D8.1 Analysis of the decision context of the Demonstration Projects

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Preface

The importance of biodiversity, natural capital and healthy ecosystems and the services they supply has increasingly been acknowledged in diverse policy initiatives (e.g., EU Biodiversity Strategies 2020 and 2030, Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), Natural Capital and Ecosystem Services Accounting, Intergovernmental Panel on Climate Change (IPCC) and Convention on Biological Diversity (CBD)).

The EU Horizon Research and Innovation Action "Science for Evidence-based and sustainabLe decIsions about NAtural capital" (SELINA) aims to provide robust information and guidance that can be harnessed by different stakeholder groups to support transformative change in the EU, to halt biodiversity decline, to support ecosystem restoration and to secure the sustainable supply and use of essential Ecosystem Services (ES) in the EU by 2030.

SELINA builds upon the Mapping and Assessment of Ecosystems and their Services (MAES) initiative that has provided the conceptual, methodological, data and knowledge base for comprehensive assessments on different spatial scales, including the EU-wide assessment and assessments in EU member states. Knowledge and data for different ecosystem types are increasingly available.

This Deliverable examines the decision-making context of the seven public Demonstration Projects (DPs) through a transdisciplinary knowledge co-production process proposed by SELINA's Work Package 8 (WP8).

In traditional decision-making processes, there is often a gap between scientific information and its implementation in policy and practice. However, within transdisciplinary knowledge co-production, diverse types of stakeholders (researchers, policymakers, practitioners, etc.) collaborate to generate knowledge and co-design solutions to specific social and environmental problems. This process can guarantee that public decision-makers have access to relevant, contextualised, and actionable evidence related to ES, biodiversity (BD), and ecosystem condition (EC).

The setting of the decision-making context of each DP took place from September 2022 to December 2023 as part of Task 8.1, *"Setting the decision context".* During this stage, each project implemented diverse activities that are particularly critical as they serve as the basis for translating a real-world problem into a researchable objective, which can be re-integrated into policy and science.

Against this background, the main objective of this Deliverable is to disseminate valuable insights by showing the initial results of this transdisciplinary process for each DP and provide information on how the framework could be implemented to effectively inform decision-making and facilitate the integration of BD, ES and EC evidence into public policy and practice.

List of abbreviations

EU	European Union
DPs	Demonstration Project
WP	Work Package
ES	Ecosystem Services
BD	Biodiversity
EC	Ecosystem Condition

PART 1

1. Introduction and objectives

1.1. SELINA's Demonstration Projects

SELINA aims to provide scientific information to support the EU's protection, restoration, and sustainable use of ecosystems. To fulfil this objective, the project will deliver guidance for evidence-based decision-making by developing real-world innovative examples known as Demonstration Projects (DPs). These DPs will further illustrate how knowledge related to biodiversity (BD), ecosystem services (ES) and ecosystem condition (EC) can inform decision-making across different sectors such as urban and regional development, sustainable agriculture and energy production, marine spatial planning, forest and nature conservation, green infrastructure, ecosystem restoration, among others.

The project currently features 15 DPs from different countries, including Spain, Lithuania, Italy, Belgium, France, Switzerland, Latvia, Bulgaria, Norway, Malta, Finland, and the Netherlands, highlighting their geographical diversity and relevance for both public and private decision-making (Figure 1.1). Hence, the 15 DPs in SELINA were chosen for their capacity to demonstrate the practical application of scientific knowledge in different contexts, fostering a comprehensive understanding of its impact on policy decisions.

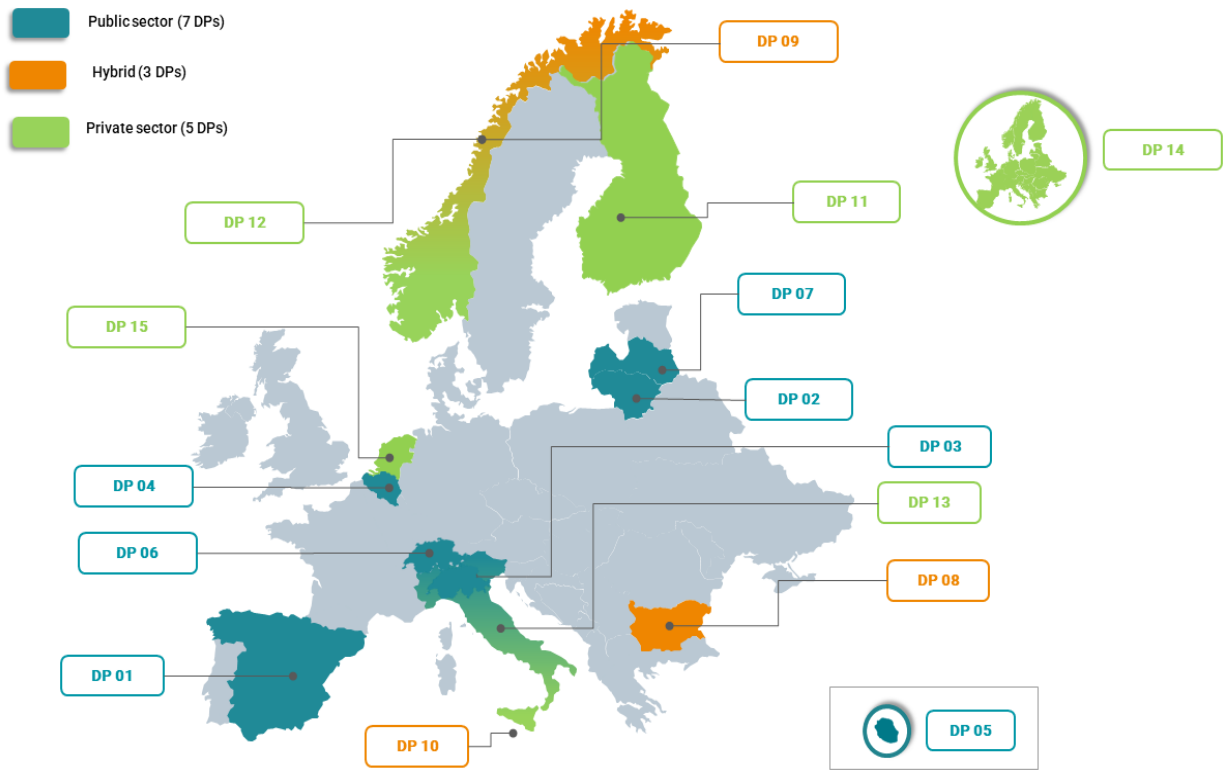


***Figure 1.1**. Landscape of SELINA'S Demonstration Projects across Europe*

Within the project's structure, SELINA's Work Package 8 (WP8) provides concrete examples of how the integration of BD, ES, and EC evidence contributes to public decision-making, including through the development of plans and policies that benefit communities and the environment. Hence, WP8 aims to showcase the practical utility of this knowledge across various domains, ensuring its relevance and applicability in real-world scenarios that could bridge the gap between scientific information and public policymaking.

The WP currently features seven DPs that cover different decision backgrounds and timeframes, geographical locations, ecosystem types, and socio-cultural contexts within the EU, including its overseas territories (Figure 1.2). A brief description of each DP is provided in the following paragraphs.

- Spanish National Strategy for Green Infrastructure and Ecosystem Restoration: This DP focuses on Spain's national strategy for green infrastructure and ecosystem restoration to demonstrate how scientific evidence can inform and enhance this policy.

- Supporting Sustainable Agriculture in the Comprehensive Plan of Lithuania: The project aims to illustrate how ES and EC evidence can be used to support sustainable agricultural practices within the Comprehensive Plan of the Republic of Lithuania, contributing to both environmental and agricultural goals at the national level.

- Urban Greening Management Plan of Trento: This local DP addresses sustainable urban green management within the city of Trento, providing insights into the application of ES and EC knowledge in urban planning and management.

- Bosland National Park: This is a local DP from Belgium that showcases how scientific knowledge can be integrated into forest conservation and ecosystem management practices, ensuring the preservation of ES through active collaboration among different stakeholders.

- Marine and Terrestrial Spatial Planning in Reunion Island: This project explores the integration of marine and terrestrial spatial planning in the overseas territory of Reunion Island, demonstrating how ES-related evidence can support decision-making for both on-land and marine ecosystems.

- Sustainable Energy Production in Switzerland: This national DP emphasises the importance of minimising the impact on BD and ES during the strategic planning of sustainable energy infrastructure, further highlighting the practical application of scientific information in the energy production sector.

- Latvia's Maritime and Coastal Spatial Planning: This national DP from Latvia illustrates how scientific outputs could be integrated into assessing and evaluating maritime and coastal spatial planning, emphasising the importance of preserving these types of ecosystems and their services.

These seven DPs collectively represent diverse topics where BD, ES, and EC knowledge can be applied to inform and improve public decision-making processes, contributing to more sustainable and environmentally conscious outcomes across various sectors and domains.

Figure 1.2. *Representative ecosystem types of the seven Public Demonstration Projects. From top to bottom and left to right: Spain, Lithuania, Trento (Italy), Bosland (Belgium), Reunion Island (France), Switzerland and Latvia. Photo credits: DP leads*

1.2. Timeline of implemented activities and Deliverable structure

From September 2022 to December 2023, SELINA's WP8 has been actively engaged in diverse activities to enhance collaborative efforts with stakeholders and DP representatives. These initial 18 months have been primarily dedicated to Task 8.1, which represents the focus of this Deliverable.

Task 8.1 aimed to analyse the decision context in each public DP, which refers to the process of defining the scope, goals, constraints, and considerations that determine how specific policy decisions are taken. Hence, within this Task, the seven public DPs have worked comprehensively to understand the unique decision contexts in which they are currently operating or expected to operate. The assessment of the decision-making context involves examining the challenges, opportunities, stakeholders, and regulatory policies characterising their policy settings. By familiarising with this information, Task 8.1 further aimed to gain information on the complexities that influence the uptake of scientific evidence in public decision-making. Hence, diverse activities and meetings took place to fulfil the objectives of Task 8.1 (Figure 1.3).

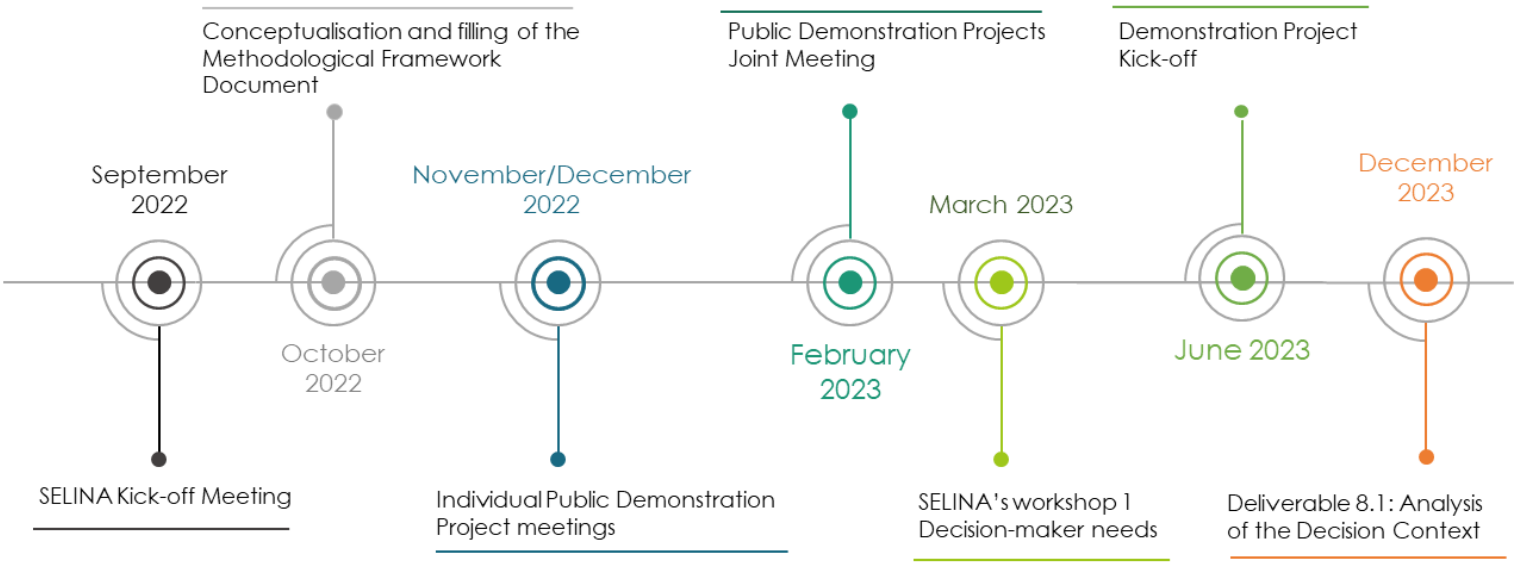


Figure 1.3. *Timeline followed to fulfil the objectives of Task 8.1*

The first activity of WP8 took place in September 2022 during the SELINA Kick-off meeting, where the project's core objectives and the relevance of the DPs were introduced. This meeting fostered a shared vision among project participants and set the stage for the work ahead. In October of 2022, WP8 took a significant step by disseminating the methodological framework document for transdisciplinary knowledge co-production, which will be explored in more detail in the following subsections. This action underscored the project's commitment to collaboration, encouraging the exchange of ideas and expertise across various domains and ensuring that the knowledge generated by the scientific-oriented WP 3 to 6 will be relevant and applicable across the public sectors under analysis.

From November 2022 to February 2023, seven Individual Demonstration Project meetings took place. These individual meetings fostered in-depth discussions, progress assessments, and the exchange of insights among WP8 and DP leads. The main outcomes of these individual meetings included creating strategies and addressing expected or potential challenges to contribute to the overall advances of the individual DPs. As a follow-up to the individual meetings, on February 15th of 2023, a joint public DP meeting was organised to review the advancements of each project, share ideas, and identify potential synergies based on the policy contexts of each project. This event also served as a crucial step to verify that the seven DPs aligned with the transdisciplinary knowledge co-production framework's overarching goals and were on track to deliver the expected results.

From 27th to 31st March, SELINA hosted its first Workshop in Sofia, Bulgaria, which delved into the identification of decision-maker needs. This workshop facilitated engaged discussions and the sharing of stakeholder perspectives and requirements for effective evidence-based decision-making. The insights gained from this event informed subsequent project activities and strategies, thus ensuring that SELINA's work remains closely aligned with the practical and operational needs of decision-makers.

Finally, on June 7th, a significant milestone for SELINA was achieved with the Demonstration Project Kick-off. This event showcased the goals and advancements of the 15 public and private DPs and the identification of potential synergies between the two SELINA WPs that focus on public and private decision-making. Within the framing of WP8, these activities collectively underscore SELINA's dedication to meaningful progress by enhancing the uptake of scientific information while fostering transdisciplinary collaboration.

Considering this context, this Deliverable represents the culmination of a year's work and is structured into three main parts:

- Part 1 presents the overarching objectives of each DP and a brief overview of them. Subsequent chapters will introduce the proposed transdisciplinary knowledge co-production framework designed to guide the development of activities within Task 8.1.
- Part 2 provides a comprehensive overview of the results related to the decision context in seven public and two hybrid DP. The latter submitted their information voluntarily to complement this Deliverable. The results, divided into 11 different chapters, are presented through the lens of the proposed transdisciplinary framework.
- Finally, in Part 3, a summary of the outcomes and insights derived from this approach is provided, along with an outline of the forthcoming activities related to WP8.

2. Transdisciplinary knowledge co-production for increased ES uptake

Ecosystem services encompass the diverse benefits ecosystems provide to societies and are directly related to biodiversity and the condition and functioning of ecosystems (Maes et al., 2020). As protecting these elements is vital to guarantee the sustainable use of natural resources, an informed decision-making process is critical for optimising their delivery, safeguarding ecosystem health, and preserving the variety of life forms within the existing ecosystem diversity (Wong et al., 2015). Despite the widespread acknowledgement of the relevance of these concepts for formulating public policies, the incorporation of BD, ES and EC information in decision-making varies widely depending on the region, country, and specific policy context. This variation is partly due to the complexity of scientific information, which spans ecological, social, and economic domains. In this sense, an approach to better incorporate BD, ES and EC knowledge into public policy and decision-making involves creating a transdisciplinary knowledge co-production process that can align with the different stages of the policy cycle (Figure 2.1).

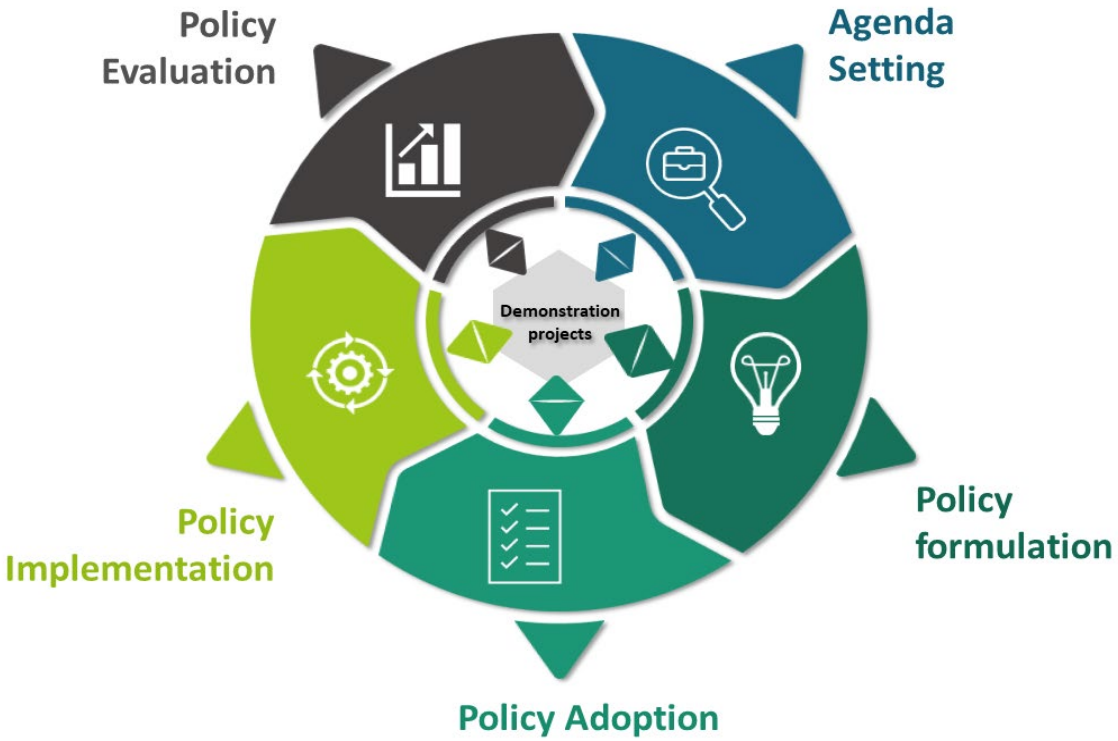


Figure 2.1. *Policy cycle and potential entry points of SELINA'S public Demonstration Projects*

The public policy cycle illustrates how governments develop, implement, and evaluate public policies and typically includes the following phases (Haddad et al., 2022):

- ***Agenda Setting:*** At this initial stage, issues or problems are identified and brought to the attention of policymakers to be addressed through specific actions. Factors influencing agenda setting include public pressure, advocacy efforts, social or environmental crises, and expert recommendations.

- ***Policy Formulation***: Once an issue is on the policy agenda, policymakers work to formulate potential solutions. This stage involves research, analysis, and the development of policy proposals. Policy objectives and specific strategies are defined during this stage.

- ***Policy Adoption:*** The formal adoption or approval process occurs after policymakers have formulated potential policies. This often involves legislative bodies passing laws or regulations, executive orders, or other formal actions.

- ***Policy Implementation:*** Once a policy is adopted, it must be put into practice. This phase involves translating policy into action, allocating resources, and establishing the necessary administrative structures to enforce and execute the policy.

- ***Policy Evaluation:*** Policymakers assess the impact and effectiveness of the policy after it has been implemented. Evaluation includes analysing whether the policy achieved its objectives and assessing unintended consequences. This information is crucial for adjusting and improving the policy in question.

It is important to note that the policy cycle is not a linear or straightforward process. Instead, it can be iterative, with feedback loops and revisions occurring at various stages (IPBS, 2022). In this regard, understanding the policy cycle is helpful for analysing how policies are developed and implemented and the potential role of transdisciplinary knowledge co-production in each stage.

Transdisciplinary knowledge co-production requires bringing together stakeholders with various expertise, interests, values, and priorities to produce knowledge and pathways towards a sustainable future (Norström et al., 2020). Furthermore, this collaborative approach promotes data integration and effective communication of scientific evidence to ensure policies are grounded in relevant, comprehensive, and context-specific information (Matschoss et al., 2020). As the policy cycle progresses, this collaborative process allows for continuously refining policy objectives, questions, and strategies in response to changing circumstances and emerging evidence.

Due to the information presented above, the activities conducted as part of Task 8.1 and the subsequent and parallel Tasks 8.2 and 8.3 have been framed as a transdisciplinary knowledge co-production process involving steps derived from existing literature (Figure 2.2). Each of these steps facilitates the effective uptake of ES, BD and EC information and could potentially

lead to changes that align with the public policy cycle's dynamic nature. Moreover, transdisciplinary knowledge co-production enhances the salience, credibility, and legitimacy of scientific knowledge used in decision-making by involving stakeholders with different perspectives, expertise, and interests (Steelman et al., 2021). This collaborative approach fosters credibility and promotes decisions based on well-grounded scientific knowledge, making it more salient and relevant to policymakers. Finally, the legitimacy of BD, ES, and EC knowledge is transversal to all the co-production process as it reflects a broader acknowledgement of different types of perspectives, increasing its acceptability and utility in informing policies and actions aimed at sustaining ecosystems and the services they provide (Lam et al., 2020).

As this framework serves as the basis for analysing environmental decision-making within the public sector, WP8's primary goal is to scrutinise its effectiveness. Additionally, the aim is to anticipate advancements in each DP to expand and refine the framework. This adjustment is intended to better align with the various stages of the policy cycle, facilitating a comprehensive integration of ES-related knowledge into the formulation and implementation of public policies. This strategy also seeks to establish synergies and collaborations with the private DOs by understanding how to leverage expertise and innovation capacities in different sectors.

The following paragraphs will delve into the proposed activities within the transdisciplinary knowledge co-production process, linked explicitly to Task 8.1.

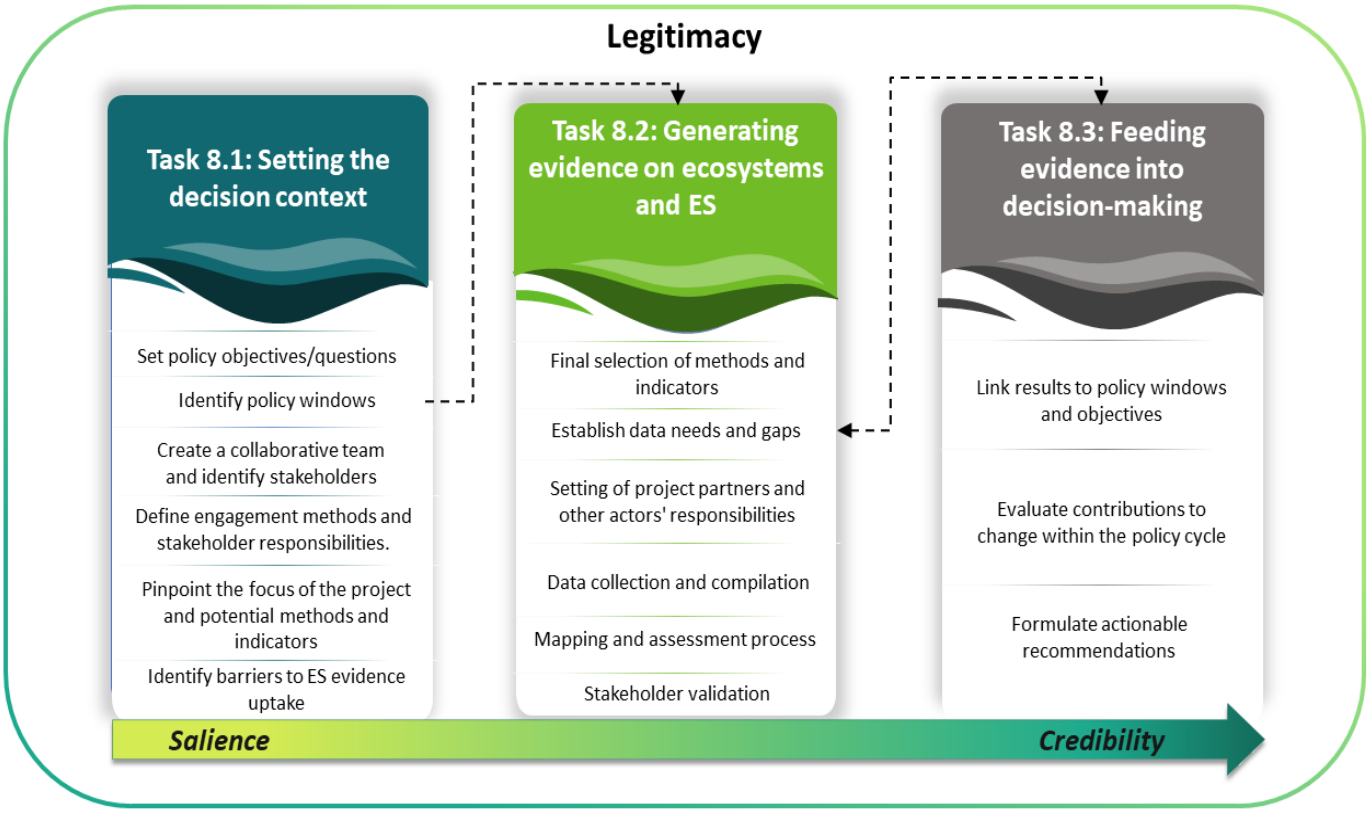


Figure 2.2. *Methodological approach for the Public Demonstration Projects framed as a Transdisciplinary Knowledge co-production process*

2.1. Set policy objectives and questions

Setting policy objectives within a transdisciplinary knowledge co-production process entails identifying and articulating the desired outcomes or goals that policy initiatives should achieve. This involves a collaborative effort to identify the policy's specific aims and intended impacts, and these should be clear, measurable, and aligned with the broader goals of addressing pre-identified societal and environmental challenges or needs (Stewart, 2014). These objectives serve as the foundation for guiding the research process and assessing the effectiveness of policy interventions.

In contrast, setting policy questions involves formulating specific inquiries to provide insights and evidence that could then be used to inform public policy decisions. These questions should also be developed collaboratively to reflect key issues, uncertainties, or gaps in the knowledge that policymakers need to address (Geneletti et al., 2020). Moreover, policy questions should be designed to guide the research efforts and could help structure diverse activities and data collection and analysis methods to generate scientifically driven knowledge for effective public decision-making (Sienkiewicz, 2020).

2.2. Identify policy windows for effective ES integration

In a transdisciplinary knowledge co-production process, the identification of policy windows refers to the strategic assessment of the external political, social, and economic contexts in which policy decisions are made (Michaels et al., 2006). It involves recognising specific moments or conditions when policymakers and key stakeholders are particularly receptive to new ideas, evidence, or policy proposals related to BD, ES and EC (Rose et al., 2020). These policy windows may arise due to changes in public opinion, shifts in political leadership and regulatory frameworks, or emerging crises that create a demand for innovative solutions (Farley et al., 2007; Ferraro et al., 2022; Longato et al., 2021).

The identification of such windows within a specific context provides a tangible starting place to consider how knowledge co-production can contribute to existing policy goals and objectives. This requires understanding the right timing and ideal dissemination and communication of research findings to align with these favourable conditions. It allows for the effective integration of research into the policy process, increasing the likelihood that policymakers will consider and adopt scientific evidence, thereby promoting the application of transdisciplinary knowledge to address complex social and environmental challenges (Rosenthal et al., 2015).

2.3. Create a collaborative team and identify stakeholders

Collaboration and identification of stakeholders in this context refers to the active and coordinated participation of people from different disciplines, backgrounds, or organisations

who work together towards a common goal (Sesan et al., 2021). In transdisciplinary knowledge co-production, diverse stakeholders collaborate across disciplinary boundaries to jointly create, integrate, and apply BD, ES and EC-related knowledge through shared decision-making, pooling of resources, and mutual learning (Luetkemeier et al., 2021).
In this regard, stakeholder identification requires finding, involving, and communicating with individuals, groups, or organisations with an interest or stake in the policy at hand to ensure that scientific outcomes are relevant, applicable, and responsive to real-world needs and concerns (Roux et al., 2017). Hence, identified stakeholders may include decision-makers from the public sector, researchers, private sector representatives, non-governmental organisations, advocacy groups and the civil society, etc. In a transdisciplinary knowledge co-production process, the identified people should have an active role in each aspect of decision-making and in shaping research agendas to ensure their concerns and aspirations are consistently understood and considered (Carrard et al., 2022).

2.4. Define engagement methods and stakeholder responsibilities

This step entails identifying and delineating stakeholders' roles and responsibilities and determining what each stakeholder group or individual is expected to contribute, whether providing expertise, data, financial support, or engaging in active decision-making (Hilger et al., 2021). Assigning clear responsibilities helps to guarantee that all stakeholders are actively involved and that their contributions align with the objectives of the co-production effort.
In contrast, engagement methods are the mechanisms and strategies employed to involve stakeholders. These methods can vary and may include techniques such as workshops, focus groups, surveys, interviews, world cafes, scenario workshops, or horizon-scanning initiatives (Sesan et al., 2021). The choice of engagement methods should be informed by the nature of the research and the policy, the diversity of stakeholders and the desired level of participation, and should foster communication, information exchange, and collaboration among all the involved parties (Maas et al., 2021; Swilling, 2014).
In essence, this step regards structuring and organising the participation of diverse stakeholders in a purposeful and coordinated manner. It helps ensure that stakeholders are actively engaged in generating, integrating, and applying scientific information to address complex issues, thereby promoting the success and impact of the co-production effort (O'Connor et al., 2019).

2.5. Pinpoint the focus of the project and potential methods and indicators

This stage in a transdisciplinary knowledge co-production process involves selecting the specific area of interest or the primary goal that the project aims to achieve. It delineates what the transdisciplinary research intends to demonstrate or highlight through its activities and the use of methods and indicators. Potential focus areas for each project can encompass

tasks such as ecosystem mapping, selecting EC indicators, EC assessment, mapping and assessment of ES supply and demand, the implementation of ecosystem accounts, among others (Maes et al., 2020). The choice of focus should be driven by the project's distinct objectives, the intended audience, and the desired policy outcomes.

Once the project's focus is established, the next step is to determine the research methods and indicators expected to collect and analyse data, generate knowledge on BD, ES and EC, and address the pre-identified policy questions (Reed et al., 2022). In this regard, selected methods can span the biophysical, socio-cultural, and economic domains and should align with the objectives to leverage the expertise of the transdisciplinary team (Geneletti et al., 2020). In the case of indicator selection, these should be relevant, reliable, and sensitive to changes related to the project's policy objectives (Schröter et al., 2017).

2.6. Identify barriers to ES evidence uptake

In a transdisciplinary knowledge co-production process, identifying barriers to the uptake of BD, ES and EC evidence refers to systematically identifying and understanding the obstacles, challenges, or constraints that impede the effective use of scientific evidence in decision-making and policy formulation (Keenan et al., 2019). These barriers can encompass a wide range of factors, including institutional, cultural, technical, economic, or political aspects, which may inhibit the incorporation of information into policy and management decisions (Grunewald et al., 2021).

The barriers could be identified through a collaborative dialogue between researchers, practitioners, and stakeholders to collectively assess the specific challenges and constraints that limit the uptake of scientific evidence. Once identified, these barriers can be analysed, prioritised, and addressed through targeted strategies (Laurans et al., 2013). Hence, identifying barriers is crucial for guaranteeing that the scientific knowledge related to ecosystems informs decision-making processes effectively.

PART 2

Decision-making context of seven public and two hybrid Demonstration Projects

DP 01

Spanish National Strategy for Green Infrastructure and Ecosystem Restoration

- Forests
- Agroecosystems
- Heath and grasslands
- Urban
- Wetlands
- Rivers and lakes
- Marine ecosystems

Identification of main green infrastructure (GI) elements to be declared at the national scale

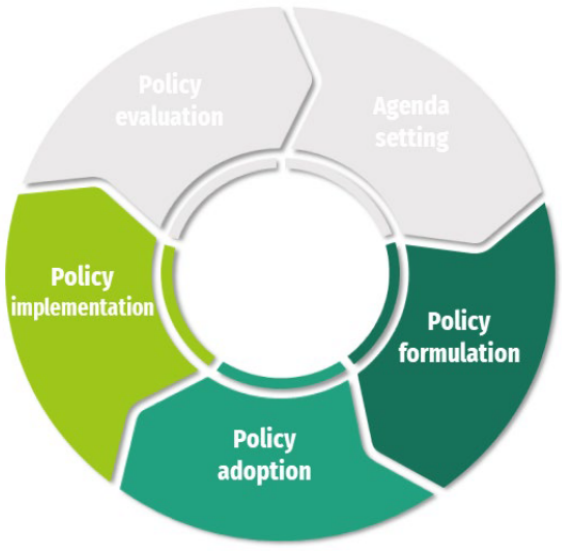
MAIN TOPICS

- Identification of green infrastructure elements at the national level based on the ecosystem services (ES) they provide, their connectivity and biodiversity.
- Identification of hotspots of ES potential based on the GI elements
- Delimitation of areas in need of restoration or protection according to their potential to provide ES, connectivity and conserve biodiversity

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT



3.1. Context and themes covered by the DP

Spain, known for its rich biodiversity, faces a critical threat of habitat loss and declining species resilience that affect the landscape. This challenge emerges from detrimental human activities—rampant urbanisation, intensified agriculture, and infrastructure expansion—that disrupt ecosystems, impacting coastal and water-based environments. As these habitats degrade, essential ecosystem services suffer, especially those involved in regulation and maintenance.

Spain is actively seeking solutions to address these threats, recognising that 45% of evaluated ecosystem services are degrading or being unsustainable used. Efforts are directed at identifying and prioritising areas for conservation and ecosystem restoration by considering critical impacts, including that the land has seen a 30% increase in infrastructure, affecting wildlife across 97.7% of the territory for mammals and 55.5% for birds, with an anticipated decrease of 46.6% and 22.6%, respectively (Gobierno de España, 2020).

While terrestrial habitat fragmentation is under scrutiny, marine ecosystem connectivity remains relatively understudied, with concerns emerging about genetic homogeneity. Hence, preserving ecological connectivity emerges as a biological necessity and a crucial adaptation strategy for species grappling with climate change. Both national and EU policies underscore the urgency of addressing biodiversity loss, highlighting the critical need for comprehensive strategies and initiatives to protect and restore Spain's diverse ecosystems.

Spain's dedication to environmental consciousness intertwines with strategic policies regarding green infrastructure. The integration of the national strategy into sectoral policies has been pivotal. Spain has framed its legislative landscape around Law 33/2015, an amendment to Law 42/2007, delineating the national strategy for green infrastructure, ecological connectivity, and restoration. Additionally, Order PCM/735/2021 is central in guiding the development and execution of the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration. Aligned with broader EU biodiversity strategies and UN Sustainable Development Goals, this strategy aims to preserve and revitalise ecosystems and their services through green infrastructure.

A collaborative effort among various stakeholders, including autonomous communities, ministries, and public administrations, is essential for effectively implementing this strategy. Coordination and cooperation among these entities are critical to maintain and enhance green infrastructure. Hence, the current focus is not only on identifying components but also on ensuring the integration of standardised and regularly updated cartography.

The ongoing political process aims to develop regional green infrastructure plans by 2024 tailored to Spain's diverse environmental landscapes and needs. Embedded within this framework, the SELINA Demonstration Project (DP) is a case study focused on identifying significant elements of green infrastructure on a national scale. The DP encompasses an in-depth analysis of the environmental landscape, assessing vital ecosystems, ecological

corridors, biodiversity hotspots, potential restoration sites, and climate change mitigation measures. The insights will inform national decisions regarding the preservation of significant green infrastructure elements.

The DP aims to contribute to several crucial themes, including spatial planning, nature conservation, climate change mitigation, and social cohesion. It delves into land use, the protection of critical habitats, adaptation to climate change, and the intersection of environmental policies with societal well-being.

3.2. *Policy objectives and questions*

Policy objectives:

- To apply territorial planning and management tools designed from a perspective that logically links actions with the expected results of biodiversity conservation, maintenance and restoration of ecosystem connectivity and functionality, and their services. This planning and management will be supported by the systematic evaluation of outcomes as a source of information for continuous improvement. The application of these tools should contribute to mitigating the effects and pressures that current development models generate on the environment, as well as adaptation to global and hardly avoidable changes such as climate change.
- To strengthen effective coordination among different Public Administrations and their respective bodies to successfully implement the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration.
- To maximise the cross-sectional integration of concepts, objectives, and approaches of Green Infrastructure at different levels of territorial planning. Integration will be achieved through appropriately trained and equipped transdisciplinary human teams, establishing prioritisation protocols, implementing adequate information and public participation procedures, and promoting and recognising contributions proposed or supported by civil society.
- To promote the improvement of knowledge, research, and information transfer within the framework of Green Infrastructure objectives, as well as the dissemination of information at all levels of society, aiming to achieve adequate awareness about the relevance of this environmental conservation instrument.

Vision of the National Strategy for Green Infrastructure and Ecological Connectivity and Restoration

By 2050, Spain has established a National Green Infrastructure that guarantees the reduction of habitat and ecosystem fragmentation, improved ecological connectivity, the provision of key ecosystem services (provisioning, regulation, and cultural) for human well-being, the mitigation of climate change effects in both rural and urban areas, and the enhancement of societal resilience and adaptation capacities in the face of climate change risks. The establishment of this National Green Infrastructure has been achieved through the restoration of degraded ecosystems, the application of nature-based solutions, the integration of strategic sectoral policies, territorial planning at various scales (local, metropolitan, regional), the implementation of governance models ensuring inter-administrative and inter-territorial coordination, the full integration of green infrastructure in the environmental evaluation processes of territorial plans, programs, and projects, and social awareness, commitment, and shared responsibility among strategic actors.

Goals

- Goal 0: Identify and spatially delimit the basic network of Green Infrastructure in Spain at different scales.
- Goal 1: Reduce the effects of fragmentation and the loss of ecological connectivity caused by changes in land use or the presence of infrastructure.
- Goal 2: Restore habitats and ecosystems in key areas to promote biodiversity, connectivity, or the provision of ecosystem services, prioritising nature-based solutions.
- Goal 3: Maintain and improve the provision of ecosystem services from the Green Infrastructure elements.
- Goal 4: Improve the resilience of the elements associated with Green Infrastructure, favouring climate change mitigation and adaptation.
- Goal 5: Ensure the territorial coherence of the Green Infrastructure by defining a governance model that ensures coordination among the different administrative levels and institutions involved.
- Goal 6: Effectively incorporate Green Infrastructure, the improvement of ecological connectivity, and ecological restoration into sectoral policies, especially in terms of territorial planning and, maritime spatial planning, and environmental assessment.
- Goal 7: Ensure adequate communication, education, and involvement of stakeholders and society in the development of Green Infrastructure.

3.3. *Policy windows*

The EU Green Infrastructure Strategy, established in 2013, aims to improve the conservation and restoration of natural habitats and ecosystems. It advocates for developing green spaces and promoting biodiversity conservation in urban and rural areas. The strategy seeks to address issues such as habitat fragmentation, declining biodiversity, and the deterioration of ecosystem services. Key objectives include the integration of green infrastructure into spatial planning and supporting ecosystem-based approaches in different sectors. The strategy also encourages the use of green infrastructure to combat climate change and promote human well-being by enhancing ecosystem services and improving the quality of life for EU citizens.

Law 42/2007 on natural heritage and biodiversity establishes the conservation of biological diversity and ecosystems, recognising the value of biodiversity and its role in sustainability. It provides measures for the conservation of species and habitats, sustainable resource management, ecosystem protection, and environmental planning and management guidelines. This law focuses on preserving biodiversity and promoting the sustainable use of resources, addressing the conservation of natural and protected areas, the restoration of degraded areas, and establishing measures to ensure biodiversity and ecosystem services.

Law 33/2015 is an amendment of Law 42/2007, which sets out the guiding principles for preserving biodiversity and the responsible use of Spain's natural heritage. It introduces the creation of a National Strategy for Green Infrastructure and Ecological Connectivity, aiming to conserve ecosystems, promote their connectivity, and restore degraded areas. It also proposes improving territorial planning to ensure ecosystem functionality and mitigate the impacts of climate change. Furthermore, the law protects specific natural areas, promotes nature-based solutions, and fosters social awareness and responsibility for environmental conservation.

Order PCM/735/2021 establishes the guidelines and framework for developing and implementing the National Strategy for Green Infrastructure, Connectivity, and Ecological Restoration. This strategy focuses on preserving and enhancing the functionality of ecosystems, ensuring their connectivity, and restoring degraded areas. It aligns with existing environmental legislation and outlines guidelines for identifying and conserving key elements in the territory, such as protected areas, endangered habitats, mountainous regions, and more. Additionally, it promotes coherence and coordination among different administrative levels to ensure territorial and sectoral planning that supports ecosystem connectivity and functionality.

3.4. Collaborative team and stakeholder identification

In October 2022, MITECO and URJC met online to explore the focal points of the Demonstration Project in Spain that directly align with pressing policy needs: either a national strategy for green infrastructure and restoration or delving into ecosystem accounting. This meeting laid the groundwork for the direction of subsequent workshops, meetings, and involved stakeholders (Table 3.1).

In February 2023, an in-person workshop between MITECO, URJC and Tragsatec was held, aiming to finalise the focus of the DP. The session involved a presentation from a Tragsatec representative, showing the outcomes of a prior application of the Methodological guide for identifying green infrastructure elements (MITECO, 2021) at the national level. URJC shared initial proposals for updating this guide.

In March 2023, a second workshop was held between MITECO, URJC and Tragsatec. The goal was to craft a comprehensive strategy for the guide's update, and URJC presented the progress in this ongoing effort. The DP was set to become operational by June 2023.

In July 2023, MITECO, URJC and Tragsatec met to review the advancements in the guide's updates. In another meeting, MITECO, URJC, Tragsatec and the Polytechnic University of Madrid (UPM) addressed the integration of elements in green infrastructure through the lens of ecosystem services, biodiversity, and connectivity.

In October 2023, a green infrastructure working group composed of MITECO representatives, Tragsatec, autonomous community technicians, and three collaborating universities assembled for a workshop focused on the application of the methodological guide. MITECO opened the session, URJC elaborated on methodologies for ecosystem service assessment and mapping, UPM presented an approach to assess ecological connectivity, and The University of Seville (US) introduced methodological enhancements for calculating and cartographically representing ecological connectivity in river ecosystems.

***Table 3.1**. Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Ministry for the Ecological Transition and the Demographic Challenge (MITECO). Technicians from the Autonomous Communities of Spain Tragsatec
Research and education organisations	Rey Juan Carlos University (URJC) Polytechnic University of Madrid (UPM) University of Seville (US)

3.5. *Engagement methods and stakeholders' responsibilities*

The stakeholder engagement within the DP has been structured around discerning critical policy needs and devising appropriate solutions to tackle these needs effectively (i.e., green infrastructure vs. ecosystem accounting). Following this identification phase, a sequence of meetings (Figure 3.1; refer to section 3.4 for details) has been conducted to move forward with the progress of the DP. The paragraphs below delineate the various stakeholders' responsibilities in this process.

The Ministry for the Ecological Transition and the Demographic Challenge (MITECO) is at the forefront of collating the requirements of the Autonomous Communities and global authorities on Green Infrastructure (GI). This process involves gathering diverse insights to inform the country's environmental strategies. Simultaneously, MITECO acts as a liaison between these regions and the broader international community, ensuring a comprehensive understanding of their GI needs.

Rey Juan Carlos University (URJC) plays a pivotal role in this collaborative effort. It actively participates in updating the Methodological Guide for GI elements, adding new insights, strategies, and updated methodologies to enhance the guide's relevance and applicability. URJC is also in charge of implementing and applying the revised guide across Spain. This on-the-ground application is crucial for translating theoretical revisions into practical environmental action.

In parallel, UPM and the University of Seville focus on specialised areas. They undertake the responsibility of enhancing the chapters concerning terrestrial ecological connectivity and the intricate web of ecological links within river ecosystems of the guide. Their expertise ensures that these specific areas are thoroughly revised and aligned with the latest scientific understanding and methodologies.

Tragsatec, a public company with a wide array of expertise, significantly supports Spanish authorities in various technical and environmental domains. Its scope of work extends across multiple sectors, including environmental quality and evaluation, biodiversity, rural development, and water management. More specifically, Tragsatec is responsible for compiling the different chapters of the guide. Furthermore, it serves as a nexus, bringing together MITECO and the universities to discuss needs, potential solutions, and the effective implementation of revised guidelines. This comprehensive collaboration ensures that the efforts are aligned with the requirements of MITECO and leverage the expertise and innovative solutions generated by the academic institutions.

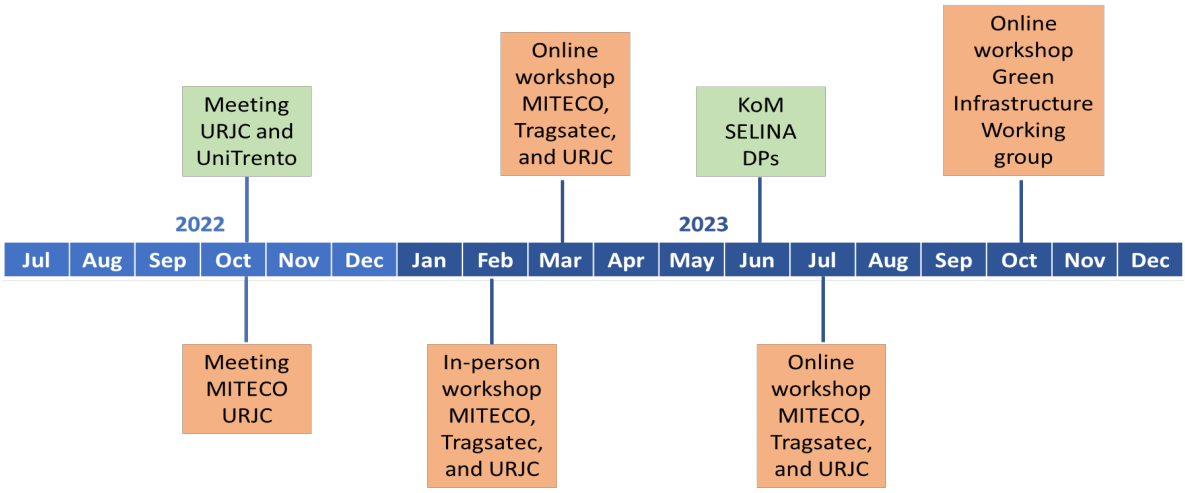


Figure 3.1. *Timeline of the activities of the DP*

3.6. ES focus, including preliminary identification of methods and indicators

The DP will apply the second version of the methodological Guide for the Identification of Green Infrastructure in Spain. In this version of the Guide (v.2.0) (unpublished), a review and update of the proposed methodologies for assessing and mapping ecosystem services and ecological connectivity have been carried out by URJC, reflecting the theoretical and methodological advances in these areas. In Chapter 2*: Ecosystem Services*, a redefinition of the evaluated ecosystem services has been performed, aligning with the Common International Classification of Ecosystem Services (CICES) and identifying the services that will be part of the European regulation on environmental accounts (ENV/EA-MESA/WG/2023/18). New methodological approaches (Tier 1 to 3) have been proposed for all of these, evaluating their complexity and applicability for assessing and mapping ecosystem services at different scales (local, regional, national). Moreover, suggestions have been expanded for analysing trade-offs and synergies and for the integrated valuation of ecosystem services.

The ecosystem services covered in the guide include:

Provisioning services:

1.1.1.1. Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes

1.1.1.2. Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)- wood.

4.2.1.1. Surface water for drinking

Regulating and maintenance services:

2.2.6.1. Regulation of chemical composition of atmosphere and oceans

2.1.1.2. Filtration/sequestration/storage/accumulation by microorganisms, algae, plants, and animals (Figure 3.2)

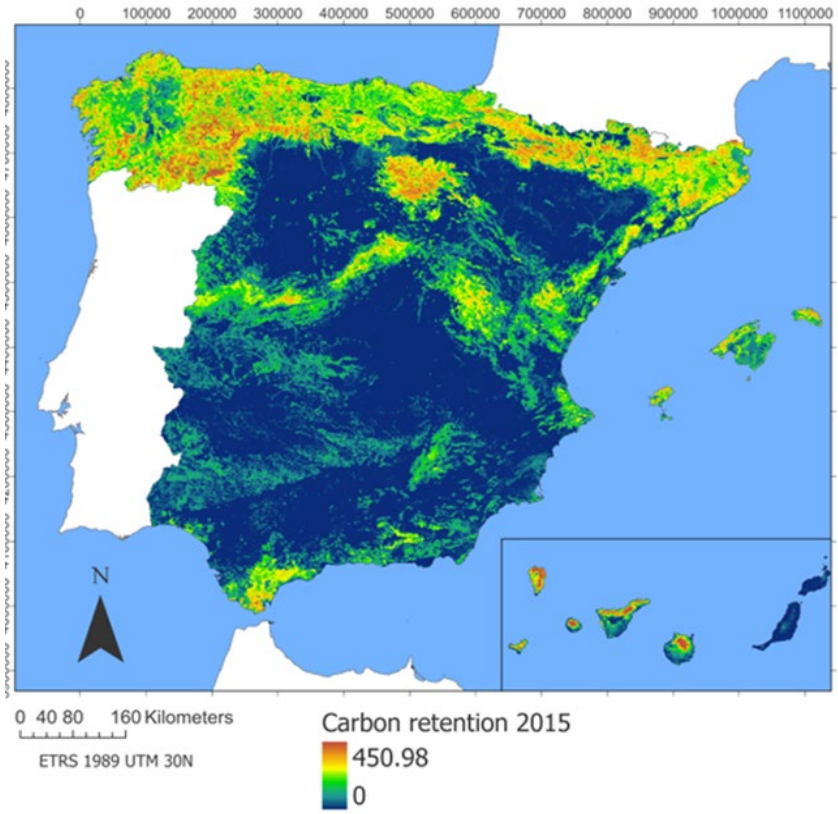


Figure 3.2. *Boundary of the study area. Example of the calculation of the ecosystem service 2.1.1.2. Source URJC (2023)*

2.2.2.1. Pollination
2.2.1.3. Hydrological cycle and water flow regulation (Including flood control and coastal protection)
2.2.1.1. Control of erosion rates

Cultural Services

3.1.1.1. Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions.
3.1.2.4. Characteristics of living systems that enable aesthetic experiences.

The methodology presented in the guide for the identification of Green Infrastructure is based on the proposal developed by the European Environment Agency (EEA, 2014), selected by considering the following:

- It establishes values for indicators related to ecosystem service provision using simple methodologies adaptable to the best available information, with varying precision and scale, enabling their cartographic representation and analysis of synergies and commitments among them.
- It allows the categorisation of the entire territory based on its supply related to the provision of ecosystem services, the value of conserving threatened biodiversity, and its contribution to ecological connectivity.

- It considers the possibility of adaptation, addressing foreseeable changes in the territory, uses, and ecosystems, and the consequent modification of its capacity for biodiversity conservation, regulation, supply, cultural services, and ecological connectivity management.

Building upon these elements will enable the determination of Green Infrastructure predominantly focused on biodiversity conservation and ensuring the provision of ecosystem services and territorial connectivity.

Based on the previous considerations, the methodology proposed in the guide for assessing the various components comprising Green Infrastructure is developed at different stages that are subsequently integrated to relate ecosystem services to the territory's values associated with biodiversity function and ecological connectivity.

The method involves assessing services, biodiversity, and ecological connectivity at varying territorial scales. The resultant values per territorial cell define their potential to deliver services, conservation contribution, and functional connectivity. The Green Infrastructure categorises areas into two levels: one for conservation and another for restoration, excluding areas that don't meet these criteria. The methodology stresses the need for scientific analysis and social participation to recognise the infrastructure, promote consensus-building for shared benefits, and identify vulnerable social actors affected by ecosystem service loss. Lastly, it recommends involving various administrative bodies to ensure effective and practical management decisions for Green Infrastructure.

3.7. Barriers to ES evidence uptake

- Lack of high-resolution data at a national level to make decisions at the regional or local level.
- Uncertainties related to data or models (from Tier 1 -3)
- Standardisation of existing data and maps, avoiding inconsistencies between the different geographical scales and Administrations
- Lack of technical capacity to develop the Tier approach from some stakeholders

The DP identified several obstacles to the effective uptake of ecosystem services evidence. These barriers impede the smooth integration and practical application of the generated knowledge. One of the primary issues recognised is the absence of high-resolution data at a national level. This scarcity hampers the ability to make informed decisions at regional or local levels. It impedes the nuanced understanding of ecosystem dynamics and services within specific territories.

Uncertainties from the data or models used across the Tier approach - ranging from Tier 1 to Tier 3 - were highlighted as a significant impediment. The lack of precision or reliability within the various tiers of data analysis and modelling could cause doubts about the accuracy and applicability of the information used, undermining the decision-making process.

Another challenge revolves around the standardisation of existing data and maps. Inconsistencies between different geographical scales and among various administrative bodies add complexity and ambiguity to the data interpretation. The absence of standardised data hinders the ability to draw accurate comparisons or analyses across different regions.

Moreover, there's a deficiency in the technical capacity among certain stakeholders. Some lack the necessary skills or expertise to develop the Tier approach effectively. This technical insufficiency presents a significant barrier, limiting the effective implementation of the tier-based methodology and its application in decision-making processes related to ecosystem services.

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SELINA

DP02 Sustainable agricultural practices in the Comprehensive Plan of Lithuania

- Forests
- **Agroecosystems**
- Heath and grasslands
- Urban
- Wetlands
- Rivers and lakes
- Marine ecosystems

Comprehensive Plan of the Territory of the Republic of Lithuania for 2030

MAIN TOPICS

- Sustainable management of agricultural areas
- Improvement of existing ES supply and identification of restoration areas

STAKEHOLDERS

- **Public sector**
- **Research and education**
- **NGOs and civil society**
- **Private sector and industry**

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

4.1. Context and themes covered by the DP

Lithuanian DP covers all the agricultural areas of the country, which occupies 9.768 Km2 (30.55% of the country). Here, only agroecosystems (e.g., croplands) are studied; other types of ecosystems are excluded. Cropland areas are mainly located in the central and southwest part of the country (Figure 4.1). Although the rural population has decreased due to land abandonment, 56.2% live in rural areas, amongst the highest rates in the European Union (European Commission, 2023). From 2005 to 2015, the farm average size increased, and the number decreased (OSP, 2021), which represents evidence of agricultural intensification. Between 2016 and 2020, crop production increased while animal production remained stable (OSP, 2021). Most of the cropland is occupied by grain crops (e.g., wheat). Nevertheless, between 2016 and 2020, the area cultivated with rapeseed increased significantly (OSP, 2021).

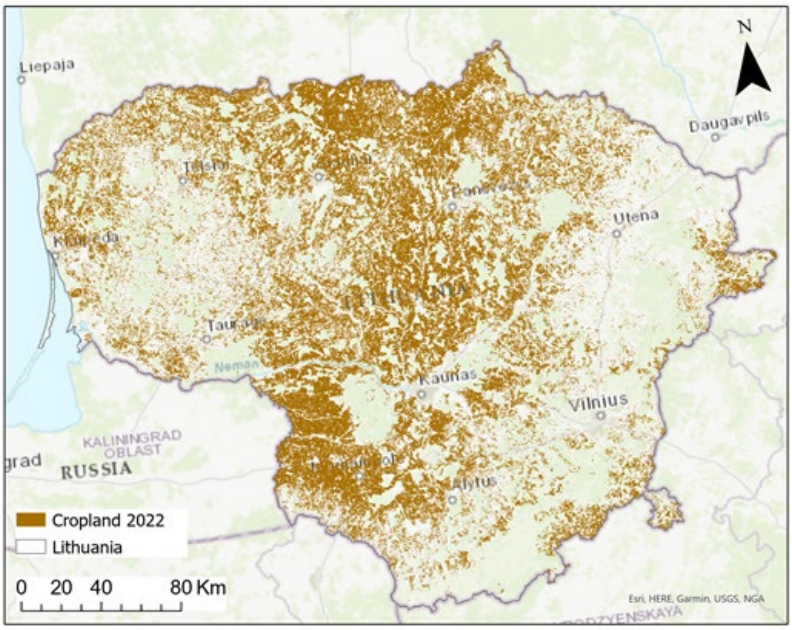

Figure 4.1. *Study area.*

As the Lithuanian DP focuses on agricultural ecosystem services., the main objectives of the project are:

- Mapping ecosystem conditions of agriculture areas in Lithuania.
- Mapping and assessment of temporal carbon sequestration, erosion regulation, flood regulation and food production using field and remote sensing techniques.
- Identifying the externalities (not-deliberate, negative environmental impacts) and ecosystem disservices.
- Identify the best method to value the assessed ES.
- Integrating SEEA in policy making.

The knowledge generated by the DP02 will support public decision-making processes as the Comprehensive Plan of the Territory of the Republic of Lithuania for 2030 (hence referred to as the CPRL) is implemented. The CPRL is the country's central territorial planning document that provides a long-term perspective for developing the country's territory. The CPRL specifies solutions that are valid until 2030 and the Conceptual Framework that is valid until 2050. The CPRL's Conceptual Framework is congruent with the two main strategic state documents: the State Progress Strategy and the National Security Strategy. Furthermore, the CPRL's solutions are congruent with the National Progress Strategy (hence referred to as the 'NPS'). Due to this information, the implementation of the DP02 requires the active involvement of public authorities (ministries, municipalities), NGOs, local farmers, and their associations.

During the implementation of Task 8.1, the Lithuanian team (MRU and LRAM) followed the Methodological Framework proposed by the WP8 leader – the University of Trento. The activities were conducted in 5 steps:

- Create a collaborative team and engage stakeholders
- Identify policy objectives and policy questions
- Identify policy windows
- Set stakeholder responsibilities and engagement methods
- Determine barriers to ES evidence uptake

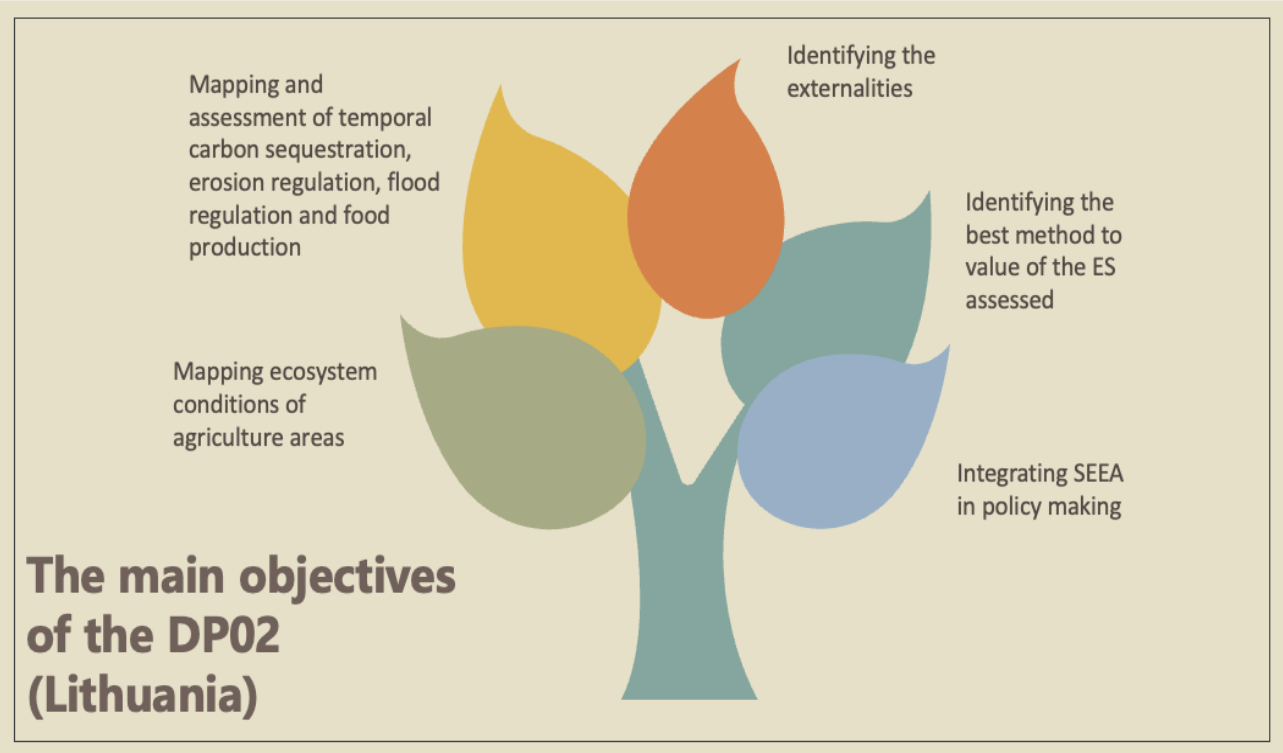

Figure 4.2. *The main themes covered by the DP02.*

4.2. *Policy objectives and questions*

The policy agenda can be expressed in several ways, such as policy objectives, which are the policy's direct goals (Diercks et al. 2019). Policy objectives are defined as the intended outcomes that policymakers hope to attain. In the case of the Lithuanian DP, the CPRL was the first document to be examined because it established the goals for all the other state planning papers. The document generally establishes over 600 goals that must be implemented in other planning documents, legal acts, and strategies.

Sustainable, bio-based activities in agriculture, forestry, and fisheries are among the CPRL's primary goals. Additional policy objectives expand on the content of the aforementioned goal, so the following are the primary objectives related to DP02:

1. To halt the loss of biodiversity, the degradation of ecosystems, and the quality of the services they provide, and restore them where possible.
2. To protect soils, use them sustainably, stabilise soil degradation and erosion and restore degraded soils.
3. To manage the resources of bio-productive agricultural territories based on the principles of sustainable agricultural development as defined by the EU but scientifically adapted to the Lithuanian context, the geo-ecological and agroecological potential of the territories, their resilience to anthropogenic pressures, and their ability to assimilate or neutralise these pressures. Hence, agriculture in agrarian areas must be developed to balance the ecological stability of agroecosystems, economic efficiency, and social equity.
4. To rationally use and protect resources suitable for agriculture.

It is worth noting that the CPRL clearly references the EU Biodiversity Strategy for 2030 and mandates explicit compliance with its call for action on soil protection.

Additionally, the following related documents were analysed: Territorial Planning Law (1995); National Progress Plan (until 2030); National Progress Strategy (NPS); National Security Strategy; Land and Food Agriculture, Rural Development and fisheries development program of the Ministry of Agriculture of the Republic of Lithuania, managing the 2022-2030 development program; The spatial development directions of the state territory of the general plan of the territory of the Republic of Lithuania and the functional priorities of territory use (of 4 June 2020). These documents complement the CPRL and its objectives.

Analysing the above documents allowed us to identify the most important environmental and agricultural objectives and the identification of an initial set of policy questions:

1. How can the data and expertise gathered while carrying out SELINAS's DP02 be used to implement the CPRL and the supporting documents?

2. How can we effectively communicate the advantages of using nature-based solutions in decision-making? What kind of data will be recognised?
3. How would ministries use the scientific data generated to strengthen sectoral policies?
4. What is required to link the information about ES from the scientific community to the policy domain?

The policy questions are formulated based on Maes et al. (2018). These policy questions will be reviewed with stakeholders at the first meeting, which is scheduled for January 2024. The first meeting will bring together experts from the Ministries of Environment and Agriculture, and meetings with other stakeholders interested in participating in project activities are planned for March-April 2024.

4.3. Policy windows

The CPRL establishes goals for all future state territorial planning. It is a collection of broad, specific objectives that frequently necessitate scientific understanding. That information can be incorporated once municipal, territorial, agricultural, and environmental plans and strategies are in place.

The CPRL will be implemented:

1) by detailing the solutions in territorial planning documents of the same and lower level.

2) by drawing up programmes for the implementation of the decisions, which shall be coordinated with long-, medium- or short-term planning documents providing the possibility of implementing investment projects in the planned territories and enabling the attraction of private investment.

3) through the preparation of national development programmes, regional development programmes and plans, other strategic action plans and development programmes of public authorities, which must include appropriate measures (actions) to implement the decisions of the CPRL.

4) through the preparation of a programme for the implementation of the decisions of the CPRL, which sets out the deadlines, measures and sources of funding for their implementation.

The CPRL is consistent with the NPS, another critical strategic document that was enacted in 2020 and is in effect until 2030. The document reflects a national vision, development priorities, and recommendations for implementation by 2030. The most crucial, according to the DP, is strategic aim number 6: guaranteeing good environmental quality and sustainable use of natural resources, protecting biodiversity, and reducing and strengthening resilience

to climate change. The NPS includes 11 tasks that help achieve the aforementioned goal. The DP's knowledge could potentially aid in implementing NPS tasks and fulfilling target No. 6. The NPS is being implemented through sectoral strategy plans, such as the Minister of Agriculture of the Republic of Lithuania's Strategic Action Plan for 2023-2025. If the collaboration with the Agricultural Ministry is successful, the knowledge gained throughout the DP could be used to develop the next strategic plan (2025-2027).

4.4. Collaborative team and stakeholder identification

MRU and the Ministry of Environment (LRAM) have been working jointly since 2018 when an official Memorandum of Understanding was signed between the two organisations. Since then, both institutions have held frequent meetings to share information, and the primary focus of collaboration is on ecosystem services. Throughout the implementation of SELINA, the collaboration of academia and the state agency will enable successful science-policy interaction.

This prior expertise allowed for the effortless organisation of a collaborative team of MRU scientists and LRAM personnel. Katažyna Bogdzevič (MRU) and Ieva Čaraitė (LRAM) have been designated as the task coordinators for Task 8.1. The collaborative team's cooperation began in October 2022.

The preliminary stakeholder list was created in October 2022. It was prepared based on the university's previous cooperation with stakeholders during the implementation of the national project Linesam and based on the list of potentially interested stakeholders possessed by the Ministry of the Environment.

Stakeholders were invited to collaborate using a preliminary list that included 167 potentially interested persons from different governmental and municipal bodies, NGOs, and academic institutions (Table 4.1). The identified persons were contacted by LRAM (January 2023) with a short e-mail introducing the SELINA project, DP02, and an invitation to collaborate in the project's future activities. Positive answers were received from 49 persons. Furthermore, snowball sampling was conducted based on the responses, and two more persons were identified as interested in cooperating in future activities. The final list includes 51 persons and was expected to be finalised at the end of January 2023; however, due to some delays in answers, it was finalised in mid-March 2023.

Identification of potential language barriers. Analysis of the two main documents, the CPRL and NPS, revealed that keywords such as ecosystems (LT – ekosistemos), ecosystem services (LT – ekosistemų paslaugos), biodiversity (LT – biojvairovė, biologinė įvairovė) – are used in the same way. The other important documents, for instance, the Law on Territorial Planning, do not use the concept of ES at all. It is worth noting that the Ministry of Environment has hired a specialist responsible for including the ES concept in different strategies for several

years. Therefore, the terms mentioned earlier are used uniformly in laws, policies, and strategies related to the environment.

Table 4.1. *Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Aukštaitijos nacionalinio parko ir Labanoro regioninio parko direkcija (Aukštaitija National Park and Labanoras Regional Park Directorate) Ministry of Environment Ministry of Agriculture Aukštaitijos saugomų teritorijų direkcija (Directorate of Aukštaitija Protected Areas) Central Project Management Agency Dzūkijos nacionalinio parko ir Čepkelių valstybinio gamtinio rezervato direkcija (Dzukija National Park and Cepkeliai State Nature Reserve Directorate) Chamber of Agriculture of the Republic of Lithuania State Data Agency of Lithuania State Service for Protected Areas under this Ministry of Environment Žemaitija Protected Areas Directorate
Research and education organisations	Vilnius University Klaipėda University Nature Research Center Lithuanian Agriculture and Forestry Sciences Center Vytautas Magnus University Vytautas Magnus University Agriculture Academy
Private sector and industry	Katalista Ventures Smart Continent LT UAB Tautvydas Beinoras (consultant) UAB ALFA AGRO
NGOs and Civil Society representatives	Aplinkos apsaugos politikos centras (Center for Environmental Policy) Association "Viva sol" Association Gyvo Žalio Baltic Environmental Forum Association Croplife Lietuva Lietuvos bitininkų sąjunga (Lithuanian Beekeepers' Union) Lietuvos geografų draugija (Society of Lithuanian Geographers) Lietuvos mėsinių galvijų augintojų ir gerintojų asociacija (Association of Lithuanian beef cattle breeders) Lietuvos miško ir žemės savininkų asociacija (Lithuanian Forest and Land Owners Association) Lithuanian Ornithological Society Lithuanian Farmers' Union VšĮ Lietuvos žemės ūkio konsultavimo tarnyba (Lithuanian Agriculturas Advisory Service)

4.5. Engagement methods and stakeholders' responsibilities

The stakeholder engagement plan was prepared following Durham et al., 2014. As mentioned, the final stakeholder list includes 51 persons representing 32 public and private organisations. To better understand this representation, organisations were grouped into the following categories: Research and education organisations (REO), National-level state institutions that form and implement policy (NLSI), NGOs, and businesses.

Some stakeholders' answers included information about why they would like to cooperate with SELINA's team. Among the answers, we could find willingness to learn how to use the ES concept in practice and new methods for ES assessment.

The grouping of the stakeholders was prepared in February 2023 and updated in March 2023 (after snowball sampling was finished). The grouping is presented in Table 4.1.

After the list was finalised and stakeholders were grouped, they were categorised concerning their relative levels of interest and influence/relevance (Figure 4.3) (interest: low-high; influence: low-high, following Reed et al., 2009).

To assess and prioritise the stakeholder, the following questions were addressed:

- How will they be affected by the project results?
- How can they affect the project?
- Does the stakeholder have important connections to policy?

This approach helped us better tailor stakeholders' responsibilities and engagement levels. For instance, it is useful for identifying which stakeholders must be actively involved in the project, which are kept informed, and which are consulted.

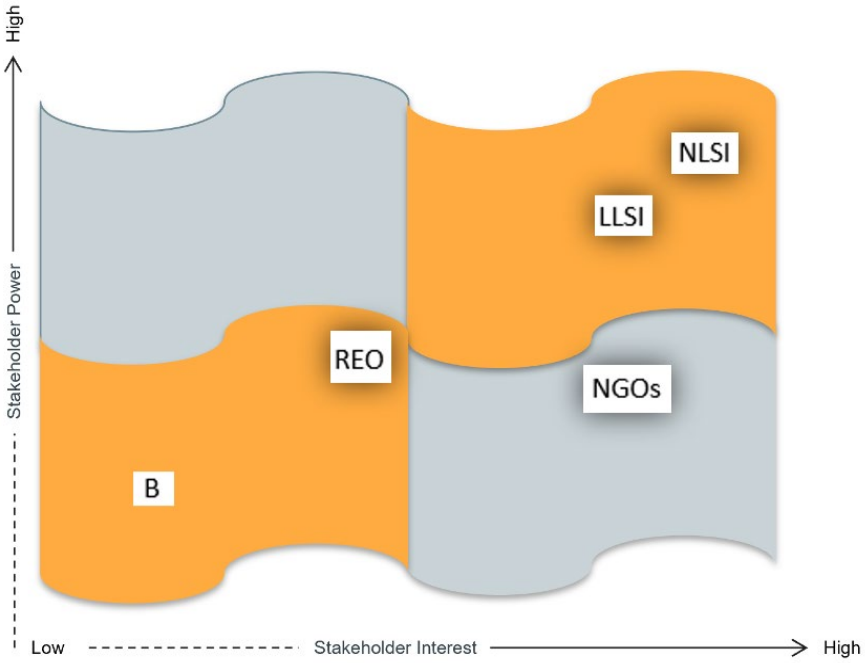

Figure 4.3. *Interest and power of the stakeholders.*

Finally, stakeholders' relationships with other stakeholders were assessed (e.g. is there any accountability, control, or potential conflicts between them?), knowledge and attitudes towards the research (do they possess the knowledge needed for the project?), willingness and capacity to engage (are the stakeholders likely to hold about the project and its results?) and the best ways of communicating with them (e.g. focus groups only of specific stakeholders to avoid potential conflicts and acquire maximum information). The timeline of Figure 4.4 represents the engagement activities carried out by the DP.

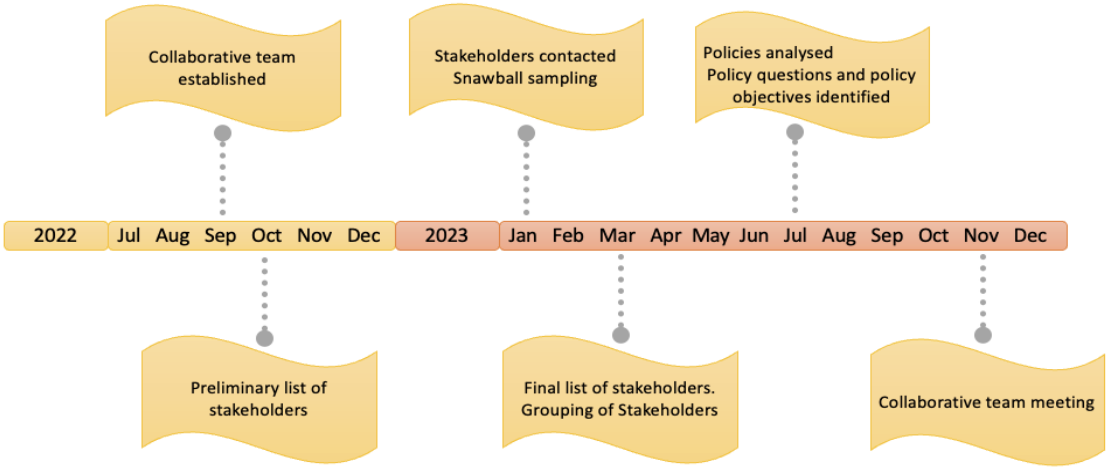

Figure 4.4. *Engagement activities.*

4.6. ES focus, including preliminary identification of methods and indicators

The Lithuanian DP will assess Ecosystem condition, Ecosystem Services, disservices, and externalities. Ecosystem condition will be assessed following the guidelines established by SEEA (UN, 2021). Ecosystem condition depends on the physical state, chemical state, compositional state, structural state and functional state of the landscape/seascape. As the Lithuanian DP focuses on agroecosystems, the biome T7 *Intensive land use*, and more specifically, T7.1 *Annual croplands*, will be assessed. For this, a set of indicators were selected to evaluate the different components of ecosystem condition. For physical state, we selected soil bulk density + Normalised Difference Water Index; chemical state, Soil organic carbon; Structural state, crop diversity; Functional state, Gross primary production; and for Landscape, Landscape diversity (e.g., roughness index). Regarding the Compositional state, we aim to use the Common farmland bird index. However, this data is very coarse, and we aim to find data with a better spatial resolution. The final index will be calculated following SEEA guidelines (UN, 2021). The data to measure these indicators will be collected from the European Union and national databases and remote sensing.

In Lithuanian DP, the following Ecosystem Services will be assessed (following the Common International Classification of Ecosystem Services, version 5.1):

Regulating and maintaining Ecosystem Services

- Hydrological cycle and water flow regulation (Including flood control and coastal protection) (CICES code 2.2.1.3)
- Control of erosion rates (CICES code 2.2.1.1)
- Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals (CICES code 2.1.1.2)

Provisioning Ecosystem Services

- Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes (CICES code 1.1.1.1.)

To assess the Hydrological cycle and water flow regulation (Including flood control and coastal protection), a model considering multiple variables (e.g., topography, soil conditions, anthropogenic features at tier ⅔ level, and control of erosion rates) was assessed using the InVEST method sedimentary delivery ratio method. Regarding Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals, the InVEST carbon sequestration module was applied. Finally, data from Agricultural statistics has been used to calculate *Cultivated terrestrial plants (including fungi and algae) grown for nutritional purposes* in Lithuania. The agricultural crop yield data is available in tons per hectare. For the convenience of the calculation, data in ton\hectare has been converted into ton/pixel (10000 m2) (Rimal et al., 2019). All the models will be subjected to external validation to ensure their credibility. InVEST models were conducted to have a primary approach and quantification of the Ecosystem Services supplied by Lithuanian Agroecosystems. Nevertheless, it is well known that they have numerous pitfalls, such as overlooking ecosystem conditions and other important landscape features (e.g., topography). Therefore, the services assessed with inVEST models will be subjected to more advanced models (e.g., processed-based models) to increase their accuracy.

The ecosystem disservices will be assessed for erosion, flood, and carbon loss. Currently, remote sensing/topographic/ management indicators are being evaluated to determine these disservices. The externalities considered as indicators for floods were the drainage density and the bare soil index for erosion.

4.7. Barriers to ES evidence uptake

- Barrier 1. Limited knowledge of the stakeholders.
- Barrier 2. Lack of data or its inaccuracy

The prior experience with ES assessment at the national level and engagement with the stakeholders shows that there might be some obstacles to the uptake of ES evidence. The first problem is that the stakeholders have just a limited amount of information. An earlier

engagement with stakeholders highlighted that there may be different understandings of what ES are and what kinds of drivers of change affect ecosystems and ES.

In addition, the scarcity of data in Lithuania and its accuracy presents a significant obstacle to assessing ES. Previous research that was carried out demonstrated that the data that is required for the ES assessment and mapping is frequently unavailable to the public. For example, data might be viewable on specific geoportals managed by public authorities. However, it might still belong to a private entity and, as a result, it might not be available for reuse. In addition, the data that is currently available is either inaccurate or out of date.

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DP03 Urban Greening Management Plan of Trento (Italy)

- Forests
- Agroecosystems
- Heath and grasslands
- **Urban**
- Wetlands
- Rivers and lakes
- Marine ecosystems

Drafting an Urban Greening Management Plan and a public and private green regulation for the Municipality of Trento

MAIN TOPICS

- Global vision of public and private green spaces in Trento and good management practices
- Analysis of ecosystem services and identification of some areas where to introduce nature-base solutions

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

5.1. Context and themes covered by the DP

Trento is an alpine city of 119.004 inhabitants located in north-eastern Italy. The main settlement is located along the Adige River's valley floor and hosts around 70% of the city's population, as well as most of the industrial areas, commercial units and transport infrastructures. The remaining 30% of the population lives in small villages in the surrounding hills and mountains.
The total surface area of the municipal territory is 158 km2, of which 58 km2 represents the urbanised part of the valley floor and east hills. The altitude is between a minimum of 194 m asl and a maximum of 2180 m asl at the summit of Monte Bondone.

The Municipality of Trento has been involved in the study and valorisation of green spaces for many years, mainly through its involvement in various European projects. The most relevant are Alptrees (focused on climate change and alien tree species, census and management system of the city's trees), Los_Dama! (sustainable enhancement of the Alpine cultural and natural heritage through the development of a green infrastructure network), ESMERALDA (mapping and assessing the conservation status of ecosystems by presenting an analysis of the positive and negative effects of ecosystem services) and BioValue (analysing the processes that drive spatial decisions and policies related to the defence and enhancement of biodiversity in urban areas). Participating in these projects partially explains the desire to develop a greening plan to gather the ideas collected over the years.

By participating in the SELINA project, the Parks and Gardens office and the University of Trento aim to draft an Urban Greening Management Plan (UGMP) and a public and private green regulation.

In Trento, urban and peri-urban public green areas account for around 400 ha, with forest covering around 1/3 of the municipal territory. This determines the high proximity of urban areas to natural environments. The city also includes the largest total agricultural area among all province municipalities. Hence, it is important to have an overall idea of the entire green heritage to better determine relevant ecosystem services provided. In the following paragraphs, we define the plan's two main components:

GREENING: This term refers to the strategic part of the plan. In particular, the term refers to initiatives and actions to integrate, promote and improve the green areas within an urban environment. This may include planning and creating parks, urban gardens, tree plantations and other green infrastructure to promote sustainability, biodiversity, and community well-being within the urban context.
MANAGEMENT: Management refers to the operational section of the intended plan. It concerns the planning, management, and efficient implementation of resources and activities related to existing green areas within the urban context of the city of Trento. This includes

developing and maintaining parks, gardens and other green areas, assessing environmental needs, defining sustainable policies, and promoting community participation to ensure a balanced and sustainable management of urban green areas.

Against this background, it is essential to have a UGMP as it is a strategic tool to enhance the existing cover of urban green spaces. Moreover, this tool will be based on information regarding current vegetation cover, biodiversity, air quality and other environmental data. It will also allow short- and long-term management and define a priority of interventions. Finally, this plan will also include goals for tree planting, park creation, and sustainable landscaping strategies to enhance environmental quality and the overall well-being of citizens.

The development of our plan includes sharing the progress with the City Council so they can approve it. This process will be followed by an internal drafting between our offices and the University of Trento and a participatory discussion within and outside the municipal administration.

According to Cortinovis & Geneletti (2021) relevant ecosystem services for the city of Trento are habitat for biodiversity, risk mitigation, air purification and noise reduction, landscape value, nature-based recreation, food production, cooling, and additional cultural services.

The relevant regulations for establishing the type of information and policies to be considered within the UGMP are:

- National Law number 10 of 14 January 2013, “Regulations for developing urban green spaces”.
- “Guidelines for the management of Urban Green and first indications for sustainable planning”, Ministry of the Environment and Land and Sea Protection. Committee for the Development of Public Green Space, 2017.
- “National Urban Green Strategy. Resilient and heterogeneous forests for the health and well-being of citizens”, Ministry of the Environment and Land and Sea Protection. Committee for the Development of Green Space, 2018.
- “National Plan for Adaptation to Climate Change” (PNACC, 2022) and PAESC, the PNACC at the municipal level.
- EU Biodiversity Strategy for 2030.
- “Urban Greening Plans - guidance for cities to help prepare an Urban Greening Plan”.
- “General Regulatory Plan” (PRG).

After identifying the main objectives, the steps to draft the plan are:

1. Determine policy questions and the main ecosystem services to be analysed and mapped.

2. Definition of the spatial levels at which ecosystem services must be studied
3. Identification of data needs
4. Organisation of meetings, discussions, focus groups, workshops with civil associations, and large-scale collection of ideas through population surveys
5. Organisation of dissemination moments to update and inform the population

5.2. Policy objectives and questions

The main policy objectives of DP03 are:

1. To have quantitative and qualitative knowledge concerning the existing green spaces and determine suitable and strategic locations to implement new green areas.
2. To introduce innovations in internal project planning and management of municipal green areas.
3. To develop scientific knowledge for drafting rules that aid in regulating, conservating, and managing green areas. Public services, maintenance companies, and private citizens could use these rules.
4. To implement green management strategies that rely on assessing ecosystem services provided by urban green spaces, both private and public, in the city of Trento. This involves identifying and quantifying the most relevant services according to the social and environmental characteristics of the Municipality.
5. To assess the identified ecosystem services by implementing diverse pilot projects. These projects serve as test cases to evaluate the effectiveness of assessment methods and provide valuable data for decision-making.
6. To use comprehensive scientific data and the ES assessment results to inform the development and drafting of an evidence based UGMP to optimise ecosystem services provision for the city.

Over the past few years, there has been a growing environmental awareness reflected in the relevant will of administrative offices to draft the UGMP. Hence, we want to investigate the most valuable and relevant ecosystem services in the urban environment for our DP and develop specific pilot projects for some of them. For example, by analysing the current heat island effect, it is possible to investigate where to plant new trees and create new green spaces to improve the city's cooling capacity.
We also want to work for public and private green regulation to provide stronger accountabilities for all green spaces being managed in the best way possible.

Against this background, the following policy question will be addressed:

1. What are the criteria for identifying strategic locations for new green areas, considering factors such as population density, urban development plans and urban environmental impact?
2. How can the community be actively involved in the decision-making process for introducing and designing new green infrastructures?
3. How can we adapt our irrigation practices in the context of ongoing climate change?
4. How can clear guidelines be established to delineate the responsibilities of different entities in maintaining and preserving green spaces?
5. Are there specific services that are more critical for the community's well-being or significantly impact the local environment?
6. How can management strategies enhance the sustainability and resilience of urban green spaces in the face of climate change and other environmental challenges?

5.3. Policy windows

By analysing the current situation at local, national and European levels, it is possible to understand why it is currently an appropriate moment for the Municipality of Trento to implement a UGMP. For example, at this time, the Municipality has considerable interest in developing topics related to the environment and climate change and implementing nature-based solutions.

It should be stressed that until 2025, it is possible to have the political support of the municipal council, which shows interest in developing and drafting a UGMP plan in a short timeframe. In addition, there is interest from other municipal technical offices in cooperating in parallel with the civil protection plan and in implementing some actions identified and proposed by the Sustainable Energy and Climate Action Plan.

At the national level, the Urban Greening Plan is a voluntary tool that can be developed locally in response to the European Union's biodiversity strategy. Moreover, it is also a policy proposed in Law 10/2013 to define the future structure of the city's green and blue infrastructure and respond to urban territories' social and environmental demands[1].

Participation in the European SELINA project is also relevant for developing the proposed plan thanks to the collaboration and continuous dialogue with the University of Trento as our scientific partner. This collaboration allows us to give the plan a scientific and innovative approach.

[1] Ministry of the Environment and Protection of Land and Sea. (2017). *Guidelines for urban green management and first indications for sustainable planning*. Committee for the development of public green. https://www.mase.gov.it/sites/default/files/archivio/allegati/comitato%20verde%20pubblico/linee_guida_finale_25_maggio_17.pdf

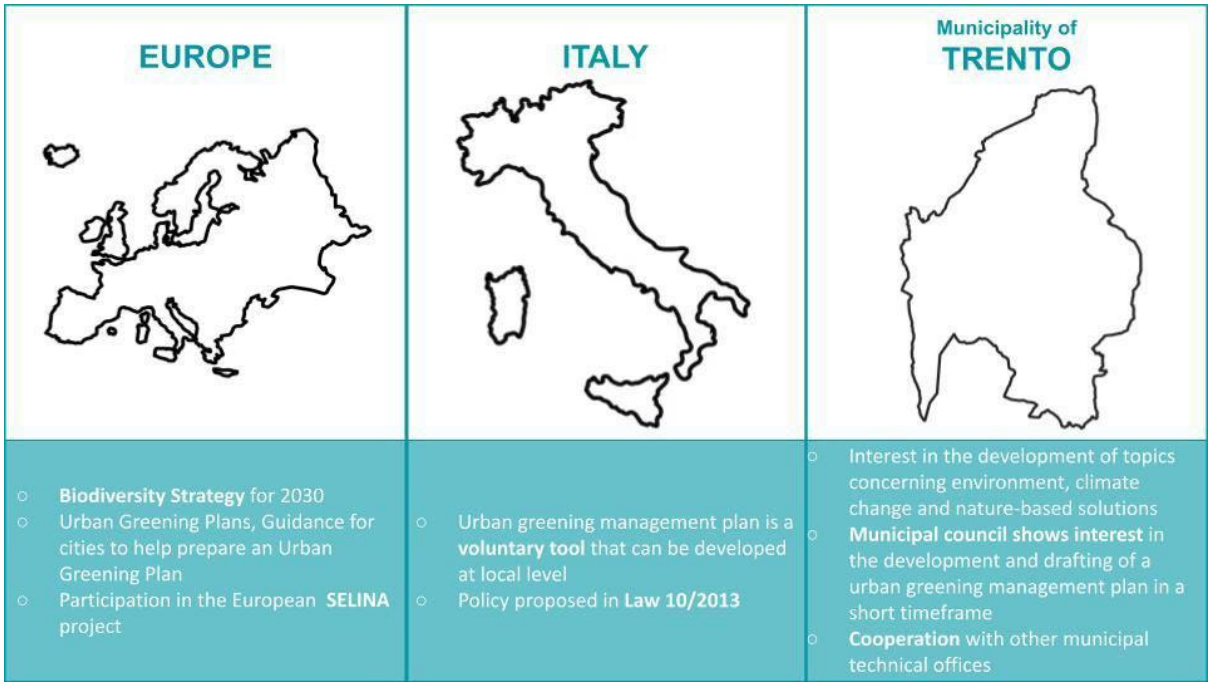

Figure 5.1: *Overview of the policy windows identified by the DP.*

5.4. Collaborative team and stakeholder identification

The meetings with the University of Trento (Figure 5.2) covered important aspects of the collaboration process, including the delimitation of SELINA's objectives and the UGMP development. Other meetings helped focus on methodological clarifications regarding the UGMP planning process, discussions on the co-creation process, and identifying research questions based on pilot projects. Moreover, other meetings focused on critical planning factors and opportunities for integrating biodiversity and ecosystem service indicators. The University of Trento also provided scientific support on the urban heat island effect and related assessment methods. Other sessions deepened how to survey green areas in the municipality, particularly private spades, using orthophotos and semi-automatic classification. The last meeting focused on the spatial scale at which ecosystem services must be studied and analysed. Overall, these meetings facilitated progress in understanding and implementing the project's objectives.

With the University of Bolzano, the Science Museum of Trento (MUSE), and the Trentino Federation of Biological and Biodynamics, we have recently started the BeeTrento project. The pilot project concerning the analysis of the valley floor has been carried out, and now the data analysis and the definition of the next step extended to the whole municipal area is underway. This is a pilot project for environmental monitoring by placing beehives in roadside flowerbeds. This collaboration was established after Trento joined the “Bee Friendly City” network, which aims to map air quality and plant biodiversity indicators through bee pollen analysis.

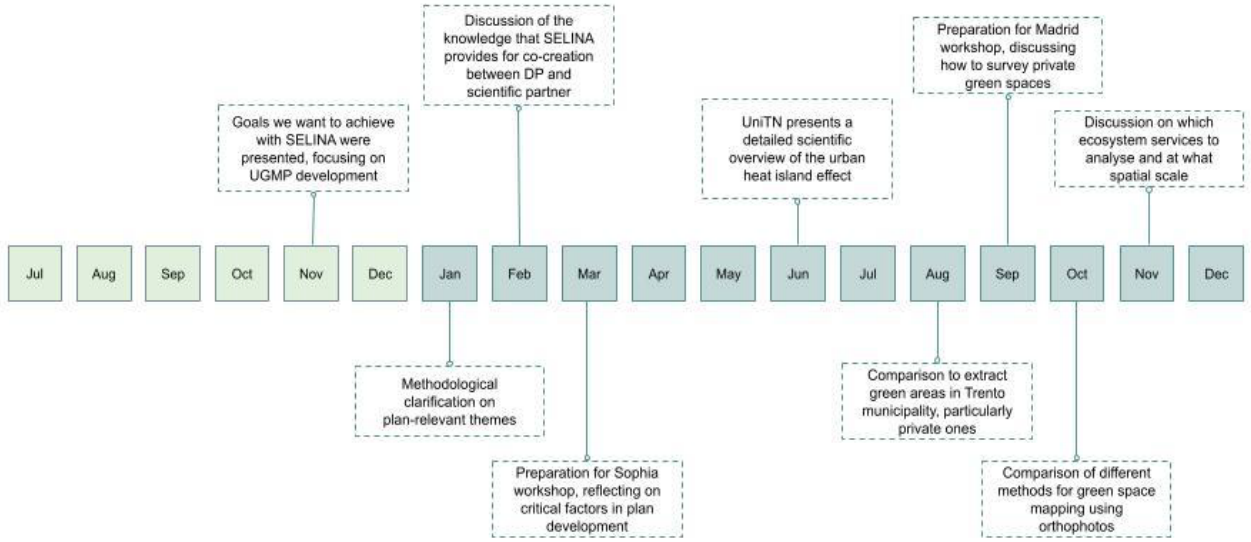

Figure 5.2. *Timeline of the meetings with the scientific partner (University of Trento).*

With the University of Bolzano, the Science Museum of Trento (MUSE) and the Trentino Federation of Biological and Biodynamic and other stakeholders (Table 5.1), we have recently started the BeeTrento project. The pilot project concerning the analysis of the valley floor has been carried out, and now the data analysis and the definition of the next step extended to the whole municipal area is underway. This is a pilot project for environmental monitoring by placing beehives in roadside flowerbeds. This collaboration was established after Trento joined the "Bee Friendly City" network, which aims to map air quality and plant biodiversity indicators through bee pollen analysis.

Table 5.1. *Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Municipality's urban planning office
Research and education organisations	University of Trento University of Bolzano Science Museum of Trento (MUSE)
Private sector and industry	Trentino Federation of Biological and Biodynamic Urban beekeepers NGO working on Urban Green
NGOs and Civil Society representatives	Garden Club Citizens

5.5. Engagement methods and stakeholders' responsibilities

To draft the urban greening management plan, we consider listening to and involving different types of stakeholders and citizens. Currently, the stakeholders already involved are the ones listed in Table 5.1. We were also involved in the SuperTrento project, a participatory process on the city's future in which Selina's work was presented and worked with the urban regeneration and development office dealing with the BioValue project. Finally, a presentation of the work was also presented to the City Council's Environment Committee (2022).

Concerning the involvement of citizens as users of Trento's urban green spaces, a survey was developed to determine the population's involvement. The survey was used to collect information, opinions, ideas and proposals for managing and improving the quality of the city's parks and gardens. The survey was disseminated online on social networks, by QR code in the flower beds of the "Fiori al Centro" event and by interviewing park attendants with the help of the University of Trento trainees. In this case, in addition to the collection of information from the survey, it was possible to dialogue with people and explore some of the issues that were most important to them. Of the 468 answers, 57 were obtained from talking to people in green areas.

Regarding future activities, focus groups will be organised with stakeholders from the public sector, governmental institutions, and research and education organisations in the 2023-2024 winter period. These meetings will be thematic and based on the topics developed within the plan. The aim is to create moments of debate and the collection of ideas between experts on the topic addressed. Finally, workshops will be organised to actively involve NGOs and civil society representatives and implement project activities related to the main themes developed in the plan.

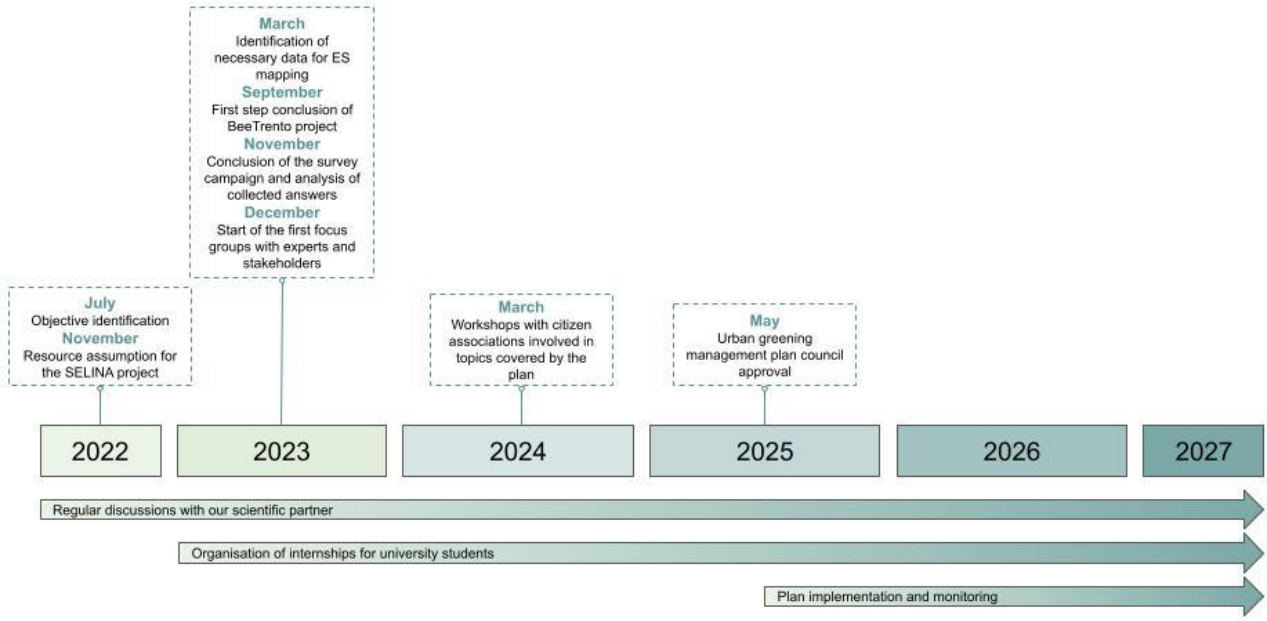

Figure 5.2. *Timeline of the activities of the DP*

5.6. ES focus, including preliminary identification of methods and indicators

As part of our urban greening management plan, we want to analyse various ecosystem services such as temperature regulation/cooling, hydrogeological protection, pollutant removal, CO2 storage, biodiversity, pollination, and nature-based recreation.

The aim is to map ecosystem services and assess their condition. Moreover, we aim to map the population's perception of ecosystem services through surveys and community meetings.

The ecosystem services will be studied at two different spatial scales. Some ecosystem services, such as stormwater retention and heat island mitigation, will be analysed at the municipal scale. The aim is to understand the contribution of urban green spaces to citizens' well-being while highlighting areas where future interventions should take priority. On the other hand, we want to focus on detailed analyses of the services provided by public trees, with methods that allow us to assess diverse planning and management choices for public green areas. To exemplify, one of our main goals is to analyse the urban heat island phenomenon. This analysis will make it possible to identify the areas where the temperature is highest and where urgent action is needed by introducing trees or new green areas. Hence, the project will develop information on the social benefits of green spaces in terms of cooling capacity at the local and municipal level.

With the European project BioValue, we would like to develop a pilot project on integrating green and blue infrastructure. This aims to introduce nature-based solutions and study how green spaces could enhance hydrogeological protection. In this project, we would like to identify how design development could be integrated with green infrastructure and with existing urban areas.

With the BeeTrento pilot project, we want to analyse the tree species most popular with bees and the pollutants found in Trento territory. This is to understand if the seasonality of tree species introduced in the municipal area is sufficient for bees' survival. It would also allow us to map in which areas it will be necessary to introduce more plants to provide sufficient nutrition or where there is nutrition, and it is possible to introduce new hives.

5.7. Barriers to ES evidence uptake

- Difficult scientific/public collaboration that could hurdle concrete results.
- Giving pilot projects a scientific and innovative imprint.
- Data availability. There is a lack of spatial data on private green areas.
- Managing many different topics with the support of several research organisations. Lack of collaboration between involved stakeholders.
- Getting the plan and the private and public regulations accepted by municipal institutions and private groups.
- Guarantee the involvement of citizens.

We believe that drafting a UGMP could involve challenges at different application levels. In particular, to publish and share the plan, it needs to be accepted by municipal institutions. For this reason, having the support of the current municipal council is necessary to comply with the identified policy window.
Then, to give a scientific and innovative imprint to the pilot projects, it is necessary to find a connection with the research world. Hence, challenges could relate to achieving concrete results, collaborating with different stakeholders, and finding the best way to involve them.
Above all, guaranteeing involvement and sharing with citizens regarding the plan implementation is a significant difficulty.
Finally, another difficulty will be filling the potential voids of missing information after identifying the data needed for analysis.

Acknowledgements

We would like to thank all the students from the University of Trento who contributed to the development of some parts of the plan and pilot projects through their internships.

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DP04 Bosland National Park (Belgium)

- Forests
- Agroecosystems
- Heath and grasslands
- Urban
- Wetlands
- Rivers and lakes
- Marine ecosystems

Development of Bosland into a National Park

MAIN TOPICS

- Sustainable management of agricultural areas
- Improvement of existing ES supply and identification of restoration areas
- Monitoring
- Ecohydrological studies
- Recreation and Tourism
- Water retention and water supply
- Wood production
- Climate stress and climate change
- Process-oriented nature conservation

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

6.1. Context and themes covered by the DP

The Bosland National Park is situated in Flanders (Belgium), north of the province of Limburg, and is a valuable nature complex of exceptional size in the Flemish context.

On the one hand, the National Park starts from the idea that nature does not stop at borders and focuses on nature enhancement and connection. On the other hand, intrinsic quality enhancement benefits biodiversity. Added to this, climate challenges are an urgent task. The National Park, therefore, focuses on opportunities and challenges in terms of nature enhancement, biodiversity and climate resilience.

The National Park also offers space for living, experiencing and entrepreneurship in symbiosis with nature and landscape. the focus lies on opportunities and challenges related to accessing the National Park and valorising its heritage qualities. Because everyone is welcome in this National Park, sustainable development and accessibility will focus on offering a National Park experience tailored to target groups. Moreover, Bosland National Park wants to be an international leader in the field of park, nature, and landscape management to significantly contribute to scientific research. As an open attitude and professional communication are essential to achieve this purpose, Bosland puts the focus on cooperation with and interaction between partners and stakeholders.

Bosland is an Intermunicipal Association created in 2006 between the municipalities of Lommel, Hechtel-Eksel, Overpelt, Peer and the Flemish Region. Together with the Regional Landschap Lage Kempen, Visit Limburg and the Agency for Nature and Forest the nature management, tourist-recreational development, and accessibility of Bosland - now for more than 17 years - is expertly organised.

In 2016, Bosland organised the international 'Passion for Nature' conference, focusing on how to create a social commitment to nature and how to leverage social cohesion and community building. The Bosland Manifesto presented at this conference covers the unique way in which Bosland is passionately committed to community building and sustainable development. The Manifesto describes how the local community plays an active role in the decision-making and implementation of plans. True to this manifesto, Bosland remains consistently committed to local engagement, social entrepreneurship, and public-private alliances even as a National Park.

The Bosland Project is, therefore, more than a collaboration between four municipalities as various organisations and actors actively contribute to Bosland, including nature organisations that help manage the terrain and nature education, tourism entrepreneurs and attractions, agricultural entrepreneurs, cultural organisations and heritage associations, many volunteers from the region, sports organisations, and event organisers, among others.

The starting point for the design and development of the Bosland National Park is the conviction that only a sustainable human-nature relationship could make the park truly flourish. The Master Plan 2024-2048 and Operational Plan 2024-2030 aim to facilitate this as man and nature live close to each other and will always be connected in the future Bosland National Park. Together with the many stakeholders involved, we have developed an integral vision for the park as a coherent system. Hence, we start from the idea that Bosland is home to special species, many residents, and active entrepreneurs. At the same time, the vision of this initiative interprets the responsibility we feel towards future generations.

The vision of the future (Figure 6.1) consists of three ambitions: the realisation of an ecologically valuable, attractive, and exemplary Bosland National Park. These ambitions form the compass for developing and opening Bosland as a National Park, where the balance and relationship between people and nature takes precedence. For each ambition, strategic programmes are elaborated, consisting of concrete objectives to be achieved through cooperation.

Figure 6.1: *The main themes covered by the DP*

6.2. Policy objectives and questions

Ecologically connected and growing entity

- Phased expansion of the national park
- Connecting and defragmenting

Biodiverse top nature

- Strengthening biological quality
- Restoring source and valley areas

- Protection of (rare) species

Climate-robust

- Preventing and mitigating drought
- Increasing carbon storage

Smart unlocking and genius reception

- Sustainable travel
- welcoming visitors qualitatively
- High-quality and safe route network

Heritage as a deepening experience

- Inventorying and valuing heritage
- Selecting and developing heritage
- Innovative and public-oriented disclosure and maintenance of heritage

Tailor-made experience

- Developing a tourism strategy
- Experiencing nature and landscape- ecologically responsible, qualitative and target-group-oriented
- Perspective for entrepreneurs

Collective management and cooperation

- encouraging cooperation around nature management, restoration and development
- encouraging effective management through education/training and (re)integration

Community Building

- community building through alliance
- recruiting communication tailored to National Park Forestland

BosLAB, a catalyst for scientific research

- Developing an innovative Nature science centre for nature research and development
- Facilitating and coordinating research and monitoring
- Casual learning in nature

6.3. Policy windows

Following the Flemish Government's initiative to create Flemish Parks, a broadening of the partnership is being explored in 2021. With the existing coalition and these strategic partners, Bosland is applying for recognition as a National Park. After withholding the candidacy, a complex, substantive and time-intensive planning process follows as part of the procedure to obtain recognition. Based on a targeted exploration of joint future opportunities, the municipalities of Hechtel-Eksel, Lommel and Pelt decided to go ahead together and form an administrative lever for the further development of Bosland into a National Park. Together

with the Agency for Nature and Forests, the Regional Landscape Lage Kempen, Sibelco, and Natuurpunt, a powerful area coalition will eventually be formed that will realise the realisation of the Bosland National Park.

6.4. Collaborative team and stakeholders identification

For the Bosland National Park, we strive for a solid anchoring of cooperation but also an open attitude and targeted coordination with the area development and ambitions in terms of nature goals, heritage, recreation, and tourism of (potential) partners in Flanders and the neighbouring Netherlands.

The Bosland National Park is a project by and for many stakeholders: administrations, citizens, entrepreneurs, organisations, etc. For a supported development and opening of the National Park, creating a healthy organisational culture between the core partners and the various stakeholders in the community-building process is crucial.

The plan process was initiated in the summer of 2022 and ran until the spring of 2023, with a deadline for submission of 31 May 2023. Several participation intervals were provided within the planning process for collective alignment with experts and stakeholders. In addition, there was frequent bilateral coordination. The purpose of these participation and consultation intervals was threefold:

- Context and timing: to provide insight into the recognition procedure for Flemish Parks and associated conditions and to provide insight into the planning process outlined for this purpose so that boards and administrations, experts and stakeholders could adequately prepare.
- Content and feedback: providing insight into the interim results and fine-tuning them with the stakeholders. Information, concerns, objections, and concrete suggestions were carefully captured and incorporated into the various documents.
- Start-up of a more structural consultation with theme experts (nature, tourism, heritage, agriculture, etc and scientific experts and with stakeholder groups (entrepreneurs, organisations, residents).

Bosland made full use of the planning process for multidisciplinary area research, policy coordination, bilateral coordination, broad questioning, and opportunity exploration with very diverse stakeholders (over 200 actors), including scientists, subject matter experts, farmers, teachers, accommodation operators, nature managers, local associations, social employment organisations, among others.

The entire planning process is based on the principles of co-creation and co-production. All municipalities involved in the application process were equally involved in drawing up and fine-tuning the scope and ambition of the envisaged Bosland National Park.

Bosland National Park is a social project with a tradition of community building and sustainable planning and development. As a National Park, Bosland remains consistently committed to engaging local stakeholders and partners, encouraging social entrepreneurship, and forging a strong public-private alliance (Figure 6.2). To this end, various participation instruments are deployed, including citizen consultation and participation, co-creation and network development. These instruments can be used in varying or combined ways, depending on the situation and objective.

***Figure 6.2**. DP activities.*

***Table 6.2.**Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Municipalities: Pelt, Lommel, Hechtel-Eksel Province of limburg: Visit Limburg, Regional Landschap Lage Kempen Flemish government Agency for Nature and Forests Coördination body Bosland National Park
Research and education organisations	BosLAB: Scientific organisation within Bosland. They also liaise with other research institutions, such as universities and colleges. VITO: Flemish institute for technological research
Private sector and industry	Sibelco: a global material solutions company with a branch in Lommel
NGOs and Civil Society representatives	Nature Associations: Natuurpunt, Heritage Associations

6.5. Engagement methods and stakeholders responsibilities

Bosland's National Park Master Plan 2024-2048 will be concretely implemented through an Operational Plan. This Operational Plan describes the actions that will be carried out within the relevant plan period. A first Operational Plan, with a planning period from 2024 to 2030, has already been drawn up. For the following six-year planning periods, a new plan will be drawn up each time - always within the strategic vision of the Master Plan 2024-2048.

The purpose of this operationalisation is to ensure that the realisations stem from the integral vision of the Master Plan 2024-2048 and that are also supported by the coalition of partners and actors involved within a certain plan period. The action plan provides the necessary tools to get started with the actions. A description, actors, location, budget, role, and the responsible Park Bureau, etc. are indicated for each action. In short, all the information needed to get started decisively.

The Park Office always keeps the overview and follows the actions. This enables them to monitor progress or achievements so that operationalisation can be consistently evaluated and adjusted where necessary.

Many small and large projects are needed to achieve the objectives. In fact, most projects have five phases: initiation, planning, implementation, monitoring and control and closure.

Within one operational plan period, some projects go through all five phases while others are just initiation and all possibilities in between. The Bosland National Park has divided projects that need more than six years so that the phase(s) achievable in the first plan period can be included as action(s). As a result, some actions comprise an entire project while others realise only a particular phase. In the latter case, well-defined actions follow each other sequentially. It is also possible that not all phases have to take place within the National Park, but are, for example, initiated or carried out by another actor.

6.6. ES focus, including preliminary identification of methods and indicators

We have previously mapped most of our ecosystems, and the available data will be used in further envisioning and management planning. On the other hand, we will do in-depth eco-hydrological studies to better understand wet ecosystems' functioning and elaborate appropriate restoration measures. We have a running method for a follow-up of our important vegetation in plots all over Bosland.

The ecosystem services that will be analysed are recreation and tourism (e.g., arriving visitors, overnight stays, amount of visitors to specific areas in Bosland); water retention and water supply (especially for little but important river valleys, also in areas surrounding the park): wood production (data of wood supply each year available, data of species distribution, age distribution, volumes, homogeneous versus mixed forests, broadleaved versus pine forests,

exotic species.); data on climate stress and climate change (scientific set up is currently in progress).

We will try to integrate data collection organised on the regional and provincial levels in the ES-quantification in Bosland as a local park. For instance, the periodic habitat inventories and monitoring programs for Natura 2000 habitats and species will be used in Bosland's policy and practice. Moreover, we will use yearly data collection of the organisation *Visit Limburg* for data on recreational and touristic sectors.

Finally, in-depth data collecting via grids will be used to measure water levels that will be used to model the eco-hydrological system of wet areas. We have specific 'visitor counters' placed at strategic entrances to our most important nature areas. We will use scientific-based monitoring systems for the follow-up of species or species groups (nightjar, butterflies etc.).

6.7. Barriers to ES evidence uptake

As with most projects, the success of the implementation of the Bosland National Park depends on diverse factors. In this sense, important leverages are:

- Stakeholder's involvement
- Transdisciplinary collaboration
- Political will/policy window
- Good practices
- Available data, indicators, methods
- Using system thinking, not only one perspective
- Science communication- cross-sectoral findings in a common language or appealing to specific sectors – media involvement.

Key barriers are often:

- Lack of a binding/ legal framework/ regulations
- Funding
- Scepticism of stakeholders/ lack of awareness of the society
- Lack of collaboration between different involved parties/stakeholders
- Political will
- Complexity (approach, system, nature, political process)
- Lack of common language/approaches confusing
- (Perception of) lack of guidance, lack of data…
- Fear, conservative thinking, lack of awareness
- Power imbalances
- Lack of (multidisciplinary) communication

Acknowledgements
We would like to thank all stakeholders involved, with particular thanks to the National Park Bureau.

DP05 Marine and terrestrial Spatial Planning in Reunion Island (France)

- Forests
- Agroecosystems
- Heath and grasslands
- **Urban**
- Wetlands
- Rivers and lakes
- **Marine ecosystems**

Integrating marine and terrestrial ecosystem services and disservices (ESD) into spatial planning

MAIN TOPICS

- Seamless ESD mapping/assessment/planning across terrestrial and marine realms
- Identification of priority areas for ESD management under different planning scenarios
- An ESD-oriented approach for two apex species management: bull/tiger shark risk reduction management (in collaboration with WP5) and Réunion harrier conservation

STAKEHOLDERS

- **Public sector**
- **Research and education**
- **NGOs and civil society**
- **Private sector and industry**

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

7.1. Context and themes covered by the DP

Reunion Island, a French tropical volcanic island in the Indian Ocean, is surrounded by a large economic zone (Figure 7.1). The island is about 50 km in diameter, reaching a maximum elevation of 3,070 m, and covers a total area of 2,512 km^2. Due to its location in the trade-wind zone, especially the eastern side, it gets high annual rainfall, over 3,000 mm, causing significant runoff in the rainy season. The island is in the path of the westward South Equatorial Current, creating warm and nutrient-poor conditions. Iconic marine species migrate through this part of the Indian Ocean. Coral reefs cover about 25 km on the western side (Figure 7.1).

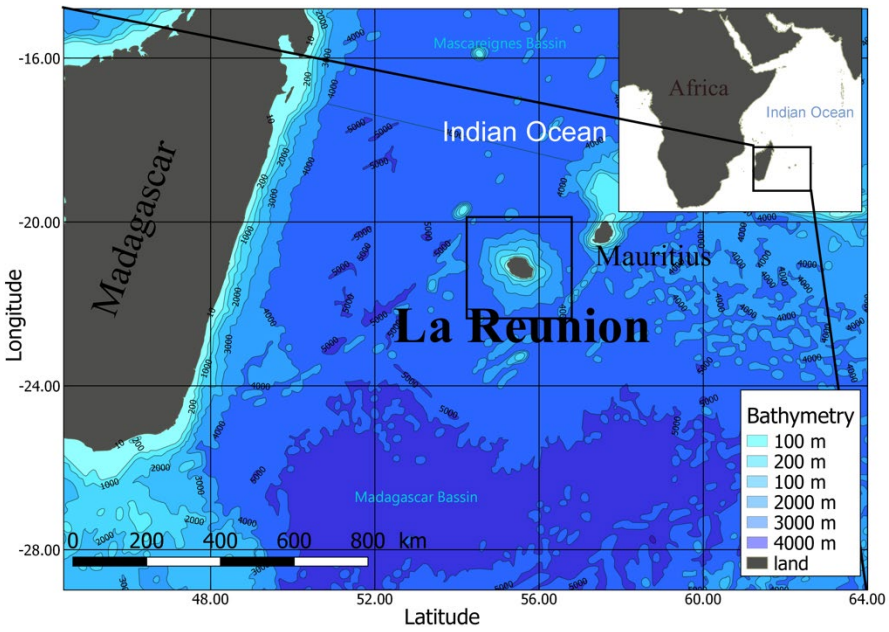

***Figure 7.1**. Location of Réunion Island and bathymetry of the Western Indian Ocean*

Most inhabitants on Réunion Island live along the coasts, especially in the heavily urbanised northern and western areas. In the past 30 years, the island has seen rapid changes in land use and increased human activity due to population growth and economic development. The population grew from 500,000 to 870,000, and urban areas expanded from 59 km^2 to 300 km^2 between 1980 and 2023.

About one-third of the island is still covered by native vegetation, making it globally important for conservation, especially for endemic plant species. Human arrival 350 years ago caused massive biodiversity loss and introduced non-native species, threatening native habitats. Réunion faces increasing threats to its terrestrial species, leading to extinction of 30 out of 45 vertebrate species.

Habitat degradation by invasive species, urbanisation, and agriculture, mainly sugar cane and market gardening, is destroying the remaining pristine vegetation in the lowlands. Forestry and clearing native forests for cattle grazing pose major threats to upland biodiversity

(Strasberg et al. 2005). Since the creation of a National Park in 2007, 43% of the island is protected, with a bias towards the uplands.

Marine activities in Réunion include shipping, civil and military harbour activities, and fishing, mainly by small vessels. Coastal tourism and leisure activities are concentrated on the west side, with tourism growing from 120,000 to 400,000 since the early 1980s. Over 50 scuba diving operators are active, mostly on the west coast. Since 2007, 80% of fringing coral reefs along the western and southern coasts have been protected by the Réserve Naturelle Nationale Marine de La Réunion.

Future challenges for the long-term delivery of ecosystem services in Réunion Island include the protection of agricultural land from conversion by urbanisation, the control of urban sprawl, the protection and restoration of marine and terrestrial ecosystems, the prevention of sea uses conflicts and the mitigation of natural hazards (Lagabrielle et al. 2018). With very few and narrow protected areas in the lowlands and along the coast (none in the pelagic environment), the persistence of good quality ecosystem services in Réunion Island depends heavily on the successful integration of development, conservation and restoration strategies and plans.

Réunion is a region and an overseas department of France. It's also an overseas region (OR) of the European Union. Environmental management in Réunion involves different levels of government: national, regional, departmental, and municipal. The national government is represented through the Préfecture, which manages decentralised services like DEAL (Annex A1) and DMSOI. DEAL deals with housing, equipment, and biodiversity, while DMSOI manages the sea and fisheries. The Regional Assembly, with 45 elected representatives, guides the 2,300 civil servants in the regional administration (Trégarot and Failler, 2021).

As part of France, Réunion follows international conventions like the CBD, Convention on Climate Change, and Convention on the Law of the Sea. It also follows national and EU laws. In 2023, Réunion established its regional biodiversity agency (ARB) in partnership with the State, Regional Council, and French Biodiversity Office. Réunion has regional strategic documents like the Réunion Biodiversity Strategy, Strategy for flora and habitat conservation, and Strategy against invasive species. In the marine domain, Réunion adopted the South Indian Ocean maritime basin strategic document for 2020–2026 as part of the National Strategy for the sea and the coast.

The Réunion Island DP aims to inform and guide spatial planning across terrestrial and marine realms and scales through coherent, proof-based, and transparent strategic spatial planning in the terrestrial and marine domain (Figure 7.2). Using ecosystem services and disservices as a core unifying concept, the DP will contribute to sustainable economic development, nature conservation, hazard mitigation and social cohesion in Réunion Island. The DP targets two spatial planning development/revision processes: the SAR-SMVM terrestrial-coastal and DSBM marine plans. The DP builds upon the legacy of the MOVE and MOVE-ON ESDs mapping and assessment projects in Réunion Island (2017-2022). The main topics that will be

developed during the policy process are 1) Seamless ESD mapping/assessment/planning across terrestrial and marine realms, 2) Identification of priority areas for ESD management under a set of scenarios and 3) An ESD-oriented approach to two apex species: shark (bull/tiger) risk management (cooperation with WP5) and Réunion harrier conservation plan.

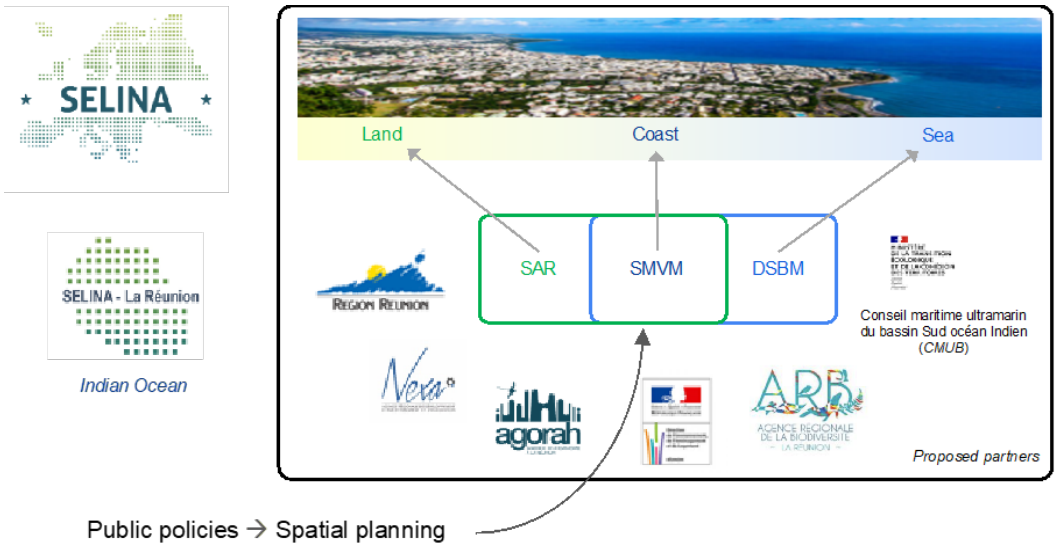

Figure 7.2. *Graphical summary of the Réunion Island SELINA Demonstration Project 05*

7.2. Policy objectives and questions

The overall objective of the SELINA Demonstration Project in Réunion Island is to contribute, via the prismatic concept of ecosystem services and disservices (ESDs), to develop and implement transparent, proof-based and sustainable spatial planning policies to allocate a range of development activities and conservation zones across the terrestrial and maritime space of the island, under a growing demographic and climatic pressure, taking into account constraints from natural hazards and the objective of addressing social inequities.
The objectives and actions of the DP are summarised in the table below (Table 7.1).

The policy questions presented are based on the priorities discussed in Sieber et al. 2022):

- *How to trade development and conservation in a small island spatial planning process?*
- *What are the important areas for ESDs regarding those two objectives and associated trade-offs under different scenarios?*
- *How to develop a seamless coverage of both land and sea ESDs?*
- *How to improve stakeholder participation in ESDs policy negotiation and decision?*
- *How to disseminate and communicate results to different stakeholders?*
- *How to anchor ESDs in Réunion Island policy and decision-making?*

Table 7.1. *Policy objectives identified in the terrestrial-coastal SAR-SMVM and the strategic document of the South Indian Ocean Maritime Basin*

	Objectives	Terrestrial	Marine
SAR (2011-2025)			
1	To meet the needs of a growing population and protect agricultural and natural spaces	x	(x)
2	To strengthen the cohesion of Reunion society in an increasingly urban context	x	(x)
3	To strengthen economic dynamism in a united territory	x	(x)
4	To secure the functioning of the territory by anticipating climate change	x	(x)
SMVM (2011-2025)			
1	To protect coastal ecosystems	(x)	x
2	To organize coastal activities	(x)	x
3	To ontain urban sprawl in coastal areas	(x)	x
SAR-SMVM (post-2026)			
1	To strengthen social cohesion by preserving major balances, and promote an economic development that is both united, virtuous, self-sufficient, resilient, rewarding local resources and connected to the Indian Ocean area, and to the world	x	x
2	To integrate the principles of ecological and energy transition into all dimensions of the draft plan (spatial and economic planning, mobility and urban forms/functions, habitat, housing, etc.), taking into account diversity and specificities of the territory	x	x
3	To take into consideration, at the different scales of the territory, all the wealth and the assets of Reunion Island's exceptional biodiversity and heritage, preserving the public health, and enhance the living environment	x	x
Strategic document of the South Indian Ocean maritime basin (2020-2026) and revised version (post-2027)			
1	To ensure the necessary transition ecological	(x)	x
2	To develop a sustainable blue economy	(x)	x
3	To maintain or restore the good ecological status of the environment	(x)	x
4	To maintain France as an influential maritime nation	(x)	x

7.3. Policy windows

A terrestrial spatial plan (SAR) and a coastal spatial plan (SMVM) rule land use allocation at the scale of the island and constraint sub-level land-use plans (SCOT and municipal PLU). For French overseas communities, the SAR is the main tool for planning territorial development, setting priorities for developing and protecting the regional territory and natural heritage (historical, material, cultural and human) by law no. 95-115 of February 4, 1995. The Sea Development Scheme, or SMVM, is a territorial planning tool that aims to better integrate and develop the coastal area. The SMVM plan is an annex to the SAR spatially explicit plan. It is a zoning tool aiming at two objectives that are difficult to reconcile: the development of activities linked to the sea and ecosystem conservation. The SAR-SMVM has a prescriptive value. It frames and determines the major destinations of areas of the territory, particularly the establishment of structuring facilities (including transport and communication infrastructures). It produces a zonation that identifies areas preferentially reserved for

urbanisation, seeking to limit the negative effects of urban housing sprawl on industrial, port, artisanal, agricultural, forestry and tourist activities. Those plans (SAR and SMVM) are initiated and adopted by the Regional Council and must be approved by the Council of State. The SAR-SMVM (2011-present) is currently under revision in Réunion Island. The next version of the plan will be approved in 2026, after the following steps: assessment (in 2023), policy formulation (in 2024) and public consultation (in 2025).

The South Indian Ocean Maritime Basin Strategic Document could rule marine spatial planning (at the Exclusive Economic Zone scale) in 2027. To set its maritime ambition in the long term, France adopted, in February 2017, a National Strategy for the Sea and the Coast (SNML), which constitutes the reference document for the protection of the environment, the development of marine resources and the integrated and concerted management of activities linked to the sea. and the coast. The National Council for the Sea and Coasts, which brings together elected officials and civil society representatives, ensured its development, implementation, monitoring and evaluation. Unlike the facades of mainland France, for its overseas territories, France is not obliged to transpose the "strategy for the marine environment" framework directive (directive 2008/56/EC of June 17, 2008), which aims by 2020 to achieve or maintain the good ecological status of marine environments. Likewise, the framework directive "maritime space planning" (directive 2014/89/EU of July 23, 2014) does not apply to overseas territories. The maritime areas of these territories represent nearly 97% of the economic zones exclusive French zones (ZEE), which gives France a second place in the world; the Government desired, in 2009, to promote the maritime dimension of overseas territories. Thus, the law of July 12, 2010, known as "Grenelle II", created the overseas maritime councils of basins (CMUB) and prescribed the development, for each basin, of a planning document – the strategic document of the maritime basin – which must specify and complete the orientations of the National Strategy for the Sea and the coast. The South Indian Ocean maritime basin strategic document has been approved for the 2020-26. This document is subject to review every six years and is enforceable. In particular, the programs and plans, as well as various public and private projects linked to the sea and the coast, must be compatible or made compatible with the strategic sea basin document. Nevertheless, this first ongoing strategic document (2020-26) is not (yet) spatially explicit: the strategy remains general and not translated into a zoning plan.

Two additional focal sectoral management plans have been identified as narrower entry points to develop ESDs knowledge and to impact management measures in a straighter way. They will be addressed through the DP (demonstration project) and through the CS (case study in WP5 SELINA): the Shark risk reduction public policy and the National Action Plan for Papangue conservation.

Shark risk reduction public policy: Since 2010, the increasing occurrence of shark bites led to implementing several risk mitigation measures (Lagabrielle et al. 2018). A total ban on swimming and surfing was introduced in 2013 and is still active. Shark nets were implemented at three beaches. A shark patrol system involving immersed shark spotters and jetskis has

been operational since 2015. In 2016, the Réunion Shark Security Centre (CSR) was created to coordinate public authorities, stakeholders, ocean users and experts in shaping future shark-risk mitigation measures in La Réunion. The so-called “shark crisis” in La Réunion polarised antagonistic opinions and social conflicts. Fuelled by controversies publicised through the press and social networks, conflicts have arisen about the lack of, or slow progress towards, shark-risk management strategies being implemented in La Reunion. Heavy debates focus on bull/tiger shark fishing activities as a protective measure, including the deployment of drumlines inside an MPA. When decision-makers tend to manage public emotions rather than the hazard itself, efficient management of negative human-wildlife interactions needs to be based on scientific evidence. An ESD approach to shark risk is expected to renew and shed new light on shark risk management in public policy.

National Action Plan for Papangue Conservation. The ‘Papangue’ Maillard's Harrier (*Circus maillardi*, Réunion harrier) is the last diurnal raptor endemic to the island of La Réunion (200 couples distributed across the island landscape), with the Dubois Falcon (Falco duboisi) having become extinct since 1670. It is critically endangered, classified as "Endangered" by the IUCN since 2000. The main threats include poisoning by rodenticides, collisions with roads and power lines, intentional acts such as shooting, nest disturbance, captivity, glue trapping, and predation of young birds. To enhance species conservation, the National Action Plan aims to integrate the harrier's needs into public policies, improve the management of favourable habitats, and significantly reduce key threats. The actions include considering harrier conservation in spatial management (SAR-SMVM) (actions 6.1 and 6.2).

7.4. Collaborative team and stakeholder identification

Since October 2022, 12 in-person meetings and one on-line meeting, gathering 30 different stakeholders from 12 institutions were organised (Annex A2). The objective was to introduce the SELINA project to key decision-makers, managers, planners and stakeholders. These stakeholders (Table 7.2) belong primarily to institutions having authority or expertise in spatial planning: the regional council (in charge of the SAR-SMVM plan) and the DMSOI (in charge of the DSBM). Those planning institutions organise arenas to inform, negotiate, design and produce decisions regarding spatial zoning plans.

Another objective was to ensure a smooth transition from the MOVE-ON ecosystem mapping project toward the SELINA DP. For this purpose, we met with MOVE-ON project officers from NEXA during a meeting held in September 2022 at NEXA Réunion. A second meeting was organised in February 2023 at NEXA. A map of ecosystem services at the scale of the Island was being produced by NEXA following the method by Burkhard et al. (2012) in the continuity of the MOVE-ON project (extended to the entire island). A proposition of collaboration was made to the NEXA project officer. A meeting was also organised with the University partners involved in the MOVE-ON project to accompany the transmission of the project.

In November 2022, two sectoral management plans (the shark risk reduction plan and the papangue conservation plan) and their supporting institutions (CSR and SEOR) were identified as potential partnering institutions that could benefit from the SELINA DP. Project officers of those two institutions met in person at their management site during an in-person meeting with their collaborators.

In December 2022, the SELINA DP leader attended a workshop of the Southwest Overseas Maritime Council of Basin (CMUB). A researcher from Brest University specialising in marine spatial planning facilitated this meeting, which provided an access window to a wider range of marine stakeholders from the western Indian Ocean region.

In January 2023, the technical planning team and the elected regional council assembly representative in charge of the SAR-SMVM was met at the regional council. In September 2023, a meeting was organised by NEXA with the technical planning team and the elected regional council assembly representative in charge of the Blue Economy Unit. During this meeting, the Blue Institute was identified as a key partner and access point to the private sector and industry stakeholders.

In November 2023, the University of Brest organised and facilitated a meeting to introduce SELINA to the newly appointed director of the DMSOI and the project officer in charge of the South Indian Ocean Maritime Basin Strategic Document.

Table 7.2. *Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Direction of the South Indian Ocean Sea (DMSOI) DEAL Regional Council of La Réunion AGORAH CSR National Park SPL HORIZON NEXA
Research and education organisations	University of Brest/CMUB University of La Réunion
Private sector and industry	Blue Institute
NGOs and Civil Society representatives	SEOS

7.5. Engagement methods and stakeholders' responsibilities

The stakeholder engagement within the DP has been structured around the two major spatial planning processes: the SAR-SMVM and the Strategic Document of the Southwest Indian Ocean Maritime Basin (Figure 7.2). The level of engagement depends on the willingness of the stakeholders to collaborate, the demand-supply in terms of data, skills, knowledge, and the level of expectation.

The administrative director in charge of the SAR-SMVM unit expressed a clear message regarding the willingness to reduce uncertainty in ESD data provision from SELINA along the SAR-SMVM development process. The elected representative in charge of the SAR-SMVM was more open to collaboration but remained aligned with its administrative servant. It was agreed that ESDs products would be sent to the SAR-SMVM unit but the effective use of this data will remain optional in the SAR-SMVM.

The meeting with the Blue Economy Unit of the Regional Council opened a collaboration with the Blue Institute. It was agreed that the SELINA DP should provide information on marine spatial planning issues, including wind farm energy development, and foster public participation. The meeting with the DMSOI confirmed those two priority themes (marine wind farm and public participation) to policy making and a clear willingness to collaborate with the regional council Blue Economy Unit, including throughout the SELINA DP. An additional meeting with the SPL HORIZON in charge of wind farm energy also concluded on the importance of the topic together with public participation.

The collaboration with the focal projects on apex species (and associated habitat) management (bull/tiger shark risk reduction and "papangue" Réunion harrier conservation plan) relies on a closer mutual interest relationship to provide ESD data and analytical skills to guide the implementation of the public policy (shark risk management and papangue conservation plan).

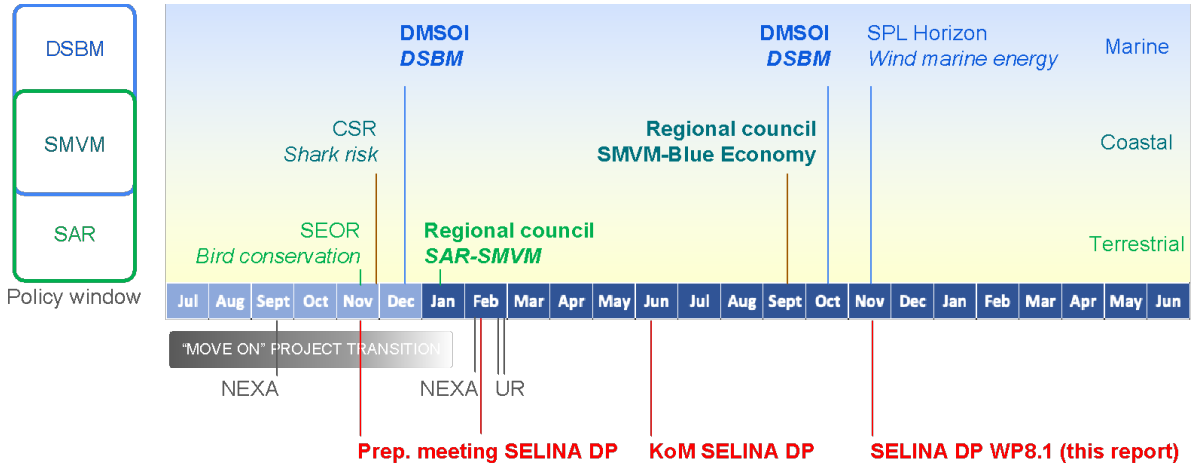

Figure 7.3. *Timeline of the activities of the DP. Meetings with the MOVE-ON project are in black. Meetings with terrestrial institutions are in green. Meetings with maritime institutions are in blue.*

7.6. ES focus, including preliminary identification of methods and indicators

The implementation of D8.2 will consist of "Generating evidence on ecosystems and ESDs"

- define the action plan and a timetable for generating relevant information on ecosystems and ecosystem services: identification of the necessary data and those responsible for their production
- collect data and carry out analyses defined in the previous plan
- validate the results with the decision stakeholders to check if it corresponds to their needs and serve the decision process well

The Réunion DP will focus on the following ecosystem services (Table 7.3)

Table 7.3. *Priority ecosystem services identified for La Réunion. The shark bite risk disservice/sea bathing service is investigated in collaboration with WP5.*

Provisioning services:	
1.1.1.1.	*Cultivated terrestrial plants (including fungi, algae) grown for nutritional purposes*
1.1.1.2.	*Fibres and other materials from cultivated plants, fungi, algae and bacteria for direct use or processing (excluding genetic materials)- wood.*
4.2.1.1.	*Surface water for drinking*
Regulating and maintenance services:	
2.2.6.1.	*Regulation of chemical composition of atmosphere and oceans*
2.1.1.2.	*Filtration/sequestration/storage/accumulation by microorganisms, algae, plants, and animals*
2.2.1.3.	*Hydrological cycle and water flow regulation (Including flood control, and coastal protection)*
2.2.1.1.	*Control of erosion rates*
2.3.2.4.	*Maintaining or regulating refuge habitats*
Cultural services	
3.1.1.1.	*Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through active or immersive interactions.*
3.1.2.4.	*Characteristics of living systems that enable aesthetic experiences*

Preliminary identification of methods includes a Tier 1 to 3 approach built upon GIS layers (land-use and historical data), InVEST integrated tools, STRAVA data, and social methods to investigate aesthetic preferences. A retrospective (1950) and prospective (2050) land-use change modelling approach will provide insights to explore trade-offs and synergies along a range of scenarios (using available modelling tools in QGIS or previously developed models as developed by Lagabrielle et al. (2010) for the study site).

The Seasketch online planning tool (Figure 7.4) developed for La Réunion will be used to share SELINA DP products with stakeholders and allow them to share their spatial planning preferences and concerns.

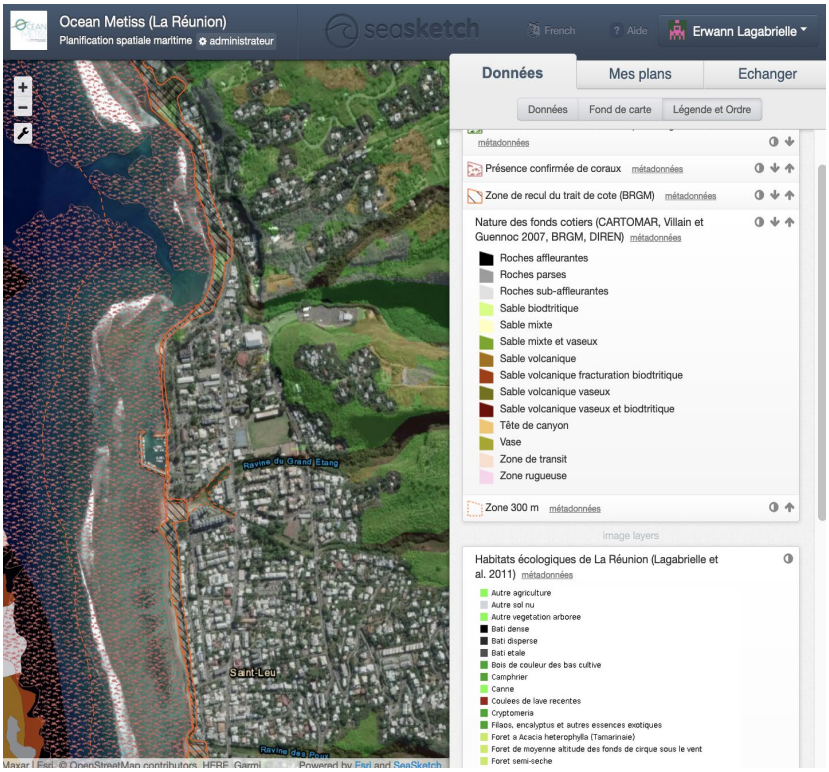

Figure 7.4. *The Seasketch interface for La Réunion*

7.7. Barriers to ES evidence uptake

General obstacles to ESD policy development and implementation have been identified in Réunion Island (completed by Trégarot and Failler, 2021)

- Decentralisation of powers
- Overlapping skills
- Implementation of conflicting policies
- Lack of fluid coordination mechanisms
- Low awareness/mobilisation of local stakeholders
- Weak technical capabilities
- Few analyses on an island scale
- Colonial history

Solutions advised by Trégarot and Failler (2021) in Réunion Island aim to improve the national-subnational linkage through involvement and coordination by:

1. Reinforcing horizontal coordination through a regional strategy
2. Strengthening public engagement
3. Enhancing capacity for biodiversity protection through transnational collaboration

The solutions advanced are being implemented throughout the SELINA DP.

Acknowledgements

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DP06 Sustainable energy production in Switzerland

- Forests
- Agroecosystems
- Heath and grasslands
- Urban
- Wetlands
- Rivers and lakes
- Marine ecosystems

Supporting the design of cantonal spatial plans (Richtpläne) designating optimal locations of renewable energy systems in the Swiss Alps

MAIN TOPICS

- Integrating renewable energy infrastructure (REIs) in the Swiss Alps
- Preservation of local biodiversity and ecosystem services despite the construction of REIs
- Stakeholder engagement to identify preferences (e.g., for energy production, biodiversity & landscape protection)
- Identification of optimal and robust solutions (e.g. solutions that are robust to uncertainties)
- Integration of Ecosystem Condition indicators

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

8.1. Context and themes covered by the DP

The decentralised production of renewable energies (RE) within Switzerland has gained significant importance in recent years, driven by multiple factors, including energy shortages due to the ongoing war in Ukraine, the aspiration to become climate neutral and the upcoming nuclear phase-out. The rapid expansion of renewable energy infrastructure (REIs) can be a crucial step towards climate neutrality but can also cause a substantial loss in local biodiversity and ESs (Grimsrud et al., 2023; Rehbein et al., 2020).

In 2017, the Swiss population endorsed the Swiss Energy Strategy 2050, which implies a nuclear phase-out and promotes renewable energies and energy efficiency (BFE, 2017). Although there isn't a fixed timeline for the complete phase-out, the last one is predicted to be shut down by 2035 (BFE, 2020). In 2019, the Swiss Federal Council launched a climate strategy setting the goal for Switzerland to become climate neutral by 2050 to satisfy the Paris Agreement. Therefore, the burning of fossil fuels will decrease substantially and is often replaced by electricity-demanding alternatives. This expected electrification is mainly happening in the mobility sector and heat and storage pumps. This explains the increase from 66 TWh in 2019 to 84 TWh in 2050 (Annex A3). The complete phase-out of nuclear power corresponds to a loss of 25 TWh, while the overall increase in electricity demand is projected to be around 18 TWh.

A large amount of the electricity gap (Annex A3) is expected to be addressed with rooftop PV (estimates range between 16 to 50 TWh). However, this is the maximum potential if all rooftops are completely covered with PV. Rohrer (2022) argues that the realistic potential lies somewhere between 13 - 15 TWh by 2050 due to the limited willingness of landlords, time pressure, monetary effort and ambiguous PV cover used in the calculations. Switzerland already has an abundance of electricity in the summertime but lacks winter energy production, forcing it to import electricity throughout winter. Given their substantially higher energy production in winter, wind turbines (WT) can significantly address this seasonal disparity (BFE, 2020). Alpine PV is another promising winter energy supplier as the colder temperature, higher altitude, and less cloud cover increase its performance (Rohrer, 2022). A combination of PV and wind turbines (as illustrated in Figure 8.2) can be very useful as they complement each other (Dujardin et al., 2017).

On the 30th of November 2022, the Federal Assembly of the Swiss Confederation passed a new act to the Energy Law, promoting large-scale photovoltaic (PV) installations called the "Solar-Express". This law states that promoting renewable energies is of national interest and outweighs most other national interests. This means that biodiversity and ESs are widely neglected. Only critical national habitats (called "biotope inventories") are protected from the installation of REs.

If a PV project meets the "Solar Express" requirements on energy production (e.g., 10 % of the total capacity of a planned project, of at least a minimum yearly production of 10 GWh, is connected to the grid by the end of 2025), subsidies of up to 60% of investment costs can

be received. While the "Solar-Express" highlights Switzerland's commitment to addressing its energy challenges and climate goals, it could cause many adverse effects on local biodiversity and ESs.

Against this background, the main goal of this Demonstration Project is to show that it is possible to account for several objectives simultaneously (e.g., increasing energy production while preserving or even increasing biodiversity and ESs). As such, integrating biodiversity and ESs when searching for suitable locations could also help to increase the acceptance of REIs (Figure 8.1), which often face strong opposition from the local population (Betakova et al., 2015; van der Horst, 2007).

Figure 8.1. *Left: Example of landscape with low acceptance (PV and wind turbines in an arcadian landscape. Right: Higher acceptance of renewable energy systems in a touristic/technical landscape with pre-existing skiing infrastructure (https://energyscape.ethz.ch/).*

8.2. Policy objectives and questions

The Solar Express aims to subsidise large PV systems until 2025, so most energy companies planning new RE installations are targeting these state subsidies. As they are currently under policy-induced time pressure to realise their projects, this is causing projects to be launched with large controversies related to biodiversity and ES threats.

A main tool to balance trade-offs between a fast expansion of REs, biodiversity and ecosystem services are the cantonal spatial plans. Cantons are asking for support to design these plans and to identify areas that protect biodiversity and allow for profitable production of PV energy. Thus, the main policy- and research objective is to assist cantonal administrations in Switzerland in balancing trade-offs between renewable energy production and the preservation of local biodiversity and ecosystem services.

Summary of policy- and research objectives

- Balance trade-offs between a rapid development of REIs, local biodiversity and ESs
- Identify robust "no-regret/low-conflict" locations of REIs, i.e., locations that have a low impact on ESs and biodiversity but a high energy potential
- Identify robust locations taking major uncertainties into account (e.g., including uncertainties about climate and land-use change)

- (4) Search for robust “pathways” of REIs expansion
- (5) Develop indicators that consider ecosystem condition and land ownership
- (6) Analyse trade-offs between Swiss-scale optimal solutions (with potential concentrations of REIs in specific locations) vs. fair share of the burden solutions (e.g., fair burden between cantons)

8.3. Policy windows

Switzerland is aiming for a fast energy transition towards REs. Recent and planned changes in the Swiss energy law enable a rapid expansion of REs in the Swiss Alps (Figure 8.2). The Cantons play a crucial role in approving the installation of REs in the Alps and in identifying and designating suitable areas for REs. In the coming years, the Cantons will develop spatial plans - Richtpläne- depicting suitable locations for REs. The Richtpläne are one of the most important spatial planning tools in Switzerland as they define in a legally binding manner which areas can be attributed to a certain land use, e.g., which areas can be used to build PV systems or wind turbines.

The cantons have recognized the challenges involved in including REs in the Richtpläne. These challenges are, for example, obtaining suitable information/data on the potential impacts of RE systems and balancing trade-offs between energy production goals and preservation of biodiversity and ES. As such, the cantons are calling for scientific support in designating areas for REs, which creates a major policy window.

The changes in the Swiss energy laws that enable a fast expansion of REs in the Swiss Alps (Solar Express, Figure 8.2) are causing large-spread controversies within science and public on whether goals other than energy production are sufficiently considered. As a result, many initiatives have formed (from NGOs and governmental organizations) that emphasize the potential impact of RE on ESs and make decision-making processes more transparent and well-balanced. The controversies and initiatives that have formed open a policy window within the public discourse which relies on scientific information about the consequences of REs on biodiversity and ES. Providing this information in a timely and salient manner will help shape future political decisions and policies.

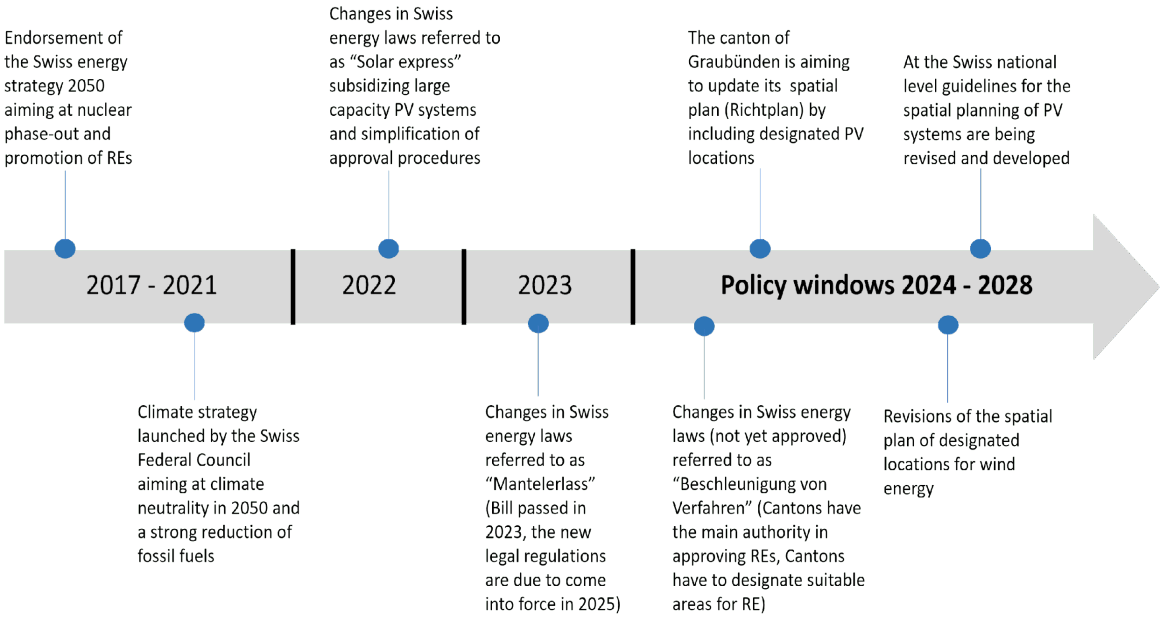

Figure 8.2. *Overview of past policies and changes in the Swiss legislation as well as the policy windows identified by DP 06.*

8.4. Collaborative team and stakeholders identification

We followed two approaches to identify a collaborative team (Table 8.1) and engage with stakeholders. First, together with our policy partner, the applied research institute CERC (Climate Change, Extremes and Natural Hazards in Alpine Regions Research Centre CERC) we organised meetings with the administration of the canton of Grisons. The cantonal offices taking part in this meeting were the offices of spatial planning, energy and transportation, nature and environment and forests and natural hazards. During this meeting, we discussed the needs of the canton, potential policy windows and collaborations. We found that a collaboration with the Office of Spatial Planning could be promising. The office of spatial planning has the main responsibility in designing the spatial plans (Richtpläne) and it has a major interest in considering novel methodologies to account for spatial inter-dependencies (e.g., the effect of land-use/REs spatial configuration) and to understand how dynamic changes in the landscape and uncertainties influence which locations are deemed to be robust and optimal for REs.

In a second approach, we collaborated with the Forum for Climate and Global Change (ProClim), which is part of the Swiss Academy of Sciences (SCNAT). Specifically, we collaborate with Urs Neu (deputy head of ProClim) and Sasch Ismail (Scientific Officer of the Swiss Biodiversity Forum). ProClim has identified more than 100 experts and stakeholders in Switzerland with interest and expertise concerning the locations of REs. First workshops with this group of stakeholders have already been taking place with scientific support from ETH.

Table 8.1. *A shortened list of organisations that have been participating in the workshops with the cantonal administration of Graubünden and during the ProClim workshops.*

Stakeholder	Organisation
Public sector and governmental institutions	Office of Spatial Planning Canton of Graubünden
Research and education organisations	ProClim scnat slf ZHAW ETHZ
Private sector and industry	Swisssolar Axpo CKW Energiezukunft Schweiz
NGOs and Civil Society representatives	Espace Suisse WWF Schweiz Pro Natura Stift. Landschaftsschutz BirdLife Schweiz

8.5. Engagement methods and stakeholders' responsibilities

Stakeholders will and have been engaged in various activities such as workshops, surveys, and game-playing sessions. These activities will be coordinated with other projects/initiatives in Switzerland that aim at stakeholder engagement (e.g. Speed2Zero[2] and ENGAGE[3]).

Several finalised and ongoing activities (Figure 8.3) aim to identify the most relevant criteria that should be considered when designating suitable areas for REs. Identifying the most important criteria was carried out with ProClim at three different workshops between December 2022 and September 2023. In addition, we developed a survey for several experts who had taken part in these workshops. In this survey, the experts were asked to rank the different lower-level criteria identified within the three categories of biodiversity, landscape, and energy production (Annex A4).

In planned workshops with ProClim (2024) we will aim at creating a science-stakeholder interaction to support stakeholders when defining and refining their preferences and objectives. So far, stakeholders have expressed their preferences for criteria at a very abstract level without any information on concrete data or models that could be used. Discussing

[2] https://speed2zero .ethz.ch/en/

[3] https://www.epfl.ch/labs/herus/index-html/projects/engage/

these data and models and how they are interrelated will help identify redundancies among the criteria, which is a crucial step in preference elicitation.

In planned workshops (2024/2025) with the cantonal administration of Graubünden, CERC and ProClim experts, we aim to formulate guidelines on integrating biodiversity and ESs, particularly how to balance the trade-offs among those.

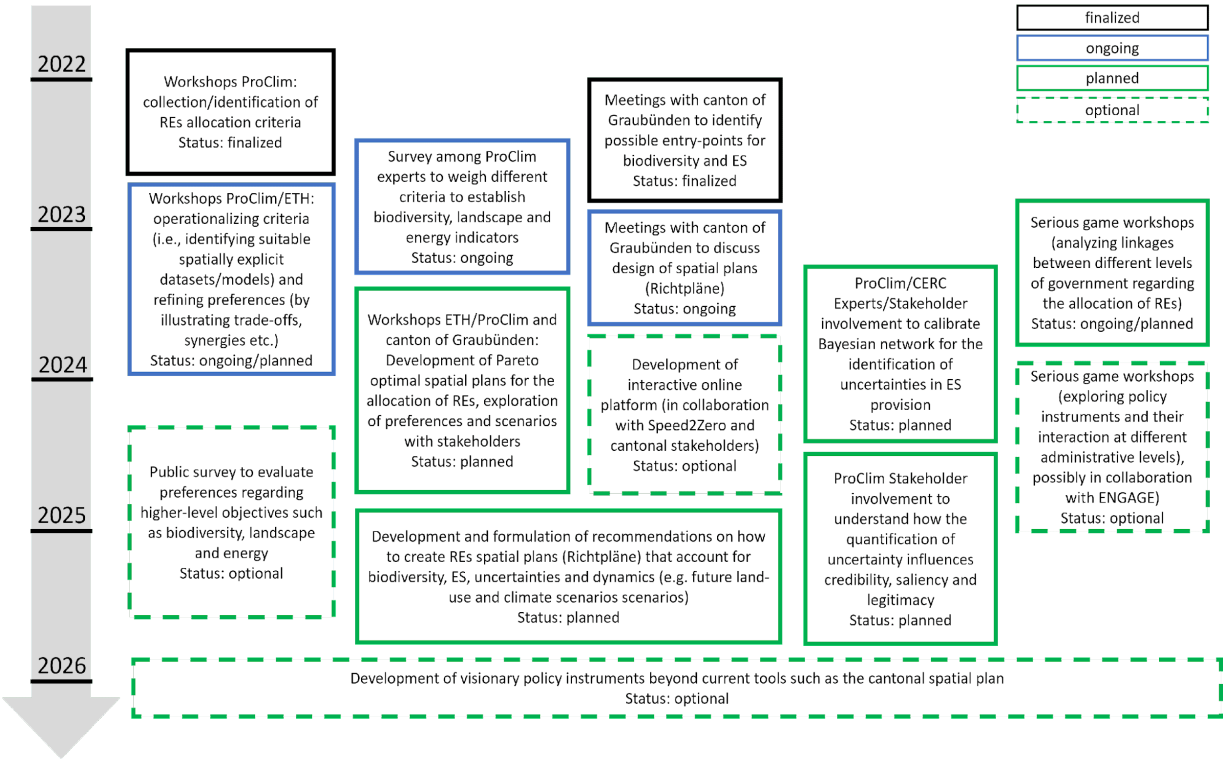

Figure 8.3. *Timeline of the stakeholder engagement activities and all policy-relevant research efforts of the DP.*

8.6. ES focus, including preliminary identification of methods and indicators

Our focus will be on biodiversity and cultural ecosystem services and how they are affected by REIs. The relationship between cultural ecosystem services and renewable energy infrastructure (REIs) has been studied in past and ongoing projects (e.g., ENERGYSCAPE) with a strong focus on how REIs influence landscape perception and values. The results of the ENERGYSCAPE project will be included. Among other aspects, they will indicate the acceptance of REIs in different types of landscapes in Switzerland (Annex A4). We are also planning to integrate further indicators for cultural ecosystem services and how they will be affected by REIs. For example, we intend to include visibility maps, a landscape beauty, and a wilderness indicator (Radford et al., 2019; Wartmann et al., 2021).

There is little empirical research within Switzerland on how biodiversity will be affected by REIs. Thus, we will rely on biodiversity indicators that indicate the current endangerment of biodiversity, the current regeneration potential of ecosystems and the estimated diversity of bird and bat species of each location in Switzerland (e.g. Price et al., 2023). We will rely on

expert opinion to assess how each biodiversity indicator will be affected (i.e., how it will deteriorate or potentially increase) when new REIs are built. For example, we will ask experts to estimate the influence of REIs on biodiversity endangerment for each land cover and/or habitat type or even on the level of individual species.

Our main goal is to make the trade-offs between different objectives more transparent, support policy- and decision-makers in finding compromise solutions, and facilitate uptake. We will rely on multi-criteria decision-making methods and multi-objective optimisation to achieve this. Specifically, we aim to analyse different stakeholders' preferences to show synergies and to formulate positive visions.

The Assessment of Ecosystem Condition - as ETH plans to assess in WP3 of SELINA and in this DP – could also deliver a crucial aspect to identify suitable areas for REIs. While REIs may lead to a degradation of highly biodiverse and high ESs supply areas, installing REIs on degraded areas could have a small effect on biodiversity or even allow for an upgrading of these areas. Such areas could, for example, be skiing areas that are sometimes heavily degraded and, at the same time, very accessible through existing infrastructure. Ongoing and projected degradation as well as Ecosystem condition will also be considered. For example, extensively managed agricultural and highly biodiverse grassland in the Alps is often abandoned leading to scrub encroachment and loss of biodiversity.

In addition, it is our goal to identify robust solutions. We consider solutions to be robust if they allow us to achieve defined goals even though there are significant uncertainties. For example, a solution is robust if it yields a close-to-optimal outcome, even though preferences may not always be perfectly defined and may change in the future. To include further uncertainties and show which solutions could be robust, we aim to develop a Bayesian network that shows how ESs are affected by REIs. Relying on a Bayesian network will help model a complex interaction and uncertainty network.

8.7. Barriers to ES evidence uptake

One of our main goals is to represent the interests of all legitimate stakeholders in a transparent and balanced way to facilitate ES evidence uptake. However, there could be several barriers to a balanced view on REIs expansion, ESs and biodiversity, which would, for example, hinder legitimacy in ES valuation and uptake: (1) The new Swiss energy laws promote a fast expansion of REIs in the Alps and make it possible to widely ignore regulations and cantonal spatial plans that can be used to balance trade-offs among different objectives. (2) Policymakers are pushing for a fast expansion of REIs in Switzerland to secure energy supply. While this aligns with the goal and urgency of climate mitigation, it ignores the urgency of protecting biodiversity and ESs in Switzerland. (3) While there are financial incentives to build REIs fast and in areas with high potential for energy production, there are no financial incentives to protect local biodiversity and ESs. (4) Complex ownership could sometimes cause difficulty in developing REIs on the most suitable land (e.g., already

degraded skiing areas are considered “no-regret” solutions, but fragmented landownership can make it challenging to realise large REIs projects). (5) Uncertainties in quantifying biodiversity and ESs could decrease credibility if not communicated transparently and clearly.

- Lack or ignorance of supportive policy or legal frameworks
- One-sided sense of urgency among policymakers
- Siloed mentality
- Lack of financial incentives
- Property ownership complexity
- Uncertainties

Acknowledgements

We would like to thank Urs Neu (ProClim, scnat) and his team including Sascha Ismail and Lea Reusser for facilitating active stakeholder engagement. We thank the Canton of Graubünden for several discussions that helped us explore policy windows and potential entry points for ES valuation. In addition, we would like to thank Marc Reusser for his great contributions in collaboration with ProClim. We also thank Hughes Desponds and Mirko Schell for their important exploration of stakeholder preferences.

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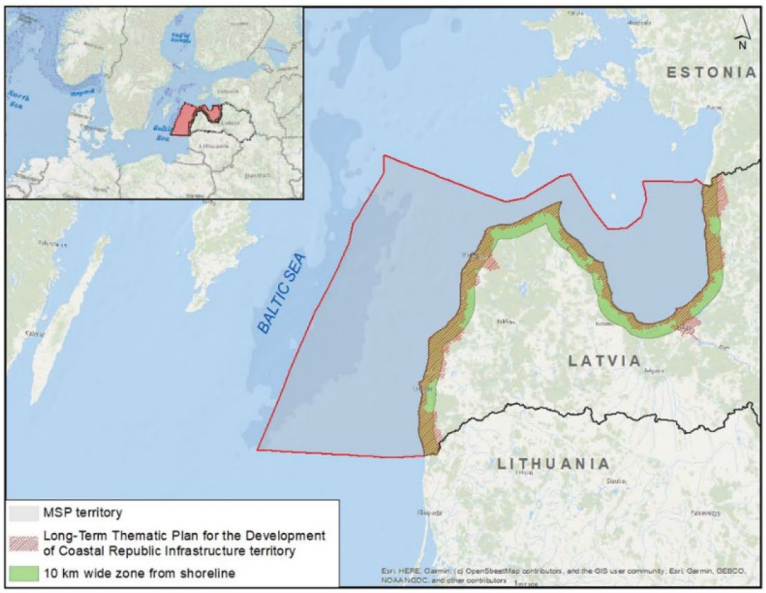
DP07 Latvia's Maritime and Coastal Spatial Planning

- Forests
- Agroecosystems
- Heath and grasslands
- Urban
- Wetlands
- Rivers and lakes
- **Marine ecosystems**



Interim evaluation and updating of the *Latvian National Maritime Spatial Plan until 2030* (MSP of Latvia) and of the *Long Term Thematic Plan on Coastal Public Infrastructure Development* (Coastal Plan)

MAIN TOPICS

- Updating of MAES information on marine and coastal ecosystems
- Evaluation of the policy implementation process of the MSP of Latvia and Coastal plan
- Proposals for update of MSP of Latvia and Coastal Plan by uptake of enhanced knowledge on ecosystem services

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

9.1. Context and themes covered by the DP

Geographic characteristics

The Demonstration Project (DP) area includes the internal marine waters, territorial waters and Exclusive Economic Zone (EEZ) of the Republic of Latvia (in total ~28 500 km^2) and the coastal (terrestrial) part, up to 10 km inland from the shoreline, covering the coastal parishes (smaller territorial units of municipalities) – about 4952 km^2. For the DP it was also decided to extend the coastal area (Figure 9.2) up to 10 km, as the territory included in the coastal plan is, in some cases, too narrow for qualitative assessment of ecosystem services.

The DP area represents marine ecosystem types (marine inlets and transitional waters, coastal waters and shelf) and many types of terrestrial ecosystems in the coastal zone (sparsely vegetated land such as beaches & dunes, grasslands, forests and woodland, inland wetlands, rivers and lakes and urban). The marine waters include the open sea part – the Baltic Proper and the Riga Gulf with diverse physical and ecological characteristics. The seabed in the coastal waters is formed by rocks and boulders (reefs) and sandy sediments, while submarine slopes and deeper parts are mostly covered by mud and mixed sediments. The reefs represent ecologically most valuable habitat – mussels and red algae cover them in the open part, and brown algae in the Gulf of Riga serve as fish nurseries, spawning grounds, and bird feeding areas (Figure 9.1). Seven marine protected areas are established within territorial waters, covering about 15% of the entire marine waters of the Republic of Latvia. About 50% of the shoreline is protected as part of the Natura 2000 network in the terrestrial part.

***Figure 9.1**. Reefs covered by mussels and red algae (Photo by Latvian Institute of Aquatic Ecology)*

***Figure 9.2**. Western Coast of Latvia, at the Baltic Proper (Photo by BEF)*

Socio-economic characteristics

The marine waters presently are used for shipping and fishery (the last one has declined over the last decades). However, there is an emerging interest in the development of offshore wind farms, as well as marine aquaculture. The coastline is an important tourism destination, and the terrestrial part is also used for agriculture, forestry and, more recently, for wind energy production. The settlement structure along the coast is unevenly developed. There are four large cities - Riga, Jūrmala, Liepāja and Ventspils - and scattered small villages

interspersed with vast nature areas. Latvia has three large ports in Riga, Liepāja and Ventspils and seven small ports – Skulte, Salacgrīva, Jūrmala, Mērsrags, Engure and Roja located in the Gulf of Riga and Pāvilosta at the Baltic Sea.

***Figure 9.3**. Old fisherman's boats at Jūrmalciems seaside (Photo by BEF)*

***Figure 9.4.** Liepāja Port (Photo by BEF)*

Policy context

The *Sustainable Development Strategy of Latvia* (Latvija2030*)* - the main national long-term development planning document - defines the coast of the Baltic Sea (including the terrestrial part as well coastal waters) as one of the areas of national interest: *"the Coast of Baltic Sea is one of Latvia's greatest values, where nature and the preservation of cultural heritage must be balanced with the promotion of economic development*". One of the long-term development directions of *Latvija2030* is to develop the coastal environment favourable for economic activities and employment possibilities, balancing the traditional activities (fishery, fish processing, recreation, resort farm) and new types of economic activity (tourism, yacht tourism, alternative renewable energy resources) with the interests of environmental protection.

The Maritime Spatial Planning Directive (Directive 2014/89/EU) requires the EU Member States to establish a formal process by which human activities in marine areas are organised and managed to achieve ecological, economic and social objectives (EU 2014). *The Marine Strategy Framework Directive* (Directive 2008/56/EC) identifies maritime spatial planning as a tool to support the ecosystem-based approach to managing human activities to achieve good environmental status.

Decision-making context and process addressed by DP7

The *Maritime Spatial Plan of Latvia 2030 (MSP of Latvia)* was adopted by the government in 2019. It is a national-level long-term spatial development planning document that defines the use of the sea, also considering the terrestrial part that is functionally interlinked with the sea and coordinating interests of various sectors and local governments in the use of the sea. *MSP of Latvia* was elaborated for the whole Baltic Sea area under Latvia's jurisdiction, including

internal marine waters, territorial sea and EEZ. The boundaries of marine areas were delineated from the coastline to the outreach of the EEZ (figure 1)

The *MSP of Latvia* aims to balance the interests of the environment, society and economy and promote sustainable marine space development, permitting or restricting specific actions in the sea and along the coast. The plan defines three zoning categories within the marine space: priority, existing, and general uses. By determining the priority uses of the sea, the coastal (terrestrial) area that is functionally interlinked with the sea has been considered. Besides, the priority uses include investigating areas of nature values and research areas for wind park development. The ecosystem-based approach was applied in developing Latvia's MSP by assessing the possible negative impacts on nature's assets and ecologically significant areas, thus avoiding the negative impacts on marine ecosystems as much as possible.

The *Long-Term Thematic Plan for the Development of Coastal Public Infrastructure (Coastal Plan*), adopted by the Government in 2016, aims to develop a joint network of public infrastructure in the coastal (terrestrial) areas of the Baltic Sea, which helps to balance nature conservation and economic interests, facilitating the development of joint tourism products, as well as strives to achieve good governance of coastal areas. The coastal plan includes small coastal parishes, which are territorial units of municipalities. There are two strategic goals (directions) defined in the Plan:

- A unified coastal public infrastructure network that balances nature protection and economic interests.
- Good coastal management.

Both planning documents – the *MSP of Latvia* and the Coastal Plan are at the stage of the interim evaluation of the policy implementation. Based on the evaluation results, updating the plans might be required. Proposals for updating the MSP must be prepared by 2029, and options for integration of the coastal plan will be analysed.

Themes covered by the Demonstration Project

Proposals for an update of MSP of Latvia and Coastal Plan concerning:

- Maintenance of resilient marine and coastal ecosystems.
- Sustainable and effective use of marine space, including identification of suitable areas for new developments – marine aquaculture and offshore wind parks.
- Sustainable development of coastal tourism and recreation.

9.2. Policy objectives and questions

Strategic objectives defined in the MSP of Latvia:

- **Policy objective 1:** Rational and balanced use of the marine space, preventing inter-sectoral conflicts and preserving free space for future needs and opportunities.
- **Policy objective 2:** The marine ecosystem and its ability to regenerate is preserved, ensuring the protection of biological diversity and averting excessive pressure from economic activities.

Strategic objectives defined in the Coastal Plan:

- **Policy objective 3:** A coherent coastal public infrastructure network that balances nature conservation and economic interests, promoting economic activity, reducing seasonality, preserving coastal values, and adapting to climate change.

Policy Objective 1 addresses the sustainable and effective use of marine space. The current changes in policy priorities, including the increasing demand for renewable energy and energy independence, require an update of the MSP solutions for offshore wind energy production. At the same time, interest in developing marine aquaculture is emerging, for which no priority areas have been defined in the MSP so far. The allocation of space for new developments shall respect the latest results of mapping benthic habitats, marine ecosystem service supply, and coastal landscape qualities. Furthermore, it is necessary to review and evaluate the coexistence of different sectors (wind energy production, aquaculture, fishery, nature protection, tourism) and to develop concrete recommendations to promote the multifunctional use of marine space.

The implementation of policy objective two is related to the uptake of the latest scientific evidence and mapping results on marine biodiversity and ecosystem service potential or supply in assessing the impacts of the ongoing and planned sea uses. The same applies to the implementation of policy objective 3, which requires the uptake of the latest data on coastal ecosystem services and landscape qualities in promoting sustainable coastal tourism development.

- **Policy question 1**: What are the most suitable spatial solutions for new sea uses, including offshore wind parks and marine aquaculture, which would balance development and societal interest and would not have an adverse impact on the marine environment, biodiversity and ecosystem service supply?
- **Policy Question 2**: How can the latest scientific evidence and mapping results be applied to marine biodiversity and ecosystem service in the public decision-making process – maritime spatial planning and licensing procedures for new sea uses?

- **Policy question 3**: How can sustainable coastal tourism be enhanced by balancing economic and nature conservation interests?

Policy question 1 is related to updating spatial priority areas defined by the MSP of Latvia. Identification of the priority areas for offshore wind energy development and marine aquaculture should consider not only the interests of developers and the technical suitability of the sites for the construction of wind turbines but also the latest results on mapping of benthic habitats, marine ecosystem service supply, coastal landscape qualities and the interests of coastal communities. Furthermore, the opportunities for marine multi-use areas, including innovations, should be explored, defining criteria for coexistence.

Policy question 2 addresses the challenge of identifying the most suitable spatial solutions for new sea uses by considering the biodiversity and ecosystem service supply (as formulated in Policy question 1). The Demonstration Project shall provide an overview of the latest scientific evidence in mapping and assessment of marine ecosystem services and identify the relevant information to support the decision-making process. This includes assessing the impacts of the potential new developments on ecosystem service supply and using the recent modelling results of marine aquaculture potential to identify suitable areas for aquaculture development. To date, the latest results of the mapping of maritime ecosystem services in Latvia's marine waters have been compiled and presented to the MSP and coastal planning coordination group, and the relevant information has been integrated into the interim evaluation report of the MSP of Latvia.

Policy question 3 is related to the interim evaluation and update of the Coastal plan. The information on nature and cultural heritage assets, landscape characteristics, and ecosystem service supply shall be considered in targeting tourism offers and infrastructure development. Hence, DP07 will ensure the integration of the latest data and results from studies on coastal ecosystem service mapping and assessment in the interim evaluation report of the Coastal Plan and the development of proposals for sustainable coastal tourism.

9.3. Policy windows

National-level policy windows and milestones

- *"Interim evaluation report on the implementation of MSP of Latvia*" due by the end of 2023
- Updating of *MSP of Latvia* due by the end of 2029
- *"2nd interim evaluation report on the implementation of the Coastal Plan"* due by the end of 2024

In compliance with the regulatory framework, once every six years, the midterm informative reports regarding the implementation of the *MSP of Latvia* should be prepared. The ***Interim***

evaluation report on the implementation of MSP of Latvia should be completed by the 31st of December 2023. Following the requirements of the ***Marine Spatial Planning Directive***, the review or update of the *MSP* must be performed based on the monitoring results of the implementation, including the results of the national report on the status of their marine waters, required by the ***Marine Strategy Framework Directive (MSFD***). The law also requires an interim evaluation report on implementing Latvia's MSP on strategic environmental assessment. The MSP of Latvia, adopted in 2019, already included initial ES mapping and characterisation, and this information was applied to assess the impacts of proposed sea use solutions. Now, the governmental regulation on spatial planning requires the consideration of ES evidence and climate change aspects in MSP.

*The **2nd interim evaluation report on implementing the Coastal Plan should be developed by 31st December 2024. It should identify gaps in coastal development policy to elaborate proposals for actions after 2030 - the*** due date of the Coastal Plan.

Other essential national policy documents relevant to the implementation of the DP07:

- In the ***National Environmental Policy Guidelines*** concerning biodiversity, it is envisaged that the mapping of ecosystem services for 25% of Latvia's territory will be prepared by 2027.
- In the ***National Program of Measures for achieving a good state of marine,*** it is set that the good condition must correspond to five characteristics up to 2024 and 9 characteristics up to 2027.
- The Latvian National Energy and Climate Plan 2021-2030 envisages stimulatinge the development of research and innovations that contribute to developing the sustainable energy sector and climate change mitigation. To implement the long-term goal, one of the targets has been set to enable 50% of total energy consumption from renewable energy sources.

EU-level policy windows and milestones relevant to the implementation of the DP07:

- The ***European Green Deal's*** objectives for an affordable and secure energy supply require developing the full potential of Europe's offshore wind energy. Safeguarding the marine environment includes, among other things, the sustainability of the blue economy and fisheries.
- The ***EU Biodiversity strategy for 2030,*** a key pillar of the European Green Deal to achieve the recovery of Europe's biodiversity by 2030, includes a commitment to legally protect a minimum of 30% of the EU's land area and 30% of the EU's sea, including 10 % of land and 10 % of the sea to be strictly protected.
- **The *Kunming-Montreal Global Biodiversity Framework (GBF),*** adopted in December 2022, set the target (30 to 30) to designate 30% of Earth's land and ocean area as protected areas by 2030.

- ***HELCOM Baltic Sea Action Plan*** has set the Biodiversity goal – *the Baltic Sea ecosystem is healthy and resilient*. By 2030 at the latest, it is intended to establish a resilient, regionally coherent, effectively, and equitably managed, ecologically representative and well-connected system of HELCOM marine protected areas (MPAs). The network of marine protected areas will cover at least 30% of the marine area of the Baltic Sea, of which at least 1/3 will be strictly protected.

These policy windows are summarised in Figure 9.5

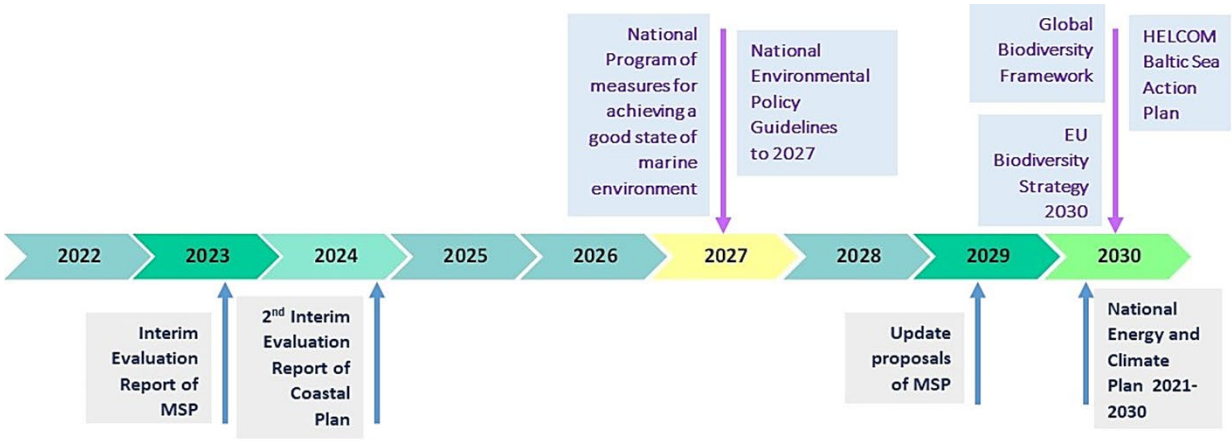


Figure 9.5*. The policy windows addressed by the Latvian Demonstration Project (DP07)*

The uptake of the latest knowledge on biodiversity and ecosystem services in the interim evaluation and update of the MSP and coastal plan will support the implementation of the above-listed national and EU policy objectives.

9.4. Collaborative team and stakeholders identification

Initially, the Collaborative team, involving BEF and MoEPRD experts, was established, and roles and tasks defined:

- MoEPRD is responsible for stakeholder involvement in the Demonstration Project and integrating the project results and issues into the MSP and Coastal Plan.
- BEF is responsible for providing the latest scientific knowledge and data on marine and coastal ecosystems to support the process of policy evaluation and updating.

The collaborative team identified the data and information necessary for the MSP of Latvia and Coastal Plan update and clarified the data sources related to ES. The Collaborative team's work is arranged flexibly by carrying out meetings, discussions, and consultations as often as necessary.

Figure 9.6. *Images from Coordination group meetings. Source: MoEPRD*

The stakeholder engagement is organised by the setting up of a cooperation platform - the *Marine Spatial Planning and Coastal Planning Coordination Group* (Coordination Group), established in November of 2022, involving representatives from relevant ministries, regional and local authorities, and NGOs. Up to November 2023, the six Coordination group meetings have been held. (Figure 9.6)

- The first Coordination group meeting (25.11.2022) was dedicated to the actualities of the implementation and evaluation of Marine and Coastal planning and considerations on further scientific and consultative support in the evaluation and improvement of marine and coastal planning documents within the framework of the initiated projects, including SELINA project.
- The main topics of the 2nd Coordination group meeting (17.02.2023) were energy issues, the current affairs of the shipping industry and ports, and the interests of the defence field in Maritime Planning.
- The main topics of the 3rd Coordination group meeting (28.04.2023) were marine fisheries, aquaculture, use of other marine resources (minerals, offshore sand mining, bottom deposits and sand drift flows) and ongoing processes.
- The main topics of the 4th Coordination group meeting (30.06.2023) were the state of the marine environment and the implementation of the nature protection objectives in connection with Marine planning.
- The 5th Coordination group meeting (24.08.2023) was dedicated to climate change impacts and tourism interests in sea and coastal planning.

- At the 6th Coordination group meeting (20.10.2023), the ***Draft of the first Interim evaluation report on the implementation of MSP of Latvia*** was discussed and commented on.

The stakeholder engagement process for implementing the DP was complemented by the renewal of the national CoP on biodiversity and ecosystem services (led by BEF within WP2). The first CoP meeting was held on 23 May and involved about 30 participants representing researchers, experts from different fields, and NGOs interested in the topic of ecosystem services. The latest developments in Latvia related to ecosystem service studies in the fields of nature conservation, forestry, marine and freshwater ecosystems, landscape architecture and green infrastructure planning were shared following a structured discussion on identifying the "seeds of change". Participants are strongly interested in further cooperation and information exchange for supporting ecosystem service research and uptake in decision-making. Thus, the next CoP meetings shall support the implementation of the DP by engaging the scientific community and practitioners in discussion on integrating ecosystem service information in MSP and coastal planning.

On 14 September 2023, in Sigulda (Latvia), BEF, in cooperation with the University of Tartu (Estonia), provided training on the use of the online GIS platform PlanWise4Blue**,** developed by scientists at the University of Tartu. The training was intended to inform national and regional authorities, NGOs, and scientific organisations about modelling marine ecosystem service supply and assessment of cumulative impacts, learn more about SELINA's Demonstration Project, and practically test the PlanWise4Blue platform. The platform will play a role in implementing SELINA's Latvian Demonstration Project, where the BEF is contributing recent data on marine ecosystem services to update the national Maritime Spatial Plan.

***Table 9.1**. Institutions and stakeholder categories involved in the DP*

Stakeholder	Organisation
Public sector and governmental institutions	Ministry of Defence Ministry of Agriculture Ministry of Environmental Protection and Regional Development (MoEPRD) Ministry of Economic Ministry of Foreign Affairs Ministry of Transport Ministry of Climate and Energy State Fire and Rescue Service State Land Service State Environmental Service Nature Conservation Agency (DAP) Coast Guard of Latvian Navy National Cultural Heritage Administration Health Inspectorate JSC "Latvijas valsts meži" SLLC "Latvian Environment, Geology and Meteorology Centre" (LVĢMC) SLLA "Maritime Administration of Latvia" Investment and Development Agency of Latvia Vidzeme Planning Region Riga Planning Region Kurzeme Planning Region Limbaži County Municipality Dienvidkurzeme County municipality Ventspils State City municipality Liepāja State City municipality Jūrmala State City municipality Rīga State City municipality Saulkrasti County municipality Ādaži County municipality Talsi County municipality Tukums County municipality
Research and education organisations	Daugavpils University agency "Latvian Institute of Aquatic Ecology" (LHEI) Institute of Agriculture and Economics (AREI) Vidzeme University of Applied Sciences (VA) Riga Technical University (RTU) University of Latvia (LU) Institute of Food Safety, Animal Health and Environment (BIOR) RTU Maritime Academy
Private sector and industry	AST "Augstsprieguma tīkls" Mērsrags Port of Talsi municipality Rojas Port Authority Ventspils Freeport Authority Liepāja Special Economic Zone Authority Ltd "Sudrablīnis" Ltd "VA Government" Ltd " LATNET"
NGOs and Civil Society representatives	Society "Latvian Small Ports Association" Society "Latvian Association of Local Governments" (LPS) Society "Environmental Advisory Council" Society "Baltic Environmental Forum Latvia" (BEF) Society "Wind Energy Association" Society "Latvijas Ornitoloģijas biedrība" Society "Zemes draugi" Society "Lauku ceļotājs"

9.5. Engagement methods and stakeholders' responsibilities

Different stakeholder involvement activities (Figure 9.7) were performed and envisaged hereafter - regular targeted meetings and exchange of information, consultations, workshops, and surveys, including participatory GIS methods. A multilevel government and cross-sectoral involvement approach has been applied for the most effective engagement of stakeholders. Various stakeholder groups are involved in implementing the Demonstration Project, including national competent authorities, local and regional authorities, representatives of the sea use sector, tourism and other economic actors from the coastal areas, researchers, NGOs and general public representatives. Besides the Coordination group members, the experts from various sectors and fields (nature protection, fishery, shipping, energy production, etc.) were invited to the meetings to present their policies and inform about their interests, needs and problems. The coordination group meetings are open to all interested parties (not only the nominated members), and the materials for the meetings, such as presentations and summaries, are published on the MoEPRD[4] webpage.

In parallel, consultations with state institutions and sectoral ministries were organised on actual challenges, their needs, and interests to find synergies between different kinds of marine space use. The project team has also actively participated in different events, seminars, and webinars related to marine and coastal development activities, e.g., meetings on "*Development of energy sector and marine environment protection*" - to discuss the aspects of overlapping offshore wind park investigation zones and biodiversity investigation zones, concerning the ongoing ELWIND project.

This all helped to build common insight on the multi-use of the sea environment, promoted the exchange of information in setting spatial priority areas, and highlighted the important climate change aspects.

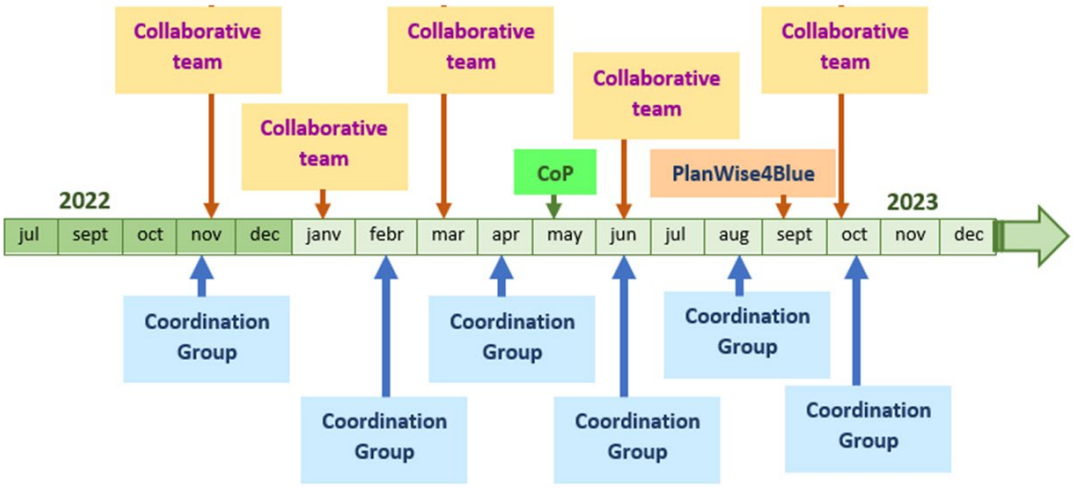


Figure 9.7. *Timeline of the activities of the Latvian Demonstration Project (DP07).*

[4] https://www.varam.gov.lv/lv/juras-un-piekrastes-telpiskas-planosanas-koordinacijas-grupa-no-2022g

To get feedback, a questionnaire was organised after Coordination group meetings, and most of the respondents suggested dedicating more time to discussions instead of theoretical presentations.

The responsibilities and roles of stakeholders have been defined and specified. The sectoral ministries - Ministry of Transport, Ministry of Defence, Ministry of Agriculture, Ministry of Economics- were asked to provide the latest information about their policy, legislation requirements, and interests and needs in marine space use. State institutions - Nature Protection Administration, National Cultural Heritage Administration, Latvian Environment, Geology and Meteorology Centre provided the actual data on marine nature protected areas, cultural heritage, and water quality for the ongoing projects and expected results. Scientists, researchers and experts from universities and institutes (LHEI, BIOR) provided information, data and assessment reports on specific fields. The data and information were used to prepare the interim evaluation on the implementation of MSP in *Latvia.* However, the lack of some essential data on ecosystem conditions was identified (bird migration routes, mechanical pollution, impact from inland waters quality, etc.). Entrepreneurs from the private sector were informed about their interests in aquaculture (Ltd "Sudrablīnis") and wind energy development (ELWIND, Wind Energy Association). Representatives of ports and the Maritime Administration were concerned about shipping lines.

9.6. ES focus, including preliminary identification of methods and indicators

So far, DP07 has focused on analysing the results of the existing study on marine and coastal ecosystem service supply. The following ES mapping results were included in the Interim Evaluation report of the MSP:

Provisioning services:

- Cultivated aquatic plants for nutrition, materials or energy:
    - **Farming potential of brown algae *Fucus vesiculosus***: Indicators - farm biomass yield (kg per m3 in season); farm growth rate (% per day);
    - **Farming potential of green algae *Ulva intestinalis***: Indicators - farm biomass yield (kg per rope m in a month); farm growth rate (% per day);

  Method: Process-based modelling: Macroalgal growth models and Boosted Regression Trees are used to model the relationship between macroalgal growth yields and different environmental variables (Forsblom et al., 2022).

- Reared aquatic animals for nutrition, materials or energy:
    - **Farming potential of mussel *Mytilus trossulus*:** Indicators - farm yield value (tonnes wet weight per harvest); mussel length (cm);
    - **Farming potential of trout**: Indicator - Trout farm yield (tonnes weight per year); trout length (cm)

Method: Dynamic Energy Budget models for modelling mussel growth and the flows of nutrients in mussel farms (Forsblom et al., 2022).

- Wild animals (terrestrial and aquatic) for nutrition:
    - **Fish for food**: Indicator - Total catch of commercially important fish species (sprat, herring, flounder and cod) in open sea (tons, aggregated data from 2014 – 2022)

  Method: Data on fish landings from fishermen's fishery logbooks was processed with R Statistical Software to estimate the total value of fish landings in a grid cell per species (Veidemane et al., 2017).

Regulating services:

- Mediation of wastes or toxic substances of anthropogenic origin by living processes:
    - **Bioremediation by micro-organisms, algae, plants, and animals**: Indicator: Aquatic vegetation bioremediation potential on hard and soft bottoms (index 0…1)
    - **Filtration/sequestration/storage/accumulation by micro-organisms, algae, plants, and animals**: Indicators: Aquatic vegetation nutrient storage potential on hard and soft bottoms (index 0…1); Aquatic vegetation nutrient storage potential on hard and soft bottoms (index 0…1); Dreissena polymorpha population biodeposition (micrograms/hour, per m2); Mytilus trossulus biodeposition (micrograms/hour, per 20 mm individual); Mytilus trossulus population induced P and N flows (kg/km2, per yr); Mytilus trossulus population N sequestration (kg per km2 per yr)
- Regulation of baseline flows and extreme events:
    - **Control of erosion rates**: Indicator: Aquatic vegetation erosion protection potential on soft bottoms (index 0…1)
    - **Hydrological cycle and water flow regulation**: Aquatic vegetation flood protection potential on soft bottoms (index 0…1)
- Lifecycle maintenance, habitat and gene pool protection:
    - **Maintaining nursery populations and habitats**: Indicators: Aquatic vegetation habitat maintenance potential on hard and soft bottoms (index 0…1); Baltic flounder nursery areas, potential; Baltic flounder spawning areas, potential; Herring spawning areas, potential; Sprat spawning areas, potential; Pikeperch spawning areas, potential
- Water conditions:
    - **Regulation of the chemical condition of salt waters by living processes**: Indicator - Aquatic vegetation oxygen production potential on soft bottoms (index 0…1)
- Atmospheric composition and conditions:

- **Regulation of chemical composition of atmosphere and oceans:** Indicator - Aquatic vegetation carbon storage potential on hard and soft bottoms (index 0…1)

Methods: Modelling the service flow based on species distribution models (biomass) and aggregation and normalising aquatic vegetation data (Forsblom et al., 2022).

Cultural services:

- Physical and experiential interactions with the natural environment:
  - Characteristics of living systems that enable activities promoting health, recuperation or enjoyment through **active or immersive interactions and passive or observational interactions**.

  Methods: 1) Modelling of the service potential by a combination of spatial data on environmental conditions with public survey data on preferences of environmental variables for certain activities; 2) PPGIS survey on actual use of beach for recreation

- Intellectual and representative interactions with the natural environment
  - Characteristics of living systems that enable **education and training**
  - Characteristics of living systems that are resonant in terms of **culture or heritage**
  - Characteristics of living systems that enable **aesthetic experiences**.

  Methods: PPGIS survey on actual use of the beach for recreation

The next steps in the implementation of the DP will include the following:

- exploring additional data and possible modelling methods to assess provisioning services (potential of marine aquaculture) and fish stocks.
- further analysis of the survey data on the use of cultural services in coastal areas: i) to identify the environmental and behavioural factors that influence the choice of activity and location; ii) to link cultural services with well-being benefits.
- assessing possible impacts of planned sea use activities on marine and coastal ecosystems and services supply by using, e.g., PlanWise4Blue[5] or other cumulative impact assessment tools (Armoškaitė et al. 2023).

The results will be used to input proposals for updating Latvia's MSP and coastal plan.

9.7. Barriers to ES evidence uptake

- **Barrier 1:** scarcity of spatially explicit data on marine ecosystems, including species distribution and benthic habitats.

[5] https://gis.sea.ee/bluebiosites/

- **Barrier 2:** no spatially explicit information on the condition of marine ecosystems and lack of knowledge/methodology for linking marine ecosystem condition to ecosystem service supply.
- **Barrier 3:** lack of confidence/trust in existing models of marine ecosystem service supply
- **Barrier 4:** low awareness/understanding of the ecosystem service concept among developers and decision-makers.
- **Barrier 5:** The decision-making process often lacks transparency and is strongly influenced by developers' interests.

There are no formal barriers to integrating the ES evidence in the marine and coastal planning process. The initial ES mapping and characterisation were already included in the MSP of Latvia and applied to assess the impacts of proposed sea use solutions (Veidemane et al., 2017). Now, the consideration of ES evidence and climate change aspects in maritime spatial planning is required by governmental regulation. The DP will test the possibilities for uptake of the ES evidence in coastal planning; so far, it has been applied only in a few case studies.

However, the actual uptake of this information in decision-making on allocating sea space or licensing sea use activities is limited by several factors. First, the field data on the distribution of benthic habitats or ecosystem components essential for ES supply do not sufficiently cover Latvia's marine water. Still, they are limited to already established protected areas or the investigation areas for new MPAs (see Figure 5). Also, the assessment of marine ecosystem condition is not spatially explicit – it is based on the MSFD environmental status assessment, which provides values on the level of two sub-basins of Latvian marine water (the Gulf of Riga and the Baltic Proper). No methodology so far has been established in Latvia for linking marine ecosystem condition with ecosystem service supply. ES models developed by Tartu University (Estonia) cover all the marine waters of Latvia (and provided by the DP for the interim evaluation of the MSP). These model results could potentially be used to inform the decision-making on the allocation of space for specific sea uses, e.g., marine aquaculture (based on the potential of the service supply) or offshore wind parks (by identifying ES hot-spot areas to be preserved/avoided). The modelling results on marine aquaculture potential are limited only to environmental factors, not considering the socio-economic aspects necessary to establish aquaculture farms.

The uptake of the ES evidence is also limited by low awareness and understanding of this information among developers and decision-makers. Including this information in the official requirement for the environmental impact assessment procedure will be necessary.

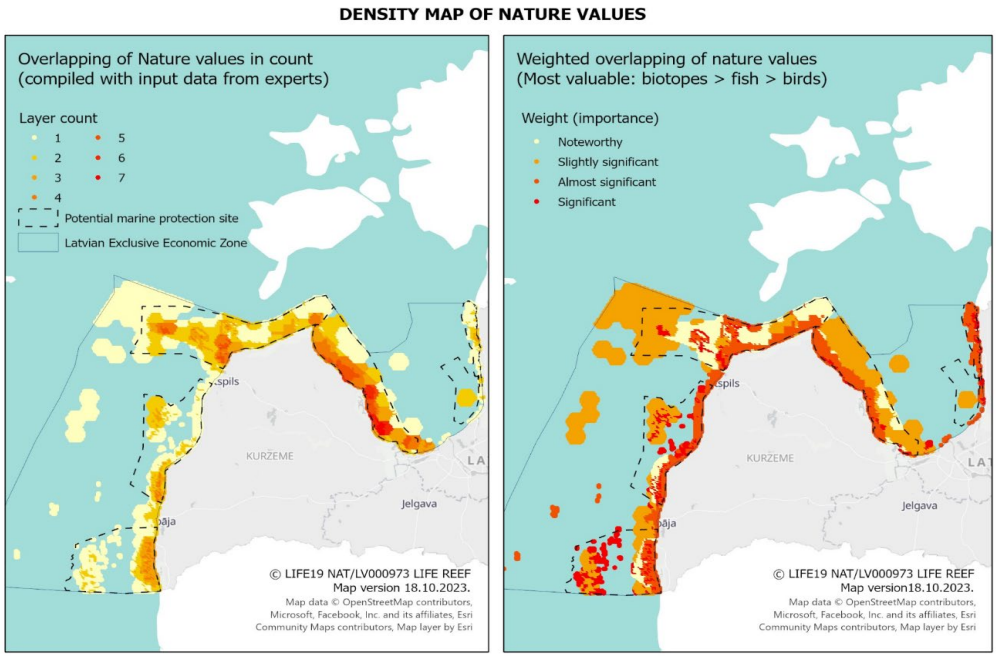


Figure 9.8. *Density maps of nature value. Source: Nature Conservation Agency, LIFE REEF project (situation in November 2023)*

Acknowledgements

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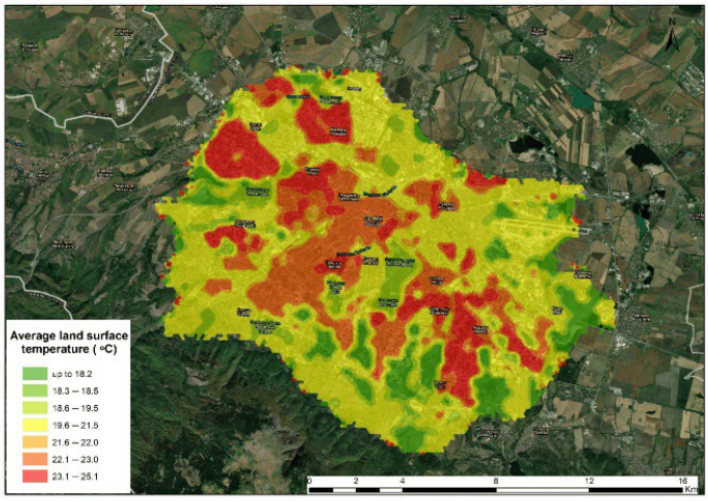
DP08 Urban masterplan of Sofia municipality (Bulgaria)

- Forests
- Agroecosystems
- Heath and grasslands
- **Urban**
- Wetlands
- Rivers and lakes
- Marine ecosystems



DP08 is a hybrid Demonstration Project whose activities are not part of Task 8.1 and WP8. DP leads have voluntarily provided this information to fill in the factsheet.

The *Urban masterplan of Sofia Municipality* and the *Adapted national methodology for mapping and biophysical assessment of ecosystem services for the Municipality of Sofia* (under development)

MAIN TOPICS

- Innovative GIS-based analytic tool for supporting the decision-making processes in urban and spatial planning (to make more informed decisions on urban design and planning to mitigate for urban heat islands)
- Methodology for the mapping and assessment of the ecosystem service of regulation of temperature and humidity, including ventilation and transpiration
- Effects of urban heat island in the city of Sofia

STAKEHOLDERS

- Public sector
- Research and education
- NGOs and civil society
- Private sector and industry

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

DP09 Zoning plan for Grønlikaia, Oslo (Norway)

- Forests
- Agroecosystems
- Heath and grasslands
- **Urban**
- Wetlands
- Rivers and lakes
- Marine ecosystems

DP09 is a hybrid Demonstration Project whose activities are not part of Task 8.1 and WP8. DP leads have voluntarily provided this information to fill in the factsheet.

Development of the zoning plan for Grønlikaia

MAIN TOPICS

- Monitoring of design of water solutions and green areas
- Digital 3d-model with architecture and green areas that is under planning

STAKEHOLDERS

- **Public sector**
- **Research and education**
- **NGOs and civil society**
- **Private sector and industry**

STAGES OF THE CYCLE TO BE COVERED DURING THE PROJECT

PART 3

12. Summary overview of the Demonstration projects

As observed in the preceding sections, the decision-making context of the seven public DPs and the two hybrid DPs integrated into this Deliverable cover a diverse spectrum of policy initiatives, with the primary focus being spatial planning and management.

Concerning the scale of the decision-making context, four DPs will focus on the integration and execution of National policies. Additionally, the same number of DPs will concentrate on relevant policies at the local level, while only one DP will explore policies operating at the regional level.

Regarding the current standing of the DPs within the policy cycle, the majority are either at the policy formulation stage, where the objectives and structure of policies are being defined or at the policy implementation stage. One DP (Latvia) is engaged in two stages within the cycle: the implementation of marine spatial planning and coastal public infrastructure policies and their evaluation phase.

Considering the anticipated stages to be covered, most DPs (five out of nine) aim to progress to the policy implementation stage. This phase involves the actual execution and enforcement of the policy proposal. Only one DP (Bosland) expressed interest in advancing to policy evaluation, which involves monitoring and assessing the efficiency of the implemented policy.

The DPs from the public sector are currently covering a wide array of ecosystem types. Four DPs will specifically focus on multiple ecosystems and five will concentrate on specific categories, with three DPs targeting urban areas. Concerning the ecosystem services that will be assessed, all projects will cover more than one category according to existing classifications.

Finally, the central focus of all projects is mapping and assessing both ecosystem condition and ecosystem services. Regarding the latter, all the DPs analysed have expressed interest in concentrating on ES supply. However, the DPs of Trento, Bosland, Reunion Island, and Latvia will potentially focus on ES demand. Two of the nine analysed DPs will also prioritise ecosystem services accounting as their primary focus.

A summary outlining the principal findings of the DP's decision-making contexts is presented in Table 12.1

Table 12.1. *Overview of the decision-making context of the analysed DPs*

DP	Scale	Decision-making	Current standing in the policy cycle	Expected standing in 5 years	Ecosystem Types	Ecosystem Services addressed**	Mapping and assessment of EC	Mapping and assessment of ES and/or disservices	Ecosystem accounting
Spain	National	National Strategy for Green Infrastructure and Ecosystem Restoration	Formulation	Implementation	-Forest -Agroecosystems -Heath and grassland -Urban -Wetlands	Food and fibre provision *(A)* Water purification *(H)* Carbon storage Pollination Water flow regulation *(H)* Erosion control Recreation *(AR)* Aesthetic experience *(AR)*	✓	✓	✗
Lithuania	National	Comprehensive Plan of the Territory of the Republic of Lithuania	Implementation	Implementation	-Agroecosystems	Water flow regulation *(H)* Erosion control Carbon storage Food provision *(A)*	✓	✓	✓
Trento	Local	Urban Greening Management Plan	Agenda setting	Formulation	-Urban	Microclimate regulation *(C)* Carbon Storage Air quality regulation *(C)* Water flow regulation *(H)* Recreation *(AR)*	✓	✓	✗
Bosland	Local	Bosland National Park	Adoption	Evaluation	-Forest -Agroecosystems -Heath and grassland -Urban -Wetlands -Rivers and lakes	Tourism *(AR)* Recreation *(AR)* Water flow regulation *(H)* Water purification *(H)* Wood provision *(A)* Microclimate regulation *(C)*	✓	✓	✗
Reunion Island	Regional	Marine and terrestrial Spatial Planning	Formulation	Implementation	-Forest -Agroecosystems -Urban -Marine	Food provision *(F)* Water purification *(H)* Water flow regulation *(H)* Carbon sequestration *(C)* Erosion Control Aesthetic Experience *(AR)* Recreation *(AR)*	✓	✓	✓
Switzerland	National	Swiss Energy Strategy 2050 and Energy perspectives 2050+	Formulation	Implementation	-Forest -Agroecosystems -Heath and grasslands -Wetlands	Biodiversity conservation Recreation *(AR)* Aesthetic experience *(AR)*	✓	✓	✗
Latvia	National	Maritime and Coastal Spatial Planning	Implementation and evaluation	Formulation	-Marine	Food provision *(F)* Water purification *(H)* Erosion control Water flow regulation (H) Biodiversity protection Carbon storage Recreation *(AR)* Education *(AR)* Aesthetic experience *(AR)* Cultural Heritage *(AR)*	✓	✓	✗
Sofia	Local	Urban Masterplan	Agenda setting	Formulation	-Urban	Microclimate regulation *(C)* Water flow regulation *(H)*	✓	✓	✗
Oslo	Local	Zoning Plan	Implementation	Implementation	-Urban	Microclimate regulation *(C)* Recreation *(AR)*	✓	✓	✗

*** Matching with SELINA's WP4 ES groups where A = Agriculture & forestry provision; AR = Amenity & Recreation; C = climate & air quality related ES; F = Fisheries, aquaculture & marine provisioning ES; H = Hydrology / water quality related*

13. Next steps

As outlined in the introduction, Deliverable 8.1 concentrates on comprehending the decision-making contexts of seven public and two hybrid DPs. To this purpose, a transdisciplinary approach has been proposed to foster productive collaboration between experts and diverse stakeholders. Moreover, the insights gained will be the foundation for subsequent Tasks 8.2 and 8.3, scheduled for completion by Month 36 (Figure 13.1).

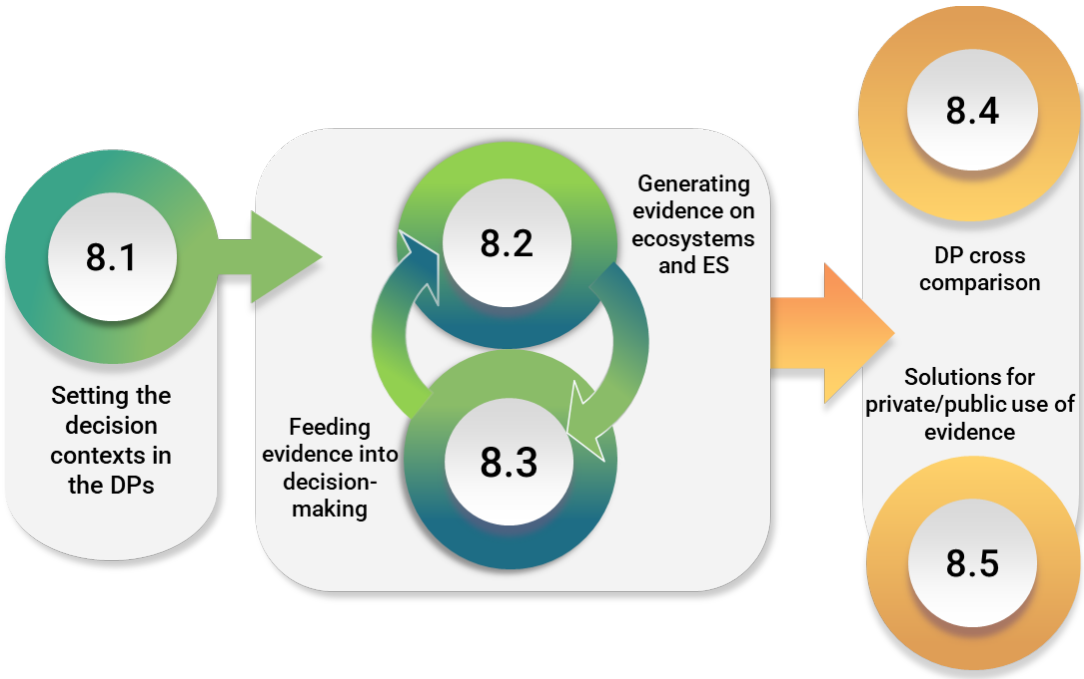


Figure 13.1. *Overview of SELINAS WP8 Tasks*

Task 8.2 is expected to happen in close collaboration with SELINA's WP3-6, thus aligning efforts to select methodologies, indicators and conduct relevant analyses on BD, EC and ES-related information. This coordination will lead to a more informed choice of methods and will aid in connecting expertise across different Tasks within SELINA.

Simultaneously, Task 8.3 will engage in two distinct sets of activities. First, a process-oriented approach will focus on effectively integrating scientific evidence into the decision-making processes described in this document. Second, analytical tasks will use scientific data to meet decision-maker needs and explore policy alternatives through biodiversity, EC and ES-related information.

The coordination between Tasks 8.2 and 8.3 underscores SELINA's commitment to bridging the gap between scientific knowledge and decision-making. Ultimately, the policy contexts delineated in this Deliverable and the subsequent Tasks of WP8 are pivotal in fostering adaptive and evidence-based outcomes to address the existing challenges of environmental public decision-making.

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https://project-selina.eu/

Annex

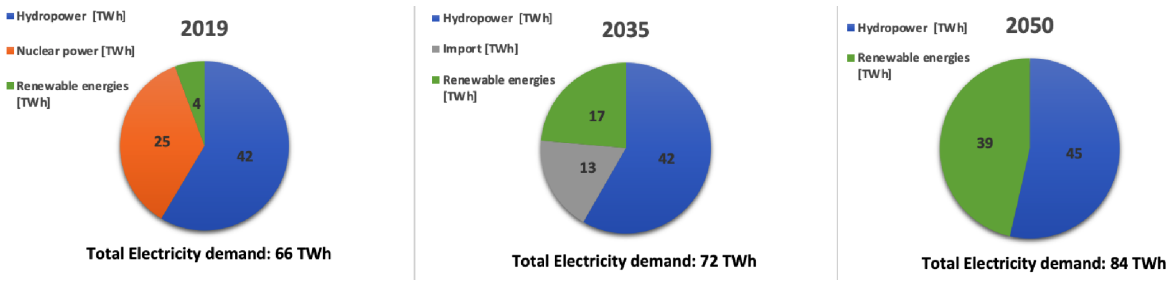
A1: List of Acronyms (Reunion Island)

Acronym	Full name
AGORAH	Agency for the observation of Réunion, Planning and Housing
CITEB	Technological resource centre for aquaculture, fishing, marine biotechnologies, risks assessment and environmental impacts
CSR	Shark Security Centre
DEAL Réunion	Department of Environment, Planning and Housing (DEAL)
DMSOI	Direction of the South Indian Ocean Sea (DMSOI)
DSBM	Maritime basin strategic document
ESD	Ecosystem services and disservices
NEXA	Regional Agency for Development, Investment and Innovation
PNA Papangue	National Management/Action Plan for the Papangue (Circus maillardi)
SAR	Regional Spatial Land Development Plan
SEOR	Society for Ornithological Studies of Reunion Island.
SMVM	Regional Spatial Sea Development Plan
UMR AMURE	Management of uses of resources and marine and coastal spaces (lab)
UMR ESPACE-DEV	Space observation, Models & Socially Involved Sciences (lab)
UMR PVBMT	Plant Communities and Biological Invaders in Tropical Ecosystems (lab)

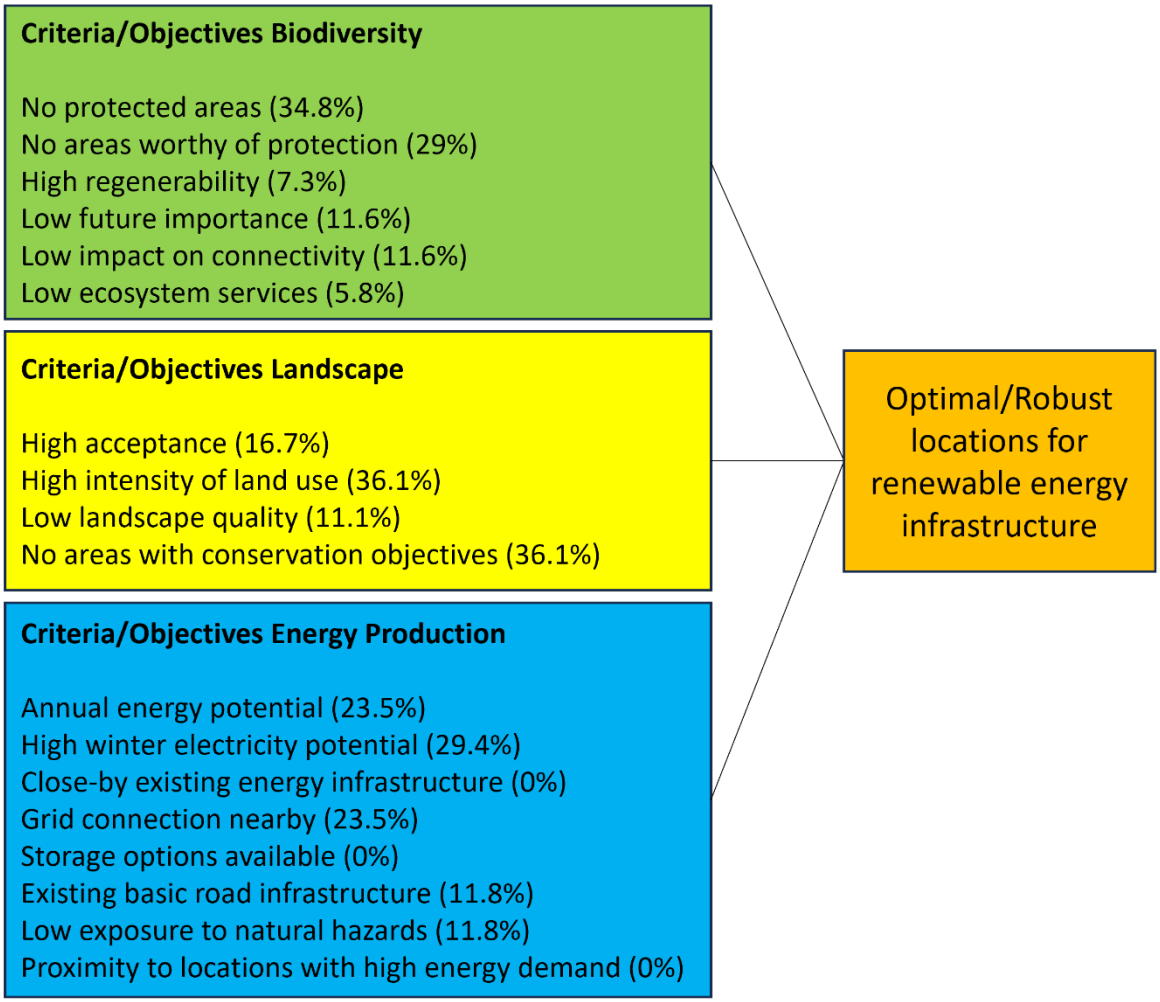
A2: List of Meetings (Reunion Island)

Date	Duration (h)	Thematic/entry point	Place	Participants	Intitutions	Unit	Function (may not reflect the exact position)	Marine	Terrestrial
29 Sept. 2022	1	DP strategy	NEXA, Saint-Denis	Dr Philippe HOLSTEIN	NEXA		Unit officer	(x)	x
29 Sept. 2022	1	DP strategy	NEXA, Saint-Denis	Dr Cathleen CYBELE	NEXA		Project officer	(x)	x
17 Nov. 2022	1	Bird conservation	MOKA, Saint-Denis	Dr Steve AUGIRON	SEOR		Project Officer		
				Dr Capucine CROSNIER	DEAL	Biodiversity unit	Unit officer		x
				Dr Marc SALAMOLARD	National Park	Fauna unit	Officer		
25 Nov. 2022	3	Shark risk	CSR, Saint-Leu	Willy CAIL	CSR		Director	x	(x)
				Michael HOARAU	CSR		Vice-director		
1 Dec. 2022	5	DSBM	University of La Réunion (SEAS-OI), Saint-Pierre	Jerome LAFFONT	Direction of the South Indian Ocean Sea (DMSOI)		Vice-director		
				Pr Denis BAILLY	University of Brest/CMUB	UMR AMURE	Researcher/Project officer	x	
				x 20	20 stakeholders from the French Indian Ocean islands		Diverse		
25 Jan. 2023	2	SAR/SMVM	Regional councile of La Réunion, Saint-Denis	Pr Wilfried BERTILE	Regional councile of La Réunion	SAR/SMVM unit	Elected representative in charge of the SAR/SMVM		
				Didier AUBRY	Regional councile of La Réunion	SAR/SMVM unit	Unit director		
				Marie-Pierre NEHOUA-NATIHA	Regional councile of La Réunion	SAR/SMVM unit	Project officer	(x)	x
				Dr Philippe HOLSTEIN	NEXA		Unit officer		
				Dr Daniel DAVID	AGORAH		Director		
6 feb. 2023	1	DP strategy	NEXA, Saint-Denis	Dr Cathleen CYBELE	NEXA		Project officer		
				Dr Philippe HOLSTEIN	NEXA		Unit officer	(x)	x
				Ina SIEBER	Univ. Hannover		Researcher		
6 Feb. 2023	1	DP strategy	NEXA, Saint-Denis	Jean-Fabrice VANDOMEL	NEXA	Director	Director	(x)	x
				Dr Cathleen CYBELE	NEXA		Project officer		
14 Feb. 2023	1	DP strategy	University of La Réunion, Saint-Denis	Pr Dominique STRASBERG	University of La Réunion	UMR PVBMT	Researcher	(x)	x
				Dr Philippe HOLSTEIN	NEXA		Unit officer		
24 Feb. 2023	2	DP strategy	University of La Réunion (SEAS-OI)	Pr Rodolphe DEVILLERS	University of La Réunion	UMR ESPACE-DEV	Researcher	(x)	x
				Dr Christophe REVILLION	University of La Réunion	UMR ESPACE-DEV	Researcher		
13 Sept. 2023	2	SMVM/Blue Economy	Regional councile of La Réunion, Saint-Denis	Dr Maya CESARI	Regional councile of La Réunion	Blue economy unit	Elected representative in charge of the Blue economy		
				Caroline QUOD	Regional councile of La Réunion	Blue economy unit	Unit officer		
				Candida ALDEHUELO	Regional councile of La Réunion	OCT/OR cooperation unit	Unit director		
				Dr Jean TURQUET	Regional councile of La Réunion	CITEB	Director	x	
				Yéléna LAFORCE-CADOT	Blue Institute (NGO)		Project officer		
				Pr Patrick MAVINGUY	University of La Réunion	Presidency	Vice-president in charge of research		
				Dr Anna SZEGVARI-MAS	University of La Réunion	International relations unit	Project officer		
10 Oct. 2023	1	Marine wind energy	On-line	Nathalie ETHEVE	SPL HORIZON		Project officer	x	
2 Nov. 2023	2	DSBM	DMSOI, Le Port	Nicolas LE BIANNIC	Direction of the South Indian Ocean Sea (DMSOI)		Director		
				Robert MAUVE	Direction of the South Indian Ocean Sea (DMSOI)		Officer	x	
				Pr Denis BAILLY	University of Brest/CMUB	UMR AMURE	Researcher/Project officer		
				Dr Joanna KOLASINSKY	University of La Réunion	International relations unit	Project officer		

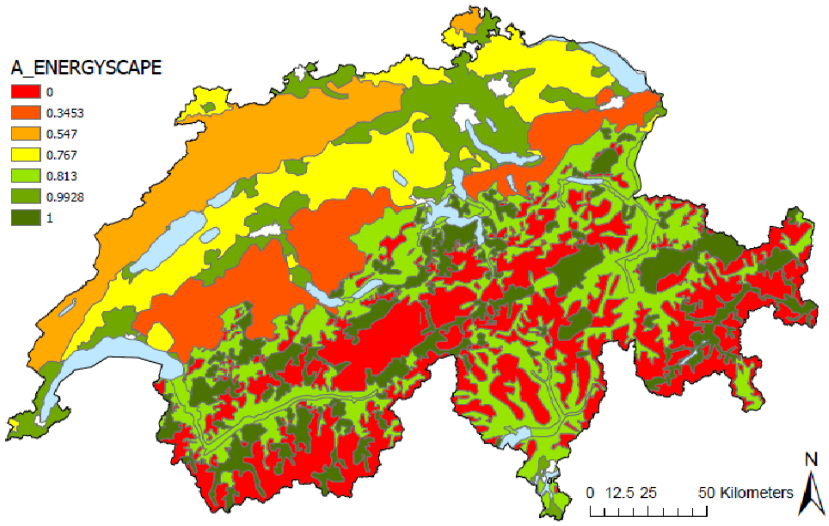
A3: The Swiss Electricity production from different technologies and the demand based on the Zero Base Scenario from Energy perspectives 2050+ (BFE, 2020) (Switzerland)



A4: The main criteria biodiversity, landscape and energy and their sub-categories (Schell et al. 2023) with expert-based weights in % (Switzerland)

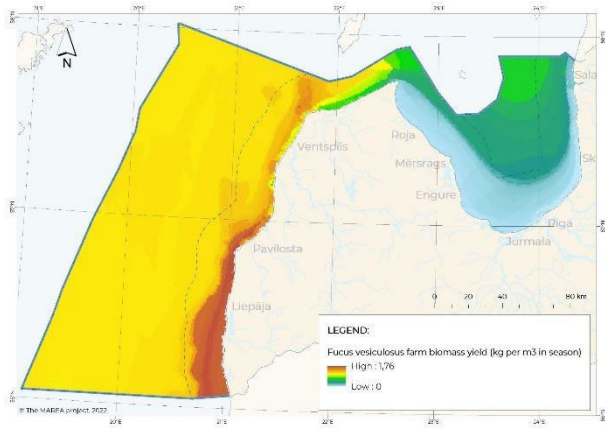


A5: Based on the Energyscape project this map indicates acceptance of REIs in different landscape types (https://energyscape.ethz.ch/). Areas in red depict low acceptance of REIs. Areas in green indicate higher acceptance (Switzerland)

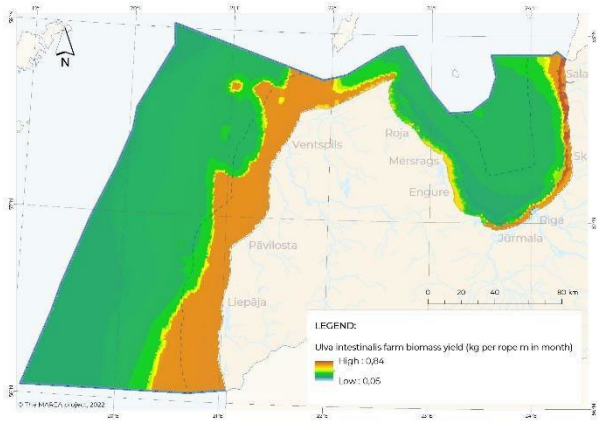


A6: Examples of ecosystem service maps provided to the Interim evaluation report of MS (Latvia)

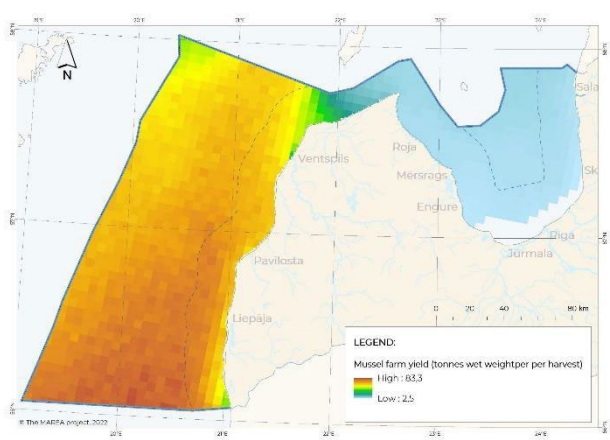
Provisioning services:



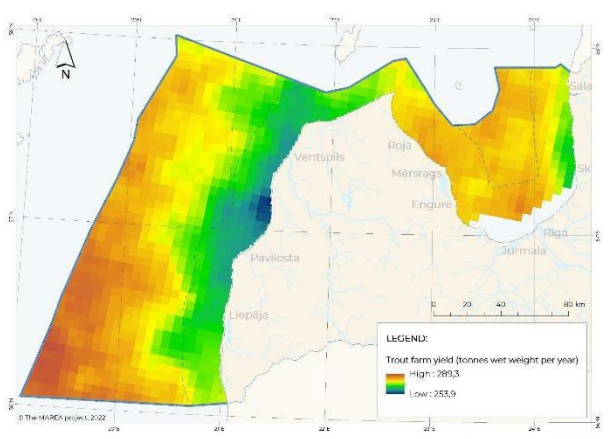
1.1.2.1. Farming potential of *Fucus vesiculosus:* farm biomass yield (kg per m3 in season)



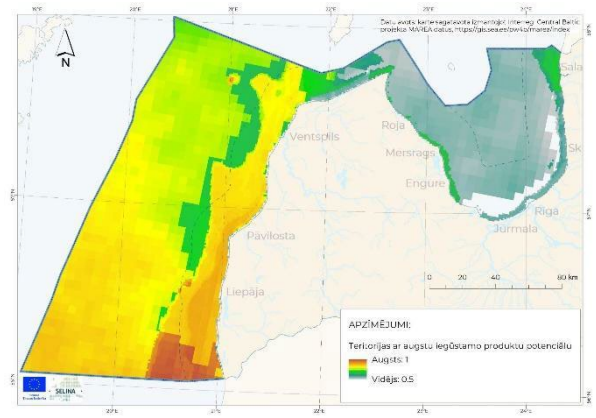
1.1.2.1. Farming potential of *Ulva intestinalis:* farm biomass yield (kg per rope m in month)



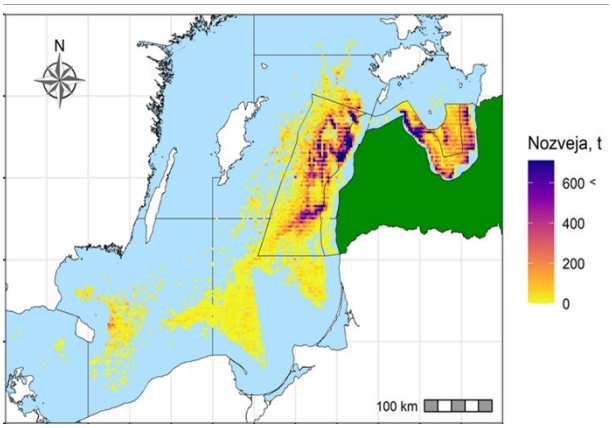
1.1.4.1. Farming potential of *Mytilus trossulus*: farm yield value (tonnes wet weight per harvest)



1.1.4.1. Farming potential of trout: farm yield (tonnes weight per year)

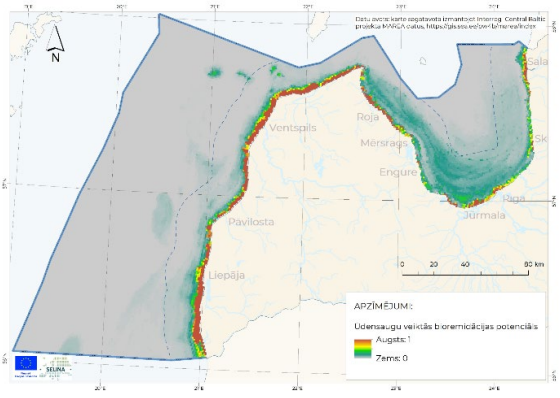


Aggregate map of areas with high aquaculture potential (hot spots)

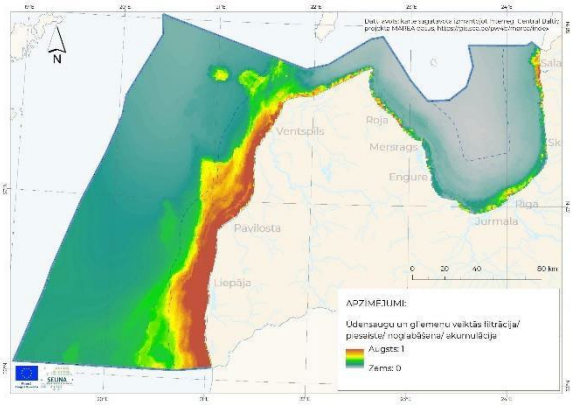


1.1.6.1. Fish for food: Total catch of commercially important fish species (tonnes 2014 – 2022)

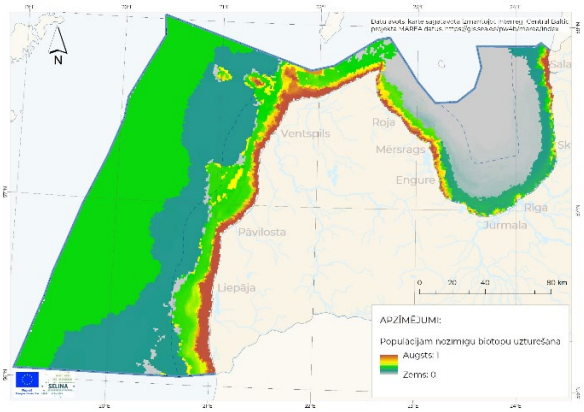
Regulating services:



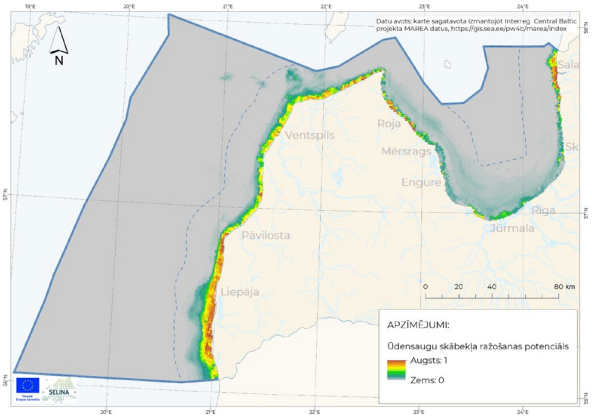
2.1.1.1. Aquatic vegetation bioremedation potential on hard and soft bottoms (index 0…1)



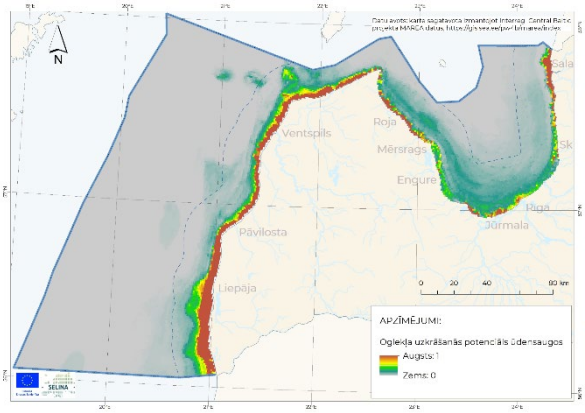
2.1.1.2. Filtration/sequestration/storage/ accumulation by aquatic vegetation and mussels: Aggregate map



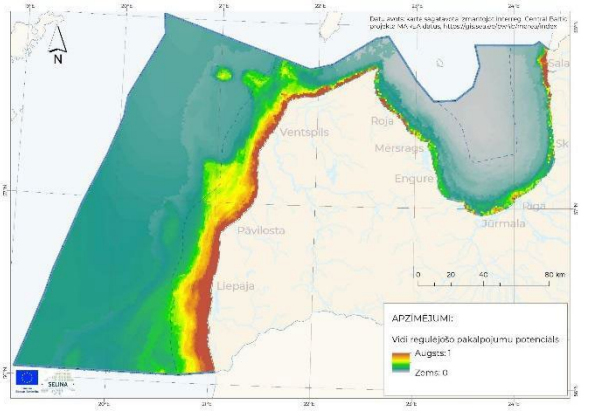
2.2.2.3. Maintaining nursery populations and habitats: Aggregated map



2.2.5.2. Regulation of the chemical condition of salt waters by living processes: Indicator - Aquatic vegetation oxygen production potential on soft bottoms (index 0…1)

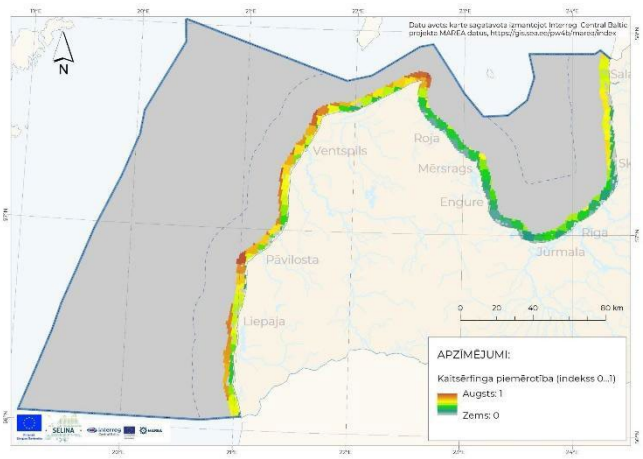


2.2.6.1. Regulation of chemical composition of atmosphere and oceans: Aquatic vegetation carbon storage potential on hard and soft bottoms (index 0…1)

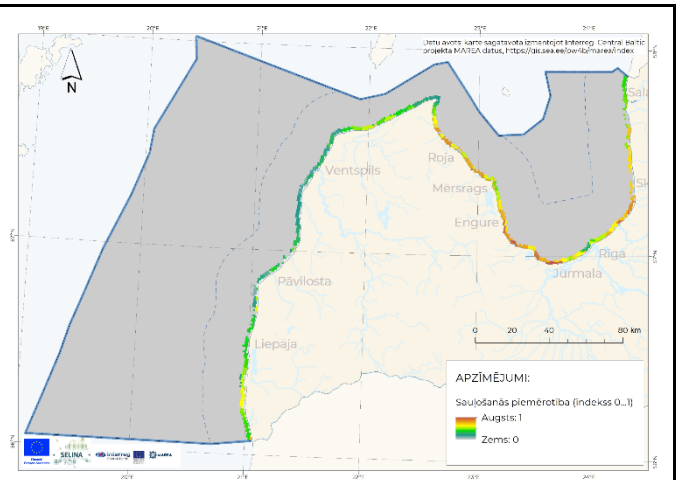


Aggregate map of regulating service potential

Cultural services

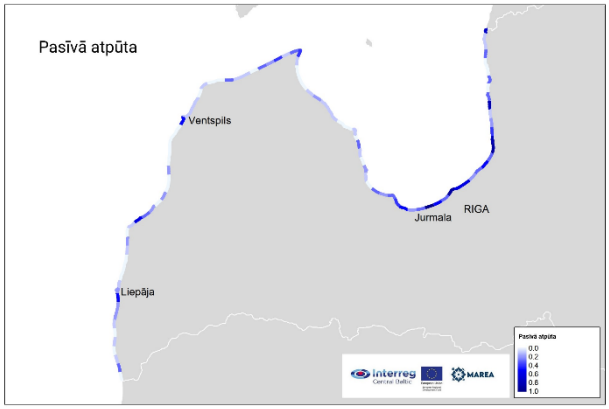


3.1.1.1. Characteristics of living systems that enable **active or immersive interactions - kitesurfing:** modelling results (index 0…1)

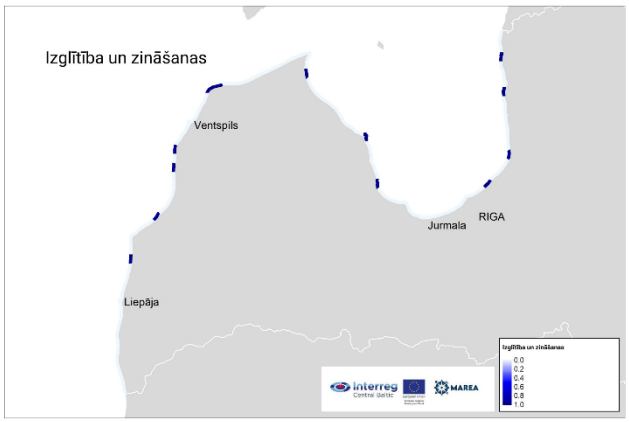


3.1.1.2. Characteristics of living systems that enable **passive or observational interactions - sunbathing:** modelling results (index 0…1)

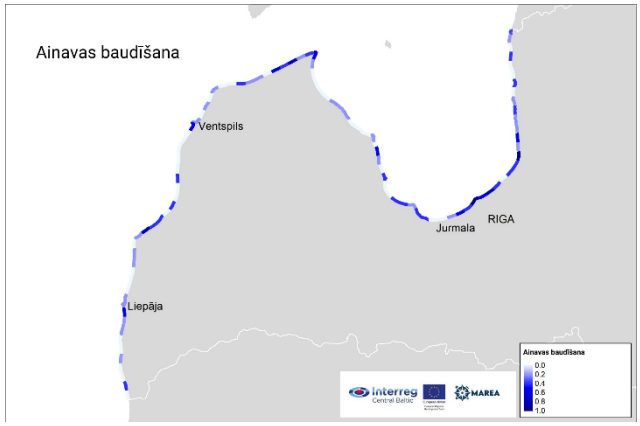
3.1.1.1. Characteristics of living systems that enable **active or immersive interactions:** survey results



3.1.1.2. Characteristics of living systems that enable **passive or observational interactions:** survey results

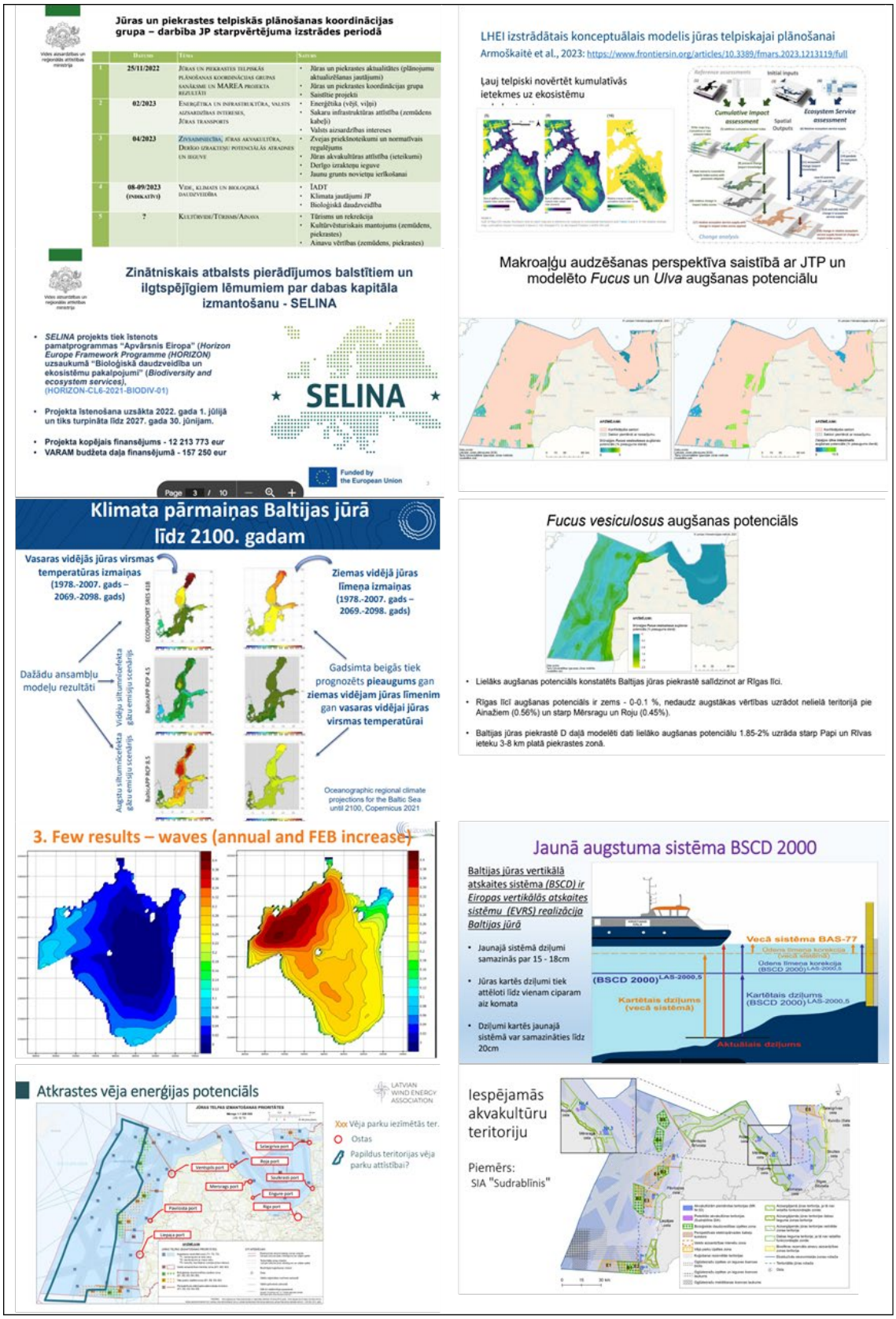


3.1.2.1./3.1.2.2. Characteristics of living systems that enable **education and training:** survey results



3.1.2.4. Characteristics of living systems that enable **aesthetic experiences:** survey results

A7: Insight into the topics discussed in Coordination Group meetings. Source: MoEPRD (Latvia)



A8: Links to Coordination Group meetings materials:
https://www.varam.gov.lv/lv/juras-un-piekrastes-telpiskas-planosanas-koordinacijas-grupa-no-2022g
https://www.varam.gov.lv/lv/prezentacijas-uc-materiali
https://drive.google.com/file/d/1QW7Tys0xbtzWjMTFBkivswthJ2K1qxMD/view

A9: Links to CoP (Community of Practice) meetings materials:
https://www.bef.lv/sadarbibas-kopienas-1-seminara-materiali/
https://www.bef.lv/wp-content/uploads/2023/06/08_Sadarbibas-kopienas-uzdevumi-un-parmainu-iedigli_A.Ruskule.pdf