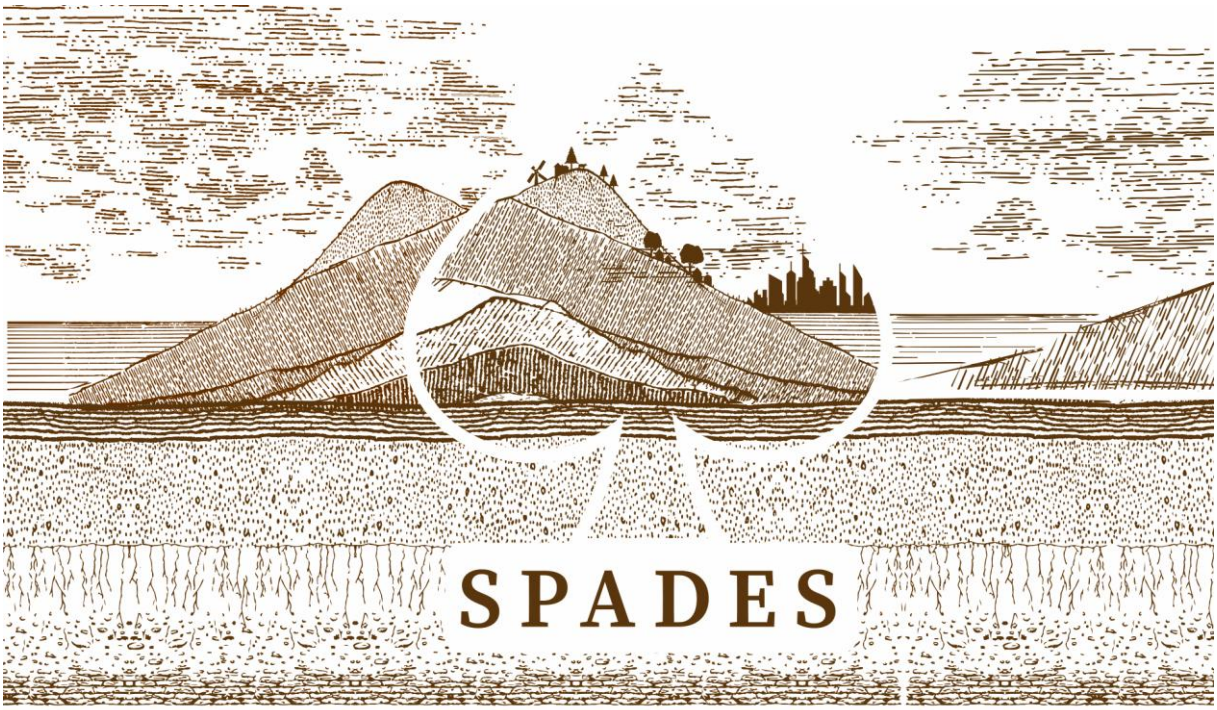
EVALUATION FRAMEWORK

FOR SOIL-INCLUSIVE INSTRUMENTS AND PRACTICES

SPADES D2.3



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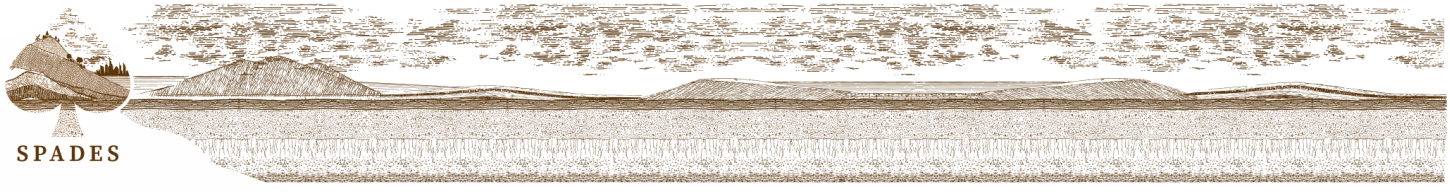

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Abbreviations and acronyms

AB	Advisory Board
C&I	Connectivity & Integration
D	Deliverable
EC	European Commission
ES	Ecosystem Services
LDN	Land Degradation Neutrality
M	Month
MS	Member States
NbS	Nature-based Solutions
NNLT	No Net Land Take
T	Task
UNCCD	United Nations Convention to Combat Desertification
WP	Work Package

Glossary

Term	What is meant
Applicability	The extent to which an instrument or practice can be effectively applied in different contexts, scales, and geographic locations.
Curation criteria	Criteria that provide valuable information about instruments and practices and enable their categorization (e.g., soil challenges addressed, geographic location).
Diagnosis Workbook	A template used to diagnose current situations and identify needs in the SPADES pilots in a comparable manner.
Evaluation Framework	A systematic approach to assess, identify and select instruments and best practices to enable soil-inclusive planning.
Instruments	Instruments to support soil-inclusive planning and include data and information base, maps, concepts, approaches, strategies, methods and tools
Land Degradation Neutrality (LDN)	A state whereby the amount and quality of land resources necessary to support ecosystem functions and services remain stable or increase within specified temporal and spatial scales.
Long list	At M12, both T2.1 and T2.2 are each producing an inventory of instruments and practices respectively. These long list need to be processed by the Evaluation Framework to produce short lists (one for instruments, one for practices)
No Net Land Take (NNLT)	EU policy objective to achieve no net land take by 2050, meaning that any new land take should be compensated by recultivation of artificial land.
Practices	Examples of implemented soil-inclusive planning strategies and approaches that have proven to contribute to enhance soil functions and optimise ecosystem services to meet societal demands.

Term	What is meant
Scoring criteria	Criteria that enable scoring and comparison between instruments and practices, primarily focused on usability aspects.
Short list	The output of the Evaluation Framework is two short lists: one for instruments, one for practices.
Soil challenges	Issues affecting soil quality, quantity, and performance that can be addressed through spatial planning and design.
Soil health	The continued capacity of soils to support ecosystem services.
Soil performance	The contribution of soil (functions, ecosystem services) to spatial demands and challenges such as climate change, biodiversity, spatial quality. Both soil quality and quantity determine the soil performance.
Soil quality	The chemical, biological, and physical conditions of soil. Exemplary soil challenges are contamination, soil degradation, fertility and biodiversity loss.
Soil quantity	The availability of land and soil in relation to societal challenges, Exemplary soil challenges are land take, soil sealing, resource depletion, competition for land.
SPADES Manual	Manual with holistic overarching support for the actors in land use decisions to set-up soil inclusive spatial planning and design strategies and use the instruments of the SPADES Navigator.
SPADES Navigator	An online instrument, which is being developed in the SPADES project, which provides access to instruments and best practices of soil-inclusive spatial planning and design strategies, guiding users to appropriate tools and/or methods based on their specific needs.
Spatial design	A multidisciplinary approach to shaping physical environments that combines elements from architecture, infrastructure development, urban design, and landscape design.
Spatial planning	A multifaceted process that combines legislative, regulatory, policy, and institutional frameworks to manage and organize space at different scales, setting conditions for spatial (re)development projects.
Usability	The extent to which instruments and practices are well-documented, accessible, provide appropriately detailed output, and are easy to use by their intended audience.

EXECUTIVE SUMMARY

This document, deliverable 2.3, presents the Evaluation Framework to process the draft outputs of Work Package 2 (WP2) 'The potential of soil in spatial strategies'. In WP2, Task 2.1 and Task 2.2 are respectively compiling instruments for soil assessments and practices to enhance soil-inclusive planning strategies. These inventories of compiled instruments and practices are evaluated through this Evaluation Framework to produce systematised outputs with best instruments and practices (e.g. that have the most potential in integrating soil in planning).

The Evaluation Framework has two main objectives: (1) curating short lists of successful and promising instruments and practices and (2) to identify topical emphasis and gaps within these short-lists to inform future developments. The Evaluation framework follows a step-by-step approach that is organised in four main steps: filtering, scoring, curating and sorting. Sorting involves the elimination of instruments and practices that do not relate to the identified soil challenges. Scoring involves assigning numerical scores to instruments and practices based on a usability assessment. Based on the first two steps, shortlists are curated. These curates are sorted to analyse emphasis and gaps for future development. Several criteria have been defined within the evaluation framework to process the instruments and cases across the four steps. These criteria encompass topical alignment as well as useability considerations.

The Evaluation Framework was developed based on the on the four-step approach presented in the European Environmental Agency report: Assessment Frameworks for Nature-based Solutions (Veerkamp et al., 2021). This includes (1) identifying assessment purposes and goals, (2) defining assessment characteristics as guided by the purposes (3) selection of elements to be included in the assessment and (4) choice of assessment approach. The Evaluation Framework was co-created with input from various SPADES work packages (1, 2, 3 & 4). The development was an iterative process with interactive workshops.

The Evaluation Framework will be used by the SPADES consortium, specifically WP2, to determine whether an instrument (T2.1) contributes to soil-inclusive planning strategies or has the potential to become such a tool with limited modifications, and to assess what best practices (T2.2) are. Once instruments and practices are shortlisted, they will be presented by the SPADES Navigator (online instrument development by WP4) and the SPADES Manual, in such a way that they can be found by the right user, at the right phase of the planning and design process, and for the right purpose. The gaps identified through the Evaluation Framework will inform the cocreation work with SPADES pilots, where new instruments and practices will be explored.

1 INTRODUCTION

1.1 The SPADES project and consortium

SPADES' mission is to develop, test, and implement soil-inclusive practices in spatial planning and design. This aligns with the EU Mission: A Soil Deal for Europe (European Commission, 2021a) objectives by working to improve soil health, reduce global footprint, and enhance soil literacy by developing and leveraging spatial concepts and solutions. By highlighting soil health in terms of soil's ability to deliver ecosystem services, SPADES aims to foster healthier, more resilient, and soil-aware societies across urban, peri-urban, and rural areas in Europe. Ultimately, the consortium aims to operationalise the integration of soil into spatial planning and design to support a sustainable Soil-Sediment-Water system, vital for Europe's future.

The SPADES project is being undertaken at a time when over 60% of European soils are unhealthy (European Commission, 2021). Degradation has many causes, including but not limited to unsustainable land management, sealing, contamination, and climate impacts, costing the EU at least €50 billion annually (European Commission, 2020). Degraded soils hinder the delivery of ecosystem services like food provision, carbon sequestration, and water regulation. Soil is a non-renewable resource, and its inclusion in long-term spatial planning is essential to address emerging challenges (European Commission, 2023a). Spatial planning is an important and underutilised tool in the field of soil conservation, as it can address interconnected challenges, including climate change, biodiversity loss, urbanisation, and energy transitions. The integration of soil into spatial planning tools and processes is not straightforward and context-dependent, as soil quality, quantity, and performance vary across urban, peri-urban, and rural contexts. Furthermore, across governance levels, environmental policies are fragmented, siloed, and lack coherent soil-focused strategies, leading to inconsistent or duplicated efforts.

In SPADES, 19 partners (13 research and 6 pilot partners) both from planning and soil backgrounds work together. SPADES encompasses 17 pilots in 10 EU Member States, covering a broad range of land uses (urban, peri-urban and rural areas), time and spatial scales, and different soil and planning challenges (Figure 1). SPADES has started with a thorough inventory phase, on both planning systems, soil policy, existing instruments and best practices, to improve integration of soil knowledge, data, tools, and concepts into planning systems to enable sustainable land use decisions. The SPADES instruments and best practices will be presented by the SPADES Navigator (online instrument) and the SPADES Manual, in such a way that they can be found by the right user, at the right phase of the planning and design process, and for the right purpose.

Soil Impact in Spatial Planning and Design / Spatial Planning and design impact on SOIL Health	**SOIL QUALITY** Chemical, biological and physical qualities. Challenges: contamination, soil degradation, fertility and biodiversity loss	**SOIL QUANTITY** Availability of land and soil in relation to societal challenges Challenges: Land take, Soil sealing, resource depletion ((European) competition for land for nature preservation, food security and urbanization)	**SOIL PERFORMANCE** Soil functions and ES role in: Climate buffering, Biodiversity, Spatial Quality Challenges: spatial continuity, maintenance regimes (part of European Green Deal initiatives (Land Use, Forestry and Agriculture Regulation, EU Forest Strategy) EU initiatives focusing on climate mitigation and adaptation, renewable energy, etc
RURAL Production space of food, fiber, bio-energy, natural resources	NbS	RE-Zoning	NbS, Re-Zoning
PERI-URBAN Space for recreation, climate services, natural resources	NbS, Permaculture, Food Forest	Green Belt, Green Heart	NbS, Sponge city, Green Blue Infrastructure, Resiliency
URBAN Space for climate, biodiversity, human health, spatial quality	NbS, Permaculture, Food Forest	Green City, Compact City	NbS, Sponge city, Green Blue Infrastructure, Resiliency

FIGURE 1 OVERVIEW OF SOIL QUALITY, QUANTITY AND PERFORMANCE IN RELATION TO AREA TYPOLOGIES AND WELL-KNOWN SPATIAL CONCEPTS.

1.2 SPADES Work Package 2 and the Evaluation Framework

The objectives of Work Package 2 (WP2), *"The potential of soil in spatial strategies",* in which the Evaluation Framework is developed, are to:

- Identify, systematise and evaluate instruments for assessment of soil functions and soil ecosystem services with potential to integrate in plans for spatial transformation at different scales.
- Develop a systematised portfolio of best practices from EU Member States, associated and third countries of solutions supporting soil functions and ecosystem services proven to reconcile several societal goals regarding soil and land.
- Formulate recommendations for the integration of selected instruments and practices in the spatial planning process.

The Evaluation Framework as is described in this report (D2.3), supports the above objectives. It will be used for the evaluation and thereby identification of the most advanced instruments and those with the highest potential to support soil-inclusive planning strategies, as well as the best practices of soil-inclusive planning strategies (based on real-world cases). The framework will also support the systematisation of the WP2 portfolios with instruments and best practices.

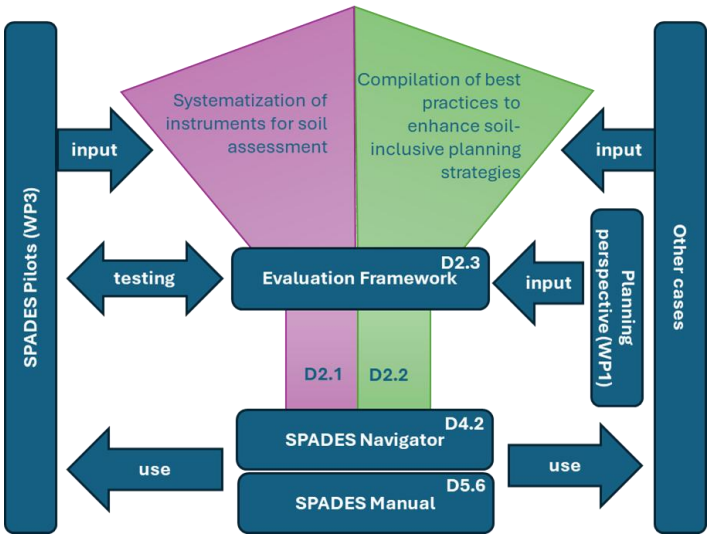

FIGURE 2 FUNCTION OF THE EVALUATION FRAMEWORK WITHIN THE SPADES PROJECT.

Figure 2 explains how the Evaluation Framework is situated in the SPADES activities. D2.1 Systematization of instruments for soil assessment and D2.2 Compilation of best practices to enhance soil-inclusive planning strategies are deliverables of T2.1 Inventory of soil assessment instruments and T2.2 Inventory of best practices. D4.2 SPADES Navigator is the deliverable of T4.1 Develop SPADES Navigator T4.2 Test and innovate SPADES Navigator; D5.6 SPADES Manual refers to the deliverable of T5.4 SPADES Legacy (See Annex A – Overview of SPADES Work Packages, Tasks and Public Deliverables).

1.3 The Evaluation Framework in the context of SPADES

Although the Evaluation Framework is a WP2 result, it also has relations with the other WPs in SPADES. An overview of all SPADES Work Packages, Tasks and public deliverables is found in Annex A. The SPADES consortium operates through a structured collaborative approach coordinated via regular Connectivity & Integration (C&I) workshops that facilitate collaboration across work packages. The Evaluation Framework serves as a central connecting tool within this structure, linking planning expertise from WP1, soil science from WP2, pilot validation from WP3, Navigator development from WP4, and dissemination from WP5, all

coordinated through WP6's quality assurance mechanisms, including the Management Board and the Advisory Board.

The Evaluation Framework in WP2 *The potential of soil in spatial strategies*

In T2.3 (*Evaluation of instruments and best practices)* the Evaluation Framework, including the selected evaluation criteria and categorization methodology, is detailed. The Evaluation Framework is meant to serve as a support tool for the other WP2 tasks T2.1 (*Inventory of soil assessment instruments*) and Task 2.2 (*Inventory of best practices*). The long-lists with instruments and practices from these tasks are filtered and refined using the Evaluation Framework, resulting in short-lists of selected instruments and practices. The short-lists and evaluation results feed back into WP2's final outputs (D2.1 and D2.2), incorporating the Evaluation Framework's recommendations and categorization.

Relation with WP1 *Soil in spatial planning systems, design concepts and strategies*

To ensure a good link with both soil and planning, the Evaluation Framework is grounded in the context and inputs provided by both WP2 and WP1 *Soil in spatial planning systems, design concepts and strategies*. Beyond soil challenges (WP2), the Evaluation Framework also includes considerations regarding planning (WP1) to ensure that the selected soil instruments and best practices align with real-world planning needs and frameworks. This guarantees that the Evaluation Framework builds directly on WP1's foundation of planning terminology, phases, and integration mechanisms, allowing selected soil instruments and/or their outputs to be readily usable in the planning process.

Relation with WP3 *Pilots: Co-creation of soil-inclusive spatial strategies*

Cases from EU Member States, Associated and Third Countries, as well as the pilots in WP3, are used for the development of the long-lists of instruments and practices with diverse contexts, challenges, and innovations. The Evaluation Framework is used to generate curated short-lists of selected instruments and best practices. These short-lists can be used to inspire and guide the pilot's co-creation and testing phases, enabling local stakeholders to apply selected instruments and refine them to context-specific conditions.

Relation with WP4 *Implementation of soil in spatial strategies*

The SPADES Navigator is one of the main results of SPADES and will be developed in WP4. It will guide the user to the right instrument or best practice for their activity and the soil and planning challenges at hand. The relations between the Evaluation Framework and WP4 are twofold. The Evaluation Framework directly influences:

1) the SPADES Navigator's organization. The first design (Mock-Up) of the SPADES Navigator (D4.1) uses the Evaluation Framework's categorization scheme, leading to the final SPADES Navigator (D4.2).

2) its content. The Evaluation Framework provides the content- only by the Evaluation Framework selected instruments and practices become candidates for the SPADES Navigator inclusion. The selected instruments will be tested and further enhanced using the pilots (WP3), and then included in the SPADES Navigator.

Relation with WP5 *Soil Literacy and CDE*

The Evaluation Framework results also inform WP5's capacity-building and communication activities (T5.2 and T5.3), ensuring that training materials and stakeholder engagement strategies reflect the instruments and best practices identified through evaluation. The SPADES Manual (D5.6) accompanies the SPADES Navigator and is being aimed to disseminate the SPADES results towards a large audience.

1.4 Use of the Evaluation Framework

The Evaluation Framework will initially be used as a Frame of Reference by the SPADES consortium to determine whether an instrument contributes to soil-inclusive planning strategies or has the potential to become such a tool with limited modifications, and to assess what best practices are.

The long-lists inventoried in WP2 on soil instruments and practices are being evaluated by the consortium, and the selection of instruments that remain can either a) be tested and refined within the pilots or b) end up immediately in the SPADES Navigator and accompanying Manual, in case they are ready to use and fit for purpose. The Evaluation Framework also contributes to the categorization of instruments and best practice portfolios (that will be reported in D2.1 *Systematization of instruments for soil assessment* and D2.2 *Compilation of best practices to enhance soil-inclusive planning strategies*, both due by M24) and will be used as a basis to build the SPADES Navigator structure (D4.1 Navigator Mock-up and D4.2 SPADES Navigator). The application of the Evaluation Framework is further described in the Step-by-Step approach in Chapter 5.

1.5 Outline of the document

After the introduction, where the context of the SPADES project and the Evaluation Framework are introduced in Chapter 1, Chapter 2 contains the purpose of and requirements for the Evaluation Framework for soil practices and instruments. Chapter 3 explains the methodology that is used to develop the Evaluation Framework. Chapter 4 goes into the criteria and scoring used to select instruments and best practices and Chapter 5 describes the step wise application of the Evaluation Framework and Chapter 6 contains conclusions and discussion including recommendations for next steps. The report closes with references and Annexes with A an overview of SPADES Work Packages, Tasks and public deliverables and B Screengrabs of the working sessions to setup the Evaluation Framework.

2 PURPOSE OF AND REQUIREMENTS FOR THE EVALUATION FRAMEWORK

2.1 Purpose of the Evaluation Framework

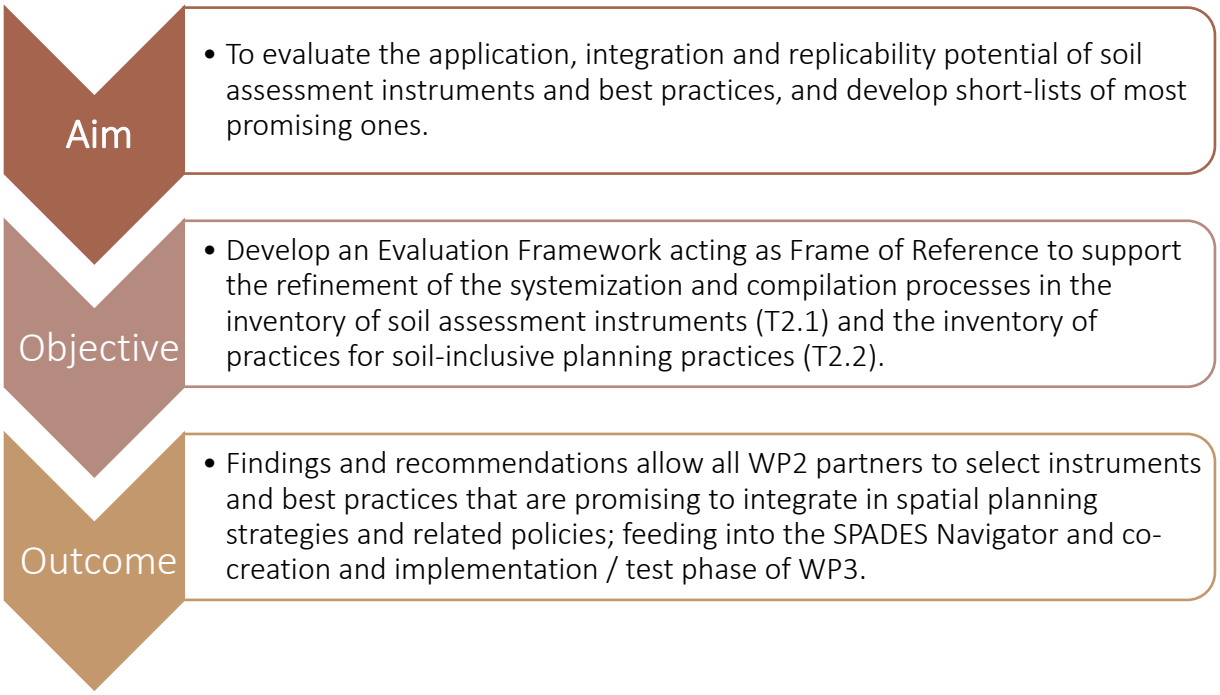

FIGURE 3 SCHEMATIC OVERVIEW OF THE AIM, OBJECTIVE AND OUTCOME OF TASK 2.3.

The Evaluation Framework evaluates, selects and curates inventoried instruments (T2.1) and practices (T2.2) with a maximum integration and replicability potential in spatial planning strategies. The evaluation categorizes instruments and practices based on their effectiveness, applicability, sustainability, alignment with soil conservation and management principles, and integration potential in existing policy frameworks. This enables the selection of instruments and practices that have the potential to contribute to objectives such as Land Degradation Neutrality and No Net Land Take and to support soil quality, quantity and performance and territorial challenges.

The application of the Evaluation Framework has the following two main objectives:

1. Curating short-lists of successful and promising
    a. instruments dedicated to assessment of soil functions and/or soil-related ecosystem services
    b. practices of soil-inclusive planning strategies
2. Assessing short-lists to identify topical emphasis and gaps. Where are instruments and practices lacking, or where should more attention be put on providing new instruments and best practices?

2.2 Requirements to the Evaluation Framework

In addition to supporting the SPADES Navigator, pilots and broader dissemination (as elaborated in paragraphs 1.3 and 1.4), six requirements were identified for the design of the Evaluation Framework.

1. **Simple**: the rationale of the Evaluation Framework should be understandable and logical.
2. **Appropriate effort**: The Evaluation Framework should result in appropriate scoring efforts across a large data set.
3. **Balanced**: the Evaluation Framework should not exclude too many instruments and practices, neither should it include too many instruments and practices. The aim is to create short-lists of a defined size as described in the step-wise approach to apply the Evaluation Framework Step 3.2 (paragraph 5.1.3).
4. **Inclusive**: the selected set of best instruments and practices should speak to a diverse audience by including a geographical diversity, including both well-proven and high-potential instruments and practices, and should address all the identified soil challenges.
5. **Informative:** The Evaluation Framework should give insight into where additional effort can be placed to further develop instruments and practices.
6. **Effective**: the Evaluation Framework should provide high-quality instruments and practices.

The short-listed instruments and practices, generated by using the Evaluation Framework, should have the potential to contribute to integrating soils in spatial planning. This puts requirements on the quality of the instruments, which, for the purpose of this framework, is defined as:

1. **Usability**: Are the selected instruments and practices well documented, accessible, appropriately detailed output and easy to use? Are they practical, manageable, and accessible to a spectrum of users (see Table 1 in section 3.1)? These are further treated as *scoring criteria*, used to assess whether instruments and practices are usable enough to have a place on the short-lists.

2. **Addressing soil and planning and design challenges**: Do the selected instruments and practices address a wide spectrum of identified soil and planning challenges? These are further treated as *curation criteria*, used to inform the coverage of instruments and practices across soil and planning and design challenges. These descriptive criteria are used for further analysis of the short-lists.

N.B.: What is this Evaluation Framework NOT for?

- The Evaluation Framework evaluates if instruments or practices address soil challenges within planning and design contexts but is does not score **how well** this is done by the instruments or practices. .
- The Evaluation Framework does not aim to **assess spatial planning and design concepts** (that is the focus of T1.2 in WP1). While there is a clear connection, and use-cases of such concepts are intended to be included in the practices gathered under T2.2, the concepts themselves are outside the scope of WP2.

3 METHODOLOGY

3.1 Development of the Evaluation Framework

The Evaluation Framework was co-created with input from SPADES WP1, WP2, WP3 & WP4. The development was an iterative process with interactive workshops.

The methodology applied to develop the D2.3 Evaluation Framework is based on the four-step approach in the EEA report: *Assessment Frameworks for Nature-based Solutions* (Veerkamp et al., 2021) (Figure 4)
The resulting Evaluation Framework is based on a mixed approach with a usability evaluation at its core.

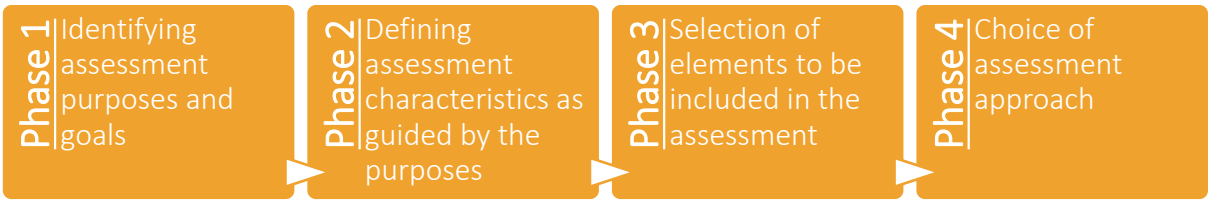

FIGURE 4 EEA PHASES (VEERKAMP ET AL., 2021) FOR ELABORATING THE SPADES EVALUATION FRAMEWORK

3.2 Phase 1: Identifying assessment purposes and goals

Stakeholder analysis
"Who will/should be using our output, for what, how and when?"

To address this phase, a broad stakeholder analysis for SPADES results was performed, identifying end-user groups and assessing their information gaps and needs. This was done through discussions around the development of the Diagnosis Workbook for pilots during the Connectivity & Integration meeting in Frankfurt in February 2025 (Figure 5), by gathering input from SPADES partners from all work packages. Additionally, insights from end-users in pilots (WP3) were collected in the process of filling out the Diagnosis Workbook for each pilot. By these activities, an overview of end-user groups (depicted in Table 1) was produced as well as a broad list of soil challenges and planning and design challenges that they (might) encounter, insights into their specific information needs: what type of information, data, tools, insights, knowledge or inspiration do they require, for what purpose, how will they use it, and when will they use it in the planning and design process?

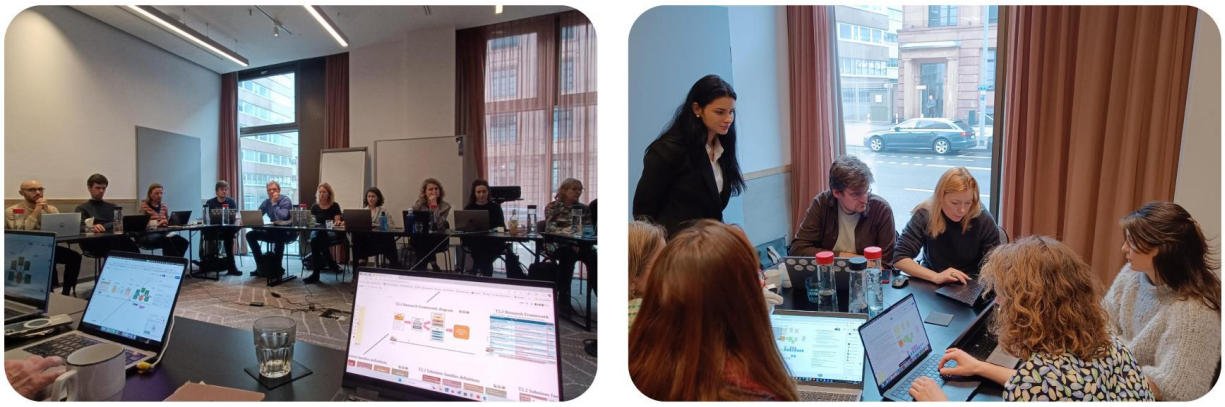

FIGURE 5 SPADES CONNECTIVITY & INTEGRATION WORKSHOP, FRANKFURT, FEBRUARY 2025

TABLE 1 OVERVIEW OF SPADES STAKEHOLDER GROUPS (SOURCE: DIAGNOSIS WORKBOOK FOR SPADES PILOTS).

Stakeholder group	Stakeholder
Public	National government
	Regional government
	Local government / municipality departments
	Water boards
	International governments
Civil society	Community groups
	NGOs
	Media
	Interest groups
	Other…
Academia	Universities
	Research institutes
	Service providers / advisors
	Other…
Private	Utilities
	Housing corporations
	Network operators
	Real estate developers
	Engineering firms
	Building companies
	Local industry
	Insurance companies
	Banks
	Other…

The following questions were posed to the SPADES team to delineate and further design the Evaluation Framework:

- Who are the end-users of the SPADES output, namely the portfolios of instruments and best practices, and the SPADES Navigator?
- What do these end-users need / use, in what phase of the planning process?
- When and for what do they use instruments and practices?
- What type of information do they need in terms of effectiveness, applicability, sustainability, etc.?

Additionally, specific questions were posed to the different work packages:

- WP1 - From a policy analysis perspective: who should integrate soils in spatial planning and how? What do they need to align boundary-spanning instruments[1]?
- WP2 - Best practices and best instruments: who needs what, when, for what purpose? What are end-users most helped by?
- WP3 - Pilots: who is involved, why, what do they need to make the pilot work?
- WP4 – SPADES Navigator: who will use the SPADES Navigator, for what purpose, how, what do they need from it?

[1] Boundary Spanning instruments are used to build 'bridges' across sectoral and intra- or interorganisational boundaries. These instruments support different actor groups (in this case those engaged in soils and planning and design) in establishing a constructive dialogue and improving coordination and articulation of (shared) procedures.

- WP5 - Capacity Building: who needs what information, training or support, in what form?
- ALL - what data, information, and knowledge does our audience need to make optimal use of the Evaluation Framework?

The responses provided a broad base of stakeholder needs highlighting that the users of the SPADES e project partners involved in pilots (WP3) and the SPADES Navigator (WP4), it was explored how to translate these broad stakeholder needs into assessment purposes and goals. Questions addressed were:

- What requirements do these needs set for the output of the SPADES Navigator?
- What should the short-lists provide, to enable our end-users to make better, soil-inclusive choices?
- What makes a best practice or instrument 'best'?

Documentation of these interactive sessions is included in Annex B, represented through screenshots of the MIRO board. The discussions led to a clear formulation of the assessment purposes and goals, as stated in paragraph 2.1, and a list of requirements for the Evaluation Framework as outlined in paragraph 2.2.

3.3 Phase 2: Defining assessment characteristics

The assessment characteristics for the Evaluation Framework were defined through interactive sessions with SPADES partners from all Work Packages. The following questions were used to guide these discussions:

- Which assessment characteristics should be included?
- How can these characteristics best be structured?
- Which of these characteristics are used for scoring?
- What makes a practice or instrument 'best'?
- What makes a practice or instrument not good enough to be on the short-list?

The insights from the discussions led to a clear structure of scoring and curation criteria (further elaborated on in Section 4) and provided the basis for the selection of elements (criteria) that were included in the assessment.

3.4 Phase 3: Selected elements to be included in the assessment and Phase 4: Choice of assessment approach

In an iterative process within WP2, the inclusion of various elements in the assessment was explored and tested. Together with T2.1 *Inventory of instruments* and T2.2 *Inventory of practices,* preliminary run-throughs of the selected criteria were done, and the process of scoring two instruments and two practices were explored, as a test. This test gave valuable insights into the difficulty or level of effort to score certain criteria, the availability of data based on which scoring was possible. Additionally, it helped to clarify the role of each criterion: which were to be used for scoring, and which were to be used for curation. Once again, the emphasis was placed on ensuring that the final short-lists should include a diverse spectrum of instruments and best practices relating to different soil challenges, design and planning challenges, geographical regions and levels of development (as detailed in 4.3 and 4.4).

Insights from this iterative process led to the selection of scoring criteria and an elaborate set of curation criteria, and shaped the current Step-by-Step Approach to the Evaluation Framework, with a usability assessment at its core. The usability assessment scores various instruments and practices based on the quality of their documentation, accessibility, adaptability etc. The application of the scoring criteria along with the curation criteria assigned per instrument and practice enables the development of the short-lists.

Throughout the development process, it became clear that the approach to apply the Evaluation Framework and criteria had to be further adapted to assess instruments and practices separately. Therefore the assessment for instruments and practices was split, and will also be described separately below.

3.4.1 Usability assessment for instruments

Instruments need to be considered usable by SPADES pilot users in order to enhance their potential uptake (Lemos et al., 2012; Raaphorst et al., 2020; Boon et al., 2022,2024). Based on one of the online SPADES workshops to develop the Evaluation Framework, project members included criteria such as 'user friendliness', 'price', 'tool maintenance', 'accessibility', 'language', and 'detailed support such as documentation' as being relevant for an instrument to be added to the short-list. In doing so, a variety of usability aspects as well as contextual factors can be distinguished. This interplay between usability and context has been documented before and is considered to be an important aspect of the usability of instruments (Findlater et al., 2021; Jebeile & Roussos, 2023; Koers et al., 2025). The co-produced and supported aspects as scoring criteria form the basis of curating the short-list of instruments. These criteria are further explained in 4.4.1.

3.4.2 Usability assessment for practices

In the usability assessment for practices was opted to primarily focus on the documentation of practices as part of their usability. Aspects such as contextual fit vary for different users of the SPADES Navigator and are therefore not considered in the usability assessment. Additionally, practices can serve as inspiration, even when they may not fit a certain context to be considered for actual implementation (Rose, 1991). However, potential users of these practices still need documentation in order to, for example, understand what the practice entails, what it is aimed at, or how it should be implemented. Furthermore, criteria were added aimed at whether these practices were tested. This helps to select practices that not only give guidance to end-users but also the results to show for it. These criteria are further explained in 4.4.2.

4 CRITERIA AND SCORING

4.1 Use of criteria in the Evaluation Framework

Different criteria are used across the step-by-step process to apply the Evaluation Framework, as detailed in Chapter 5. The criteria used to evaluate instruments and practices can be divided into two groups based on their function:

- for **scoring**,
- for **curation**

Figure 6 presents an overview of the connection between the step-wise process with the criteria elaborated within this chapter.

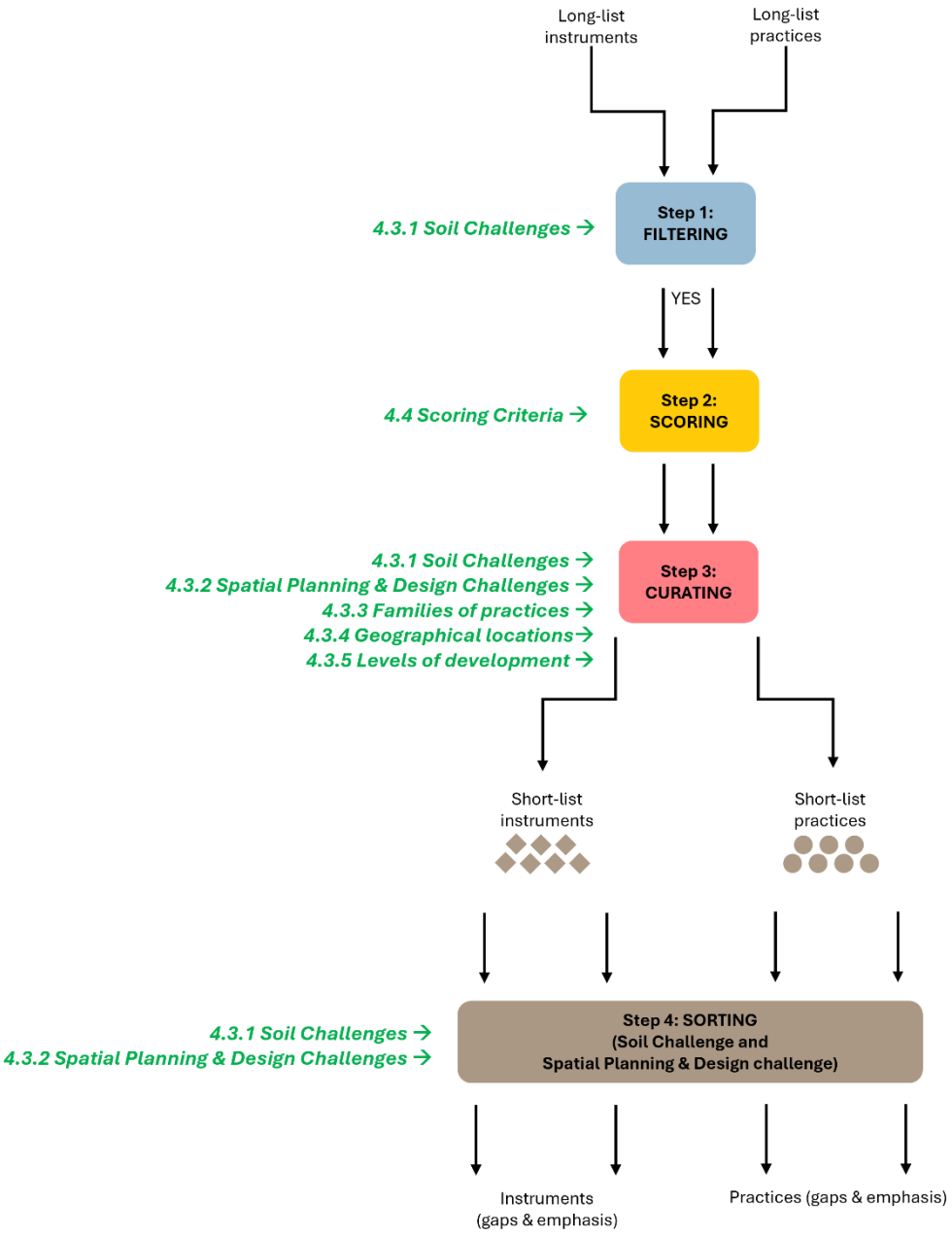

FIGURE 6 USE OF CRITERIA IN THE EVALUATION FRAMEWORK

4.2 Categories of criteria

Curation criteria provide valuable information about instruments and practices and enable their curation. These include contribution to soil challenges, contribution to planning and design challenges, geographic location etc.

Scoring criteria enable scoring and comparison between instruments and practices, respectively. These include usability criteria such as data output and level of documentation. Table 2 provides a comprehensive overview of all the scoring and curation criteria for the Evaluation Framework.

TABLE 2 OVERVIEW OF CRITERIA FOR THE EVALUATION FRAMEWORK

CURATION CRITERIA		
Contribution to soil challenges		
Soil quantity SQ1: Soil sealing SQ2: Soil excavation SQ3: Erosion SQ4: Scalping SQ5: Unused land (territorial or site) SQ6: Land grabbing Water quantity WQ1: Water quantity	Soil quality *a. Degradation of biological, physical and chemical properties* SA1: Artificialisation SA2: Compaction SA3: Subsidence SA4: Soil contamination SA5: Salinisation SA6: Soil saturation SA7: Acidification SA8: Degraded excavated soil SA9: Degraded soil nutrient cycling *b. Degradation of ecological multifunctionality* SA11: Desertification SA12: Loss of biodiversity SA13: Loss of ecological multifunctionality Water quality WA1: Water quality	Soil performance SP1: CO_2 storage SP2: Thermal regulation SP3: Flood management SP4: Energy transition SP5: Stable soil SP6: Safe soil SP7: Availability of material SP8: Availability of fresh water SP9: Drinking Water SP10: Support biodiversity SP11: Support biomass SP12: Support food production SP13: Groundwater storage
Contribution to planning and design challenges		
PD1: Sustainable urbanisation PD2: Socio-economic challenges PD3: Adaptation to climate change PD4: Mitigation of climate change PD5: Healthy natural system	PD6: Energy transition PD7: Cultural identity and experiential quality PD8: Inclusive co-creation and governance PD9: Ecological reciprocity	
Families of soil solutions		
SS1 Artificial / engineered soil systems. SS2 Circular Soil Handling SS3 De-Sealing / De-paving SS4 Ecological Farming	SS5 Planned Urban Green Spaces SS6 Protection by Coverage SS7 Reforestation / Afforestation SS8 Regulative Normative or Policy	SS9 Soil Improvement / Regeneration SS10 Use Change SS11 Water Retention and Infiltration
Geographic Location		
GL1: North Europe GL2: South Europe	GL3: East Europe GL4: West Europe	GL5: Associated countries GL6: Third countries
Levels of Development		
For instruments: DI1: TRL 4-6 DI2: TRL 7-8 DI2: TRL 9	For practices: DP1: Practical Demonstration (TRL5-6) DP2: Successful Demonstration (TRL6-7) DP3: Tested Approach (TRL 8-9)	

SCORING CRITERIA	
Usability assessment	
For instruments: UA1: Data output UA2: Data requirements UA3: Instrument accessibility UA4: Adaptability of language of instrument UA5: Level of documentation UA6: Type of documentation UA7: Accessibility of documentation UA8: Adaptability of language of documentation UA9: Instrument maintenance	For practices: UA10: Level of documentation UA11: Accessibility of documentation UA12: Adaptability of language of documentation UA13: Previous practical implementation

T2.1 and T2.2 used further classifications to systematise their inventorying / compiling work, but this are not of relevance for the Evaluation Framework as they are not used as either curation or scoring criteria and are therefore not elaborated on in this document.

4.3 Curation criteria

4.3.1 Curation criteria: Soil challenges

In the Evaluation Framework, soil challenges are curation criteria applied to both instruments and practices. Soil challenges are used in **Step 1** for filtering instruments and practices on a yes/no basis. In **Step 3**, each instrument and practice is assigned to one or more soil challenges. Finally, in **Step 4**, shortlisted instruments and practices are sorted per soil challenge to explore coverage across challenges.

The soil challenges represent potential needs that SPADES end-users may face in their efforts to improve soil health. The have been identified in alignment with the EU strategic sustainability goals in light of the EU Soil Strategy for 2030 (EC, 2021b) and the objectives of the EU Soil Mission (EC, 2021a). In particular, they consider alignment with soil conservation and management principles, Land Degradation Neutrality (LDN) and No Net Land Take (NNLT) by 2050. Aligning with SPADES conceptual approach to soil health, soil challenges are further categorized as **soil quantity**, **soil quality** and **soil performance** challenges.

Criteria: addressing soil quantity challenges

SPADES refers to **soil quantity** as: the availability of land and soil in relation to societal challenges such as soil as resource for building, the percentage of sealed areas and land take. It primarily relates to the No Net Land Take (NNLT) objective of the Soil Strategy (EC, 2021b), as well as key objectives 3 (Stop soil sealing and increase re-use of urban soils) and 5 (Prevent erosion) of the Soil Mission (EC, 2021a). Water quantity is also included under this category.

TABLE 3 SOIL QUANTITY CHALLENGES

Code	Challenge	Description
SQ1	Soil sealing	Permanent covering of an area of land and its soil by impermeable artificial material (EC, 2012).
SQ2	Soil excavation	Removal of soil from the ground resulting in volumes of excavated soil, which may be clean, fertile and healthy, but could also be degraded and / or hazardous. This has consequences for the value, application and destination of the soil, i.e. whether it can be treated as a resource or as a waste or must satisfy end-of-waste criteria before it can be recovered (EC, 2024).
SQ3	Erosion	The accelerated removal of topsoil from the land surface through water, wind and tillage (FAO, 2020).
SQ4	Scalping	Anthropogenic removal of topsoil layer.

SQ5	Unused land (site or territorial scale)	Underused or derelict sites or land, not actively contributing to economic, social, or ecological functions (including brownfields[2]).
SQ6	Land grabbing	The control of larger than locally-typical amounts of land by any person or entity via any means ('legal' or 'illegal') for purposes of speculation, extraction, resource control or commodification at the expense of peasant farmers, agroecology, land stewardship, food sovereignty and human rights (Ecoruralis, 2016).
WQ1	Water quantity	Surplus or shortage of (ground)water, by climate change, natural processes or human activities (floods and droughts)[3].

The guidance below clarifies how the filtering, classification or sorting per soil quantity challenge can be applied for instruments and practices.

TABLE 4 GUIDANCE FOR ASSESSING INSTRUMENTS AND PRACTICES IN RELATION TO SOIL QUANTITY CHALLENGE

For soil instruments	For practices
Does the instrument provide information related to one or more of the listed soil quantity challenges? Step 1: Y / N Step 3 & 4: select relevant challenge (one or more)	Does the practice – generally – address/involve/incorporate the NNLT[4] principles or the hierarchy of avoid, reuse, minimise, compensate[5]? Step 1: Y / N Step 3 & 4: select relevant challenge (one or more)

Criteria: addressing soil quality challenges

SPADES refers to **soil quality** as: the chemical, biological and physical condition of soil. It primarily relates to the Land Degradation Neutrality Target of the UNCCD (which the EU is committed to and Member States re encouraged to follow[6]), to the pollution reduction objective of the Soil Strategy, and to the Soil Mission objective 1 (Reduce desertification) (EC, 2021a). Challenges related to soil quality lead to changes in physical structure and biological activity of soil (its biochemical properties) and loss of its ecological multifunctionality, and its capacity to support ecosystem functions and services that are crucial to humans and non-humans. Water quality is also included under this category.

Soil quality challenges are further categorized under two sub-categories: **Degradation of soil chemical, biological and physical properties** and **Degradation of ecological multifunctionality.** This division into two categories is for clarity and ease of understanding by non-experts. Both are circular and interdependent, where changes to biological, chemical and physical properties focus more on the soil's composition, changes

[2] According to CABERNET (Concerted Action on Brownfield and Economic Regeneration Network). (2006). Sustainable Brownfield Regeneration: CABERNET Network Report. University of Nottingham: brownfields are sites that: have been affected by the former uses of the site and surrounding land; are derelict and underused; may have real or perceived contamination problems; are mainly in developed urban areas; and require intervention to bring them back to beneficial use

[3] See also : EEA. (2023).

[4] The 'no net land take by 2050' objective, first proposed by the European Commission in 2011 (European Commission. (2011) aims to preserve soils, protect biodiversity, and improve quality of life. It has since become a key target within the EU Soil Strategy for 2030

[5] The mitigation hierarchy is a set of guidelines consisting of three (or four) successive steps to counteract ecological loss : Avoid, Reduce, (Minimise/Restore), Compensate. The central objective of this sequence of steps is to reach ecological equivalence and, in theory, no net loss of biodiversity. See: Gelot, S., Bigarad,C. (2021)

[6] EU Soil Strategy section 4.2.1 (EC, 2021b)

to ecological multifunctionality address the broader soil ecosystem functions. Both also relate to challenges in soil quantity.

Degradation of biological, physical and chemical properties

TABLE 5 SOIL QUALITY CHALLENGES RELATED TO DEGRADATION OF BIOLOGICAL, PHYSICAL AND CHEMICAL PROPERTIES

Code	Challenge	Description
SA1	Artificialisation	The lasting alteration of all or part of the ecological functions of a soil, particularly its biological, hydric and climatic functions, as well as its agronomic potential by its occupation or use (De Redon, L., Mialot, C.,2024).
SA2	Compaction	Physical degradation resulting in densification and distortion of the soil where biological activity, porosity and permeability are reduced, strength is increased and soil structure partly destroyed. Compaction can reduce water infiltration capacity and increase erosion risk by accelerating run-of[7].
SA3	Subsidence	Land subsidence, or soil subsidence, is the sudden sinking or gradual downward settling of the ground's surface with little or no horizontal motion[8].
SA4	Soil contamination or pollution (incl. contaminated sites, brownfields[9])	The occurrence of pollutants in soil above a certain level causing a deterioration or loss of one or more soil functions. Also, Soil Contamination can be considered as the presence of man-made chemicals or other alteration in the natural soil environment[10].
SA5	Salinisation[11]	The accumulation of water-soluble salts in the soil and groundwater by natural processes, or human interventions.
SA6	Soil saturation	Soil pores are filled with water, leaving no space for air/oxygen.
SA7	Acidification	Lower pH levels that harm plant growth, nutrient cycling and living organisms.
SA8	Degraded excavated soil	Soil removed from location and lost its quality.
SA9	Degraded soil nutrient cycling	Decline in natural processes through which nutrients are transformed, mobilised and made available.

Degradation of ecological multifunctionality

TABLE 6 SOIL QUALITY CHALLENGES RELATED TO DEGRADATION OF ECOLOGICAL MULTIFUNCTIONALITY

Code	Criterion	Description
SA11	Desertification	Land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities (UNCCD, 2017).

[7] Joint Research Center - European Soil Data Centre (ESDAC), Soil Compaction, retrieved from https://esdac.jrc.ec.europa.eu/themes/soil-compaction1

[8] Dutch Research Agenda (NWA) LOSS Research Programme, What is subsidence?, retrieved from https://nwa-loss.nl/en/programme/land-subsidence/

[9] See: CABERNET, 2006

[10] Joint Research Center - European Soil Data Centre (ESDAC), Soil Contamination, retrieved from https://esdac.jrc.ec.europa.eu/themes/soil-contamination

[11] Joint Research Center - European Soil Data Centre (ESDAC), Sustainable agriculture and soil conservation Soil degradation processes_Fact sheet no.4_Salinisation and sodification. Retrieved from https://esdac.jrc.ec.europa.eu/projects/SOCO/FactSheets/ENFactSheet-04.pdf

SA12	Loss of biodiversity	Decline in the diversity of organisms present in soil that affects multiple ecosystem functions, including plant diversity, decomposition, nutrient retention and cycling, plant and animal health, soil carbon sequestration and greenhouse gas emissions (FAO, 2016).
SA13	Loss of ecological multifunctionality	Decline in the soil ecosystem's ability to provide functions and ESS.
WA1	Water quality	The deterioration of (ground)water quality due to natural processes and human interventions (pollution, eutrophication, etc)[12].

The guidance below clarifies how the filtering, classification or sorting per soil quality challenge can be applied for instruments and practices.

TABLE 7 GUIDANCE FOR ASSESSING INSTRUMENTS AND PRACTICES IN RELATION TO SOIL QUALITY CHALLENGE

For soil instruments	For practices
Does the instrument provide information on any of the listed soil quality challenges? Step 1: Y / N Step 3 & 4: select relevant challenge (one or more)	Does the practice – widely, generally – address/involve the Land Degradation Neutrality principles of Avoid / Reduce / Reverse[13]? Step 1: Y / N Step 3 & 4: select relevant challenge (one or more)

Criteria: harnessing soil performances

SPADES refers to **soil performances** as: the ability of soil quality and quality (sometimes both) to help with planning and design challenges like climate change, environmental degradation and spatial quality. It is a new category introduced by SPADES to bridge the quality and quantity of soil to the interventions in spatial planning and design. It relates to the Soil Strategy's objective to ensure that all EU soil ecosystems are healthy and more resilient, enabling them to continue delivering essential services. Pressures on soil quality and quantity lead to loss of its ecological multifunctionality and degraded provision of ecosystem services.

TABLE 8 SOIL PERFORMANCES

Code	Performance	Description
SP1	CO_2 storage & Sequestration	The sequestration (long-term stabilization of carbon) and storage (temporary accumulation which can be rapidly lost if conditions change) of atmospheric CO_2 into terrestrial reservoirs (Rumpel, C. et al., 2022 and Baveye, P. et al., 2023)
SP2	Thermal regulation	Soil / water impacts local temperatures
SP3	Flood management	Acts as buffer to regulate and/or mitigate the severity and frequency of flood (Saco, P. M., et al., 2021)
SP4	Energy transition	Contributes to energy transition (energy efficiency or renewable energy generation).
SP5	Stable soil	Provides a stable platform for human activities.
SP6	Safe soil	Safe platform for human activities (no hazard or health risks).

[12] See also European Environmental Agency. (2023).
[13] UNCCD. (2017). Land Degradation Neutrality Target Programme Technical Guide. United Nations Convention to Combat Desertification. Retrieved from https://catalogue.unccd.int/1224_UNCCD_LDN_TPP_technical_guide_GM.pdf

SP7	Availability of material	Provides raw material for human activities (EC, (2021b).
SP8	Availability of fresh water	Acts as a natural filter that cleans and regulates the flow of fresh water through ecosystems.
SP9	Drinking Water	Filters contaminants and purifies water to become part of the drinking water supply (Keesstra, S., et al., 2012).
SP10	Support biodiversity	Provides habitats for a wide range of microorganisms, fauna and flora thanks to improved soil structure and habitat (FAO, 2015)
SP11	Support biomass	Supplies nutrients necessary for plant growth / organic matter accumulation (FAO, 2015).
SP12	Support food production	Provides the nutrients, water, and structure for crops and food-producing plants.
SP13	Groundwater storage	Acts like a sponge, absorbing and holding water to replenish underground aquifers.

The guidance below clarifies how the filtering, classification or sorting per soil quality performance can be applied for instruments and practices.

TABLE 9 GUIDANCE FOR ASSESSING INSTRUMENTS AND PRACTICES IN RELATION TO SOIL PERFORMANCE

For soil instruments	For practices
Does the instrument provide information on any of the listed soil performance capacities? Step 1: Y / N Step 3 & 4: select relevant performance (one or more)	Does the practice relate to any of the listed soil performance capacities? Step 1: Y / N Step 3 & 4: select relevant performance (one or more)

4.3.2 Curation criteria: Spatial Planning and Design Challenges

Territorial development faces a number of challenges that are addressed within the broader strategic vision of the European Green Deal (EGD), which calls for sustainable urbanisation, climate adaptation and mitigation, nature restoration, and inclusive economic development to achieve climate neutrality by 2050. Planning and design practices are also constrained by organisational challenges and expectations to align with the values of the New European Bauhaus (NEB), promoting interventions that are sustainable, inclusive, and "*aesthetically enriching*". Soil instruments and practices must consider not only their effectiveness in addressing soil challenges, but also their ability to support broader ecological and social transitions and enable planning and design practice to move towards soil-sensitive approaches.

The following curation criteria allow us to categorize the shortlisted instruments and practices in Step 3 and sort them in Step 4. The criteria establish the relation of instruments and practices with the EGD and strategic sustainability challenges of relevance for planning and design. The assessment will be done based on the documentation available or by expert judgement.

TABLE 10 SPATIAL PLANNING AND DESIGN CHALLENGES

Code	Criterion	Description
PD1	Sustainable urbanisation	Does it contribute to sustainable urbanisation by supporting densification, reindustrialisation, mobility and infrastructure and / or public space development?
PD2	Socio-economic challenges	Does it contribute to reducing shrinkage, promote rural vitality, provide health benefits (opportunity for outdoor activities, positive impact on air quality, access to healthy food) and participation and representation?

PD3	Adaptation to climate change	Does it contribute to adapt to changes in water quantity (fluvial, pluvial or coastal flooding, drought), in water quality (salt intrusion), temperature rise, and climate change awareness?
PD4	Mitigation of climate change	Does it contribute to reduction of GHG emissions from farming and construction?
PD5	Healthy natural system	Does it support sustainable food production, agricultural transition, nature development / ecological expansion and biodiversity?
PD6	Energy transition	Does it support energy transition by provide space for RE production and distribution infrastructure?
PD7	Cultural identity and experiential quality[14]	Does it reflect local identity through materials, aesthetics, or vernacular forms, and does it offer sensory and emotional richness in its use or design?
PD8	Inclusive co-creation and governance[24]	Does it involve users or communities in design or maintenance, and are governance structures in place to ensure continuity and long-term care?
PD9	Ecological reciprocity[24]	Does it create or maintain habitats for other species and promote reciprocal relationships with the environment?

To check whether a practice or an instrument can relate to these planning and design challenges, the following is proposed:

TABLE 11 GUIDANCE FOR USING SPATIAL PLANNING AND DESIGN CHALLENGES CRITERIA

For soil instruments	For practices
Does the instrument provide information on any of the listed planning and design challenges? Step 3 & 4: select relevant challenge (one or more)	Does the practice relate to any of the listed planning and design challenges? Step 3 & 4: select relevant challenge (one or more)

4.3.3 Curation criteria: Families of practices

Due to the large number of practices and highly diverse dataset obtained from the inventories, as a strategic step to bring structure and analytical value to the inventory of soil-inclusive practices (T2.2), the practices were clustered into 11 families. This classification was based on specific factors such as similar characteristics of the primary function of the practice. Grouping the practices facilitates cross-comparison within and across the families. Moreover, this approach helps to identify soil challenges and select the practices that inform end users. Below are the 11 families of soil-inclusive practices as curation criteria, which enable to evaluate the coverage of practices across solution families. This gives insights into which families are well represented in the short-lists, and which families of solutions could benefit from additional attention.

TABLE 12 FAMILIES OF SOIL-INCLUSIVE PRACTICES

Code	Criterion	Description
SS1	Artificial / engineered soil systems	Artificial soil or engineered soil is an anthropogenic substrate, in many ways, resembles natural soil but is designed to possess certain properties on a controlled basis. Natural soils are physically weathered over time, decomposing organic matter, as well as influenced by biotic factors, while artificial soils are used in areas where natural soil is lacking, poor, or non-existent and are prepared purposefully to fulfil particular applications.
SS2	Circular Soil Handling	A holistic approach to soil management, emphasising closed-loop systems, soil health, and sustainability. This instrument can be used to predict how

[14] Inspired by the New European Bauhaus principles, more info on: https://new-european-bauhaus.europa.eu/about/about-initiative_en

		much soil will be excavated concerning construction works and urban development in a city.
SS3	De-Sealing / De-Paving	Physical removal of soil sealing, such as roads, parking lots, buildings, terraces, and driveways, to restore soil permeability and soil's contributions to other natural ecosystem services.
SS4	Ecological Farming	It ensures healthy farming and healthy food. It protects the soil, the water and the climate. It does not contaminate the environment with chemical inputs or use genetically engineered crops.
SS5	Planned Urban Green Spaces	Public or privately owned open-space areas planned to allocate parks, gardens, playgrounds and others, including plant life, water features.
SS6	Protection by Coverage	Planting cover crops, annual crops, and perennial crops and leaving crop residues and living mulches on the ground. Soil health practices that maintain cover year-round improve soil health and protect soil from wind and water erosion.
SS7	Reforestation / Afforestation	Reforestation is the process of replanting trees in areas that have been affected by natural disturbances. Afforestation is the establishment of a forest in an area where there was no forest before, or not for a long time.
SS8	Regulative Normative or Policy	Mandatory regulation that includes requirements related to enhancing soil health and increasing ecosystem services
SS9	Soil Improvement / Regeneration	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 could involve returning nutrients and organic matter to the soil to restore fertility and productivity.
SS10	Use Change	Use change of an area with the purpose of soil regeneration or conservation.
SS11	Water Retention and Infiltration	Measures such as soil water retention for how much water a particular type of soil can retain. Infiltration is the movement of surface water into the soil.

4.3.4 Curation criteria: Geographic locations

The European Commission has grouped its 27 Member States geographically into North, South, East, and West Europe. This regional categorization is used to evaluate the geographical coverage of the source of the instruments and practices. Instruments and practices from associated and third countries can also be included in the inventories.

Both practices and instruments are described in this criterion based on the associated geographic location. For practices, this indicates the countries where the described practice has been tested or implemented. For instruments, the country of the primary institution responsible for the instrument is used to determine the geographic location. This ensures that the curated lists have instruments and practices that originate from diverse geographic locations.

TABLE 13 GEOGRAPHIC LOCATIONS CRITERIA

Code	Criterion	Description
GL1	North Europe	Denmark, Estonia, Finland, Ireland, Latvia, Lithuania and Sweden
GL2	South Europe	Cyprus, Greece, Italy, Malta, Portugal, Spain, Slovenia and Croatia
GL3	East Europe	Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia
GL4	West Europe	Austria, Belgium, France, Germany, Luxembourg and Netherlands
GL5	Associated countries	Albania, Armenia, Bosnia and Herzegovina, Canada, Faroe Islands, Georgia, Iceland, Israel, Korea, Kosovo, Moldova, Montenegro, New Zealand, North Macedonia, Norway, Serbia, Türkiye, Tunisia, Ukraine, United Kingdom

GL6	Third countries	All other countries

4.3.5 Curation criteria: Levels of development

The levels of development categorize the instruments and practices across 2 or 3 levels of development. This stratification ensures that the short-lists include both instruments and practices which have been tested and those that have a high potential.

Criteria levels of development – For instruments

For instruments, the level of development is determined across Technology Readiness Levels (TRL). TRL is a standardized method (as originally developed by NASA and adopted by EU funded projects)[15] for assessing the maturity of a particular technology, especially in science and engineering contexts. Figure 7 illustrates the nine typical levels of technology maturity, ranging from basic principles (TRL 1) to fully operational systems (TRL 9).

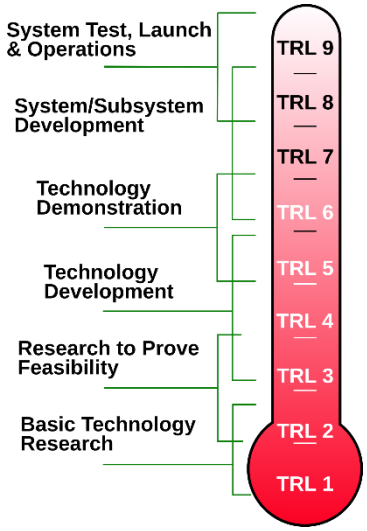

FIGURE 7 NASA TECHNOLOGY READINESS LEVEL (TRL) METER. SOURCE: NASA TRL METER – WIKIMEDIA COMMONS

TABLE 14 LEVELS OF DEVELOPMENT – FOR INSTRUMENTS

Code	TRL Level	Description
DI1	TRL 4-6	Instruments that are in intermediate levels of development. The instrument has been developed operationalized and tested with initial data processing (TRL 4), tested with real or representative data (TRL 5), has been used by real users or stakeholders (TRL 6)
DI2	TRL 7-8	Instruments that are in advanced stages of development or are fully developed. In this level of development, the instrument has been deployed and is fully functional for all users (TRL 7), has been certified as a tool (TRL 8).
DI2	TRL 9	Instruments that are fully developed. In this level of development, the instrument has been in regular use and undergoes regular and continuous improvement (TRL 9).

[15] European Commission. (2023b). Horizon Europe Work Programme 2023–2024: General Annexes (COM (2023) WP 13 final). Brussels: Publications Office of the European Union. p. 14

Levels of development – For practices

For practices, the level of development has been determined by assessing the 'mainstreaming potential' of practices. This indicates the ease with which a potential user of the SPADES Navigator can apply a practice if it is relevant. A high mainstreaming potential indicates that the soil-inclusive practices is easy to apply, because (1) it has been implemented, evaluated and validated, (2) the implementation has been tested in multiple locations and retains effectiveness, and (3) has demonstrated both technical and governance related implementation success. This can include, for example, a clear business/ ownership model and long-term sustainability plan. Based on these considerations, three bands of development are defined to categorize practices.

TABLE 15 LEVELS OF DEVELOPMENT –FOR PRACTICES

Code	Criterion	Description
DP1	Practical Demonstration (TRL5-6)	Real-world, tangible implementation of a planning concept, strategy, or policy that addressed soil challenges (quantity, quality or performance), directly (e.g. the purpose of the case is to address soil issues) or indirectly (addressing soil issues is a co-benefit) in a specific location to test its feasibility, effectiveness, and impact.
DP2	Successful Demonstration (TRL6-7)	Validates a strategy, policy, or intervention by achieving its intended soil-related goals, ideally with measurable, scalable, and adaptable results.
DP3	Tested Approach (TRL 8-9)	Implemented, evaluated, and validated through real-world applications, pilot projects, or case studies; backed by empirical evidence, stakeholder feedback, and performance data, demonstrating their effectiveness and feasibility before wider adoption.

4.4 Scoring Criteria

The only scoring criteria used to assess the instruments and practices in the Evaluation Framework are usability criteria. This section is built up as follows. Firstly, the different criteria were thematically grouped with an argumentation for why the focus was specifically on these criteria. Then, per criterion, a detailed description was provided of what the criterion entails as well as how this can be scored. This scoring is standardized and takes the following approach: 0 = the instrument or practice fails to meet the criterion, 1 = the instrument or practice meets the criterion but there is 'room for improvement', 2 = the instrument or practice meets the criterion with little or no need for improvement. Finally, it is explained how each criterion contributes to the analysis.

4.4.1 Criteria for usability evaluation – For instruments

For instruments, the usability evaluation looks at:

- User friendliness
- Accessibility
- Language
- Detailed support

Criteria: User friendliness

The aim is to evaluate how easy the instruments are to use/operate by the users (Koers et al., 2025). When looking at scoring criteria, aspects such as target audience or the level of knowledge required are not considered here, as this would potentially rule out instruments that might be relevant for specific niche audiences. Instead, focused was on the data that is required for the instrument to operate as well as the output generated by the instrument.

TABLE 16 USABILITY EVALUATION – FOR INSTRUMENTS – USER FRIENDLINESS

Code	Criterion	Description	Scoring
UA1	Data output	For the instrument to be deemed useful, the data output of the instrument needs to answer the users' questions without (much) further adjustments needed to be able to utilize the output.	0 = Instrument output can only be used by users in their decision-making process with a lot of further effort required. 1 = Instrument output can be used by users in their decision-making process with some further effort required. 2 = Instrument output can be used by users in their decision-making process with little to no further effort required.
UA2	Data inputs	Instruments often require input data from external sources in order to work. Therefore, if this data can be accessed and input easily (e.g. by loading in an existing GIS- or Excel-file) or created easily (e.g. using standardized GIS- or Excel-files where users can add the required data into), an instrument can be considered to be more useful.	0 = Additional data is required for the instrument to function, but this data needs to be collected by end-users 1 = Additional data is required for the instrument to function, but this data is easily available for end-users (e.g. a European database) 2 = No additional data is required for the instrument to function

Contribution to analysis

In evaluating the criterion it is aimed to select instruments that can actively contribute to solving or informing about identified soil challenges without requesting too much effort to our potential end-users. This is done on one hand by evaluating tools regarding their usability and relevance of the primary output of the instruments, and on the other hand by evaluating their data requirements in relation to potential extra data that might be necessary as well as how much effort it requires to do so.

Criterion: Accessibility

With regard to the *accessibility* criterion, previous research evaluated how easily accessible instruments are by potential end-users (Raaphorst et al., 2020; Koers et al., 2025). The focus is hereby only on the barriers to access the instruments, as these may affect the ability of stakeholders to be able to do so. Aspects such as level of knowledge are again not considered, as explained above.

TABLE 17 USABILITY EVALUATION – FOR INSTRUMENTS – ACCESSIBILITY

Code	Criterion	Description	Scoring
UA3	Instrument accessibility	Instruments need to be accessible for the users. For, example, instruments may not be free to use but may instead rely on for example licencing costs. This means that such instruments may not be accessible to potential end-users	0 = Instrument is accessible by users, but a paid license or account is necessary OR instrument is inaccessible to users. 1 = Instrument is accessible by users, but a free license or account is necessary.

			2 = Instrument is freely accessible by users without a license or account necessary.

Contribution to analysis

Analysing whether end-users may actually be able to access selected instruments prevents the selection of instruments that require an additional financial burden for end-users of the SPADES project in order to be used. Hereby inclusion for all end-users is promoted, as well as improving the potential uptake of such instruments by these users.

Criterion: Language

With regard to the *language* criterion, the degree to which instruments may be translated to another language is evaluated. The SPADES partners have a diverse background, not only in skill or profession, but also in regard to the countries in which they are located. Using this scoring criterion can prevent language barriers from becoming a problem, an aspect that contemporary research acknowledges (e.g., Glaas et al., 2017).

TABLE 18 USABILITY EVALUATION – FOR INSTRUMENTS – LANGUAGE

Code	Criterion	Description	Scoring
UA5	Adaptability of the language of the instrument	Instruments can be made in different languages, leading to potential language barriers. Therefore, it is good to evaluate whether the language in an instrument can be changed, and if so, how much effort this takes if required.	0 = The instrument can be translated into another language with a lot of effort, or this is not possible. 1 = The instrument can be translated into another language with some effort. 2 = The instrument can be 1) translated into another language with little to no effort OR 2) is available in English OR 3) is available in at least two languages used in SPADES pilots (e.g. French & German).

Contribution to analysis

By evaluating the effort that is required for changing languages in instruments, instruments which this is possible for are selected, which allows for a potential wider uptake by potential end-users.

Criteria: Detailed support

With regard to *detailed support*, the level of further support available for the instruments is evaluated. For this, two aspects are of particular relevance:

Is there any form of documentation available on the instrument? Within the documentation the following aspects are examined:

- Whether there is enough information available;
- Whether this information is relevant;

- Whether this information is accessible to end-users[16].
- Whether this documentation is the adaptable (This is done by checking whether this information can be translated into another language without too much effort or is readily available)

Are instruments still being **maintained by their original developer**? This is relevant since a lack of updates may lead to the presence of bugs (McEvoy et al., 2018) or outdated information (Castro & Rifai, 2021) that in turn may affect the usability of the instrument.

TABLE 19 USABILITY EVALUATION – FOR INSTRUMENTS – DETAILED SUPPORT

Code	Criterion	Description	Scoring
UA6	Level of documentation	Users need documentation (e.g. manuals, tutorials) that enables the utilisation of an instrument. This information needs to be sufficient, relevant and concrete enough. Furthermore, not all documentation may be equally relevant. Users wishing to utilize an instrument may give, for example, more value in guidance documents than in academic literature written about the instrument.	0 = No documentation is available for the user. 1 = No guidance documents are available, but other documentation is available for the user such as reports or deliverables (excluding academic articles). 2 = Detailed guidance documents on how to use the instrument are available for the user.
UA7	Accessibility of documentation	Supporting documentation needs to be accessible for potential users but may be behind paywalls preventing.	0 = documentation is 1) accessible by users, but a paid license or account is necessary OR 2) inaccessible to users. 1 = Documentation is accessible by users, but a free license or account is necessary. 2 = Documentation is freely accessible by users without a licence or account necessary.
UA8	Adaptability of language of documentation	The found documentation may need to be translated into other languages. Therefore, translating the documentation should be possible without considerable effort.	0 = The documentation can be translated into another language with a lot of effort, or this is not possible. 1 = The documentation can be translated into another language with some effort. 2 = The documentation can be 1) translated into another language with little to no effort, OR 2) is available in English, OR 3) is available in at least two languages used in SPADES pilots (e.g. French & German).

[16] N.B.: Documentation and instrument accessibility are not the same: an instrument may be free of use for users while the guidance documents cost money to access, and conversely)

UA9	Instrument maintenance	Instruments may contain data, code or models that over time may become outdated. Alternatively, bugs may also cause problems. Therefore, instrument maintenance (e.g. bug fixes, updates) are required for an instrument to remain usable in future.	0 = The tool has not been updated in the last five years. 1 = The tool has last been updated in the last five to three years. 2 = The tool has 1) been updated in the last two years OR 2) an update or maintenance is currently scheduled.

Contribution to analysis

By evaluating the availability, type, accessibility, and language adaptability of documentation, instruments can be identified that provide relevant and user-friendly support for end-users. Assessing the effort required to switch documentation languages also helps in selecting tools with broader usability and potential uptake. Additionally, evaluating whether instruments are actively maintained and updated allows for selecting tools that remain relevant and are not at the end of their life cycle.

4.4.2 Criteria for usability evaluation – for practices

For practices, the usability evaluation looks at:

- Documentation
- Demonstrated effectiveness

Criteria: Documentation

or the practices, focus is primarily on the available documentation, assessing four nested criteria : 1) whether there is enough information available, 2) whether the information is relevant, 3) whether the information is accessible to end-users, and finally, 4) whether the information can be translated into another language without too much effort.

TABLE 20 USABILITY EVALUATION – FOR PRACTICES - DOCUMENTATION

Code	Criterion	Description	Scoring
UA10	Level of documentation	Users that want to utilize or understand practices will need documentation (e.g. factsheets, reports) that provide them with the required information to do so. This information needs to be sufficient, relevant and concrete enough. Regarding practices, not all documentation may be evenly relevant. Users wishing to implement a practice may give, for example, more value in guidance documents than in academic literature written about the practice.	0 = No documentation is available for the user. 1 = No guidance documents are available, but other documentation is available for the user (excluding academic articles). 2 = Guidance documents on how to the practice was applied are available for the user.
UA11	Accessibility of documentation	Documentation on practices needs to be accessible for potential users but may instead	0 = documentation is accessible by users, but a paid license or account is

		be behind paywalls preventing this.	necessary OR documentation is inaccessible to users. 1 = Documentation is accessible by users, but a free license or account is necessary. 2 = Documentation is freely accessible by users without a licence or account necessary.
UA12	Adaptability of language of documentation	The found documentation may need to be translated to other languages. As such, translating the documentation should be possible to do so without considerable effort.	0 = The documentation can be translated to another language with a lot of effort or this is not possible. 1 = The documentation can be translated to another language with some effort. 2 = The documentation can be 1) translated to another language with little to no effort OR 2) is available in English OR 3) is available in two or more national languages shared by the SPADES-pilot (e.g. French & German).

Contribution to analysis

By looking at how much documentation is available, practices can be chosen that offer enough information for end-users. Considering the type of documentation helps ensure it is relevant and useful. Checking whether the documentation is easy to access helps to select practices that users can actually make use of. Finally, evaluating how easy it is to change the documentation into other languages allows for identifying practices that could reach a wider range of users.

Criteria: Demonstrated effectiveness of practices

Another relevant element of evaluation for practices is that these have been tested in practice. This supports the selection of practices that either have been implemented or have received a positive expert judgement on their potential.

TABLE 21 USABILITY EVALUATION – FOR PRACTICES - DEMONSTRATED EFFECTIVENESS OF PRACTICES

Code	Criterion	Description	Scoring
UA13	Previous practical implementation	The practice requires testing to show that it works.	0 = Practice has not yet been tested in practice. 1 = Practice has been tested in practice, but the results were inconclusive or unsuccessful. 2 = 1) Practice has been tested in practice, and 1) results were successful, OR 2) there is positive expert judgement on the

			potential performance of the practice.

Contribution to analysis
By evaluating whether a practice has been tested, practices can be avoided that in theory might work, but lack any concrete proof or relevant expert judgment.

5 STEP-BY-STEP APPROACH TO APPLY THE EVALUATION FRAMEWORK

The Evaluation Framework is applied on an inventory of instruments (T2.1) and practices (T2.2), or the long-lists, which are compiled with input from existing inventories from Soil Mission projects, other EU research projects, and expanded through review of scientific and grey literature, desk research and an outreach survey to collect inputs from professional planners and municipalities. Starting with these inventories, the Evaluation Framework follows a stepwise process to identify and assess the instruments and best practices, that are fit for a place on the short-lists. The steps include (1) filtering, (2) scoring, (3) curating and (4) sorting. The steps contribute to the objectives of the Evaluation Framework as described in paragraph 2.1. This is illustrated in Figure 8.

The steps to shortlist both instruments and practices are identical, although the description of the criteria is made for each of these groups (Chapter 4). Instruments and practices are assessed separately and result in two short-lists, one for instruments and one for practices.

FIGURE 8 STEP-WISE PROCESS OF THE EVALUATION FRAMEWORK

5.1 Steps supporting objective 1: Making short-lists of best instruments and practices

Steps 1, 2 and 3 support the objective 1. Curating short-lists of successful and promising instruments dedicated to assessment of soil functions and/or soil-related ecosystem services and practices of soil-inclusive planning strategies.

5.1.1 Step 1: Filtering (based on inclusion of soil challenges)

Inventories of available instruments and practices are made, collating input from SPADES partners, SPADES pilots, and desk-based research, resulting in long-lists of instruments (T2.1) and practices (T2.2). These long-lists are then filtered based on the inclusion of soil challenges (can/does this instrument / practice address soil challenges? If not, it should be excluded from the lists). For an elaboration of the identified soil challenges and their explanations see *4.3.1 Soil challenges*. Instruments and practices that do not address at least one of the defined soil challenges are filtered out. Filtering is done on a yes/no basis, based on a generic scan of the available documentation of the instruments and practices. Relevance of an instrument or practice to multiple soil challenges does not translate to additional value at this stage.

5.1.2 Step 2: Scoring (Usability evaluation)

The selected instruments and cases after step 1 are then evaluated in terms of their usability. Here scoring criteria are used to assess instruments and practices across various usability aspects such as adaptability, applicability, accessibility, level of documentation etc. For the complete list of criteria, their description and scoring, see *4.4 Scoring criteria*. Each instrument/ best practice receives a score (0-1-2) across each criterion and a cumulative score between 0 – 18 across all criteria. This score is used later to compare between instruments or between best practices.

	UA1	UA2	UA3	UA4	UA5	Score
Practice 1	I	I		I		3
Practice 2	I	I	I	I	I	5
Practice 3	I		I	I		3
Practice 4	I		I			2

UA – Usability criteria

FIGURE 9 SCORING OF PRACTICES

5.1.3 Step 3: Curating short-lists

In this step, the scored and filtered instruments/ practices are curated. In this step, both scoring and curation criteria are used to curate the final list.

The purpose of this step is to capture a diversity of instruments/ best practices in the short-lists that demonstrate maximum usability. The goal is to create a representative set that demonstrates geographical diversity, including both well-proven and high-potential instruments and practices, and address all the identified soil challenges. This will enable the SPADES Navigator to provide instruments/ practices that are relevant to a broad audience. Although expert judgment is used in the curation process, it is substantiated by clear rationales.

Step 3.1 Classification based on curation criteria

To ensure that the selection is based on a wide spectrum of soil challenges, planning and design challenges as well a diverse geographic location this step classifies each instrument and practice along various curation criteria. In this step each instrument or practice is classified under one or more criteria under the following categories:

1. Soil challenges,
2. Design and planning challenges,
3. Geographic locations: North/ South/ East/ West Europe/ not site-specific.

For the full list and explanation of curation criteria see Chapter 4, specifically *4.4 Soil challenges*, *4.5 Design and Planning challenges* and *4.3.4 Geographic locations*. These curation criteria prepare the instruments and practices for steps 3 & 4.

Step 3.2 Determine appropriate size of short-list

This step defines the limited number of instruments and practices to be included in the final short-lists. The appropriate short-list size is yet to be determined in consultation with the SPADES teams working with the pilots and the SPADES Navigator, based on available budget and time to score and curate instruments and best practices.

This ensures that the process of curating the list results in a concise short-list.

Step 3.3. Categorizing instruments and practices

This next step is to ensure that the curated short-lists represent an appropriate spectrum of instruments and cases. This is done differently for instruments and practices. Instruments are categorized based on soil challenges. See *4.3.1 Soil challenges* for elaborated list and description of criteria. Practices are categorized based on solution families. Solution families are groups of soil measures to improve soil quality, soil quantity and soil performance. Circular Soil Handling, Ecological Farming and Water Retention and Infiltration are some examples of soil solution families. See *4.3.3 Families of soil solutions* for elaborated list and description of criteria.

Step 3.4 Categorize across levels of development

In this step instruments and best practices are categorized across levels of development. This ensures that the resulting short-lists contain instruments and practices that are tested, as well as those that are newly developed or implemented, and show high potential. The step includes defining the levels of development along with assigning each instrument and practice the appropriate classification per level defined. For both instruments and practices Technology Readiness Levels (TRL) are used. Detailed explanations per levels for instruments and practices are provided in Chapter 4, page 27.

Step 3.5 Define allotment size

This step builds on Step 3.2 which defines the size of the shortlists. Here the total shortlist size is sub-divided into allotments. The size of each of these allotments should be based on the user needs gathered from the pilots. To explain how this is done an illustration is provided below.

Illustration: In step 3.2 it is decided to shortlist 27 best practices. In this step (3.5), these 27 potential best practices are sub-divided into allotments across categories (step 3.3) and levels of development (step 3.4). Figure 9 visualizes what this can look like. Here a matrix is set-up with solution families on the horizontal axis and three levels of development on the vertical axis. In this example the 27 potential best practices are subdivided into each box in this matrix. This is called the allotment size. For example, two instruments are allotted for soil family 1 (F1) at the practical demonstration level of development.

Based on user needs from pilots, it was expressed that tested approaches under soil family 1,2,3 are lacking then these allotments can be bigger than the other families. This ensures that the short-list emphasizes the needs of the users (Table 1). The outcome is a matrix with empty positions for potential instruments/ best practices. This matrix will become the basis of the curated list in the next step.

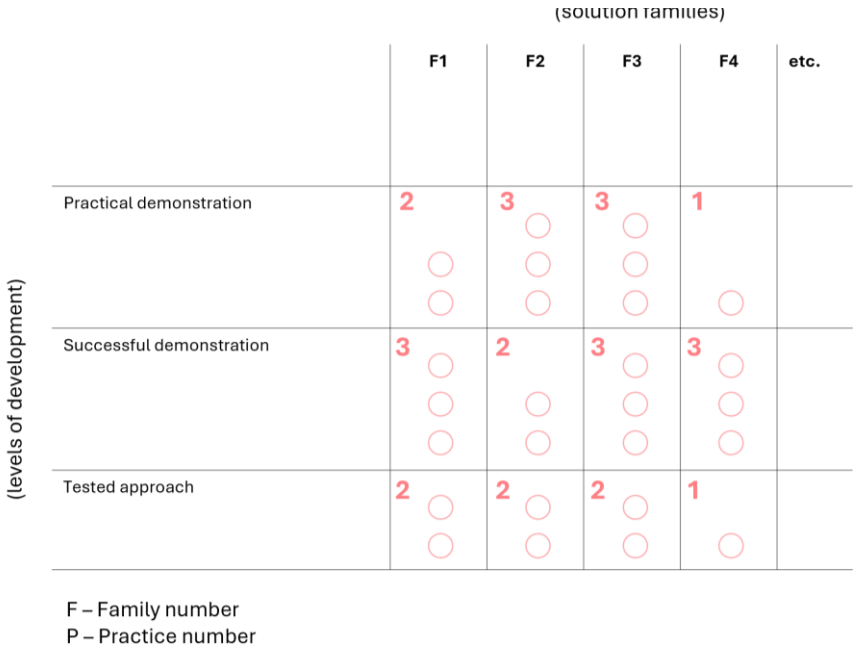

FIGURE 9 ILLUSTRATION SHOWING ALLOTMENT SIZES ACROSS LEVELS OF DEVELOPMENT (STEP 3.4) AND CATEGORIES (STEP 3.3)

Step 3.6 Selection of 'best' instruments/ practices

The table is filled up one position at a time. When two or more instruments/practices are competing for the same position, the scoring provided in previous steps is used to determine which instrument/ practice is assigned the position on the short-list. To explain how this is done an illustration is provided below.

Illustration: There are three available positions under soil family F1 and successful demonstration. From the long list there are five best practices that have been categorized under soil family 'F1' and 'successfully demonstrated'. The score of these five instruments based on Step 2 is 15, 11, 10, 8 and 5 respectively.
Based on this score the instruments with scores 15, 19 and 8 are selected to fill the three positions available.

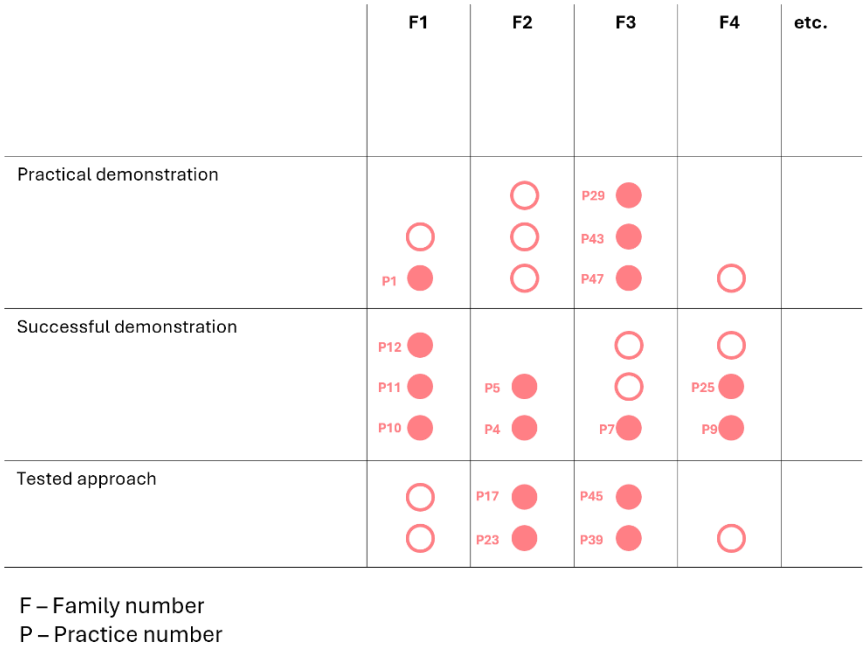

FIGURE 10 ILLUSTRATION SHOWING THE CURATED LIST OF PRACTICES ACROSS LEVELS OF DEVELOPMENT (STEP 3.4) AND CATEGORIES (STEP 3.3)

Step 3.7 Final checks and balances

This step involves a final check of the filled-in short-lists to additionally ensure that there is sufficient geographical diversity and to ensure that specific cases which are desirable are not excluded. For example, if most of the practices are from Western Europe, this step can be used to replace some instruments with those from other regions to ensure a more broad spectrum in the final list. This step serves as a common-sense filter to ensure that valuable instruments and practices are not eliminated because of the limitations in the Evaluation Framework. This step creates space for expert judgment to steer the finalization of the shortlists. The following two questions have been defined to complete this step.

1. Exceptional cases: Are there cases which have a very low usability score and yet still need to be on the list – based on expert judgement?
2. Geographical spread (paragraph 4.3.4): Is there sufficient distributions across geographical regions in Europe (North/ South/ East/ West Europe/ not-site specific)? This is based on classification performed in Step 3.1

Changes which are made at this stage are documented with reasons.

This outcome of the Steps 1-3 results in short-lists. These short-lists form the crucial input necessary for the SPADES Navigator (WP4).

Objective 1: Making short-lists

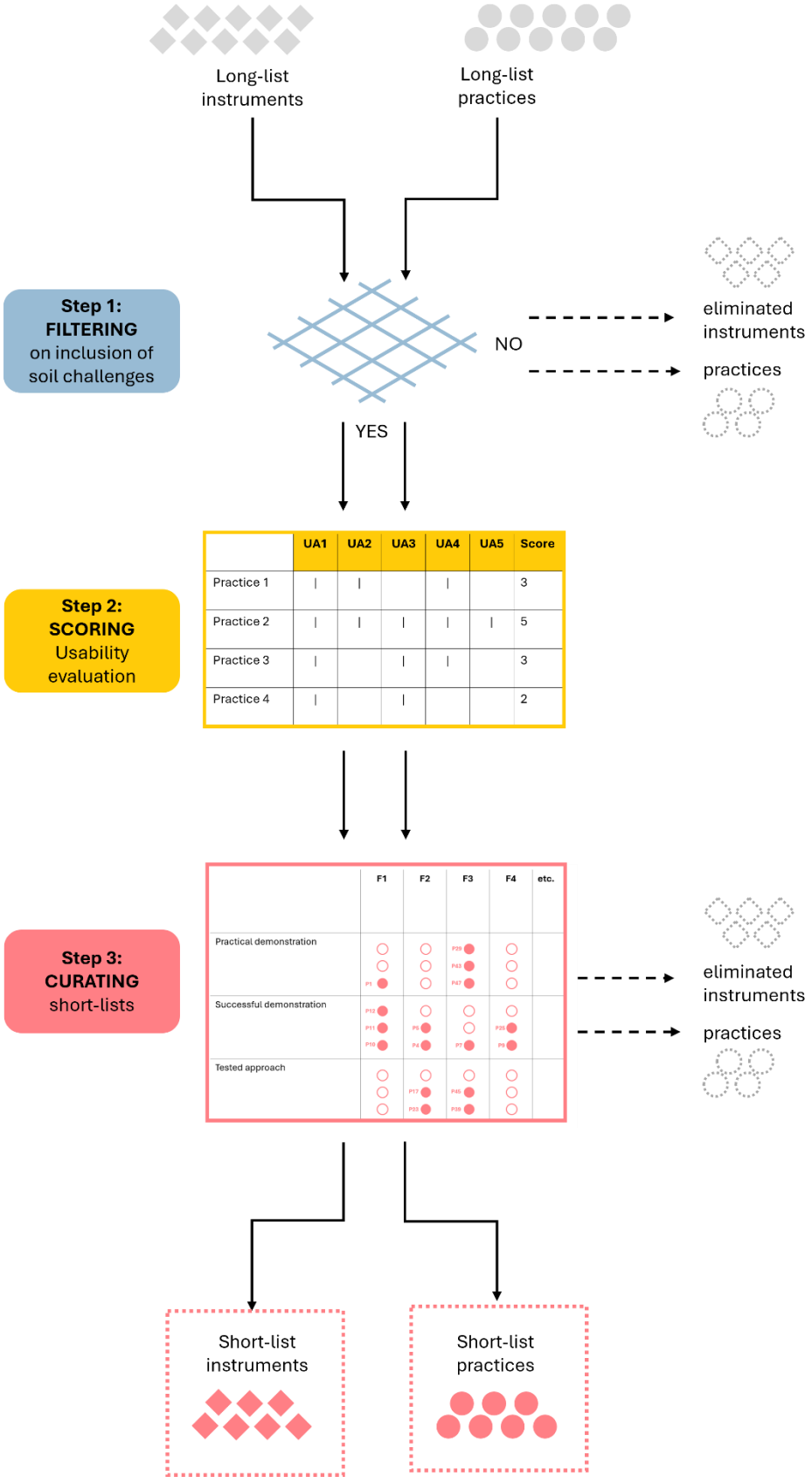

FIGURE 11 FLOW CHART ILLUSTRATING STEPS FOR OBJECTIVE 1 OF THE EVALUATION FRAMEWORK.

5.2 Steps supporting objective 2: Assessing short-lists to identify topical emphasis and gaps

Step 4 supports the objective 2: Assessing short-lists to identify topical emphasis and gaps as described in paragraph 2.1. This objective builds on the short-lists that are developed under Objective 1.

5.2.1 Step 4: Sorting

Step 4a: Sorting per soil challenge

The list of selected instruments/practices in Step 3 is used as input for this step. This list is sorted per soil challenge (Figure 12). See *4.3.1 Soil challenges f*or an elaboration of the identified soil challenges and their description. Each soil challenge is assigned a score based on the number of instruments/ practices that relate to it.

Step 4b: Sorting per Spatial planning and design challenge

The list of selected instruments/practices in Step 3 is used as input for this step. This list is sorted per Spatial planning and design challenge. The planning and design challenges are elaborated in *4.3.2 Design and Planning challenges*. Each planning and design challenge is assigned a score based on the number of instruments/ practices that relate to it.

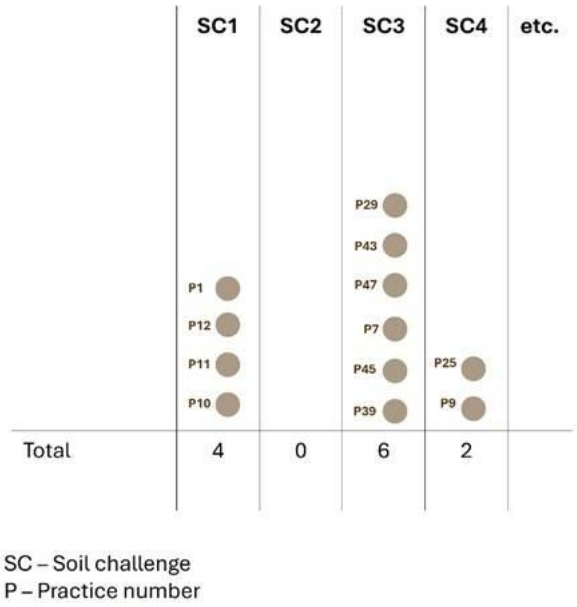

FIGURE 12 ILLUSTRATION OF SORTING OF CASES PER SOIL CHALLENGE TO IDENTIFY EMPHASIS AND GAPS.

The outcome of Step 4 are four sorted tables (Figure 12) categorizing instruments and practices with scores assigned across soil challenges and the planning and design challenges. The four tables are the following

1. Shortlisted instruments sorted per soil challenge.
2. Shortlisted best practices sorted per soil challenge.
3. Shortlisted instruments sorted per spatial planning and design challenge.
4. Shortlisted best practices sorted per spatial planning and design challenge.

Based on these tables, conclusions are drawn to assess which soil challenge has the maximum emphasis and where gaps exist. Similar conclusions are drawn for the emphasis and gaps across planning and design challenges. The identification of gaps is crucial to determine where new instruments or practices need to be developed.

Objective 2: Assessing short-lists to identify emphasis and gaps

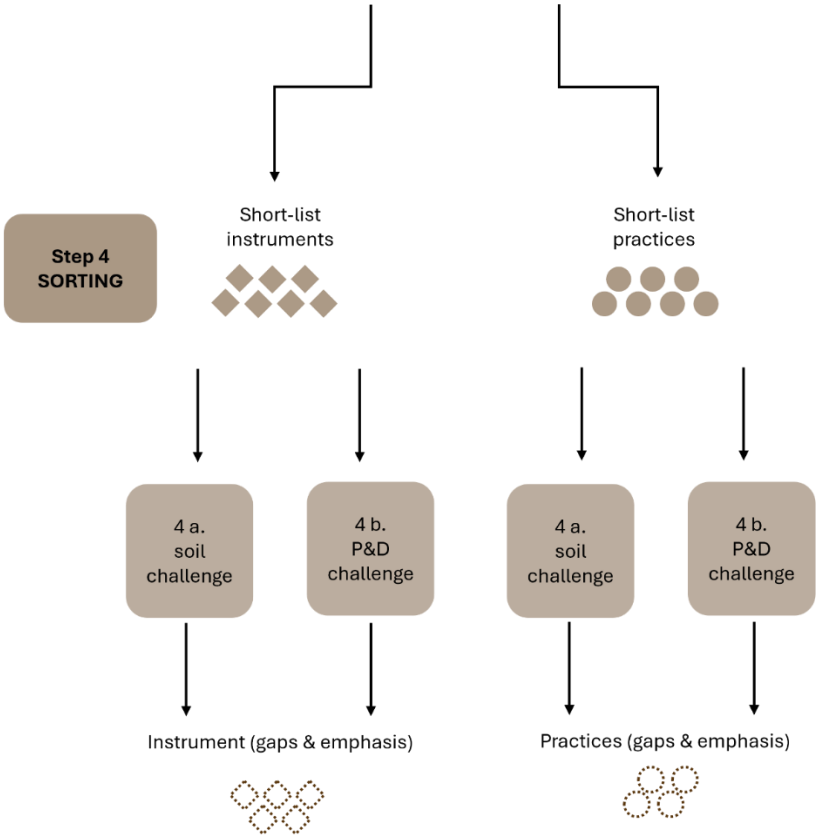

FIGURE 13 FLOW CHART ILLUSTRATING STEPS FOR OBJECTIVE 2 OF THE EVALUATION FRAMEWORK.

6 Discussion and Conclusions

This chapter revisits how the Evaluation Framework aims to meet its objectives as described in Section 2.1 Purpose of the Evaluation Framework, it addresses assumptions made, explores limitations to both the rationale and the methodology, outlines steps for further action, and formulates recommendations for operationalization and fine-tuning of the framework.

6.1 How does the proposed Evaluation Framework meets its objectives?

Objective 1 is to curate short-lists of i) successful and promising instruments dedicated to the assessment of soil functions and/or soil-related ecosystem services, and ii) practices of soil-inclusive planning strategies. The Evaluation process allows going from a long-list to a curated short-list, focusing on the one end on selecting which instruments and practices are deemed 'good enough' or 'usable enough' (Step 2), and on the other hand on ensuring the diversity of users' needs is addressed (both in Step 1 and 3). This objective is met if the final curated short-lists of instruments and cases enable a diverse group of end-users to incorporate soil in spatial planning in various contexts. The short-lists must be of manageable length, aligned with the planned effort in WP2, in WP3 (testing and elaboration in pilots), WP4 (refinement of some instruments and integration of the short-lists in the SPADES Navigator) and WP5 (dissemination and exploitation, for example via capacity building activities and the SPADES Manual)

Objective 2 is to identify emphasis and gaps in the coverage of instruments and practices. The scoring and curation criteria described in Chapter 4, will also be used to assess the resulting short-lists to identify topical emphasis / gaps. If instruments and practices are lacking in relation to specific soil and/or planning and design challenges, while these are highly prevalent in the SPADES pilots, more attention needs to be paid to finding existing, or providing new, instruments and/or best practices. This is a cross-check that needs to be performed together with WP3, where there is space in the co-creation phase with the pilots to tackle the challenges, and in collaboration with WP4 for the SPADES Navigator development.

6.2 What are assumptions behind the Evaluation Framework and its implementation?

Appropriate length of short-lists

Limiting the number of instruments and cases on the short-lists is done for practical reasons, primarily to ensure that efforts to process and prepare them as outputs for pilots in WP3 and the SPADES Navigator in WP4 is manageable. The appropriate number of instruments and cases on the short-lists is yet to be determined, based on a) the resulting scoring of the current selection criteria, and b) the required efforts in practice to 'feed' the short-listed instruments and cases into the SPADES Navigator. It is assumed that with the selected scoring criteria, the long-lists can be sifted and come to a useful, and manageable, short-lists, but this needs to be verified, and perhaps optimised, once the Evaluation Framework is put to practice. Expanding the curation criteria can be considered if the lists are too long; similarly, if too many instruments and practices are excluded, the scoring criteria potentially need to be refined.

Use of short-lists in practice

It should be stressed that the co-creation process of the Evaluation Framework rationale included a diverse group of SPADES partners, not directly involving potential end-users. However, the SPADES partners involved, especially those partnering with pilots in WP3, have an understanding of potential end-user perspectives. This assumption needs to be verified in the pilots in WP3 as well as with the first users of the SPADES Navigator in WP4.

SPADES' end-users' needs are highly diverse, as their background, location, context, expertise levels and interests will differ. therefore assumed is that the end-users in the pilots, as well as the SPADES Navigator users, will use the short-lists in various settings, for various purposes, which requires the short-lists to be

curated to make sure that this large variety of needs is catered. Together with the pilots in WP3 and the SPADES Navigator in WP4 it needs to be evaluated how the resulting short-lists are being used in practice, and how useful they are. Based on this evaluation, the curation steps may have to be fine-tuned, to add or revise the 'curation' criteria, to make sure that end-users are provided with the most useful output.

End-user representation

Similarly, it is assumed that the end-users from the pilots and the SPADES Navigator are representative of the variety of end-users beyond SPADES that may use WP2 outputs. This will have to be verified, for example, by sharing the draft short-lists with, and show-casing the SPADES Navigator to:

- SPADES Advisory Board,
- Soil knowledge networks (such as the European Soil Partnership (ESP), European Network on Soil Awareness (ENSA), and relevant national soil science societies),
- Planning professionals' networks (such as International Federation of Landscape Architects (IFLA), International Society of City and Regional Planners ISOCARP, Architects' Council of Europe (ACE) via Institute for Urban Excellence (iUE),
- Municipalities networks (via ICLEI- Local Governments for Sustainability).

Data availability

Finally, it is assumed that sufficient data is available to apply the selected criteria. If this is not the case, expert judgement will be used, or the criteria will need to be redefined/reassessed.

6.3 Limitations

For the Evaluation Framework, the quality of instruments and practices is interpreted by evaluating usability. Other quality criteria have not been considered as scoring criteria. There are other aspects to quality, such as reliability, practicability, compliance to standards or effectiveness, that are not considered for the purpose of this framework. During the operationalization of the framework in T2.1 (*Inventory of soil assessment instruments*) and T2.2 (*Inventory of best practices*), together with end-users of the short-lists, it needs to be verified that the limited of quality assessment only to usability criteria leads to appropriate usable output.

Applying the selected criteria is highly context specific and arguably open to interpretation. A rationale is proposed for the assessment of each category of criteria, developed through a co-creation process with SPADES partners from various backgrounds and work-packages. The co-created rationale is to make sure that the arguments behind the scoring approach are widely supported, and that assessment can be performed consistently.

Overlap of criteria. There is inevitably overlap, specifically in the curation criteria, not only between the criteria related to soil challenges and those related to planning and design challenges, but also amongst the soil challenges themselves, which are often interlinked (for instance, soil sealing reduces the *quantity* of soil available but also impairs its physical *quality* to absorb water and to *perform* as a buffer against flooding). These criteria intend to give insights into the distribution of instruments and practices across soil challenges, and planning and design challenges, to make sure the WP2 systematisation and inventory effort provides output that addresses all challenges. It is therefore preferable to be more inclusive than overly restrictive in our descriptions. This is relevant for the development of the SPADES Navigator, where a variety of specific challenges and framings that users of the SPADES Navigator may bring should be anticipated. Output needs to be provided that addresses all relevant challenges, and that enables WP4 to focus efforts on enhancing (or improving/enabling the wider applicability of) a limited number of instruments. For this purpose, overlap between these curation criteria is accepted.

The Evaluation Framework does not aim to evaluate how well instruments or practices address soil challenges, but rather to evaluate their usability within planning and design contexts. In the pilots in WP3, there is space together with WP4, to test a limited number of instruments and practices. However, SPADES cannot test all instruments and practices in relation to soil challenges, and relies on pre-existing research.

The Evaluation Framework does not aim to **assess spatial planning and design concepts** (that is in focus for T1.2 *Success factors in implementation of spatial planning and design concepts and strategies* in WP1). However, there is a clear connection, and use-cases of such concepts are intended to be included in the practices gathered under T2.2. The results of T1.2 will also be included in the SPADES Navigator (WP4) and Manual (WP5).

6.4 Recommendations for further study: next steps

This section outlines the next steps that need to be taken throughout SPADES to operationalize and implement the Evaluation Framework and its output, and formulates recommendations for further verification of the assumptions, fine-tuning of the criteria and curation of the short-lists.

WP1 *Soil in spatial planning systems, design concepts and strategies* – Reflections undertaken in WP2 for the design of the Evaluation Framework have already started internal discussions in WP1 regarding the evaluation lens they intend to take to assess T1.1 (*Spatial Planning systems (policy) and soil policy*), T1.2 (*Success factors in implementation of spatial planning and design concepts and strategies*) and T1.3 (*Planners' Integration Instruments*) outputs for the soil integration potential and the possible implied trade-offs. Recommendations: consider the soil challenges as described in the Evaluation Framework and provide expert judgment for the application of the planning and design challenges criteria.

WP2 *The potential of soil in spatial strategies* - The Evaluation Framework is yet to be operationalized. T2.1 and T2.2 will curate short-lists, applying the Evaluation Framework. These tasks have each individually developed an extensive inventory already. It is now necessary to score the inventoried instruments and practices along the selected scoring and curation criteria, following the steps in the rationale described in this Deliverable. Recommendations: provide feedback on availability of data and information, and resulting lengths of short-lists after going through the steps initially. Furthermore, if the exercise of applying the Evaluation Framework shows that some criteria are not useful or other criteria are necessary, it is recommended to adapt the Evaluation Framework. The current Evaluation Framework is a starting point that remains flexible, allowing for adaptation and improvement as it is applied.

WP3 *Pilots: Co-creation of soil-inclusive spatial strategies* – The pilots will use and apply some the instruments and best practices selected the short-lists. This can be used to verify the usability and usefulness of the short-lists in a variety of contexts. Recommendations: Incorporating further criteria for further refinement of the short-lists will have to be done in concert with further development of the SPADES Navigator, and based on the requirements from WP1 (the specific planning and design concepts from 1.2).

WP4 *Implementation of soil in spatial strategies* - The criteria for the Evaluation Framework will be also used in the development of the SPADES Navigator, as the selection logic for the short-listed instruments and practices to be presented through the SPADES Navigator. Also, in WP4 (together with WP3), further elaboration and improvement of a selected number of promising instruments resulting from WP2, is foreseen. Recommendations: When needed, the selection criteria as described in this report can be altered for the SPADES Navigator, when tests with the users (pilots and external stakeholders) advise this. For the instruments and practices, additional relevant tags (for which data is available) might be needed to be added.

WP5 *Soil Literacy and CDE* – In development of the Capacity Building programme, the short-listed instruments and cases will provide inspirational examples that can also be used for the general Communication activities of the project. WP5 will also ensure that short-lists widely available to an audience beyond SPADES.

WP6 *Coordination* – The Advisory Board supports SPADES with quality assurance, keeping up with developments in the outside world (EU) and the views of different kinds of organizations (policy makers, practitioners and end users). Recommendation: A workshop with the Advisory Board will be setup after finalization of this report, and before the implementation of the Evaluation Framework to further discuss its finetuning and operationalisation.

6.5 Concluding remarks

Ultimately, SPADES wants to enable its end-users to incorporate soil considerations in spatial planning, and enable better / informed / soil-inclusive decision-making and action. The Evaluation Framework has been developed with an ambition to provide end-users with useful, promising instruments and practices that support soil-inclusive spatial planning and design. Operationalization of the EF, and testing the resulting short-lists in practice, will provide us with the necessary information and insights to further fine-tune our approaches, and come to a SPADES output that enables our stakeholders to make a positive impact on soil health.

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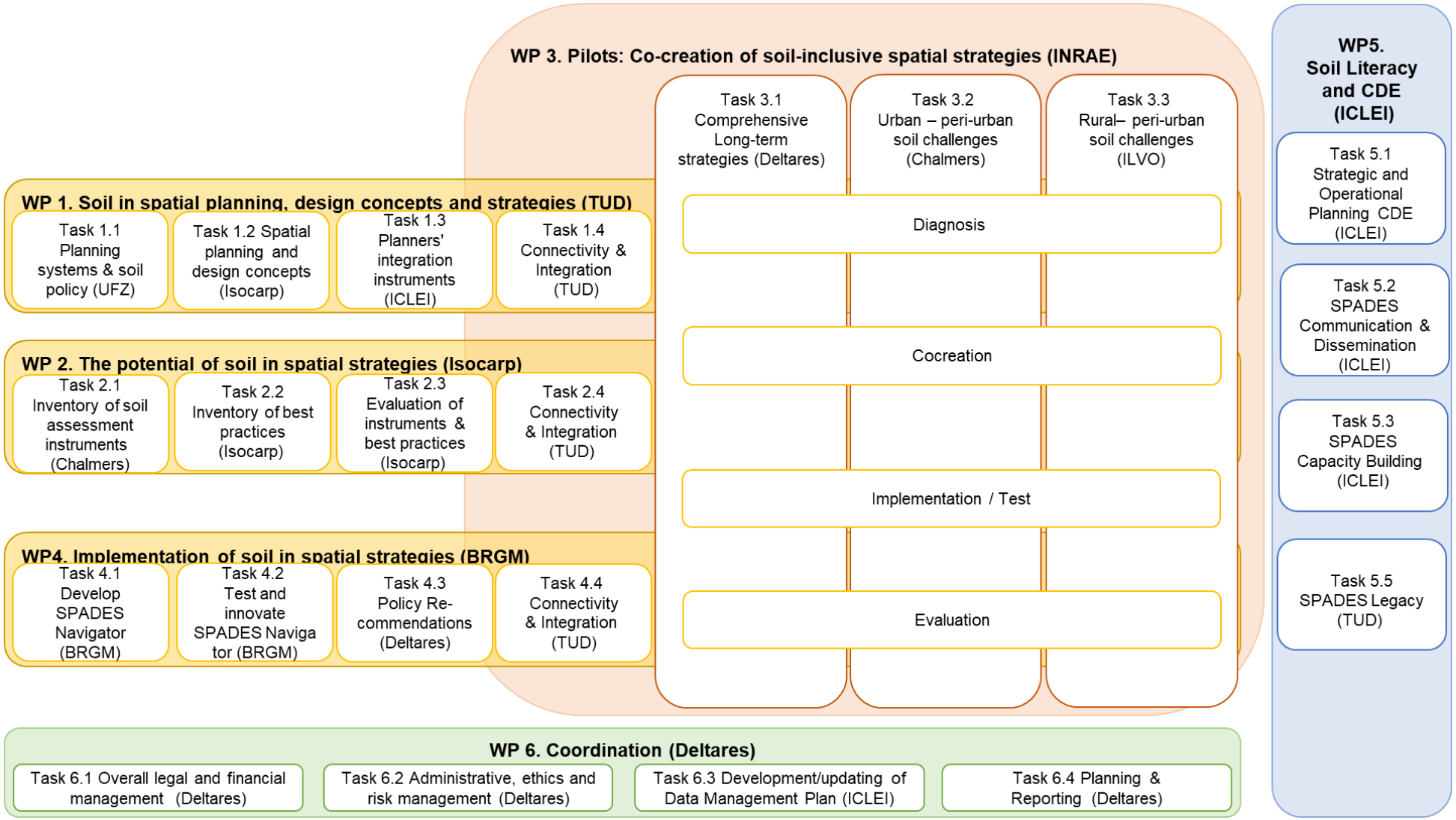
Annex A – Overview of SPADES Work Packages, Tasks and Public Deliverables



Public SPADES Deliverables		Due date
1.1	Systemic understanding of the opportunities for soil-inclusive spatial planning	24 (Aug 26)
1.2	Portfolio of Sustainable Planning and Design Concepts	24 (Aug 26)
1.3	Portfolio of Planners instruments for integration of societal challenges.	24 (Aug 26)
2.1	Systematization of instruments for soil assessment	24 (Aug 26)
2.2	Compilation of best practices to enhance soil-inclusive planning strategies	24 (Aug 26)
2.3	Evaluation framework	12 (Aug 25)
3.1	SPADES Pilots: Integration of soils in spatial planning practices	20 (Apr 25)
3.2	SPADES pilots: Conclusions and recommendations	44 (Apr 28)
4.1	Mock-up of the SPADES Navigator	18 (Feb 26)
4.2	SPADES Navigator	44 (Apr 28)
4.3	Policy briefs	44 (Apr 28)
5.3	Multimedia product	48 (Aug 28)
5.4	Initial Capacity Building Programme Strategy	12 (Aug 25)
5.5	Final Capacity Building Programme Strategy	26 (Oct 26)
5.6	SPADES Manual	46 (Jun 28)
6.2	Initial Data Management Plan	6 (Feb 25)
6.3	Updated Data Management Plan	24 (Aug 26)
6.4	Final Data Management Plan	36 (Aug 27)

Annex B – Screenshots from working sessions for D2.3

T2.3 Workshop on Evaluation Framework User Needs – 20 May 2025.

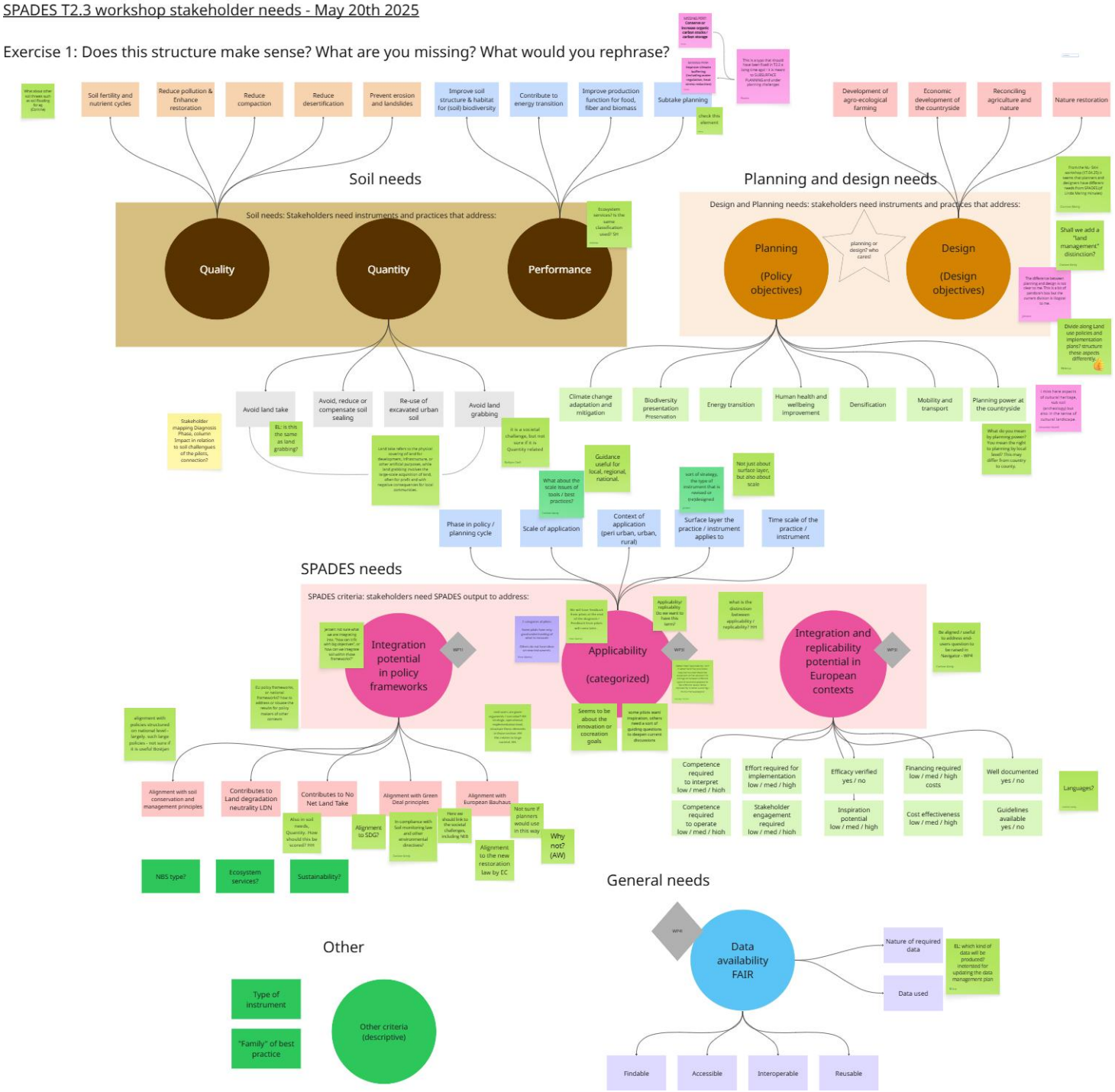
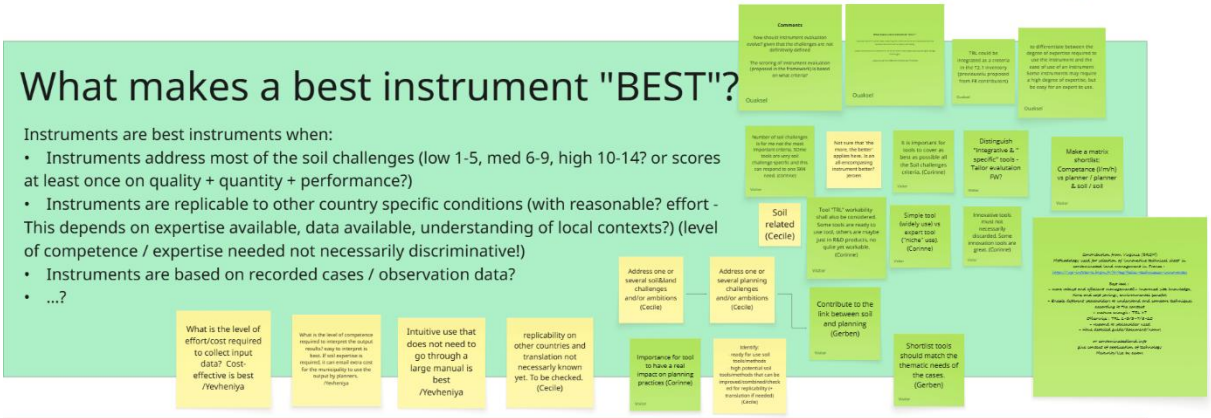


FIGURE B1 - SCREENSHOT OF THE MIRO BOARD TO DISCUSS THE USER NEEDS DURING THE ONLINE T2.3 WORKSHOP ON 20 MAY 2025, USED TO INFORM THE DESIGN OF THE EVALUATION FRAMEWORK. GREEN/ PINK POST-ITS ARE COMMENTS/SUGGESTIONS FROM SPADES PARTNERS

T2.3 Workshop Evaluation Framework working session - 27 June 2025

Exercise 1: What makes a 'best practice/instrument' "BEST"? And when should it not 'make the cut' to be on our short-list?



T2.3 Workshop Evaluation Framework working session - 27 June 2025

Exercise: run-through first draft Evaluation Framework with two practices.

	HOW TO SCORE	Urban Wetland Law -Chile	De-sealing in France
	0-1-2	41	39
1. Soil needs			
1.1 Quality			
Soil fertility and nutrient cycles	N/P/Y	2	2
Reduce pollution & enhance restoration	N/P/Y	2	2
Reduce compaction	N/P/Y	2	2
Reduce desertification	N/P/Y	2	2
Prevent erosion and landslides	N/P/Y	0	0
1.2 Quantity			
Avoid land take	N/P/Y	2	0
Avoid, reduce and compensate soil sealing	N/P/Y	2	2
Re-use of excavated urban soil	N/P/Y	2	0
Avoid land grabbing	N/P/Y	2	0
1.3 Performance			
Improve soil structure & habitat for (soil) biodiversity	N/P/Y	2	2
Contribute to energy transition	N/P/Y	0	0
Improve production function for food, fiber and biomass	N/P/Y	2	1

2. Planning needs			
2.1 Planning (policy objectives)			
Subsurface planning	N/P/Y	1	0
Climate change adaptation	N/P/Y	2	2
Climate change mitigation	N/P/Y	2	2
Biodiversity preservation	N/P/Y	2	2
Energy transition	N/P/Y	0	0
Human health and wellbeing improvement	N/P/Y	2	2
Densification	N/P/Y	0	0
Mobility and transport	N/P/Y	0	0
Planning power at the countryside	N/P/Y	0	0
2.2 Design (design objectives)			
Development of agro-ecological farming	N/P/Y	0	1
Economic development of countryside	N/P/Y	0	0
Reconciling agriculture and nature	N/P/Y	0	1
Nature restoration	N/P/Y	2	2

3.2 Tactical – Applicability			
Phase in policy / planning cycle	Inform / Plan / Implement / Evaluate		
Scales of application	(Plot / Street / Neighbourhood) / City / (Region / Nation)/ (if applicable: Multi-scalar)		
Context of application	Urban / Peri-urban / Rural		
Surface layer the practice/instrument applies to			
Time scale of the practice/instrument	0-1 years / 1-5 years / 5-10 years / 10+ years		

3. SPADES needs			
3.1 Strategic – Integration potential in policy frameworks			
Allignment with soil conservation and management principles (SC&MP)	Full allignment / Partial allignment / No allignment	2	2
Contributes to land degradation neutrality (LDN)	N/P/Y	2	2
Contributes to No Net land take	N/P/Y	2	2
Allignment with Green Deal principles	Full allignment / Partial allignment / No allignment	0	2
Allignment with European Bauhaus	Full allignment / Partial allignment / No allignment	0	2

3.3 Operational – Integration and replicability potential in European contexts			
Competence required to interpret	Low / Medium / High		
Effort required for implementation (low/med/high)	Low / Medium / High		
Efficacy verified (yes/no)	N/P/Y	2	2
License required	No/Low / Medium / High costs		
Well documented	Yes / Okay / No	2	2
Competence required to operate (low/med/high)	Low / Medium / High		
Stakeholder engagement required (low/med/high)	No / Low / Medium / High		
Inspiration potential (low/med/high)	Low / Medium / High		
Cost effectiveness (low/med/high)	Low / Medium / High		
Guidelines available (yes/no)	Yes and detailed / Yes but limited / No		

FIGURE B2 - SCREENSHOT OF THE MIRO BOARD TO DISCUSS THE USER NEEDS DURING THE ONLINE T2.3 WORKSHOP ON 27 JUNE 2025, USED TO INFORM WHICH CRITERIA ARE FOR SCORINGAND WHICH ARE FOR CURATION. GREEN/ YELLOW POST-ITS ARE COMMENTS/SUGGESTIONS FROM SPADES PARTNERS

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