FOLLOWING THE DIAGNOSIS PHASE)

As part of the interaction with WP3, and to enrich the portfolio of best practices with context-specific information, pilots were invited to contribute to the development of the portfolio; therefore, within the Diagnosis Workbook, pilots were asked to:

- Propose new cases and good practices they know about in their regions
- Comment on the proposed naming and descriptions of the "Practice Families" for further refining
- Identify the higher thematic demand among the families, based on the challenges of the pilots
- Suggestion of how to design a useful portfolio

The information they provided enriched the long list and helped refine the Practice Families framework, but it also identified demands from the pilots, both in terms of content (which Practice Families they are most interested in) and form (what is a useful format for a portfolio of best practices).

Analysis of the proposed new case studies

After the analysis of the pilots' entries, a total of 336 new suggested cases were included in the practice's long list for their suitability for the project's best-practice inventory. This analysis was divided into quantitative and qualitative assessments to refine whether the information they provided was sufficient to integrate them into the long list of good practices and ensure the proposed cases align with soil-inclusive spatial planning goals (such as explicitly promoting soil health and/or following a planning approach).

Of the 336 cases, 179 lack clear links to webpages or further documentation, which poses a challenge for the scoring and usability phases of the evaluation framework. Furthermore, the analysis reveals that some submitted data is better suited for other project tasks:

- National policy documents are more relevant for Task 1.1 (spatial planning strategies).
- Soil tools are redirected to Task 2.1 (soil tools and methods).
- Items related to soil literacy and capacity-building are relevant for WP5 "Soil literacy and CDE".

Figure 9 below shows the number of new cases contributed by pilots, and figure 10 shows the total number of suggested cases based on each family.

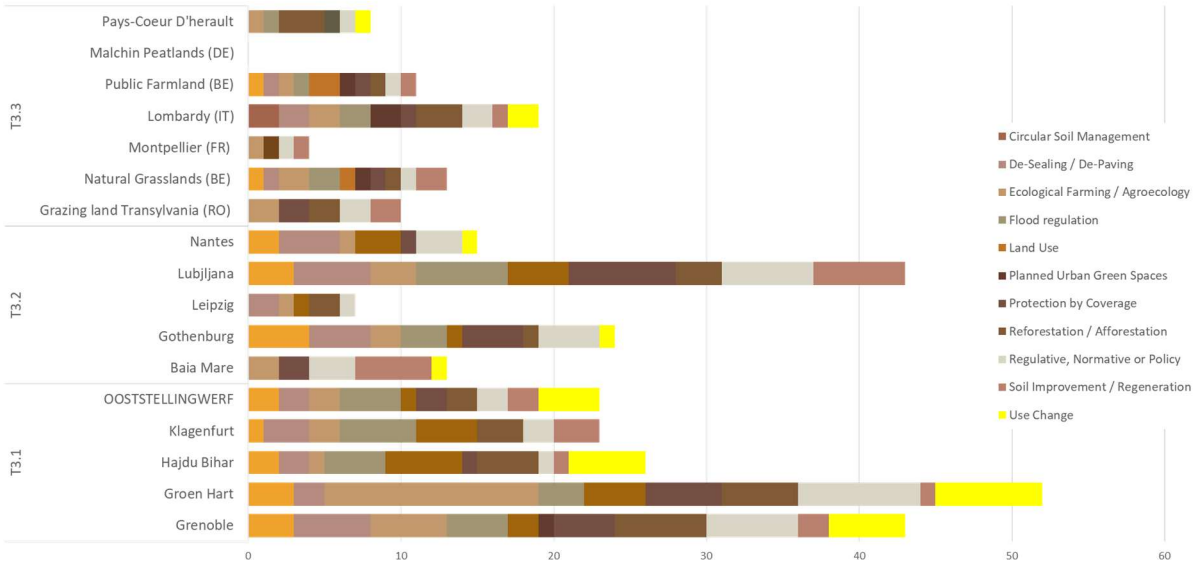


FIGURE 9: NUMBER OF NEW CASES PROPOSED SORTED BY EACH PILOT AND BY PRACTICE FAMILIES.

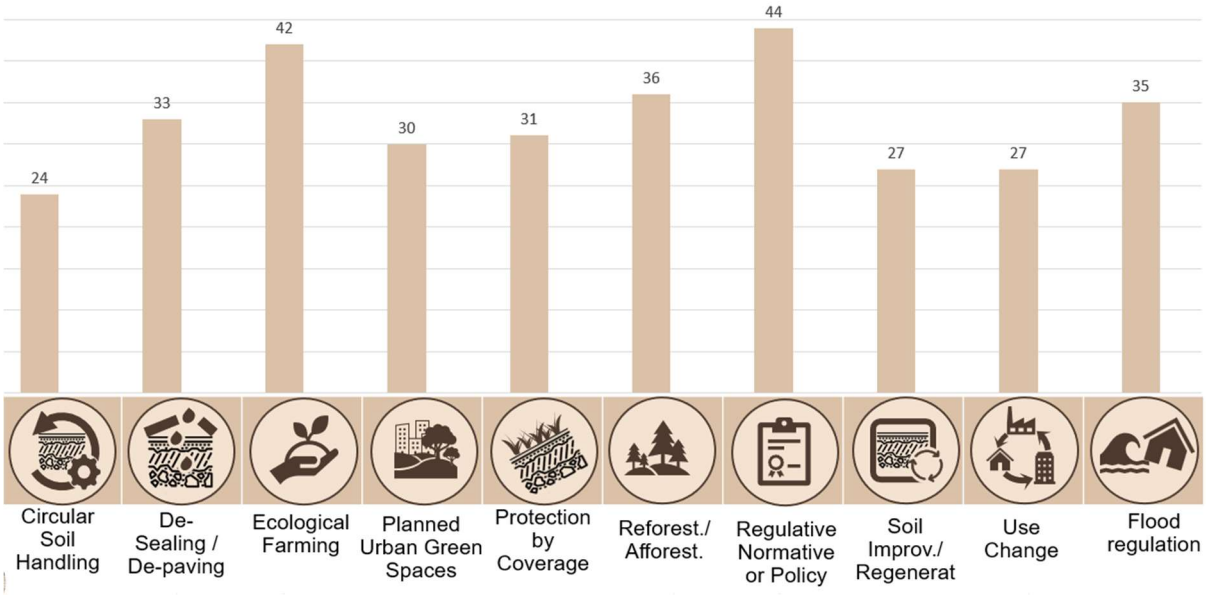


FIGURE 10: TOTAL NUMBER OF NEW CASES PROPOSED BY SOIL MANAGEMENT PRACTICE FAMILIES.

Pilots were also asked to identify "bad examples" from which lessons learned can be analysed. This showed that urban and peri-urban pilots struggle with historical problems and an uneven distribution of soil quantity/quality issues. Rural pilots are more concerned with recent changes and issues of soil quantity.

Refining the proposed good soil management Practice Families

The analysis highlights several areas where the proposed family names and descriptions must be clarified to improve the final inventory of best practices. Pilots stated that the descriptions of certain families are currently confusing or seem incomplete and require rephrasing to focus on concepts rather than just services. As a result of the suggestions, four of the 11 families have changed their names and refined their descriptions, as shown in table 12 below.

TABLE 12: SOIL MANAGEMENT PRACTICE FAMILIES CHANGES

Family original name	Changed to (following Diagnosis Phase)	Description
Circular Soil Handling	Circular Economy of Soil	Integrates circular economy principles into soil and land management, aiming to optimise soil reuse, reduce waste, and enhance sustainability in spatial development.
*Regulative, Normative, or Policy	Soil conservation	Soil conservation encompasses management strategies to prevent soil degradation, including erosion, compaction, salinisation, and organic matter loss, while maintaining soil productivity and ecosystem services.
Soil Improvement/Regeneration	Soil Functional Restoration	The process of improving the quality of soil, for example, by adding organic matter, which helps to improve drainage, water retention, and nutrition for plants. It can involve returning nutrients. It targets soil degradation and abandoned spaces through revitalisation and sustainable redevelopment.
Flood regulation	Water-sensitive practices	Practices that allow for enhancing the soil's ability to absorb and retain water (capacity of soil to hold water) and/or that allow for surface water to move through the soil (infiltration), preventing surface runoff and soil erosion.

* This family was reformulated from the name to the description, as Regulation, Norms or Policy are considered as implementation instruments, useful to promote such good soil management practices.

Thematic Demand and Relevance of the "Practice Families"

The analysis identified a high demand for solutions and examples related to Soil Improvement, Agricultural Management, and Circular Soil Management. However, the analysis notes that for agricultural practices to be relevant to T2.2, they must be integrated into spatial planning and offer benefits beyond simple soil protection or enhancing soil ecosystem services.

Conversely, there is low demand for Reforestation and Afforestation, partly because their relevance is highly dependent on specific soil types. There is also a noted demand for Flood regulation, Use change (including brownfield remediation), and De-sealing.

The outcomes of this section will be useful during the co-creation phase, which aims to develop a practical strategy for each pilot to better integrate context-specific soil best practices. The findings enable SPADES partners to place greater emphasis on the specific barriers that pilots must overcome, while also highlighting the types of support, knowledge, and resources that can facilitate implementation. It helps to tailor the theoretical strategies to real conditions on the ground, increasing their practicality, relevance, and potential for successful adoption.

How to design a useful portfolio

Pilots were also asked their opinion on what makes a portfolio of best practices useful and inspirational. They identified essential information that would need to be included, such as the planning context, implementation process, participatory dimensions, costs, and direct impacts on soil health. This helped refine the final format of the final deliverable from T2.2, the Portfolio of best practices to enhance soil-inclusive planning strategies (D2.2).

In general, the results of the analysis helped T2.2 expand the size of its long list of practices, refine the framing of its clustering approach (the “soil practice families”), and informing the final design of its outputs, which will feed into the SPADES Navigator, the online tool that will enclose the instruments and best practices from SPADES (WP4 “Implementation of soil in spatial strategies”).

3.4 Soil data, tools & instruments used in the 17 pilots

During the diagnostic phase, pilots were asked to provide information on currently used soil assessment tools and methods in their respective planning practices. Pilots have classified their currently used tools and methods according to category types of tools (soil repositories, soil health scoring method, soil function maps (GIS), and national catalogues). All answers by the pilots are presented in the following table (Table 13). Out of 17 pilots, only one pilot has not provided answers to the questionnaire below, and their entries have been marked as NA (not available). Across the pilot sites, 15 out of 17 respondents reported the use of GIS-based platforms and national soil information systems (e.g., BODEM in the Netherlands, RMQS a Soil quality measurement network in France, Flanders Subsurface Database (DOV Portal) in Belgium). This widespread use indicates a promising foundation for the development of a future operational framework that is accessible and useful for both soil experts and spatial planners. Despite this potential, several pilots expressed concerns regarding national-scale datasets, noting that their generalised estimates may limit accuracy and applicability when assessments are required at finer, local scales (Groene Hart (NL), Montpellier (FR), Brebemi Highway (IT) and Public farmland Flanders (BE) pilots).

Current GIS tools predominantly support spatial mapping, contamination monitoring, and integration of soil information with land-use data. In addition to standard GIS environments, several pilots rely on advanced proprietary platforms — including Glenn and Gokart in Sweden and ARSO indicators in Slovenia — particularly for urban planning applications and the assessment of restoration potential. Only a limited number of pilots reported the use of geoportals capable of addressing soil quality, quantity, and functional performance simultaneously. Even in these cases, pilots noted that although relevant information is available, it is often dispersed across multiple sections of the portal and therefore requires prior familiarity to navigate efficiently.

TABLE 13: DIAGNOSTIC PHASE REPORTED TOOLS AND METHODS CURRENTLY USED BY THE SPADES PILOTS

No.	Pilots' names	Currently used tools and methods by pilots	Categories of currently used tools and methods	Existing challenges with currently used tools and methods	Desired soil assessment tools
Long-term strategy pilots					
1	*Grenoble (FR)*	Soil quality measurement network (RMQS), Tool and method to map soil multifunctionality for spatial planning at territorial scale (MUSE), Georisks database (BASOL) and Database of Former Industrial Sites and Service Activities (BASIAS), Land Use Change (MOS)	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	Inability to systematically consider soil in the planning process, detailed soil information is not included in the existing internal GIS database, still mostly relying on external expertise, costs related to external expertise	Consolidated operational and awareness-raising tool
2	*Groene Hart (NL)*	Dutch Registration of Subsurface Data (BRO), National Geoportal (PDOK), Soil information system (BODEM), Cadastral data, Municipal zoning maps, etc.	Soil repositories and soil function maps (GIS)	Not detailed enough data for specific site, specialists are needed for additional sampling	Tool showcasing best practices, including details of scalability / transferability
3	*Hajdu-Bihar (HU)*	Soil Map of Hungary (AGROTOPO), National Adaptation Geo-information System of Hungary (NATéR)	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	Data access is limited or unclear, data fragmentation as different institutions store data in different formats, outdated data on land use and climate changes, no legal requirement for planning officials to include experts who could interpret existing data	Consolidated user-friendly databases and tools
4	*Klagenfurt (AT)*	Soil information system (BORIS), Soil function assessment (Bodenfunktionsbewertung Kärnten), Contaminated Sites Remediation Act (Altlastensanierungs Gesetz), Building plan	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	Little access to soil data and non-active use of existing data	Awareness-raising tool for elected officials
5	*Ooststellingwerf (NL)*	Land use maps (LGN), Soil information system (Bodemloket), Climate buffer maps (national level), Groundwater Atlas Friesland (Vitens + Wetterskip Fryslân), Peatland monitoring wells (Veenweideprogramma Fryslân), Geothermal energy potential maps, Crop suitability zoning (WUR 1:50k soil map)	Soil repositories, soil function maps (GIS), national catalogues	Data harmonisation, privacy concerns, technical support to maintain the database and update visualisations	Operational tool for planners, environment officers and spatial designers; simplified dashboard with key indicators
Peri-urban and urban pilots					
6	*Baia Mare (RO)*	ICPA Bucharest soil classification datasets, Land use plans and environmental reports, Local General urban plan and zoning regulations, Land use maps, urban regeneration strategies, National Meteorological Administrations data on soil moisture/drought, ICPA datasets, Phytoremediation green spaces established on public land	Soil type maps, national catalogues	Data fragmentation, outdated, not publicly available, costs and time, capacity and resources- soil specialist or technical experts needed for data interpretation, data formats are not always easily integrated into GIS format	Operational for planning stakeholders and awareness-raising tool for elected officials
7	*Gothenburg (SE)*	County Administrative Boards maps of potentially contaminated sites (EBH webgis portal), Soil repositories of various municipal projects (Glenn exploitering), Municipal technical guidelines for filling mass in development projects, Green Development plan, Comprehensive Development plan of City of Gothenburg	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	Data access and fragmentation, data management, lack of soil data in the urban zone	Operational tool publicly available
8	*Leipzig (DE)*	Leipzig Soil Protection Concept, Saxon soil assessment tool, Saxon disclosure and sample database, Saxon soil assessment tool, Saxon land use map, Saxony soil sensitivity map, Saxony soil function map, Saxony soil sealing map, Geochemical overview map	Soil repositories, soil function maps (GIS), national catalogues	Political resistance from other authorities, time, capacity and other resources on individual levels within agencies limit access	Awareness-raising tool for government agencies and authorities

No.	Pilots' names	Currently used tools and methods by pilots	Categories of currently used tools and methods	Existing challenges with currently used tools and methods	Desired soil assessment tools
9	*Ljubljana (SI)*	Public geoportal (eProstor/GURS), Environmental Atlas, Urban Atlas, Pedological Map of Slovenia, System for monitoring agricultural soils (SSKT and KSSKT), Soil Quality Monitoring (MKT), Soil contamination studies (ROTS);	soil function maps (GIS), national catalogues	Data access and fragmentation, data management, scale mismatch for decision making, lack of soil health indicators set for planning, time, cost and capacity constraints	Consolidated operational and awareness-raising tool
10	*Nantes (FR)*	Guide to using soil databases for the production of thematic maps (DoneSol), Database to capitalise information on urban soil analyses (BDSolU), Tool and method to map soil multifunctionality for spatial planning at territorial scale (MUSE), Georisks database (BASOL) and Database of Former Industrial Sites and Service Activities (BASIAS), Tool for integrating soil quality in planning scenarios for a qualitative approach of no net land take (QUASOZAN – DESIVILLE)	Soil repositories, soil health scoring method, soil function maps (GIS)	Scale of soil data, lack of soil data in the urban zone, collecting and maintaining data produced locally, need of experts for data interpretation	Awareness-raising tool
Peri-urban and rural					
11	*Farmland abandonment in Pays Coeur d'Hérault (FR)*	Green and blue corridor / ZNIEFF / Natura 2000 / ZICO, Flood and fire risk data, Land use map, Cadastral data, LPIS, Agronomic potential (GDPA)	soil function maps (GIS), national catalogues	Access to data, costs of soil sampling and maintaining of the database, lack of human resources, lack of skill to analyse the data	Operational tool
12	*Grazing land Transylvania (RO)*	Corine land cover databases, national databases operated by Agronomic Research Institute of Romania (ICAR), Soil Information system (SIGSTAR-200)	Soil repositories, soil function maps (GIS), national catalogues	Data is missing, costs of maintaining and updating datasets, converting national datasets through EU-INSPIRE process is time-consuming, technical capacity and limited existing infrastructure	Awareness-raising tool for elected officials and user-friendly operational tool
13	*Brebemi Highway (IT)*	Geoportal Tuscany and Arpa Piemonte, Tintaly, rendis, Climate impact calculator for the logistic sector (Ecologistico$_2$), National Repository of Territorial Data (RNDT), National reports on land consumption (National System for Environmental Protection- SNPA), National environmental catalogues (ECOATLANTE)	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	Access to data is often missing, existing data is general national/regional data and not applicable to a site-specific condition	Awareness-raising tool for elected officials
14	*Montpellier (FR)*	Land cover (Occsol, BDsol), Agronomic potential (GDPA), Multifunctionality index (Agri-SPMI), Geoportal, etc.	Soil function maps (GIS), national catalogues	Lack of information on soil biodiversity, lack of precision of data on site specific scale	Operational tool
15	*Grenzeloos Bocageland (BE)*	Flanders Subsurface Database (DOV Portal), Soil Service of Belgium, Digital Flanders (Vlaanderen), Flanders Spatial Report (RURA), etc.	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues		Awareness-raising tool for elected officials
16	*Malchin Peatlands (DE)*	NA	NA		NA
17	*Public farmland Flanders (BE)*	Flanders Subsurface Database (DOV Portal), Soil Service of Belgium, Digital Flanders (Vlaanderen), Flanders Spatial Report (RURA), etc.	Soil repositories, soil health scoring method, soil function maps (GIS), national catalogues	No publicly available data on local level, time management of sampling campaigns and collection methods, classification systems, degree of detail	Awareness-raising tool for elected officials

Identified challenges and tool needs

The primary challenges reported by pilots relate to fragmented, outdated, or inaccessible soil data, with several instances of a complete lack of information at parcel level resolution. Pilots emphasised the need for tools capable of integrating heterogeneous datasets into a single interface and supporting transparent, traceable scale transformations. A recurring observation is the absence of operational decision support systems that combine information on soil health, contamination, hydrology, and planning constraints or opportunities.

Additionally, pilots highlighted a shortage of tools designed for awareness-raising among elected officials and for participatory engagement with the public. Such tools were identified as important for supporting informed decision-making and fostering broader involvement in soil-related planning and management processes.

3.5 How SPADES could address the needs identified in pilots

The Diagnosis Workbook and the first round of exchanges with the 17 SPADES pilots provided a better understanding of the pilots' needs, capacities, and expectations regarding soil-inclusive spatial planning. Beyond identifying technical gaps, the process revealed how pilots perceive the transition from diagnosis to co-creation, and what types of support are required to translate soil knowledge into spatial planning and design practice.

Overall, pilots expressed a strong willingness to move from analysis towards action. While contexts differ across strategic, urban, and rural pilots, several transversal needs emerged concerning knowledge, governance, facilitation, and peer learning. These needs point to a clear role for SPADES in acting as a boundary-spanning platform that connects soil expertise, spatial planning practice, and participatory governance. Many pilots indicated that the Diagnosis Workbook helped clarify where soil knowledge sits within existing policy frameworks and planning systems. However, several teams emphasised that the step from diagnosis to decision-making still requires additional structure and guidance. Pilots asked for support in translating soil data and soil functions into planning-relevant arguments and instruments, building operational roadmaps that connect soil knowledge to spatial strategies and identifying feasible entry points within existing planning and regulatory frameworks. The needs identified by pilots can be divided into the below stated categories.

Knowledge and data needs

A recurring challenge, especially among rural pilots, concerns fragmented soil data. Soil information is often dispersed between ministries, research institutions, and land managers, or missing, making it difficult to mobilise in spatial planning without additional technical support. Some pilots also highlighted limited access to contamination data or soil monitoring datasets.

This points to a need for:

- support in navigating and interpreting soil datasets;
- practical guidance on soil assessment methodologies;
- visual and spatial tools (e.g., mapping, overlays, scenario visualisations) that make soil information actionable for planners and non-specialists.

Possible Support: SPADES can contribute by strengthening the brokerage function between soil knowledge and planning practice, for instance through soil expert input during the co-creation phase with stakeholders, enabling data exchange as well as shared data interpretation.

Participatory and co-creation methodologies

A second major cluster of needs relates to stakeholder engagement. Many pilots see the co-creation phase as a collective practice rather than a reporting exercise and requested clearer guidance on participatory methodologies. This includes:

- methods for engaging non-specialists in soil-related discussions;
- facilitation techniques for workshops with diverse audiences (planners, farmers, elected officials, citizens);
- creative and visual approaches to co-creation;
- capacity-building formats for local stakeholders

Several pilots also stressed that soil topics can be perceived as technical or abstract, requiring careful communication and translation into locally relevant narratives.

Possible support: SPADES can support this by providing tested participatory formats in other soil planning and design projects or contexts with similar spatial and soil challenges.

Peer learning and cross-pilot exchange

A strong transversal demand concerns learning from other pilots. Many teams expressed interest in:

- attending or observing co-creation workshops of other pilots;
- exchanging on similar thematic challenges (e.g., grasslands, public land management, contaminated soils);
- comparing approaches and procedures;
- identifying transferable practices.

Cross-pilot exchange was perceived as both inspirational and pragmatic, allowing teams to benchmark their progress and avoid working in isolation.

Possible Support: SPADES can respond by actively organising thematic clusters, joint workshops, and peer-learning moments across pilot families. WP3 started to organise this, as explained above, section 2.4.

Coalition building and governance alignment

In complex governance contexts, pilots highlighted the importance of coalition building across departments and governance levels. Needs include:

- understanding multi-level policy frameworks;
- aligning soil objectives with existing sectoral agendas (water, agriculture, climate, housing);
- strengthening cross-departmental collaboration.

Possible Support: SPADES can help by offering boundary-spanning instruments and by showcasing cases where soil has successfully acted as a connector across policy domains (work developed in WP1 “Soil in spatial planning systems, design concepts and strategies”, T1.3 “Spatial planning systems (policy) and soil policy”).

Format and facilitation

Reflections on the Diagnosis Workbook also revealed format-related needs. While the six-week rhythm for online meetings at WP3 tasks level created constructive "positive pressure" and collective momentum, smaller teams found it difficult to dedicate the same level of resources as larger research-led pilots. Several pilots called for:

- lighter and more modular formats of workbooks for next phases;
- clearer instructions on expectations and use of inputs;
- tools better suited for dialogue with local stakeholders.

Possible Support: This suggests that future SPADES support tools should balance conceptual depth with usability and adaptability to local pilots' capacities.

Moving on the co-creation phase, this can translate into four main actions which SPADES can work towards:

- providing methodological guidance and soil expertise,
-facilitating knowledge brokerage,
-supporting participatory processes, and
-enabling cross-pilot learning.

Addressing these needs will be central for the co-creation phase and for ensuring that soil-inclusive spatial planning moves from analysis to creation.

APPENDICES

The Appendices present a short overview and summary of each of the 17 pilots, grouped by pilot family / task. It is based on the 17 posters presented at the General Assembly in Leipzig in November 2025.

Appendix A: Overview and summary of the long-term strategy pilots

Klagenfurt (Austria)

Geographical Situation and Scale: The city of Klagenfurt, the capital of the province of Carinthia, encompasses an area of 120 km² and is home to approximately 104,800 inhabitants. Geographically, it is situated in a basin next to Lake Wörthersee, with a landscape that includes both lowlands and mountainous terrain. Although it is a provincial capital, only one-third of the city area is currently urbanised, while roughly two-thirds are designated for agriculture, forests, or natural areas (Figure 11).

Specific Challenges and Ambitions*:* The key planning challenge in Klagenfurt is land take, which is growing faster than population. Between 2001 and 2022, land take increased by 21% compared to a growth in population of 15%. This trend is driven by an abundance of available building land and inefficient land use, resulting in approximately 16% of zoned land remaining undeveloped alongside numerous vacant properties. Physical soil challenges include urban heat in highly sealed districts, flooding risks in northern retention areas, and the degradation of carbon-rich wetlands due to drainage and urban expansion.

A critical planning bottleneck is that soil protection currently holds a low priority in zoning decisions, often being "weighed out" in favour of development interests. Furthermore, there is no dedicated local authority for soil protection, and technical expertise regarding soil health (e.g., water retention and compaction risks) remains centralised at state and federal levels, leaving local planning teams without direct access to guidance. The city has high environmental ambitions, but binding thresholds and implementation mechanisms for conserving soil functions do not yet exist in local policy.

The pilot's strategic ambition: The pilot's strategic ambition is to integrate soil protection directly into city planning by developing a green infrastructure index to be included in the binding regulatory framework of the municipal building plan. This goal is closely tied to the development of the new Urban Development Concept (STEK 2025) and Klagenfurt's commitment to the EU Mission "100 climate-neutral and Smart Cities by 2030". The pilot aims to minimise new soil sealing in line with the EU's "no net land take" target and establish regular capacity-building and training for soil protection.

Good Practices and Enabling Mechanisms: To address these challenges, the pilot highlights the NutOpIA project, which aims at strengthening inner urban development and reuse of vacant and underused buildings. Another key practice is the Moor4Klagenfurt initiative, which focuses on the renaturation and rewetting of degraded wetlands to restore their function as CO_2 sinks. Klagenfurt has also implemented "sponge city" principles in urban redesigns (e.g. around the Carinthian Museum) to improve water supply for trees and reduce urban heat.

Noteworthy as soil-friendly spatial planning practice is the necessity to carry out a soil function assessment along preparation of the zoning plan. This practice is laid down in the Carinthian Spatial planning law and is a requirement for all municipalities. A soil function map is publicly available referring to the soil functions production, habitat, filtering of pollutants and water retention. About half of Carinthia's soils are designated as soils of special importance due to their high score with regard to soil functions. If such soils are zoned, building land mitigation measures have to be implemented; i.e. reuse of the humus layer, technical measures to ensure water run-off, or biodiversity measures nearby.

The pilot region aims at introducing a green infrastructure target as binding requirement of the building plan. A first draft was developed and discussed in the first co-creation workshop in February 2026. The final version shall be presented to the city council by the end of the year 2026.

To further enable the integration of these tools, the pilot intends to invite other cities for knowledge exchange on successful index implementation.

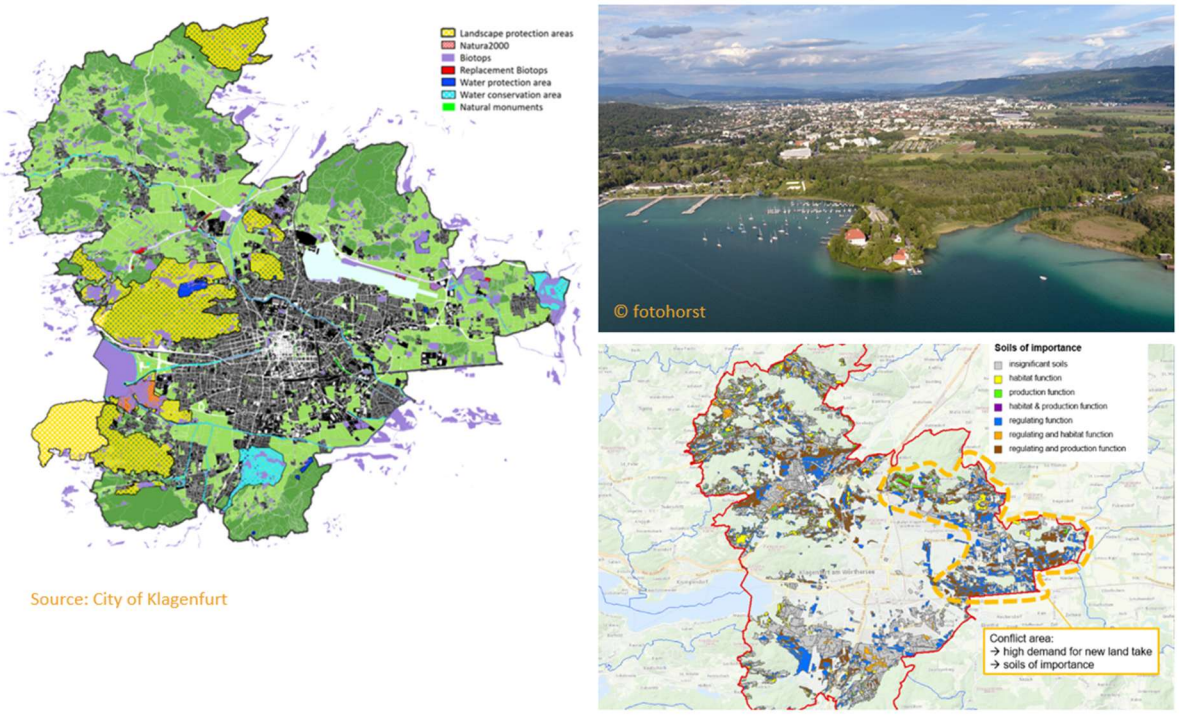


FIGURE 11: MAPS AND IMAGE PILOT KLAGENFURT (LEFT: © CITY OF KLAGENFURT, RIGHT TOP: © FOTOHORST, RIGHT BOTTOM: © KAGIS)

Grenoble-Alpes Metropole (France)

Geographical Situation and Scale: Located in southeast France, the pilot covers the administrative territory of Grenoble-Alpes-Métropole, centering on an urbanised alpine valley floor bordered by the Chartreuse, Vercors, and Belledonne ranges. It is a mixed metropolitan pilot operating at a scale of approximately 500 km² (Figure 12).

Specific Challenges and Ambitions: The territory faces extreme pressure from soil sealing, with over 60% of the urban core covered by impervious surfaces, leading to heightened flood risks and heat-island effects in a geomorphologically constrained valley. Planning bottlenecks are primarily institutional, characterised by data fragmentation and a lack of coordination between environmental services and urban development units. While quantitative land take is tracked, the planning system historically lacks functional soil indicators (e.g., carbon storage or biological activity), making it difficult to prioritise soil quality in zoning decisions.

The pilot's strategic ambition*:* The pilot's ambition is to shift from follow-up remediation to preventive soil protection by integrating soil functional parameters into the Metropolitan Urban Plan (PLUi) and the Climate-Air-Energy Plan (PCAET). This objective is directly framed by the French "Loi Climat et Résilience" and the national "Zéro Artificialisation Nette" (ZAN, zero net land take) mandate, which requires halving first the rate of land take by 2031. The pilot aims to develop a soil-based territorial diagnostic to spatially organise ecological compensation, allowing the metropolis to enhance degraded soils and restore natural infiltration through green-blue infrastructures.

Good Practices and Enabling Mechanisms: Identified good practices include the "Plan Canopée," which aims to increase canopy coverage to 40% by 2050, and mandatory on-plot rainwater infiltration rules that forbid direct connection to public drainage networks. These are enabled by "cercles interservices" (cross-departmental working groups within GAM) and the "Voyage en systémie" approach, which fosters horizontal collaboration within the metropolitan administration.

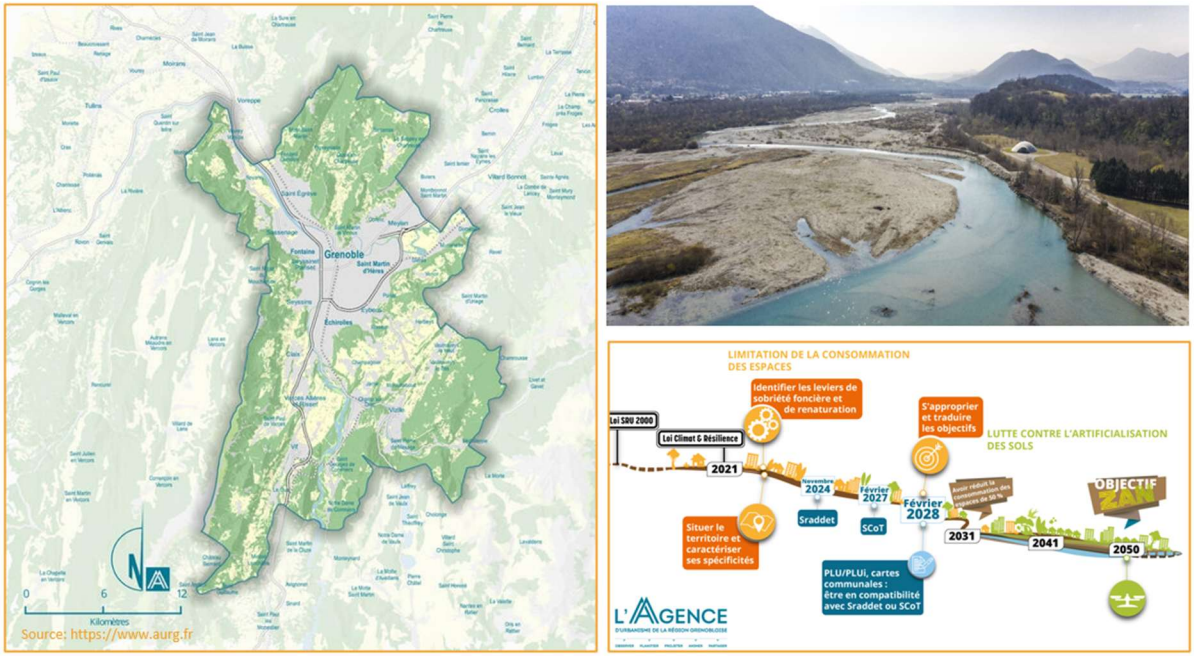


FIGURE 12: MAPS AND IMAGE PILOT GRENOBLE (LEFT AND RIGHT BOTTOM: © AURG. RIGHT TOP: ©GRENOBLE-ALPES-METROPOLE)

Ooststellingwerf (The Netherlands)

Geographical Situation and Scale: Located in the northern province of Friesland, the pilot covers 260 km² of predominantly rural landscape. The territory is characterised by a unique contrast between sandy soils in the south and peat soils in the north and west (Figure 13).

Specific Challenges and Ambitions: The primary soil challenge is land degradation through peat oxidation, resulting in 8-12mm of annual subsidence and substantial CO_2 emissions. Furthermore, the proximity of intensive dairy farming to sensitive Natura 2000 areas (Fochteloërveen and Drents-Friese Wold) creates persistent tensions over nitrogen deposition and groundwater desiccation. A significant planning bottleneck is the limited "in-house" soil expertise within the small municipal administration, coupled with a fragmentation of soil data across various provincial and regional water authorities.

The pilot's strategic ambition*:* The strategic ambition is to use the '*Water and Soil Guiding Principle'* to steer future spatial development. The pilot aims to integrate soil and water building blocks into the upcoming Municipal Environmental Plan, mandated by the Environment and Planning Act of the Netherlands (2024). Specifically, the project seeks to facilitate an agro-ecological transition for farmers located near protected nature sites, moving them from nitrogen-intensive dairy farming to sustainable, water-retentive arable or multifunctional farming models.

Good Practices and Enabling Mechanisms*:* The pilot leverages the Soil Learning Centre in the municipality as a boundary-spanning facilitator that connects farmers, researchers, and policymakers. It also utilises the regional cross-institutional funding and cooperation structure that enables integrated projects focused on brook valley restoration and biodiversity-friendly farming.

FIGURE 13: AERIAL IMAGE - OOSTSTELLINGWERF

Hajdú-Bihar (Hungary)

Geographical Situation and Scale: The pilot is located in Hajdú-Bihar County in eastern Hungary, bordering Romania. It covers an extensive regional scale of 6,210 km² (excluding the city of Debrecen) and encompasses a diverse mix of urban settlements, peri-urban zones, and rural landscapes (Figure 14).

Specific Challenges and Ambitions: The primary soil and planning challenges centre on the intense pressure of human economic development on the natural environment. Key physical challenges include wind and water erosion, declining organic matter due to intensive farming, and soil compaction from heavy machinery. The region also faces aridification and desertification driven by climate change, along with nitrate contamination of both soil and groundwater. Planning bottlenecks include urban sprawl and massive greenfield investments (such as battery factories) that result in the permanent loss of fertile arable land. While strategic documents recognise soil as a key resource, there is a lack of specific monitoring indicators and operational measures to prevent degradation in daily practice. Furthermore, soil data are often fragmented across institutions and outdated, and local municipalities frequently lack the technical staff to interpret them.

The pilot's strategic ambition: The pilot's strategic ambition is to integrate soil health into long-term strategic spatial planning to mitigate these negative effects. Within the SPADES project, the team aims to adapt innovative methodologies—such as ecosystem service assessments—for the upcoming 2028-2034 planning period. This aligns with the Hungarian Building Act and the Act on the Protection of Arable Land, which restricts the conversion of high-quality farmland for non-agricultural uses. The goal is to shift from a purely strategic awareness to an operational framework that enforces soil protection zones and the "no net land take" principle.

Good Practices and Enabling Mechanisms: Current good practices include the creation of protective forest strips to combat wind erosion and deflation around Debrecen. The region is also witnessing a rise in agroecological practices like no-till farming. These are enabled by regulatory requirements for soil protection plans during construction and financial incentives in EU funds (TOP Plusz/KEHOP Plusz), which award extra points to projects that incorporate water retention or urban greening.

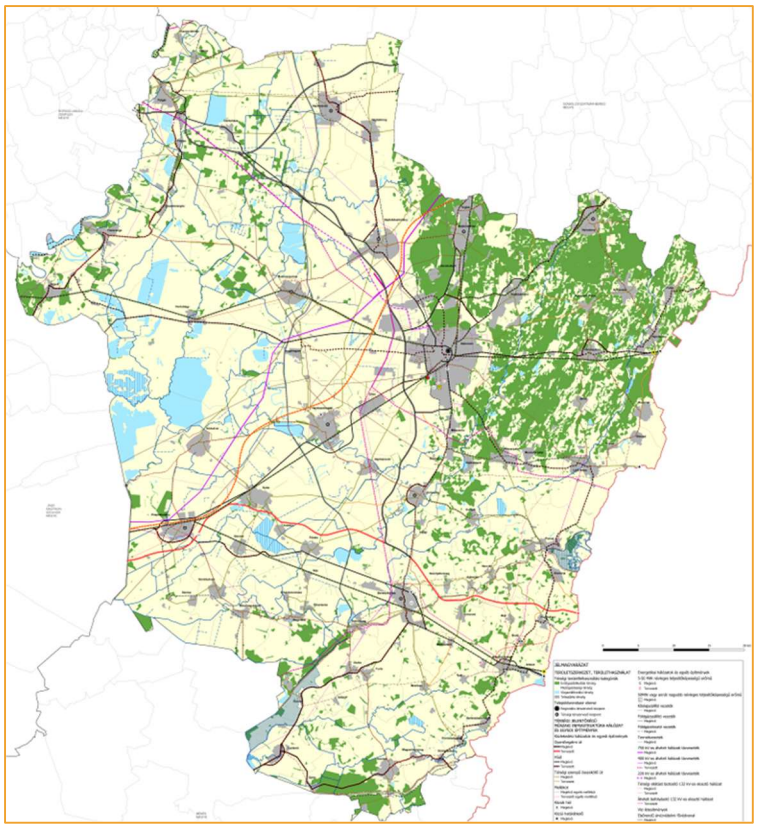


FIGURE 14: SPATIAL PLAN OF HAJDÚ-BIHAR COUNTY GOVERNMENT

Groene Hart (The Netherlands)

Geographical Situation and Scale: The Groene Hart (Green Heart) is a large, central rural region (1809 km²) situated within the Dutch Randstad. It functions as a vital open-space buffer between the major urban centres of Amsterdam, Rotterdam, The Hague, and Utrecht, involving three provinces, five water authorities, and over 30 municipalities (Figure 15).

Specific Challenges and Ambitions: The region faces a critical tension between accommodating urban pressure (housing, energy production, infrastructure) and maintaining its iconic open landscape. The most pressing soil challenge is peat oxidation, which leads to land subsidence (2-8mm/year), massive CO_2 emissions, and increased flood risks. Raising water levels to slow oxidation directly conflicts with existing dairy farming business models. Additionally, the region suffers from soil salinisation and declining biodiversity. A major planning bottleneck is the high administrative complexity involving over 40 governmental bodies, which often results in soil health being subordinate to short-term economic gains or sectoral priorities. Detailed soil data at the site-specific scale is also often missing or costly to obtain.

The pilot's strategic ambition*:* The pilot's ambition is to develop a regional Soil Vision that identifies soil potential and informs spatial planning at provincial, regional, and local levels. This is framed by the national 'Water and Soil Guiding' principle and the National Spatial Strategy, which targets zero net land take by 2050. The pilot aims to facilitate an agroecological transition for farmers, particularly through rewetting and diversifying land uses to restore the Soil-Sediment-Water system.

Good Practices and Enabling Mechanisms*:* Good practices include Clay in peat, an initiative that applies dredged clay to slow peat decomposition. Another key mechanism is the '*Valuta voor Veen'* carbon credit system, which rewards farmers for raising water tables. These practices are enabled by regional cooperations (integrated area development funds) and the use of collaborative building block toolboxes and design scenarios to support multi-functional land use.

FIGURE 15: AERIAL IMAGE GROENE HART

TABLE 14: LIST OF IN-PERSON WORK SESSIONS OF THE LONG-TERM STRATEGY PILOTS (T3.1)

Pilot	Date	Objectives and summary	No. part.
Klagenfurt (AU)	July 17 & 18, 2025	**Moorfachtagung 2025** Our contribution to the Moor4Klagenfurt biodiversity project's moorland conservation conference gave us a valuable opportunity to present the SPADES project in detail and engage in dialogue with key stakeholders. Instead of organising our own workshop, we used the existing platform to efficiently inform participants about the goals and significance of SPADES—especially in the context of sustainable soil management and integration into urban planning. The focus was on direct exchange: we presented our initial ideas and discussed with participants how the project could be further developed in Klagenfurt as an urban pilot region. The feedback and perspectives of the stakeholders were essential for shaping future steps in a targeted manner. The conference underscored how important it is to leverage synergies between existing projects such as Moor4Klagenfurt and SPADES in order to anchor the protection and sustainable use of soil in the city in the long term.	45
	August 12, 2025	**Working together for sustainable urban development: SPADES in dialogue with Klagenfurt city planners** In a constructive exchange, the Federal Environment Agency and IPAK presented the SPADES project to Klagenfurt City Planning – not only providing information, but above all working together to develop solutions. During an intensive brainstorming session, concrete implementation ideas were developed, and numerous approaches were discussed on how sustainable soil management can be anchored in urban planning. A particular success: the city planning department openly announced its willingness to actively integrate the topic of “soil” into the new urban development concept (STEK) – and invited us to help shape this central component. This step underlines the importance of SPADES for the future development of Klagenfurt.	7
	February 17, 2026	**Co-creation workshop in Klagenfurt** The purpose of the workshop was to develop a green index along the revision of the building ordinance, which includes 6 different building classes, and specifies the sealing ratio and building density for each class. The new version shall include obligatory requirements regarding the quantity and quality of green infrastructure for the non-sealed parts. Along the workshop four best practice presentations from other cities and a first draft concept were presented. Experts from all concerned departments of the city government plus external practitioners and researchers discussed the method, quality control, and monitoring. A follow-up workshop with stakeholders from the building industry is planned in autumn 2026 and submission of the revised building ordinance to the city council by the end of 2026.	21

Pilot	Date	Objectives and summary	No. part
Groene Hart (NL)	September 3, 2025	**Participatory workshop on Diagnostics** Main point for discussion where collection of input / information on regional soil and planning challenges, the ongoing spatial developments, input for the stakeholder mapping and policy analysis. An important point of discussion was defining the scope of the SPADES pilot Groene Hart.	5
	January 19, 2026	**Co-creation session Inventory soil information for Groene Hart** What are the soil qualities of the Dutch Groene Hart region and how can this information be used to support sustainable spatial transition of the area? These were the central questions of the pilot's co-creation session on January 19th 2026. The Groene Hart's existing soil data and information were inventoried and categorised in four soil qualities; informing, carrying, regulating and producing soils. These soil qualities, also considered as soil ecosystem services, were mapped and printed on posters. During the session, representatives from knowledge institutes, academia, regional environmental agencies, drinking water companies, provincial and local governments discussed if the mapped information was correct and complete. The session did not only result in a more complete overview and a better understanding of relevant soil data and information. The discussions also revealed specific stakeholder needs to better integrate soils in spatial planning.	25
Ooststelling-werf (NL)	July 17, 2025	**Diagnostic work session Ooststellingwerf** During this work session with soil and spatial planning related civil servants from the Municipality of Ooststellingwerf, the possible scope of this pilot was discussed. Representatives from the municipality indicated the importance of aligning the pilot with the development of the new Environmental Plan. It was also highlighted that a thorough inventory of available soil information and its relevance for the municipalities' spatial agendas is relevant for deepening the understanding of soil and spatial planning.	10
	September 30, 2025	**Work Session on Inventory Soil Information for Ooststellingwerf** SPADES partners carried out an inventory of existing soil, water, and subsurface information related to socially and spatially important challenges for the (region of) Ooststellingwerf. This information has been compiled into maps covering six themes: Identity & Landscape, Nature & Ecology, Agriculture, Housing, Health, and Energy. During a working session on 30 September 2025, 12 representatives from the Province of Fryslân, the Province of Drenthe, the Municipality of Ooststellingwerf, the Municipality of Weststellingwerf, Deltares, and TU Delft discussed this spatial information. They examined whether the assumptions were correct, whether information was missing, and what is important for regional spatial challenges from the perspective of water and soil.	12
Hajdu-Bihar (HU)	October 31, 2025	**1st SPADES pilot workshop: diagnosis** The purpose of the event was to bring together the stakeholders, validate the diagnosis workbook (it was ready by that time) and gather extra information about soil and planning deficiencies, potential intervention areas, legal background, soil data	11
Grenoble (FR)	October 13, 2025	The goal of the Workshop was to present the SPADES project to the participants, to share and amend the findings of the diagnosis phase and to define common objectives for the remaining project lifetime. For this first Workshop were invited the various thematic departments of Grenoble-Alpes Metropole working on soil related issues, as well as close partners (AURG – metropolitan urban planning agency) involved in planning procedures (example: development of OAP on biodiversity corridors (detailed thematic planning, included in comprehensive binding zoning plans)).	17

Appendix B: Overview and summary of the urban and peri-urban pilots

Leipzig (Germany)

Geographical Situation and Scale: The Leipzig pilot is located in central eastern Germany (Saxony) and operates at a city-wide scale of approximately 300 km². The pilot originally centred on two contrasting urban case studies: the 416 district (25 hectares), a former inner-city railway freight station, and Heiterblick-Süd (63 hectares), a greenfield site situated at the transition between urban and rural suburbs. However, the original focus on site scale has evolved to instead focus on policy integration as well as boundary spanning between departments at the city and with stakeholders (Figure 16).

Specific Challenges and Ambitions: Leipzig has experienced one of the strongest population growth rates in Germany (nearly 24% since 2010), placing massive pressure on land use and sustainable urban development. The primary soil challenges include a high degree of sealing (31.2% in 2024) and a heavy legacy of contaminated industrial wastelands and rubble areas from the GDR era. Planning bottlenecks are primarily political and administrative; while technical soil data is often available, preventive soil protection plays a subordinate role to development interests and is frequently "weighed out" in decision-making processes. There is significant institutional fragmentation, where some city departments act as a "brake" on the adoption of a formal soil protection strategy. Furthermore, the investor in one of the key case study projects has recently faced insolvency, complicating implementation.

The pilot's strategic ambition is to shift the administrative focus from follow-up remediation to preventive soil protection. This objective is framed by the national "30 ha target" for daily land-take reduction and the Leipzig City Council's intention to develop a net-zero sealing strategy by 2030. Within the SPADES project, the pilot aims to revive political momentum for the city's soil protection strategy—which contains metrics for soil quotas and consumption—by identifying synergies with established water-sensitive urban development (sponge city) networks. The goal is to align arguments for and side-specific information about soil health with the discourse of water-sensitive planning. Thus, the pilot tries to use water-sensitive urban planning networks as a detour to create stronger political arguments for soil protection.

Good Practices and Enabling Mechanisms: Identified good practices include the implementation of water-sensitive blue-green development on municipal lands and the de-sealing of public squares and street tree pits to enhance local microclimates. To enable these, the pilot aims to utilise capacity-building workshops designed to increase the "soil literacy" of non-soil-related agencies and foster cross-departmental coalitions. The team aims to provide arguments about the importance of soil in water-sensitive planning and feed this information into the political and administrative planning processes.

Source of data: A. Künzelmann/UFZ; City of Leipzig, own adaptation.

FIGURE 16: LEIPZIG IS SITUATED IN SAXONY, THE MID-EAST OF GERMANY. THE PILOT FOCUSES ON THE INTERACTION BETWEEN SEALING, WATER-SENSITIVE PLANNING AND SOIL CONTAMINATION, AND THE AMBITION TO STRENGTHEN THE SUPPORT FOR SOIL PROTECTION.

Nantes (France)

Geographical Situation and Scale: The Nantes pilot is an urban case study covering the Nantes Métropole territory, located in the Pays de la Loire region of western France that encompasses 24 municipalities - over 523.4 km² (Figure 17).

Specific Challenges and Ambitions: The metropolis has experienced sustained urban sprawl over the last half-century, leading to significant soil sealing and the fragmentation of biodiversity corridors along the Loire River and its tributaries. A primary planning bottleneck is the need to accommodate growing housing demand while strictly limiting urban expansion to already partially sealed areas. Soil challenges include contamination issues in traditional allotment gardens and a lack of systematic integration of soil quality data into tactical planning documents.

The pilot's strategic ambition is to reach the "No Net Land Take" (ZAN) and zero degradation targets by 2050. This objective is directly framed by the French Climate and Resilience Law (2021), which requires local governments to halve their rate of land take by 2031. The pilot aims to transition from purely quantitative land-use monitoring to an integrated soil-multifunctionality strategy, embedding soil health indicators into the upcoming revision of the inter-municipal local urban plan (PLUi).

Good Practices and Enabling Mechanisms: Core practices include the application of the MUSE method to map soil ecological multifunctionality and the DESIVILLE method to identify de-sealing potential at the neighbourhood scale. The metropolis enables these strategies through the "Full Soil Plan" (Plan Pleine Terre), which targets 16 hectares of de-sealing by 2026, and the Ile-de-Nantes project, which demonstrates soil reconstruction by mixing excavated materials with local compost to replace polluted industrial substrates.

Photo: author map F. Prezeau, Stakeholder workshop. Photo by C. Le Guern.

FIGURE 17: NANTES METROPOLIS IS SITUATED IN THE WEST OF FRANCE ALONG THE LOIRE RIVER.

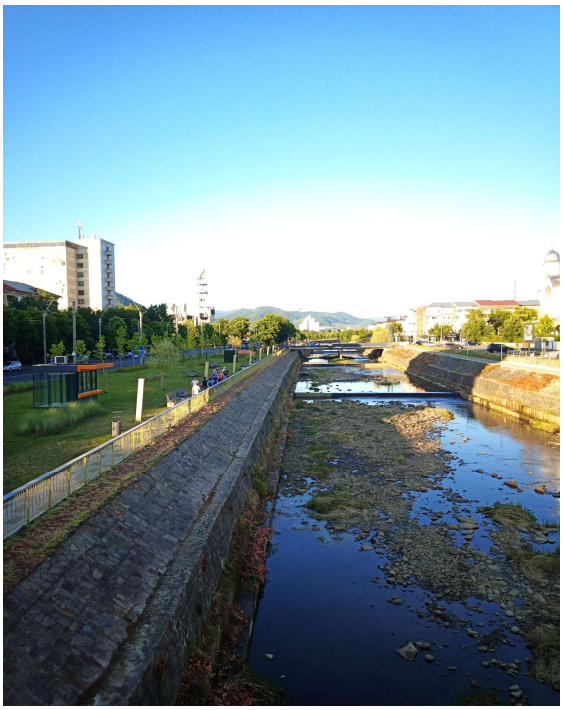
Baia Mare (Romania)

Geographical Situation and Scale: The pilot is located in the Baia Mare Metropolitan Area (ZMBM) in northwestern Romania, covering an area of 1,398 km². This peri-urban and rural territory is characterised by its transition from the Gutâi Mountains to river floodplains, housing a population of over 232,000 residents (Figure 18).

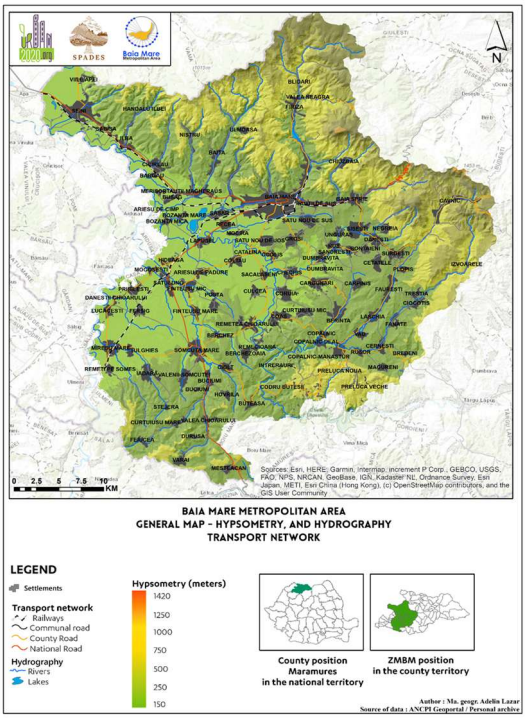
Specific Challenges and Ambitions: The region faces a severe environmental legacy of heavy metal contamination (lead, cadmium, arsenic, and zinc) resulting from centuries of non-ferrous mining and processing, which now limits land availability for safe urban and economic growth. Key planning bottlenecks include the fragmented and sometimes inaccessible soil data, especially concerning privately owned industrial sites. Also, because decision-making is dispersed across various institutional departments and administrative levels, it is difficult to consolidate scientific soil data into coordinated planning decisions or comprehensive and inclusive planning strategies. Additionally, the territory struggles with rapid soil sealing and urban sprawl, which reduces stormwater infiltration and retention, increasing runoff and flooding risks, and exacerbates the urban heat island effect.

The pilot's strategic ambition is to move beyond isolated environmental interventions toward a systemic, integrated urban planning model that prioritises soil health. This aligns with Romanian Law 246/2020 on soil protection and the European Commission's "No Net Land Take" (NNLT) objective for 2050. The pilot seeks to co-create a framework that embeds soil health indicators directly into local governance, aiming to produce realistic land-reuse scenarios that reintegrate degraded post-industrial sites into the social and economic circuits of the metropolis.

Good Practices and Enabling Mechanisms: Baia Mare took part in the SPIRE project, allowing experimentation to pioneer phytoremediation techniques using willow-based planting to extract heavy metals from soil over long-term cycles. These practices are enabled by innovative planning instruments, such as a GIS Dynamic Atlas and a Remediation Toolkit, as well as the use of the iLEU digital token to incentivise community-driven ecological behaviour.



Source of data: ZMBM archive



Author: Ma. geogr. Adelin Lazar
Source of data: ANCPI Geoportal/ Personal archive

Source of data: ZMBM archive

FIGURE 18: BAIA MARE IS SITUATED IN THE NORTH OF ROMANIA AND IS A HISTORICAL MINING AREA. THE TENSION BETWEEN URBAN EXPANSION AND NATURE PRESERVATION, AS WELL AS THE CONTAMINATION LEGACY FROM THE MINING INDUSTRY, IS AT THE HEART OF THE PILOT.

Ljubljana (Slovenia)

Geographical Situation and Scale: The pilot focuses on the Šiška Green Wedge (also known as the Northwest Sava Green Wedge) in Ljubljana, stretching from the dense urbanised core inside the highway ring to the peri-urban agricultural landscape bordering the Sava River (Figure 19).

Specific Challenges and Ambitions: The most pressing soil challenge is the irreversible loss of soil through land take and sealing; the Litostroj industrial zone, which occupies a major part of the green wedge, is currently 77% built-up. This high degree of sealing creates urban heat islands and disrupts the wedge's function as a climate and ventilation corridor. Planning bottlenecks involve the difficulty of implementing de-sealing retrofits on private industrial lands where owners prioritise development density, as well as informal land uses—such as illegal parking and non-ecological gardening—on sensitive groundwater protection zones. The pilot's ambition is to shift from "dreaming" to "doing" by developing a list of soil-inclusive actions to be formalised in the next generation of detailed spatial plans. This aligns with the national Spatial Planning Strategy, which targets zero net land take by 2050, and Ljubljana's role in the EU Mission "100 Climate-Neutral and Smart Cities by 2030".

Good Practices and Enabling Mechanisms: Strategic enabling mechanisms include plot-level standards such as FZP (green area factor) and FBP (open living area factor), which mandate a minimum percentage of greenery on natural ground during redevelopment. The pilot also builds on the Park Remiza project, which uses the relocation of municipal bus infrastructure as a lever to remove large-scale paving and restore soil infiltration and biological functions.

FIGURE 19: LJUBLJANA SITUATED IN CENTRAL SLOVENIA IS CHARACTERISED BY ITS GREEN WEDGES. THE PILOT FOCUS ON THE ŠIŠKA GREEN WEDGE, WHOSE INTEGRITY IS PARTLY BEING COMPROMISED BY URBAN SPRAWL INTO THE WEDGE, CONTAMINATION, DIFFERENT STAKEHOLDER INTERESTS AND INFORMAL ALLOTMENTS. (SOURCES: TOP LEFT PICTURE: ZRC SAZU, 2017, TOP RIGHT PICTURE: ROK BRIŠNIK (PHOTO AND MODIFICATIONS), 2024, BOTTOM MAP: ROK BRIŠNIK, UIRS, 2025

Gothenburg (Sweden)

Geographical Situation and Scale: Located on the southwest coast, the pilot covers the Gothenburg municipality (448 km²). It is primarily an urban pilot but encompasses peri-urban and rural areas, including valuable agricultural land (Figure 20).

Specific Challenges and Ambitions: Gothenburg faces significant geological challenges due to soft clay soils, which necessitate constant monitoring of groundwater levels and soil stability to prevent soil subsidence and landslides. The city has a long legacy of contaminated soils and anthropogenic fillings along the Göta Älv river from its industrial and shipping past. A bottleneck to the urban redevelopment of the city is the reactive rather than preventive management in relation to contaminated sites, which is often considered late in the planning processes. Regulatory barriers also hinder progress; strict Swedish rules often classify excavated soil as waste, making circular reuse difficult and leading to an over-reliance on virgin materials. Currently, soil investigations often occur too late in the process to inform fundamental planning strategies.

The pilot's ambition is to support the implementation of the city's ambitious goal to shift toward circular soil management, aiming for 100% reuse of technically and environmentally suitable masses by 2030. The pilot also aims to contribute to the new "Thematic Addition" on contaminated land within the municipal Comprehensive Plan (ÖP). Strategically, the pilot seeks to raise awareness regarding soil health and integrate soil assessments into the early initiation stages of urban development. This aligns with the Swedish Environmental Quality Objectives, particularly those for a "non-toxic environment" and a "safe built environment".

Good Practices and Enabling Mechanisms: A core enabling tool is the "Grönytefaktor" (Green Area Factor), a quantitative measure used in planning to regulate soil sealing and promote infiltration. However, this can sometimes conflict with contaminated sites. The city does not utilise mass logistics centres (MLC) to sort, crush, and recycle construction rock and soil, but this is recognised as a good practice that exists elsewhere.

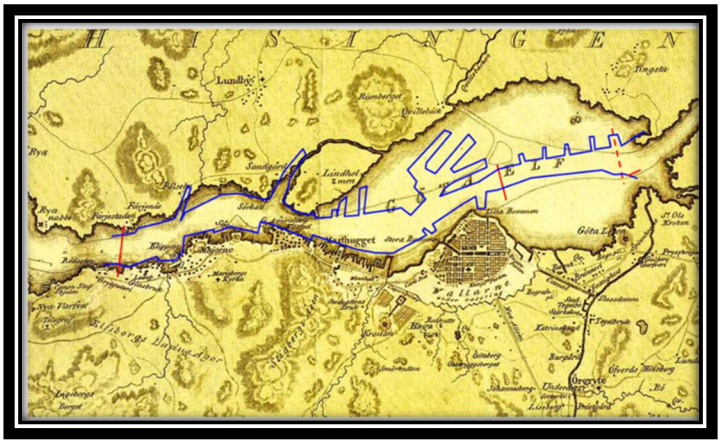


Photo: Stakeholder workshop September 2025. Photo by T. Todorcic Vekic.

Map: The Gothenburg area from 1809 with the modern shoreline in blue. Source: City of Gothenburg.

FIGURE 20: GOTHENBURG IS SITUATED IN THE SOUTH-WEST OF SWEDEN, ALONG THE COAST, WITH THE RIVER GÖTA ÄLV FLOWING THROUGH THE CITY. THE CURRENT SHORELINE OF THE RIVER HAS BEEN TRANSFORMED OVER TIME INTO ITS MODERN SHAPE, AND THE AREA IS CHARACTERISED BY HIGH PRESSURE ON THE REDEVELOPMENT OF FORMER INDUSTRIAL AREAS, SOIL CONTAMINATION, FLOODING RISKS, AND POOR SOIL STABILITY. THE MANAGEMENT OF CONTAMINATED SITES OF EXCAVATED SOIL IS CURRENTLY BEING RESHAPED, AND THE PILOT'S AMBITION IS TO CONTRIBUTE TO THIS WORK.

TABLE 15: LIST OF IN-PERSON WORK SESSIONS OF THE URBAN AND PERI-URBAN PILOTS (T3.2)

Pilot	Date & Location	Objective & summary	No. part
Baia Mare (RO)	June 26, 2025 Baia Mare City	The Baia Mare diagnostic phase stakeholder workshop combined an overview of the SPADES project with a discussion of its implementation phase and the roles of the ZMBM and the URBAN 2020 associations as support partners and knowledge providers for the pilot. Anticipating the forthcoming EU Soil Monitoring Law, the workshop aimed to strengthen inter-institutional cooperation and prepare local decision makers for coordinated soil protection within the Baia Mare functional urban area. The workshop brought together local municipalities to examine applicable EU and local legislations, share good practices, and explore recommendations for regenerating degraded soils. Key discussions addressed data collaboration, inclusive strategies, legislative challenges, technological integration, environmental and economic considerations, periodic strategy review, and strong stakeholder and public engagement.	10
Nantes (FR)	September 19, 2025 Nantes	The participatory workshop brought together participants from Nantes Métropole services, the Urban Planning Agency, and the SCoT (masterplan). Its main objective was to better identify actors linked to soil issues within the metropolitan authority and to initiate stakeholders mapping. The agenda combined project presentations (SPADES, diagnostic workbook, and collaborative research programs) with two interactive sessions focused on participants' everyday relations to soil and soil-related stakeholders in spatial planning. Key results included the creation of a core group of soil-related actors, increased awareness of soil as a transversal territorial issue, an initial stakeholder map to be refined, and the establishment of a strong interest in future workshops.	21
Ljubljana (SI)	September 23, 2025 Ljubljana	Participants from public authorities, private companies, and local stakeholders discussed urban and peri-urban challenges in Ljubljana's Šiška green wedge. Topics included the SPADES project, soil remediation technologies, climate and environmental pressures, illegal constructions, and weak planning enforcement. Development perspectives focused on increasing green surfaces, citizen participation, and green infrastructure corridors. Proposed measures ranged from green roofs and decks to soil monitoring and stricter construction control. Key conclusions stressed early community involvement and stronger integration of soil, green infrastructure, and climate adaptation in spatial planning.	10
	10 October 2025 Ljubljana.	As part of the 36th Sedlar Meeting, a large professional and scientific audience from ministries, research institutions, municipalities, the private sector, planners, and infrastructure operators discussed the role of soil protection in spatial planning. Topics included integrating soil into planning instruments, spatial regulations, use of spatial data, stakeholder involvement, and emerging EU policy frameworks, such as the Soil Monitoring Law. Practical approaches addressed land use compensation, brownfield redevelopment, and balancing protection with development. Key conclusions emphasised making soil protection an operational planning priority and aligning green infrastructure, data, regulation, and stakeholder engagement, with the possibility for SPADES to support policy implementation.	150
Leipzig (DE)	September 24, 2025 online	The first SPADES Workshop in Leipzig was held as an online focus group to reflect on findings, hypotheses, and conclusions from the project's diagnostic phase and to engage key city authorities as active supporters for the co-creation phase ("from friends to followers"). Representatives from the City Planning Office, Leipzig Waterworks and the Soil Protection Authority contributed. The workshop presented SPADES results, discussed soil-related hypotheses, mapped stakeholder power, and explored synergies between soil protection and water-sensitive urban development, building a shared strategic foundation and commitment for cooperation in the co-creation phase.	4
Gothenburg (SE)	September 30, 2025 Göteborg (+ online)	The first participatory workshop was held to explore how soil can be considered earlier in urban planning. Participants represented local and national authorities, practitioners, and academics (national and international). The workshop introduced the SPADES project, the new EU Soil Monitoring Law, and approaches to integrating land issues (by design and in planning). Through interactive sessions and group discussions, participants examined challenges and opportunities related to contaminated land and excavated mass management. Key messages highlighted the need for earlier integration of soil issues, clearer responsibilities and governance models, improved coordination across actors, better communication, and digital tools to support transparent, sustainable planning decisions.	11 + 2

Appendix C: Overview and summary of the rural and peri-urban pilots

Pays Cœur d'Hérault (France)

Geographical Situation and Scale: This pilot is a rural territory of 1,300 km² located in the hinterland of Montpellier, encompassing 77 municipalities characterised by high recent demographic growth and a traditional wine industry.

Specific Challenges and Ambitions: Abandoned farmland here is associated with high fire risk, soil erosion, and informal soil sealing through unauthorised shacks ("cabanisation"). Planning barriers include the uneven political will of 77 different mayors, high costs for specialised soil data (e.g. land price data on abandoned plots), a fragmented ownership structure and a lack of clear funding for soil regeneration on plots degraded by intensive agriculture (Figure 21).

The ambition is to build a spatialised, differentiated strategy to determine whether abandoned plots should be returned to cultivation, renatured, or used for ecological compensation or green energy production. This is framed by the SCOT (master plan), the Territorial Food Project (PAT) and relates to the Renewable Energy Acceleration Law, which targets wastelands for photovoltaics. The pilot seeks to build a coalition of informed stakeholders capable of making land-use decisions that promote long-term soil health.

Good Practices and Enabling Mechanisms: A core practice involves the "Veilleurs de Terre" (Land Stewards)— citizen volunteers who physically characterise plots to bridge the data gap. To enable site-specific decision-making, the pilot will testing a new map that assesses soil multifunctionality by cross-referencing indicators for carbon storage, water infiltration, and fire risk.

FIGURE 21: PLOTS OF ABANDONED FARMLAND AND WORKSHOP IN PAYS COEUR D'HÉRAULT - PHOTO CREDITS: TOP: M.-O. THAURY, BOTTOM: L. GARÇON

Montpellier (France)

Geographical Situation and Scale: The pilot is the Montpellier Méditerranée Métropole, covering 440 km² across 31 municipalities. It is located on the Mediterranean coast.

Specific Challenges and Ambitions: The territory faces soil desertification, salinisation near the coast, and habitat fragmentation from urban sprawl. Planning bottlenecks are characterised by a compartmentalised organisation where the metropolis acts as landowner, regulator, and planner without systematic coordination across siloed thematic departments. There is also a major data gap at the plot scale, as existing databases are often too general to inform site-specific soil management.

The pilot's ambition is to support the co-design and implementation of agroecological management plans for public non-built lands, to promote soil multifunctionality. This aligns with the French national "Zero Net Land Take" (ZAN) law and Montpellier's Agroecological and Food Policy. The goal is to move towards a land-sharing model that combines food production with biodiversity and flood-risk management on the same public plots (Figure 22).

Good Practices and Enabling Mechanisms: Key practices include the use of environmental rural leases with clauses that mandate soil health restoration. To enable these, the GAIA (Agricultural Installation Support Group) acts as a boundary-spanning facilitator, connecting metropolitan departments with agricultural NGOs and institutions, to streamline the settlement of regenerative farmers on public land.

FIGURE 22: PICTURES OF PUBLIC LAND AND WORKSHOP IN MONTPELLIER (PHOTO CREDITS: C. PERRIN), MAP OF SITE MANAGEMENT PLAN (CREDITS: MONTPELLIER MÉDITERRANÉE MÉTROPOLE)

Grazing Land Transylvania (Romania)

Geographical Situation and Scale: The pilot is located in the Țara Călatei (Kalotaszeg) bioregion, a rural and peri-urban area encompassing approximately 1,500 km² in Transylvania (Figure 23).

Specific Challenges and Ambitions: The region faces severe soil compaction and nutrient depletion due to industrial-scale shepherding on communal lands. Planning bottlenecks include land speculation (prices have risen 40% in a decade), a lack of site-specific soil data, and institutional silos that prevent soil health from informing zoning. Cultural resistance to cooperative models, stemming from post-communist trauma, further hinders collective stewardship.

The ambition is to establish a bioregional Land Trust and land banking model to secure land access for agroecological farmers. This supports Romanian Law 246/2020 on soil protection and the EU Soil Strategy 2030. The pilot aims to integrate soil indicators directly into Municipal General Urban Plans (PUGs) and pasture management regulations.

Good Practices and Enabling Mechanisms: Key practices include revitalising traditional communal governance (obști/közbirtokosság) for rotational grazing and agroforestry. The pilot enables these by using participatory soil sampling workshops to build "soil literacy" among farmers, using community-led data as a basis for administrative negotiations.

FIGURE 23: PICTURES OF TRANSYLVANIA AND WORKSHOP. PHOTO CREDITS: ATTILA MIKLÓS SZŐCS BORUSS AND BORBÁLA LÁNG (ALPA)

Malchin Peatlands (Germany)

Geographical Situation and Scale: The pilot is located in the Malchin region of Mecklenburg-Vorpommern, focusing on a rural landscape between two major lakes (Figure 24).

Specific Challenges and Ambitions: Drained peatlands are the largest regional source of greenhouse gas emissions, yet rewetting remains a voluntary process that many farmers perceive as a threat to their business viability. Planning bottlenecks include EU (common agricultural policy) subsidies that favor drainage-based agriculture and a fragmented ownership structure, where raising the water table requires the consent of hundreds of individual owners.

The ambition is to realign private and societal interests to scale up rewetting through the "MooReturn" project. This is critical for meeting German Climate Protection Law targets, which require the Land Use, Land Use Change and Forestry sector to become a net carbon sink. The pilot focuses on making rewetting logistically feasible through regional cooperatives and socially acceptable through better narrative framing.

Good Practices and Enabling Mechanisms: The primary practice is paludiculture (agriculture on wet peatlands) producing industrial biomass. To enable this, the pilot is 1) designing a "Paludi-Handels-Zentrale" (PHZ) to connect dispersed farmers with industrial markets, and 2) reframing expert language into the traditional concept of "Moorwirtschaft" to foster local acceptance.

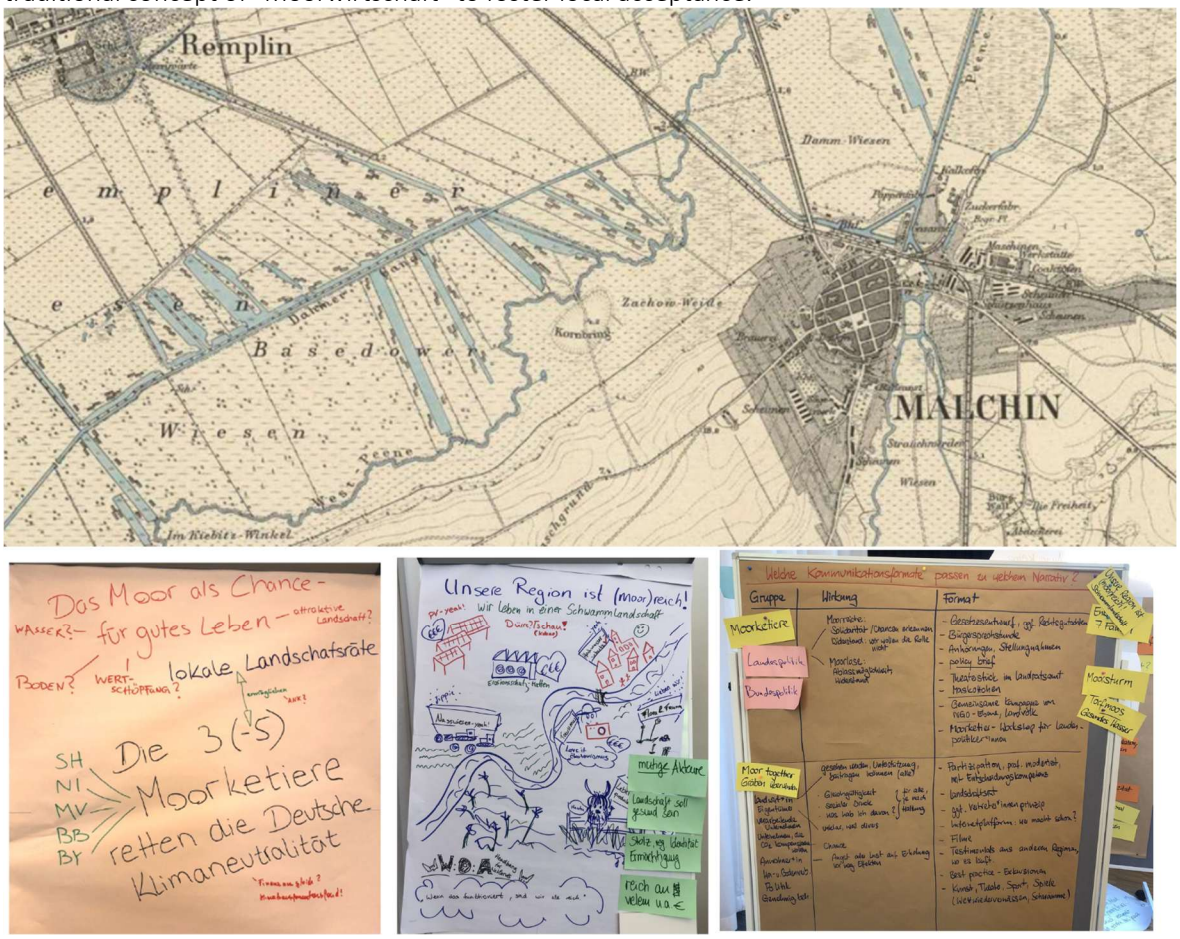


FIGURE 24: OFFICIAL PRUSSIAN MAP OF MALCHIN (1877). PICTURES OF WORKSHOP (CREDITS: AUGUSTIN BERGHÖFER (UFZ))

BreBeMi highway (Italy)

Geographical Situation and Scale: The pilot is located in the Lombardy region, covering a regional scale corridor 62.1 km long that connects Brescia and Milan through 27 municipalities and four river parks (Figure 25).

Specific Challenges and Ambitions: The primary soil challenge is massive land take and linear urban sprawl; between 2007 and 2021, the highway and its connected works consumed over 1,000 hectares of agricultural land. Additional soil performance issues include erosion, landslides, and the fragmentation of ecologically crucial fontanili (natural springs). Planning bottlenecks involve the low priority of soil in local documents, institutional fragmentation across 27 small municipalities, and resistance from private developers who view soil constraints as economic barriers.

The pilot's strategic ambition is to reassess infrastructure impacts through a shared methodology that integrates indicators for soil quality, quantity, and functionality into regional planning. This aligns with Lombardy Regional Law 31/2014, which targets zero net land take by 2050 and mandates the reuse of urbanised areas. The pilot aims to increase the "soil literacy" of local mayors and establish a set of tools to guide municipalities in proactive mitigation and compensation strategies.

Good Practices and Enabling Mechanisms: the pilot utilises boundary-spanning processes such as Strategic Environmental Assessments (SEA) to translate technical soil data into shared planning tools. Identified good practices include soil improvement/regeneration and sustainable urban drainage systems (WSUD), such as detention basins and green roofs, to mitigate hydraulic risks.

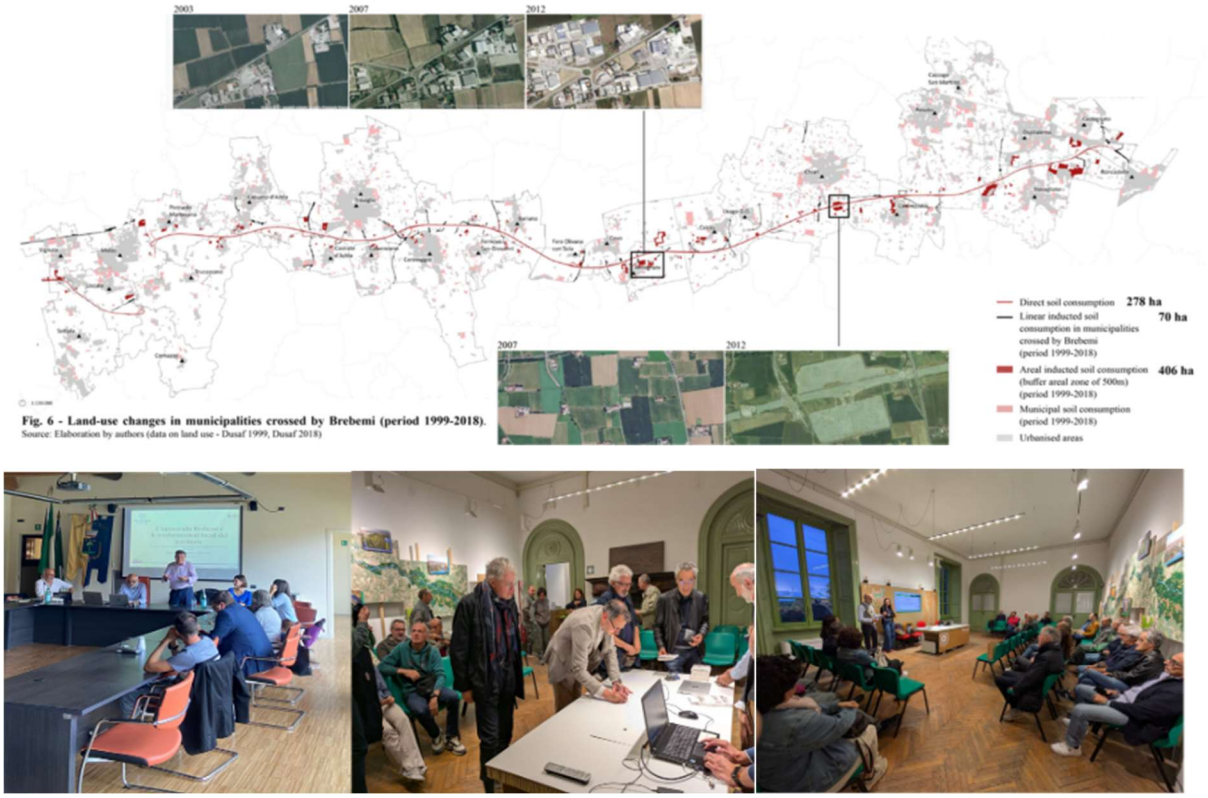


FIGURE 25: MAP OF BREBEMI HIGHWAY AND PICTURES OF WORKSHOP (PHOTO CREDITS: MARGHERITA PETRI, GIORGIA ALICE TERNO, ROSSELLA MOSCARELLI, PAOLO PILERI (POLIMI))

Grenzeloos Bocageland (Belgium)

Geographical Situation and Scale: This pilot is situated in 'Grenzeloos Bocageland' (Borderless Bocage), a cross-border landscape park covering 270 km² hectares across the Flemish, Walloon, and Dutch regions (Figure 26).

Specific Challenges and Ambitions: Soil challenges include accelerated erosion on slopes and nutrient run-off into streams, exacerbated by the conversion of grasslands to croplands due to high land prices and speculation. Planning bottlenecks are rooted in siloed, reactive policies that zone landscape features as isolated systems, without considering the agricultural systems that maintain them. A significant barrier is the mistrust between the agricultural and nature sectors, particularly regarding the Nitrogen Reduction Plan (PAS), which often penalises innovative family businesses.

The ambition is to restore a resilient landscape equilibrium by structurally re-integrating nature grasslands into viable dairy farming business models. This operates within the context of the Flemish Landscape Parks (2023) initiative, which seeks to balance ecological protection with sustainable development. The pilot aims to reframe environmental restrictions as a catalyst for an agricultural transition that supports more sustainable, soil-inclusive practices.

Good Practices and Enabling Mechanisms: Core practices include agroecology and circular soil management to restore functional synergies between farming and the landscape. The pilot enables these by using a business-economic optimisation tool to calculate feasible transition scenarios and by advocating for long-term contracts that offer multi-generational security for soil stewardship.

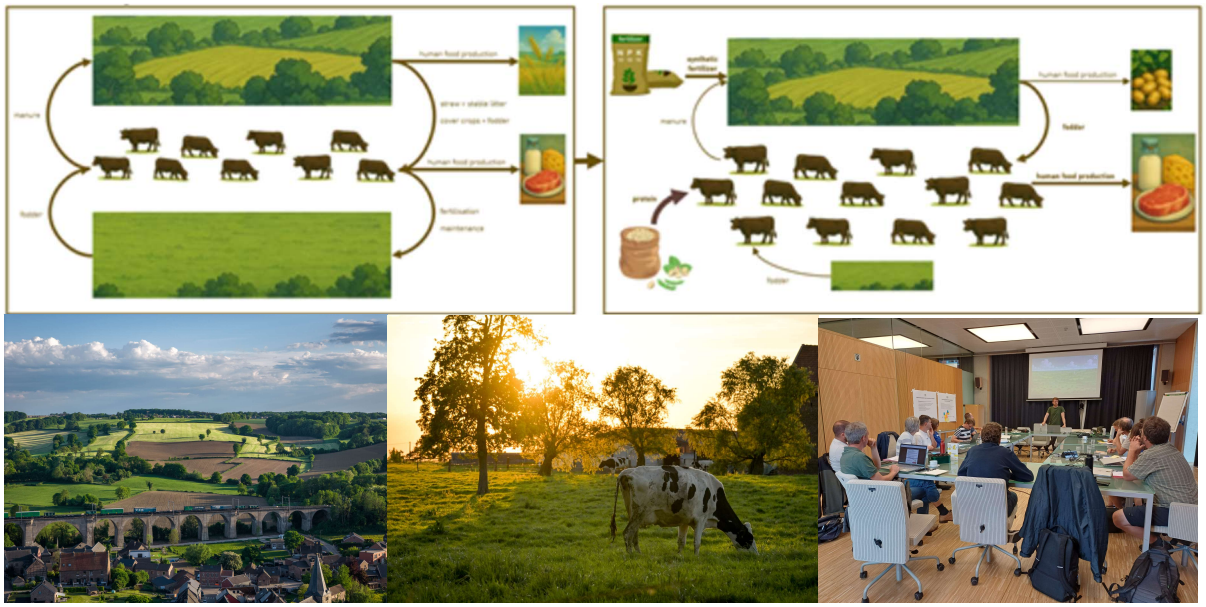


FIGURE 26: PICTURES OF GRENZELOOS BOCAGELAND AND WORKSHOP (CREDITS: GLENN WILLEMS AND HANS VANDERMAELEN (ILVO))

Public Farmland in Flanders (Belgium)

Geographical Situation and Scale: The pilot covers the region of Flanders, focusing specifically on the Plateau of Izenberge, a 115 km² rural landscape in the northwest (Figure 27).

Specific Challenges and Ambitions: Agricultural soils in Flanders suffer from low organic matter, compaction, and erosion, while farmers face average land prices of €70,000/ha, making sustainable stewardship financially prohibitive. A critical planning bottleneck is the structural privatisation of public farmland by governments to finance other goals, leading to short-term, expensive user agreements that are incompatible with soil care.

The strategic ambition is to use the allocation of the remaining 7% of public farmland as a lever to enable and reward soil stewardship at the farm level. This aligns with the EU Soil Strategy 2030 and the Flemish "Building Shift" (zero net land take) policy, which regain value for public land as compensation for development. The pilot aims to transform public land into shared infrastructure for the agroecological transition.

Good Practices and Enabling Mechanisms: Core practices include strategic land management that prioritises farmers investing in circularity and flood regulation. The pilot enables this by launching a Flemish learning network and developing standardised environmental leases that include "multiplier effect" clauses, requiring soil care across a farmer's entire holding.

FIGURE 27: PICTURES OF FLANDERS AND WORKSHOP (CREDITS: GLENN WILLEMS AND HANS VANDERMAELEN (ILVO))

TABLE 16: LIST OF IN-PERSON WORK SESSIONS OF THE RURAL AND PERI-URBAN PILOTS (T3.3)

Rural pilots	Date & location	Objectives & Summary	No. of part.
Pays Cœur d'Hérault (France)	2nd of June 2025 Le Pouget	**Exploring the future of farming on abandoned farmland plots in Pays Coeur d'Hérault.** The day aimed to assess the potential/land suitability of two plots for agricultural (re)development. A morning site visit reviewed topography, size, access, infrastructure, vegetation, and soil quality, including a practical soil check. In the afternoon, two expert farmers discussed opportunities and constraints, exploring possible farming activities. The exchanges clarified key limitations, further diagnostic needs, and required investments, highlighting secure water access as critical for viability.	9
	3th of October 2025 Le Pouget	**First participatory workshop.** The first workshop brought together diverse stakeholders concerned with the remobilisation of abandoned farmland to initiate dialogue and build a common vision on future land uses. It brought a shared understanding of key risks and opportunities, stakeholder roles, and a list of actors involved or affected. Participants were introduced to the objectives of the SPADES project and invited to express their views, concerns, and needs within a longer-term collaborative process.	32
	21st of January 2026 Le Pouget	**Public presentation of the photo exhibition on abandoned farmland in the Pays Coeur d'Hérault to local citizens and farmers.** The photo exhibition was launched with a public conference for local citizens and farmers and remained on display for six weeks in the local library. Based on stakeholder interviews, it presented diverse—sometimes conflicting—views on abandoned farmland. The conference sparked lively discussion, bringing together contrasting perspectives on agriculture and landscape issues. A local newspaper, Midi Libre, covered the event, reflecting strong public interest. Beyond the 40 conference attendees, about 300 visitors saw the exhibition.	40
Metropole Montpellier (France)	6th of February 2025 Viviers Montvilla	**Collective on-site field visit of 1 plot of public land in Viviers** (plot called Montvilla), where the Agroecological department of Montpellier metropole wanted to start testing/experimenting the process of integrating agroecology in public land management, based on the principles of regenerative hydrology, to redesign the local landscape, subdivide the 12 ha plot in several smaller plots, and allocate the 8 smallers plots to farmers with environmental clauses promoting soil health.	13
	23nd of Sept. 2025 Montpellier	**First multi-stakeholders workshop.** The meeting aimed to share information on existing public land management plans and foster a more collaborative process among stakeholders. Participants were encouraged to identify their potential roles, needs, and expectations. A common vision emerged, seeking to reconcile agriculture with biodiversity, climate adaptation, and sustainable water management, while recognising the significant challenges related to implementation and governance.	27
Grazing Land Transylvania (Romania)	31th of May 2025 Alunisu	**Bioregional mini-festival.** The background of this event was a "yearly" festival organised for the second time, but we dedicated some time to discuss SPADES related topics with the participants, like soil health increasing agricultural practices, permaculture, agroecology, risks of soil degradation and erosion etc.	60
	26-27 July Alunisu	**Soil Course** The course focused on soil-inclusive spatial planning, sustainable water management, and the role of soil organisms in maintaining ecosystem functions. Through discussions and knowledge exchange, participants explored practical approaches to integrating soil health considerations into land management and planning processes.	16
Malchin Peatlands (Germany)	11-12 July 2025 Berlin	**Transdisciplinary workshop: How to argue for rewetting?** (in collaboration with Greifswald Mire Centre). Peatland rewetting in Germany is partly hindered by polarised debate. Four stylised narratives were used to structure group work and plenary discussion. Each was examined, enriched with examples and insights, and assessed for its impact on stakeholders. These ranged from urgent climate action to green innovation, to farmer compensation for transition risks, and finally to opposition questioning the need for mitigation.	32

Rural pilots	Date & location	Objectives & Summary	No. of part.
BreBeMi highway (Italy)	21st of May 2025 Parco Adda Nord headquarters	**Participatory Workshop on the Pilot Project: An Open Dialogue on the Territorial Impacts of the BreBeMi Highway with Stakeholders.** The workshop opened with a presentation of the book *Dalla parte del suolo. L'ecosistema invisibile* by Professor Paolo Pileri (Politecnico di Milano), setting the stage for reflection on land use and soil protection. This was followed by an open dialogue on the territorial impacts of the BreBeMi highway. Representatives from provinces, municipalities, park authorities, and local associations discussed the infrastructure's effects, particularly in terms of land take, and shared the strategies and responses developed by the affected territories to address environmental and spatial challenges.	25-30
	13th of Sept. 2025 Casirate d'Adda	**Participatory Workshop on the BreBeMi Highway: presentation of findings and thematic roundtable planning with local mayors.** The meeting brought together mayors of municipalities affected by the BreBeMi highway to foster dialogue on territorial transformations. The research team presented key findings and impacts. Participants identified priority themes—environmental impacts, land use change, socio-economic effects, and compensation—to explore in upcoming workshops. The meeting marked a key step in the participatory process, strengthening engagement and supporting co-development of shared strategies.	25-30
Grenzeloos Bocageland **(Belgium)**	2nd of Sept. 2025 Hasselt	**First Participatory Workshop with involved stakeholders.** The workshop aimed to introduce the project to a broader group of stakeholders and present our approach and methodology. We gathered feedback, captured local knowledge, and explored how their expertise connects to our work, while identifying interests to support collaboration. The main conclusion was that productivity and landscape goals can align with new revenue models, but current policy frameworks remain a major obstacle.	15
Public Farmland in Flanders **(Belgium)**	20th of May, 2025 Brussels	**Participatory workshop on the pilot content and the idea of setting up a learning network on public farmland allocation policies.** This meeting discussed the need and focus of a learning network on how governments can use public farmland to support transitions in agriculture, soil and water management, climate goals, and biodiversity. Participants agreed these lands offer strong leverage for broader policy aims. Despite existing pilot initiatives, there is a clear need for more coordination, leadership, legal clarity, and shared frameworks. The discussion focused on moving from fragmented efforts to a more coherent and effective approach.	16
	9th of Oct. 21st of Nov., 19th of Dec. 2025, 3rd of January 2026 Ghent	**Monthly core group meetings learning network.** Monthly consultation between the four organisations that form the core group of the learning network for public agricultural land in development: Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Flemish Land Agency (VLM), Agriculture and Fisheries Agency (ALZ) and Department of Environment (dOMG).	4 to 5
	10th of February 2026 online	**Webinar on public land as part of the Local4Food series.** The 10 February 2026 webinar by Local4Food explored how public land can be sustainably used for sustainable agriculture and community benefit. It showcased best practices, highlighting capacity building initiatives such as the learning network in public farmland. The session provided actionable insights for local authorities to integrate sustainable food strategies into public land management.	30

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