MERLIN

Deliverable D4.7: Cross Sectoral Routemap for Mainstreaming Freshwater Nature-based Solutions in Europe

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Imprint

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MERLIN Key messages

1. This deliverable highlights the roles played by economic Sectors (groups of actors focussed on similar set of products or services) in implementing freshwater Nature-Based Solutions (NbS).
2. In this deliverable, NbS cover natural water retention measures (or sponge landscapes); peatland and wetland restoration; floodplain restoration and reconnection and removal of barriers to free-flowing rivers. These measures are relevant to the forthcoming Nature Restoration Plans, Water Resilience Strategy and Climate Adaptation and Resilience Initiative.
3. From an analysis of the MERLIN project and other examples of good practice, we have identified 19 different economic Sectors relevant to freshwater restoration. These can be different institutional types (e.g. public bodies, for profit companies, NGO organisations).
4. The focus is on 'cross-Sectoral working' (coordination between these different Sectors) so that those benefitting from the NbS support those implementing the measures or managing the land on which they are situated.
5. Cross-Sectoral working implements the EU integration principle and helps protect our environment through illustrating the risks to Sectors (from increased pressures on water quality and quantity) and benefits that could arise for business as well as society if appropriate NbS are supported through cross-Sectoral working.
6. To reach the vision of NbS becoming part of all relevant policies, plans and practices by 2050, the deliverable proposes five strategic actions that can encourage more uptake of measures, illustrating what to maintain, what to create and what to disrupt.
7. These actions are:
    - Legal & Regulatory actions (see recommendations Section 6.2)
    - Values & Attitudes (see recommendations Section 6.3)
    - Knowledge & Innovation (see recommendations Section 6.4)
    - Economic & Financial (see recommendations Section 6.5)
    - Collaborative Institutions (see recommendations Section 6.6)
8. The Routemap builds on specific guidance on how our six focal Sectors (Agriculture, Hydropower, Insurance, Navigation, Peat Extraction and Water Supply & Sanitation) can support the mainstreaming of NbS and lessons from the MERLIN case studies.

MERLIN Executive Summary

Transformative change requires that all public and private water users and managers across multiple economic Sectors work together to align economic activities with freshwater restoration. Using the Nature-based Solutions (NbS) approach, we highlight how measures such as natural water retention measures or sponge landscapes; peatland and wetland restoration; floodplain restoration and reconnection and the removal of barriers to free-flowing rivers can be used to resolve societal challenges. We illustrate how such approaches can help safeguard risks to ongoing economic activities whilst improving the economic opportunities arising from a 'nature-positive' economy.

This Routemap captures what MERLIN has learned about making cooperation between Sectors work in practice, providing a foundation for scaling up NbS and achieving the ambitions of the European Green Deal. The Routemap follows a logical progression from challenge to action and is relevant to those working with the following EU policies: Water Framework Directive (WFD), Nature Restoration Regulation (NRR), Common Agricultural Policy (CAP) and the Climate Change and Adaptation Policies.

Section 1 - Introduction (p 11 – 15): explains the focus on types of NbS and the 19 different economic Sectors that are, or could be, involved in their implementation. The focus is on mainstreaming – getting NbS considered as part of everyday practice – across all relevant Sectors through the promotion of cross-Sectoral working by regional, national and European enabling institutions.

Section 2 -Routemap Start Point (p 16 – 24): The Need for Change: examines the pressures driving freshwater degradation, the potential of NbS to address economic and environmental needs, the current policy context and opportunities; and the five strategic actions that can support mainstreaming of freshwater NbS.

Section 3 - Future Vision (p 25 – 26): presents a shared vision for cross-Sectoral working that mainstreams freshwater NbS across Europe. The vision for 2030, 2040 and 2050 illustrates some immediate policy windows and some longer-term actions involving shifting societal expectations that can take time to address.

Section 4 – Examples of Cross-Sectoral Working from MERLIN (p 27 – 56): highlights lessons from four different MERLIN case studies from Northern and Southern Europe, demonstrating successful cross-Sectoral working in small streams (CS17 Forth basin) and large rivers (CS04 Room for the Rhine, CS09 Tisza rewetting and CS08 Danube reconnection).

Section 5 – Opportunities to Mainstream Cross-Sectoral Working (p 56 – 66): has two main messages – the importance of the agricultural Sector and the existing opportunities to support cross-Sectoral actions. The Section illustrates the importance of Agriculture to the implementation of the freshwater NbS and highlights the opportunities arising from the different farm types and economic characteristics across Europe. It also summarises the state of play across Europe of the five strategic actions:

- **Legal & Regulatory**: to align legislative frameworks, enforce existing regulations and ensure the EU integration principle (Treaty of the Functioning of the European Union Art. 11) is operationalised across Sectors
- **Values & Attitudes**: to promote a cultural shift toward cooperation and shared stewardship of water.
- **Knowledge & Innovation**: to provide data, research, and technical support for evidence-based NbS design and implementation.
- **Economic Incentives**: to create incentives and funding models that reward long-term ecosystem benefits.
- **Collective Action**: to support place-based initiatives that connect Sectors, integrating these efforts with more formal cross-policy approaches in national and European institutions to build long term, open communities of practice.

Section 6 – Recommendations (p 66 – 76): provides actionable guidance for policymakers, Sectoral associations and organisations, by setting out recommendations for upcoming policy developments, including Water Dialogues and the Water Resilience Strategy, National Restoration Plans, River Basin Management Plans, Climate Adaptation and Resilience Initiative and proposed funding structures under the next Multi-annual Financial Framework. The guidance aims to keep all relevant Sectors engaged, and to embed cross-Sectoral thinking in all levels of European policies.

The Routemap builds on the work done with the six focal MERLIN Sectors to build their Sectoral pathways to transformation. It highlights the common issues of the need to share the burden and benefits of implementing NbS, to break down policy silos and to enable long term public and private financing. It recognises that widening involvement to include a range of different economic Sector interests is not easy but is essential for long-lasting transformations of how we work with nature under a changing climate.

Content

List of abbreviations

Abbreviation	Meaning
CAP	Common Agricultural Policy
CS	Case Study
CSP	CAP Strategic Plan
CBD	Convention on Biological Diversity
CBA	Cost–Benefit Analysis
CoP	Community of Practice
CRCF	Carbon Removals and Carbon Farming
DG AGRI	Directorate-General for Agriculture and Rural Development
DG CLIMA	Directorate-General for Climate Action
DG ENV	Directorate-General for Environment
DG RTD	Directorate-General for Research and Innovation
EAP	Environmental Action Programme
EBRD	European Bank for Reconstruction and Development
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESP	European Scalability Plan
FADN	Farm Accountancy Data Network
FRMP	Flood Risk Management Plan
FSDN	Farm Sustainability Data Network
GBF	Global Biodiversity Framework
GD	Green Deal
GHG	Greenhouse Gas
HD	Habitats Directive
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPPC	Integrated Pollution Prevention and Control
JHI	James Hutton Institute
JTF	Just Transition Fund
LIFE	LIFE Programme (EU Environment and Climate Action Programme)
MFF	Multiannual Financial Framework
MERLIN	Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation
MS	Member State
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategy and Action Plan
NECP	National Energy and Climate Plan
NGO	Non-Governmental Organisation
NRP	National Restoration Plan
NRR	Nature Restoration Regulation
NWRM	Natural Water Retention Measure
RBMP	River Basin Management Plan
REA	European Research Executive Agency
RSP	Regional Scalability Plan
RT	Roundtable

SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
TFEU	Treaty on the Functioning of the European Union
UAA	Utilised Agricultural Area
WFD	Water Framework Directive
WRS	Water Resilience Strategy
WWF	World Wide Fund for Nature

Glossary

Term	Definition or explanation
Community of Practice (CoP)	This is a group of people who share common concerns and challenges and interact to build common solutions (Wenger, 1998).
Cross Sectoral working	Coordination or collaboration between different **economic** Sectors to achieve a common goal.
Economic Sector	The Statistical Classification of Economic Activities in the European Community (NACE) is a standardized framework used to classify economic activities within the European Union (EU) (European Union, 2025).
(Ecological) restoration	The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration, 2004).
Freshwater ecosystems	"The living organisms and non-living materials of an Inland aquatic environment." (European Environmental Agency, 2025) including "lakes and ponds, reservoirs, rivers, streams, springs, wetlands including swamps, peat, and other vegetated wetlands." (Dickens et al., 2022).
Governance	How decisions are made by both government and other types of stakeholders – both in terms of what should be done and how it should be implemented (OECD, 2015).
Integration Principle	"Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development." (European Commission, 2016). This specific article of the European primary law (Treaty on the Functioning of the European Union – TFEU) calls for a permanent, continuous "greening" of all Community policies, however article 11 does not give priority to environment over other requirements, rather, the different objectives of EU law rank at the same level and the policy must endeavour to achieve all of them. (Krämer, 2007)
Land sharing	Land management that combines economic production with conservation (Fischer et al., 2014).
Land sparing	Land management that separates land managed for conservation and land managed for economic (normally agricultural) production (Fischer et al., 2014).
Mainstreaming	Normalizing ideas considered common in one domain, into other domains, to build shared understandings and concerted actions (Scott et al., 2022).
Nature-based Solutions (NbS)	UNEP definition accepted by the UNEA-5 resolution: Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits (UNEP, 2022).
Partnership working	Making and sustaining connections between two or more separate groups, working together to achieve a common goal (Wildridge et al., 2004).
(Public) Policy	A term covering a range of formal statements of intent (when public policy, they represent the outcome of a democratic process and are implemented by governments). Policies may be laws or regulations; strategies; or statements. A policy is generally enacted by policy instruments (Araral et al., 2012).

Policy Coherence	This refers to ensuring that there is alignment between objectives, instruments and implementation; and/or between different policy objectives or multiple policy instruments, so that together multiple policies can pull together to achieve common goals (Blackstock et al., 2023).
Social innovation	New ideas to meet social needs and create new social relationships (European Commission, 2020b)
Stakeholder engagement	A broad term, referring to any work to communicate or collaborate with stakeholders: encompassing anything from informing stakeholders through to fully involving and empowering them as part of the project team (Ibrahim et al., 2025b).
Transformation	"a fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values, needed for the conservation and sustainable use of biodiversity, good quality of life and sustainable development", according to IPBES (2019, p. 889)
Upscaling	Implementing restoration and Nature-based Solutions at larger scales, to make larger contributions to tackling problems (Battrup-Pedersen et al., 2025).

1. Introduction

Transformative change requires that all public and private water users and managers— across multiple economic Sectors - work together to align economic activities with ecological restoration. This Routemap captures what MERLIN has learned about making such cooperation work in practice, providing a structured and strategic foundation for mainstreaming Nature-based Solutions by integrated and multi-level governance to achieve the ambitions of the European Green Deal. The focus on the different roles for **economic Sectoral stakeholders** complements other strategic reports also seeking transformative action across Europe (Battrup-Pedersen et al., 2025).

1.1 Context and Rationale

Europe's freshwater ecosystems are under growing pressure from the interlinked crises of climate change, biodiversity loss, and socio-economic instability (European Environment Agency, 2024a). These challenges—described by the European Environment Agency as a global polycrisis (European Environment Agency, 2024c) threatens the foundations of our water, food, and energy systems. To address these interdependencies, the European Green Deal (EGD) and the Water Resilience Strategy (European Commission, 2025c) call for integrated, cross-Sectoral action at landscape scale.

The Horizon 2020 MERLIN project ("Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation") responded to this call by demonstrating through case studies how Nature-based Solutions (NbS) can support sustainable development, economic resilience, and ecological recovery. MERLIN also worked directly with six core economic Sectors—Agriculture, Hydropower, Insurance, Inland Navigation, Peat Extraction, and Water Supply & Sanitation - to identify pathways for mainstreaming NbS (Bérczi-Siket et al., 2025).

These pathways illustrate that this is a multi-level governance issue requiring enabling policies (primary legislation at the EU level, enacted in the Member States); appropriate policy instruments to encourage uptake within Sectoral operations and implementation on the ground by those who manage or use freshwater ecosystems and the ecosystem services they provide.

While the political focus of the 2024–2029 European Commission has shifted toward industrial competitiveness and decarbonisation, it is vital that this momentum is balanced with sustained progress on biodiversity and pollution reduction. Ensuring this balance requires stronger collaboration among Sectors that both affect and depend upon freshwater ecosystems whilst ensuring that we sustain livelihoods.

1.2 Purpose and Objectives of the Routemap

This Cross-Sectoral Routemap provides strategic guidance on how economic Sectors can jointly contribute to scaling up and embedding NbS in Europe. It synthesises evidence and experience from MERLIN's case studies, Communities of Practice, and Sectoral strategies (see Annex 1 on Methodology) to:

- Illustrate the different ways in which NbS could be relevant to a wide range of Sectors;
- Show how cross-Sectoral working can contribute to economic, environmental, and social goals;
- Identify synergies, trade-offs, and gaps to address to enable mainstreaming of NbS

The Routemap focusses on how the 'top-down' European level institutions can create an enabling environment to work with, connect and amplify the good practices taking place across Europe with the particular focus on working with economic Sectors. For more information on the 'bottom-up' approach to upscaling, see the regional scalability plans (Ojanen et al., 2024) that provide the bottom-up pathways from MERLIN implementation cases to wider uptake in their region.

Ultimately, the Routemap supports the implementation of a suite of European policy opportunities, including the EU Green Deal (GD); Nature Restoration Regulation (NRR), Common Agricultural Policy (CAP); Water Framework Directive (WFD)/Water Resilience Strategy (WRS); Climate Adaptation Strategy (AS); and Climate Law (CL). Therefore, it also supports the implementing national policies, laws and plans among others National Energy and Climate Plans (NECP); CAP Strategic Plans (CSP); River Basin Management Plans (RBMP); Adaptation Strategies (AS) and helping stakeholders develop effective National Restoration Plans (NRPs) that are inclusive, cross-Sectoral, and transformative.

1.3 Nature-Based Solutions in this Context

MERLIN's work is grounded in the philosophy of Nature-based Solutions (United Nations Environment Programme, 2025), which seek to address societal challenges—such as climate adaptation, water management, and rural development—while simultaneously enhancing biodiversity and ecosystem resilience. As shown in Figure 1a, the Routemap imagines a landscape where different NbS are implemented in rural areas whose benefits flow to urban areas.

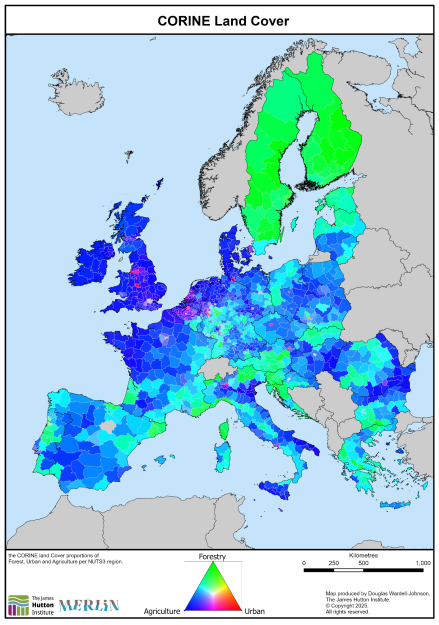


Figure 1: How NbS measures provide benefits to people and nature, which can be harnessed by economic Sectors.

Figure 2: Map of main land cover in Europe

To illustrate how NbS can serve multiple Sectors and landscapes, the Routemap focuses on four restoration measures aligned with Article 11 of the NRR (European Commission, 2024c):

- Natural Water Retention Measures (related to 'sponge' interventions, WRS, 2025)
- Peatland and wetland Restoration
- Reconnected Floodplains and River Re-meandering
- Removal of Transversal Barriers

These archetypes capture key rural intervention types across Europe's freshwater systems, reflecting MERLIN's three clusters of case studies (MERLIN, 2025a). MERLIN's experiences suggest that we are still in the early stages of understanding and trusting how NbS can contribute to resolving the pressures created by the polycrisis (Bérczi-Siket et al., 2025; Schulz et al., 2024) so NbS measures to be considered as a viable *option*, accepting that full restoration approach may not always be appropriate and NbS measures can be combined with other options (e.g. river re-meandering upstream and grey flood defences – see figure 2 in the European Scalability Plan (ESP) (Battrup-Pedersen et al., 2025). Following the IUCN global standard for NbS (IUCN, 2020), all measures must result in a net gain in biodiversity and ecosystem integrity, with the European Scalability Plan offering a way to operationalise the approach to biodiversity protection (Battrup-Pedersen et al., 2025).

These measures also encompass both land-sharing and land-sparing approaches (Green et al., 2005; Löfroth et al., 2023; Nagy et al., 2025; Zevenberg et al., 2025), highlighting the diversity of ecological, economic, and governance contexts in which restoration takes place. Because many of these measures occur on land managed for Agriculture or forestry (see Figure 2 above) engagement with public, private and non-governmental land managers and land-based businesses is critical. Indeed, understanding how and when these NbS measures can be part of a wide range of viable Sector business models will be essential for long-term uptake and sustainability.

1.4 Characterising Economic Sectors

This Routemap adopts an economic-Sector perspective to understand how different types of economic activity both affect and depend upon restored freshwater ecosystems.

Within MERLIN, an economic Sector is defined as a set of organisations engaged in similar types of economic activity—whether public, private, or non-profit — adapting the NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) classification system. This differs from an institutional type, which groups actors according to their characteristics (for example, government, household, or enterprise). While stakeholder engagement often targets individual organisations or interest groups, a Sectoral approach looks at patterns of interaction between whole domains — such as Agriculture, Hydropower, tourism, or finance — and the ecosystems on which they depend.

Looking through a cross-Sectoral lens makes it possible to identify where common incentives, trade-offs, and policy levers exist across multiple domains—helping to translate conservation concern into a NbS approach addressing shared economic and societal objectives. Delivery of multiple benefits requires the affecting and affected Sectors to collaborate to find mutually beneficial solutions; or at least be coordinated to mitigate the worst trade-offs, as required by the NbS global standard (Cohen-Shacham et al., 2016; IUCN, 2020).

Cross-Sectoral working therefore means aligning the strategies and operations of Sectors that influence or are influenced by land- and water-related activities. It recognises that achieving the European Green Deal's biodiversity, climate, and resilience goals requires transformation that extends far beyond the traditional environmental community.

1.4.1 Relevant Economic Sectors in MERLIN

The Routemap complements our Sectoral strategies (Bérczi-Siket et al., 2025). These strategies focused on six core Sectors that were selected for their relationships with freshwater systems:

- Agriculture
- Hydropower
- Insurance
- Inland Navigation
- Peat Extraction
- Water Supply and Sanitation

Drawing on a literature review, stakeholder mapping from case studies, and these Sectoral strategies, a total of 19 relevant Sectors were identified as being linked—directly or indirectly—to the design, support for, or resistance to the implementation of freshwater NbS measures (Section 1.3). These 19 Sectors can be grouped into four broad clusters that reflect their interaction with land and water systems:

Primary production and resource management

- Agriculture, Forestry, Fishery (including aquaculture), Peat Extraction, Mining and resource extraction.

Infrastructure, energy, and industry

- Hydropower, (Bio-) Renewable Energy, Inland Navigation, Construction and Urban Development, Infrastructure and Logistics, Manufacturing (food, drink, health products) and Water Supply and Sanitation.

Finance, administration, and governance

- Public Administration and Professional Activities (spatial planning, permitting, policy development), Banking and Finance, Insurance.

Societal and service Sectors

- Conservation, Education and Research, Media, and Tourism and Recreation (including health benefits).

Each of these Sectors can affect, or be affected by, NbS measures through mechanisms such as water abstraction, pollution control, land management, investment, or public awareness. Understanding these interconnections is central to identifying opportunities for synergies and managing trade-offs across the landscape. Therefore, the Routemap argues for the early participation of all relevant Sectoral stakeholders in measure implementation, landscape planning, regional planning, and national NRPs and other relevant plans (Horstmann et al., 2025) (see Section 2.3).

1.4.2 Findings from MERLIN case studies

Stakeholder mapping across the MERLIN case-studies confirms the diversity of Sectoral involvement (see Figure 3). Most case studies identified between three and eleven Sectors relevant to their restoration context. Much of the engagement within MERLIN (and in most NbS examples to date) focus on State or Non-governmental types with each Sector, as the cases were focussed on the production of public or common pool goods and therefore difficult to 'sell' to a profit-seeking organisation.

The Sectors most frequently represented were Public Administration and Conservation, followed by Agriculture and Water Supply and Sanitation—all appearing in around 15 cases. Fishery and Tourism and Recreation were mentioned less often (eight cases each), despite their potential to generate local economic value and social support (Rouillard et al., 2025). Banking & Finance, Construction & Urban Development, and Infrastructure were rarely identified. This pattern illustrates that traditional environmental and land-use Sectors are already engaged in NbS implementation, while financial, industrial, and service Sectors—although crucial for upscaling—are still peripheral to NbS governance.

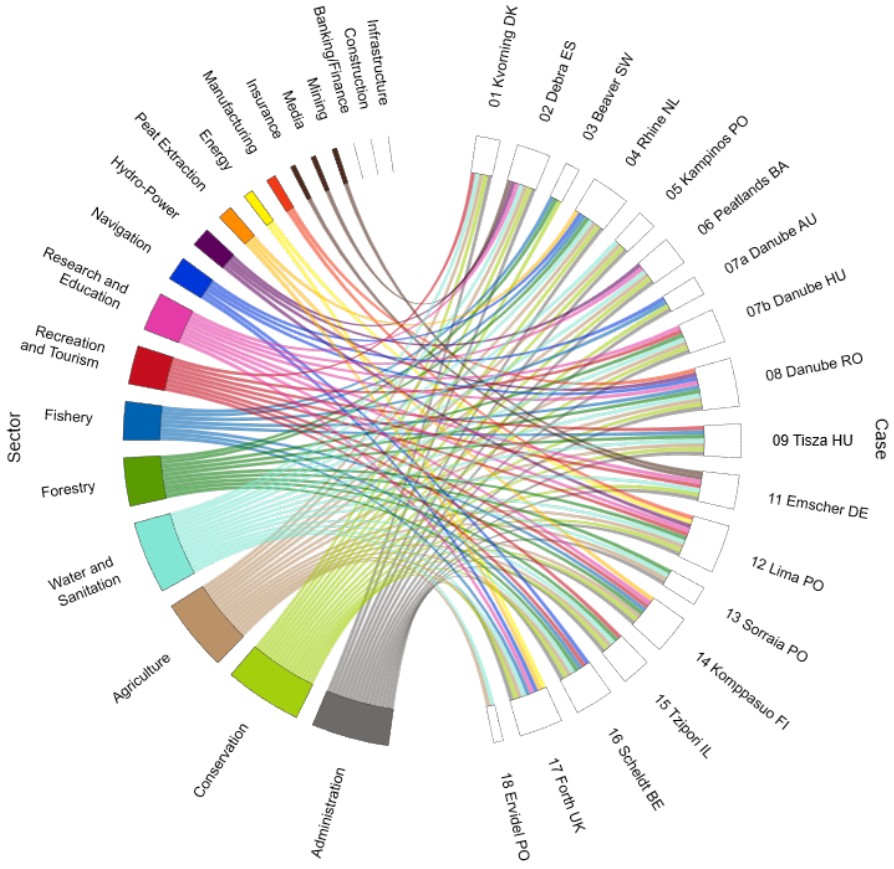


Figure 3: Illustrating the links between Sectors and case studies showing the most Sectors identified (bottom left) to the least identified (top left), adapted from Ibrahim. et al., (2025b)

1.4.3 Implications for Cross-Sectoral Working

Viewing actors through an economic-Sector lens helps to clarify the roles they play in mainstreaming NbS:

- Installers – those directly implementing or maintaining measures (e.g. contractors, land managers).
- Resource managers – those who control land or water on which measures occur.
- Enablers – those providing policy, finance, or knowledge inputs.
- Beneficiaries – those who gain indirectly from improved ecosystem services.
- Blockers – those who may resist measures due to perceived losses or conflicts.

Effective cross-Sectoral cooperation must therefore recognise both high-impact Sectors (whose activities strongly shape freshwater systems) and enabling Sectors (finance, administration, education, media) that create the conditions for transformation. Understanding these relationships provides the starting point for the Routemap, as explained in the next Section.

1.5 Structure of the Routemap

The Routemap follows a logical progression from challenge to action:

- Section 2 – Routemap Start Point: The Need for Change: Examines the pressures driving freshwater degradation and the potential of mainstreaming NbS to address economic and environmental needs.
- Section 3 – Future Vision: Presents a vision for how and when economic Sectors can collaborate to mainstream uptake of NbS across Europe.
- Section 4 – Examples of Cross-Sectoral Working from MERLIN: Highlights lessons from MERLIN case studies demonstrating successful collaboration.
- Section 5 – Opportunities to Mainstream Cross-Sectoral Working: Analyses the 'creating', 'maintaining' and 'disrupting' actions that can help with this coordination and collaboration. The actions include legal, attitudinal, knowledge, economic incentives, and collective action approaches. It also illustrates importance of the agricultural Sector and the different opportunities arising.
- Section 6 – Recommendations: for immediate policy opportunities and longer-term capacity building for policymakers, Sectoral associations and organisations to enable all relevant Sectors to become more active in supporting freshwater NbS.

1.6 Audience

The Routemap is designed for policymakers, practitioners, advisors, consultants, financiers, and researchers involved in the design and implementation of NbS and freshwater restoration. Its findings are relevant to EU institutions, Member State authorities, regional and local governments, and non-governmental organisations (NGOs) seeking to strengthen coherence between environmental and economic objectives.

2. Routemap Start point: The Need for Change

This Section outlines the need for change by examining the current challenges (Section 2.1) facing freshwater systems and the pivotal role of the economic Sectors which interact with these systems (Section 2.2). Furthermore, it explores how existing European policy frameworks from the European acquis serve as a foundation for cross-Sectoral working (Section 2.3) and the main governance actions available to accelerate and mainstream cross-Sectoral working across Europe.

2.1 The Status Quo – The Global Polycrisis during the Need for Change

The important role of healthy freshwater ecosystems has been recognized in key international development frameworks. However, current international approaches to water are not helping countries achieve the targets set out in these global frameworks fast enough. As a result, rivers and other wetlands are often insufficiently valued in policy-making (Dasgupta, 2021; WWF, 2023) and their rapid decline poses a growing threat to development gains and undermines global efforts to tackle the intertwined nature-climate crisis (Elsner, 2023; Rees et al., 2021) According to WWF's Living Planet Report (Deinet et al., 2024) monitored freshwater species have dropped by 81% since 1970 globally – more than any other group – mainly due to habitat loss and blocked migration routes.

The European Climate Risk Assessment (European Environment Agency, 2024b) states that marine, coastal, forest, and especially freshwater ecosystems are among the most vulnerable to climate change. Wetlands (including rivers, floodplains, springs, estuaries, and peatlands) already in poor condition are highly exposed to rising water temperatures, droughts that disrupt aquifer connections, and heavy rains that bring more pollution and soil runoff. The EU is still falling short of its 2030 goals (European Environment Agency, 2024c). For instance, strategic scale mapping (Figure 1) shows that many river restoration units are not yet achieving the combined objectives from the Water Framework Directive (WFD) and Habitats Directive (HD) (Duarte et al., 2023). With some exceptions (such as parts of Northern Europe and certain areas in the Balkans) biodiversity in most EU regions is in poor condition, and it does not meet the criteria for good ecological status in freshwater ecosystems. Most intensively populated and used areas are the most likely to be non-compliant with HD and WFD.

These ecological shortcomings are further compounded by the fact that the EU's sustainability transitions are unfolding in the context of a global polycrisis – a convergence of economic, social, and environmental shocks (European Environment Agency, 2024c). Since the European Green Deal's launch, crises like COVID-19, Russia's war of aggression against Ukraine, climate change, and the rise of political populism have intensified pressure on Europe's food, water, and energy systems, jeopardising economic and social stability.

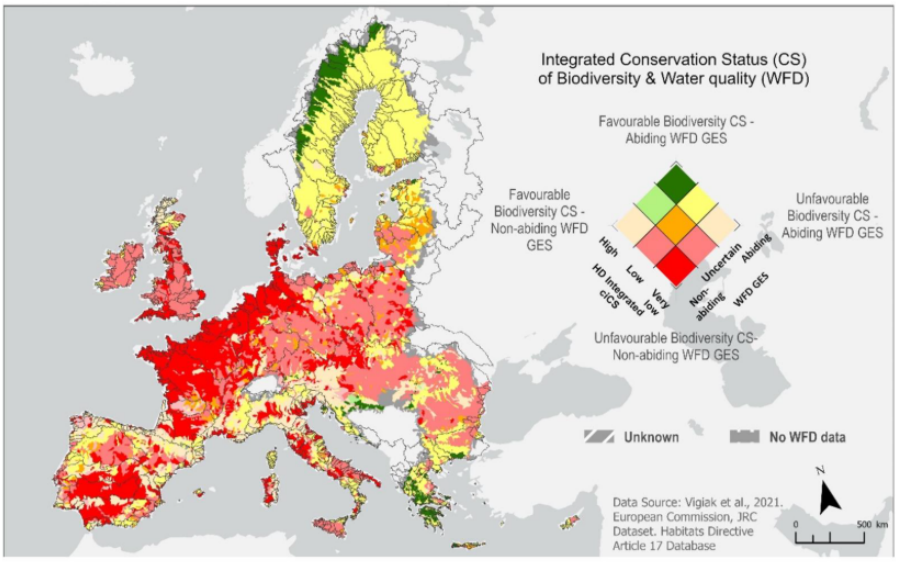


Figure 4: A Europe-wide map showing, for each river restoration unit (R2U), the combined results of an analysis of compliance with both the Habitats Directive and the Water Framework Directive (Duarte et al., 2023).

These challenges were identified as drivers for change within the MERLIN project. The majority of respondents in a baseline questionnaire (Alhassan Ibrahim et al., 2022) acknowledged multiple pressures impacting water systems within their economic Sectors, with the most frequently identified challenges including pollution and degraded water quality (57%), water scarcity (54%), increased flood risks due to excess water (51%), and loss of connectivity between elements of aquatic environments (42%). Moreover, 81% of them generally agreed that a significant shift from the current freshwater management practices is necessary. This agreement is a critical early step for cross-Sectoral working.

These pressures affect economic Sectors as the global economy is fundamentally dependent on nature (Business for Nature, 2025). According to the World Economic Forum (2021) 85% of the world's largest companies and over 50% of global economic output rely directly on nature and its services. The EU economy is vulnerable to nature degradation (Hirschbuehl et al., 2025) with up to 36% of Gross value-added to the economy being based on ecosystem services. At the same time, Sectoral activities themselves are recognised as significant contributors to environmental degradation, particularly in relation to water and biodiversity pressures.

Agriculture serves as a clear example of this interdependence. Under a projected 2°C warming scenario, research estimates a 12% decline in wheat yields in Southern Europe, with losses reaching up to 50% in certain areas. Climate impacts are compounded by biodiversity loss, which threatens the provision of essential ecosystem services for Agriculture. The absence of insect pollination would result in production losses of 25% to 32% of mostly fruit and vegetable crops. Soil degradation, affecting between 61% and 73% of EU agricultural soils, already causes annual losses of approximately 3 million tonnes of wheat and 0.6 million tonnes of maize due to erosion alone (Midler, 2022).

The loss of these ecosystem services increases operational costs and reduces productivity, causing substantial economic losses. Climate change is intensifying environmental challenges, increasing risks such as droughts, floods, and heatwaves. Energy, Agriculture, manufacturing and Water Supply and Sanitation Sectors are critically dependent on abstracting from freshwater ecosystems (Scholten et al., 2025).

Within MERLIN, modelled changes to upstream land use (plantation forestry) that decreased the fill level of reservoirs used for Water Supply and Sanitation and agricultural irrigation in the Sorraia floodplain (Case study 13) was estimated to potentially reduce crop production by 21 million euro present value (Kok et al., 2025). Estimated losses for Inland shipping due to low flow conditions under climate change are estimated to be 28-39 million euros by 2050 for the Elbe basin (Case Study 10); and these conditions also negatively affect infrastructure (locks, cables and pipelines) as well as water based recreational activities (Kok et al., 2025).

2.2 The Pull for Change – Is NbS an Answer to Economic Needs?

In this context, NbS offer a practical response, with the potential to generate economic opportunities across multiple Sectors by improving water availability, mitigating flood risk, and enhancing biodiversity (Rouillard et al., 2025). This is crucial for maintaining productivity and economic resilience across a wide range of economic Sectors. Case studies from the MERLIN project offer concrete illustrations of these benefits. Monitoring results demonstrate that well-designed NbS can deliver substantial environmental, social, and economic outcomes, contributing directly to the objectives of the European Green Deal. These include enhanced biodiversity, increased climate resilience, and broader socio-economic benefits such as job creation and improved well-being (Pott et al., 2025). The majority of MERLIN case studies report a positive impact on health and well-being, especially through improved access to restored nature, opportunities for nature-based recreation, and the expansion of active travel opportunities (e.g. biking, walking) (Schwerk et al., 2025).

Moreover, the MERLIN project has shown that ecological restoration can also generate direct income - such as the Munich use of certification to protect water resources whilst getting premium prices for farmers (Chen et al., 2024). In several case studies, materials such as gravel, clay, or biomass extracted during restoration serve the opportunity to be reintegrated into local value chains, creating marketable products that help finance the interventions. In other instances, restoration efforts opened up new revenue streams, including eco-tourism, recreational permits, and sustainable timber production (Rouillard et al., 2025). Table 1 (adapted from Battrup-Pedersen et al. (2025) to highlight cross-Sectoral working) below illustrates how emerging business opportunities arising from NWRM, rewetting peatlands, floodplain reconnection or removal of barriers can drive cross-Sectoral interactions.

Table 1: Sectors with potential economic opportunities arising from NbS that may drive cross Sectoral working – adapted from the ESP (Battrup-Pedersen et al., 2025)

Case study & relevant Sectors beyond conservation	Cross-Sectoral working opportunity
CS1 Kvorning wetland rewetting (DK) Agriculture, Energy, Infrastructure	Harvested biomass could be used for biogas production, creating green/renewable energy. This could create cross-Sectoral links between farmers and energy producers, involving infrastructure if the energy is produced off-farm.
CS2 Deba barrier removal (ES) Infrastructure, Tourism & Recreation	The sensitive removal of weirs by the local authority creates rivers that provide opportunities for tourism based on more natural rivers whilst recognising the industrial heritage of the region.
CS3 Beaver river engineering (SE) Forestry, Tourism	The forested landscape provides opportunities for nature tourism such as beaver safaris and sustainable hunting.
CS4 Room for the Rhine (NL) Mining, Construction, Infrastructure, Navigation	Mining companies sell the materials (sand and clay) to the construction Sector. The infrastructure and Navigation Sectors need to know that mining does not impede operations.
CS5 Kampinos wetland rewetting (PL) Agriculture, Energy, Forestry, Manufacturing, Tourism	Felled timber from the management of forests involves Forestry Sector working with construction, energy or manufacturing depending on the end use for the timber. Administration and Conservation organisation (National Park Authority) interacts with the tourism and recreation Sector by selling permits for using campfire facilities and enabling protected areas tourism. They also rent land to farmers. Local artisanal manufacturing sell products certified as local green products to tourists.
CS6 Hutovo Blato peatland rewetting (BH) Banking and Finance; conservation; energy; infrastructure	Carbon credits require banking and finance to facilitate connection between suppliers (here conservation) and consumers (could be any Sector wanting to offset emissions).
CS 7a Danube floodplain restoration (AT) Construction, Fisheries; Infrastructure, Navigation, Tourism	The Infrastructure Sector sells stones from riprap and groynes to construction Sector, whilst reassuring the Navigation Sector that fairways remain viable. Fishery Sector manages fish population, and recreational uses benefit from this.
CS7b Danube sidearm reconnection (HU) Conservation, Fishery, Forestry Tourism, Water Supply & Sanitation	The amenity is provided by the resource manager (conservation, fishery, forestry) and benefits recreational users and local recreation/tourism businesses plus the better water flow in the side-arm increases the water yield of nearby industrial wells, managed by the WSS Sector.
CS8 Danube floodplain reconnection (RO) Agriculture, Conservation, Fishery	The fishponds are installed on agricultural land. The amenity for eco-tourism is provided by the resource managers (Agriculture, conservation, fishery).
CS9 Tisza floodplain rewetting (HU) Agriculture, Infrastructure, Manufacturing. Tourism	Eco-tourism opportunities arising from restoration work by the resource managers (Agriculture, conservation, fishery). Diversified farming systems with short supply chains can stimulate local processing (manufacturing).
CS10 Blue Belt Germany (DE) Agriculture, Construction, Fishery, Infrastructure,	Aquaculture opportunities on agricultural land. The removed sediment can be sold to the construction industry.
CS11 Emscher basin restoration (DE) Agriculture, Conservation, Energy, Education, infrastructure, manufacturing, Water Supply and Sanitation	Farmers and infrastructure Sectors use flowering meadow cuttings in biogas production whilst WSS uses sludge co-fermentation in wastewater treatment plants for energy. The flowering meadows also provide habitat for bees, leading to local processing of honey and associated products. Citizen science project creates guided tours in collaboration with nature conservation associations.
CS12 Lima floodplain forest restoration (PT) Agriculture, Conservation, forestry, Manufacturing, tourism	Agriculture and forestry provide grazing, ecotourism amenity and pollination sites for local honey production.

Case study & relevant Sectors beyond conservation	Cross-Sectoral working opportunity
CS13 Sorraia river restoration (PT) Agriculture, banking, conservation, Energy, forestry, Tourism	Agriculture & forestry provide biomass (e.g. from harvesting water hyacinth) or site for panels (energy) and potential for carbon offsets (although further support for facilitating carbon markets is required from the banking Sector). Agriculture and forestry also create amenity for eco-tourism activities (e.g., canoeing, education/awareness programs, wildlife tours).
CS14 Komppasuo peatland re-wetting (FI) Banking, conservation, Forestry, Tourism	Alternative after use by Peat Extraction or mining are sites for renewable energy, forestry or peatland restoration, including carbon offsets (although further support for facilitating carbon markets is needed from the banking Sector). Forestry and peatland restoration creates opportunities for nature tourism and mushroom harvesting.
CS15 Tzipori basin restoration (IR) Agriculture, conservation, education, tourism	The amenity for the community-based tourism (e.g., establishing trail systems - national, regional and local, multi-day recreation) created by environmentally-friendly Agriculture and the conservation research projects add interpretation and support for the self-guided walks.
CS16 Upper Scheldt restoration (BE) Agriculture, Energy, tourism	Farmers provide biomass (grass-flower strip cuttings) for biogas production to generate energy and the and amenity for tourism and recreation (hiking, cycling).
CS17 Forth basin restoration (UK) Agriculture, Banking, conservation, Development, Infrastructure.	Habitat for Biodiversity Net Gain (BNG) is provided by farmers for developers and Infrastructure Sectors, supported by conservation organisations. Peatland restoration may be used for carbon credits (although further support for facilitating carbon markets is needed from the banking Sector).

Many of these business opportunities require Sectoral interactions (European Environment Agency, 2024b). However, these may not always translate into business opportunities for all the Sectors involved – for example, resource managers may not directly receive any payments for the recreational or touristic use of the landscape and rivers unless they can charge for permits or access; or provide tourism services through farm or forestry diversification; or apply for additional income support through rural development payments. Detailed examples of how different Sectors take on these roles and how the Sectors work together are provided in Section 4.

Often there are synergies and trade-offs between Sectors that arise from installing NbS measures as shown in Box 1 below. Economic feasibility and managing trade-offs continue to be the hardest issues to resolve for local implementation projects (Cohen-Shacham et al., 2025). Explicitly understanding stakeholder by economic Sectors (not just by type, e.g. public or for profit) can help to identify how they are affected by NbS implementation and how they are involved with each other (Tschikof et al., 2024). Section 2.3 considers the enabling policy opportunities that may support cross-Sectoral working.

Understanding Sector engagement in floodplain restoration – insights from the Rhine case

Author: Sien Kok

- In the case of the Rhine in the Netherlands (Kok et al., 2025), key Sectors affected by river-floodplain restoration interventions include recreation, Navigation, Agriculture (floodplain farming and downstream farmers dependent on irrigation water supply), nature conservation, and flood safety infrastructure managers.
- There are various trade-offs between these Sectors: for example, changes in discharge distribution across river branches under low-flow conditions benefits Inland Navigation in the Waal branch, while reducing irrigation potential for farmers downstream of the Ijssel branch.
- Similarly, nature development in floodplains may enhance habitat provision and carbon sequestration but could increase flood mitigation costs for infrastructure providers as flood water levels rise under increased roughness of floodplains. Floodplain Agriculture directly competes with most other ecosystem services, as intensive farming tends to reduce multifunctionality and overall ES supply.
- Although CBA is not designed to pinpoint these distributional effects or quantify Sector-specific benefits or costs, it does provide insights into general spatial and Sectoral impacts, which can act as a starting point for cross-Sector engagement, identifying opportunities for collaboration with specific beneficiaries and cost-sharing arrangements.

Source: (Kok et al., 2025)

Box 1: Understanding Sector engagement

2.3 Cross Sectoral Policy Levers – How could they better serve the Integration Principle?

EU public policies have the potential to support the implementation of NbS by fostering coherence across Sectors, creating enabling conditions, and providing a legal and strategic foundation for catchment-scale action (Blackstock et al., 2023). However policy silos are often a barrier to landscape scale and the strategic uptake of NbS (DataZone, 2024).

To achieve the effective implementation of these EU and global public policies there is a need for cross-scale coordinated national implementation through national legislation, plans, strategies and programs. Both the European and national law making and implementation shall be in line with the principle of integration or in other words with cross Sectoral working. The integration of environmental protection into other policy domains has long been part of the EU vision (Publications Office of the European Union, 2016a). All the current policy examples and their implementing plans at multi-level governance listed below create windows of opportunities to support this principle.

The **Environmental Action Programmes** (EAPs) aim to implement this principle. The 7th EAP (2014–2020) set out specific actions for integration across Sectors like foreign policy, security, and education. The current 8th EAP (2022–2030) refers mainly to the **Green Deal** as the main tool for integration. The Green Deal has limitations - both politically and in scope. It has been criticised for failing to involve key Sectors such as tourism, education, or other Sectors which could benefit from and contribute to freshwater NbS. Moreover, some of its commitments, such as halving pesticide use or adopting a sustainable food systems law, have been weakened, and the Clean Industrial Deal might further lessen its holistic approach. (Vela, 2025).

This weakening of the Green Deal's ambition is part of a broader trend of **accelerated deregulation** at EU level since the new Commission. After several simplification measures in 2024, the EU Commission further simplified the CAP in May 2025, weakening environmental requirements and controls, while they plan to propose more measures later this year (Meier et al., 2025). Moreover, in June 2025, a Defence Omnibus package (Directorate-General for Communication, 2025) was presented, introducing fast-track permitting procedures for strategic

defence projects, while highlighting derogation opportunities from environmental legislation (European Commission, 2025b). This process was followed up in 2025 by several other omnibus packages (European Commission, 2025g). Domestically, deregulation is also gathering momentum: Germany's regional Agriculture ministers have formally urged the Commission to repeal the NRR (Lin, 2025) in the upcoming environmental omnibus package, although German regional environment ministers have expressed their support for the implementation.

In addition to traditional cross-Sectoral tools such as Environmental Impact Assessments (EIA) (2011), Strategic Environmental Assessments (SEA) (2001), and Integrated Pollution Prevention and Control (IPPC) (2025) the EU has recently introduced new policy instruments that reflect a more integrative and forward-looking approach: the European Climate Law (2021c) and the Climate Adaptation Strategy (2021b), and recently the Nature Restoration Regulation (2024b) and the Water Resilience Strategy (2025c).

The **European Climate Law** requires Member States to adopt and implement **national adaptation strategies** and plans (Article 5, European Commission, 2021b) besides the National Climate and Energy Plans. While all Member States now have such strategies or plans in place, only eight have integrated them into national legal frameworks (European Commission, 2024e). Moreover, according to the European Commission, many of these plans still fail to adequately include NbS, limiting their potential for delivering systemic and sustainable climate adaptation outcomes. Currently the EU is working on a new climate resilience initiative with a potential legislative component, at the least amending Article 5 (European Commission, 2021c) (on adaptation) in the Climate Law to strengthen the implementation of climate adaptation goals.

Similarly, the **Nature Restoration Regulation** and the future **Nature Restoration Plans** (NRPs) mark a significant shift in EU environmental policy as the first law to establish legally binding targets for ecosystem restoration. It represents a unique opportunity to address both the biodiversity and climate crises in a coordinated way. However, the law's effectiveness will depend largely on how economic Sectors interpret and implement its provisions in practice (Hering et al., 2023). In addition to that NRR and its implementing NRPs have a clear integrative, cross-Sectoral approach as they offer a great potential to Member States to boost the implementation besides of the binding restoration targets other European policies too (e.g. WFD and its River Basin Management Plans and many others - see more details in Annex 2 about the NRR and other European policies).

To support the elaboration of the NRPs a coordinated civil society review of National Restoration Plans (NRPs) is underway, led by the #RestoreNature coalition (WWF European Policy Office, BirdLife Europe & Central Asia, the European Environmental Bureau and ClientEarth) together with national partners across the EU. The work follows a common checklist and methodology designed to ensure consistency and comparability across Member States. It assesses progress through five public criteria — science-based, inclusive, ambitious, empowered and effective — each linked to a set of indicators. National data are collected by partner organisations and reviewed externally for coherence. A mid-term assessment (September 2025) considers progress in developing the plans, while a final assessment in 2026 will review the draft plans after they are made public. Results will be published on the RestoreNature website once available (December 2025 for the mid-term assessment).

Moreover, the **EU Water Resilience Strategy** (WRS) (European Commission, 2025d) provides a non-binding strategic framework to address growing water-related challenges such as scarcity, pollution, inefficient use, and extreme weather. It emphasises the urgent need to reduce water demand across all Sectors, particularly Agriculture, industry, and digital infrastructure, and aims to improve water efficiency by at least 10% by 2030. While the Strategy highlights the role of NbS and calls for stronger integration with existing legislation, it lacks a truly cross-Sectoral approach as it does not propose concrete measures to reduce harmful subsidies or limit rising water demand linked to industrial and digital transitions. Moreover, although the Strategy refers to the Insurance Sector's potential role, it does not include actionable steps to mobilise investment in NbS.

The WRS initiates the '**Water Dialogues'** with the Member States on the implementation of the WFD. It takes place from November 2025 for the next two years[1]. They will focus first on challenges and then on solutions, with cross Sectoral governance and NbS high on the agenda. This is a great opportunity to enhance cross-Sectoral cooperation during the water dialogues and highlight the need to have a better cross Sectoral adoption process for the RBMPs (Directorate-General for Environment, 2025).

Another window of opportunity for integration will be the next **Common Agriculture Policy Strategic Plans** (CSP). The existing 'architecture' in the CAP offers opportunities to protect and restore freshwater environments through four different instruments (conditionality, eco-schemes, Environment and Climate measures and investment schemes (ENVCLIM) (Meier et al., 2025). Proposals for CAP 2028 – 2034 highlight the

[1] WRS Annex I action refers to 2025-2026 as the timeline for the dialogues, but the EU Commission latest communication refers to 2025-2027.

need to respond to climate and water resilience challenges whilst protecting soil health and biodiversity. The proposed tool box supplies conditionality but stresses the need the need for protective practices for soil and water in the new 'farm stewardship' programme for all farmers; and additional (voluntary) agri-environmental and climate actions (combining eco-schemes and ENVCLIM), investment support and payments to support the requirements of the WFD and Habits and Birds directive also provide opportunities to compensate farmers for restoration/NbS, including promotion of organic farming and extensive livestock grazing. The CAP payments can be combined with National and Regional Partnership Plans funding, which will distribute the European Regional funds in the next Multi-annual Financial Framework (European Commission, 2025a) for the period 2028-2034. National and Regional Partnership Plans could provide more opportunities for cross-Sectoral working but there is a strong need for strategic reviews of the 'territorial agendas' to ensure that 'nature' and environmental objectives remain prominent.

In addition to the European examples above, **global commitments** and policies illustrate the advantage of integrative policy creation too. For example WWF's report (Bakhtary et al., 2023) shows how aligning National climate goals (reported in the Nationally Determined Contributions (United Nations Climate Change, 2025) for the implementation of the Paris Agreement) and National Biodiversity Strategies and Action Plans (NBSAPs) of the National Biodiversity Strategies (implementing the Global Biodiversity Framework (GBF) (Convention on Biological Diversity, 2022) can improve resource use, funding access, and outcomes. The report recommends integrating food system measures (like agroecology, reducing food waste, and shifting to sustainable diets) into climate and biodiversity strategies and plans to generate multiple benefits for people and nature.

Although the NBSAPs are non-binding in several Member States at least until the NRPs are adopted, the NBSAPS serve as the main action plans with financial commitments for the implementation of GBF's biodiversity restoration targets (which are incorporated in European legislation through the NRR) at the national level. After the adoption of the NRPs, the NBSAPs and their updates will still play an important role. Further information on the implementation of important national strategies and plans and programs are found in Annex 2 and in prior deliverables (Blackstock et al., 2023).

In summary, to effectively realise the European vision of integration, European decision makers and Member States must ensure the active involvement of all relevant Sectors in the development of any policies, even in non-legally binding strategic plans (e.g. the National and regional partnership plans, Adaptation, Climate and Energy plans, RBMPs (with Flood Risk Management Plans), CAP and NRPs) that impact the environment or depend on natural capital and ecosystem services. Such cross-Sectoral cooperation is essential to uphold the EU's environmental principles like the integration principle and to dismantle persistent policy and Sectoral silos. Importantly, the current EU sustainability frameworks — such as the 8th Environmental Action Programme and the European Green Deal, along with their implementing measures — must not constrain the broader integrative policy mandate established by primary law and previous EAPs. These legal foundations call for systemic cooperation across Sectors to achieve the highest possible level of sustainability in all EU policies and actions.

Section 2.4 now addresses the five main governance actions that can deliver these policy objectives through national, regional and local implementation processes.

2.4 Actions to Support Cross-Sectoral Working

The Sectoral Strategies (Bérczi-Siket et al., 2025) and learning about from the MERLIN case studies (Ojanen et al., 2024) share some common actions to upscale and mainstream freshwater NbS. There are also recurring actions or enablers that can be found in other mainstreaming and upscaling studies (Alexander et al., 2019; Convention on Biological Diversity, 2016; Huber-Stearns et al., 2017; Jagt et al., 2023; Malekpour et al., 2021; Terrisse et al., 2025). These are both 'top-down' actions by strategic European or National stakeholders, or 'bottom-up' actions by businesses and other organisations within a shared landscape. They are shown in Figure 5 and are explained below.

- **Legal & Regulatory instruments**. These cover a range of approaches that allow, encourage or prohibit activities by the Sectors. Examples might be statutory targets, regulatory requirements, fiscal levies/taxes, mandatory guidance or licenses/permits. They are important to provide a transparent and predictable context for organisational decision making; therefore having clear, coherent and long-lasting instruments are important for mainstreaming change.
- **Values and attitudes.** These are the preconditions for voluntary actions by individuals, organisations or groups. These cover a range of issues such as individual and social attitudes to nature, intrinsic personal or cultural values, leadership and political will. Without socio-political willingness to change, mainstreaming NbS is much more difficult. However, citizens and consumers provide the social licence for economic Sectors to operate. Values and attitudes are the emergent social phenomena that we wish to influence with our Routemap. They can be catalysed through the rest of these actions.

- **Information, knowledge and social innovation.** These cover a range of voluntary approaches related to helping all the different Sectors be aware of what NbS are; monitoring based evidence of their efficacy, costs and benefits - in accessible and understandable formats; through to tools to use the information in decision making. The approaches can include technological innovations to capture, learn and share knowledge; but we stress the social nature given the importance of peer-to-peer sharing and using demonstration sites as well as data and tools.
- **Economic incentives.** These cover a range of voluntary approaches that provide funding, or finance, or another value proposition to induce uptake of NbS. They can cover grants, investments, operational cost savings; certification or market-based schemes. It is important to cover the costs of NbS implementation, even when working with not-for-profit or public Sector organisations; whilst for-profit organisations need a clear revenue stream or compensation for any income forgone (Rouillard et al., 2025).
- **Cross-Sectoral working.** Achieving benefits from the NbS measures often requires working at a landscape scale. It is possible to achieve this through **coordination** of individuals and businesses, using a coordinating institution (e.g. a national park authority). A more active form is **collaboration** that involves a commitment to joining a group and choosing to collaborate for a shared objective. These can be informal or agreement based formal co-governance institutions (Sarkki et al., 2025). It is a cross-cutting action as coordination or collaboration between Sectors often involves legal, information and economic components.

It is important to understand that these ideal types of actions often interact, as shown in Box 2.

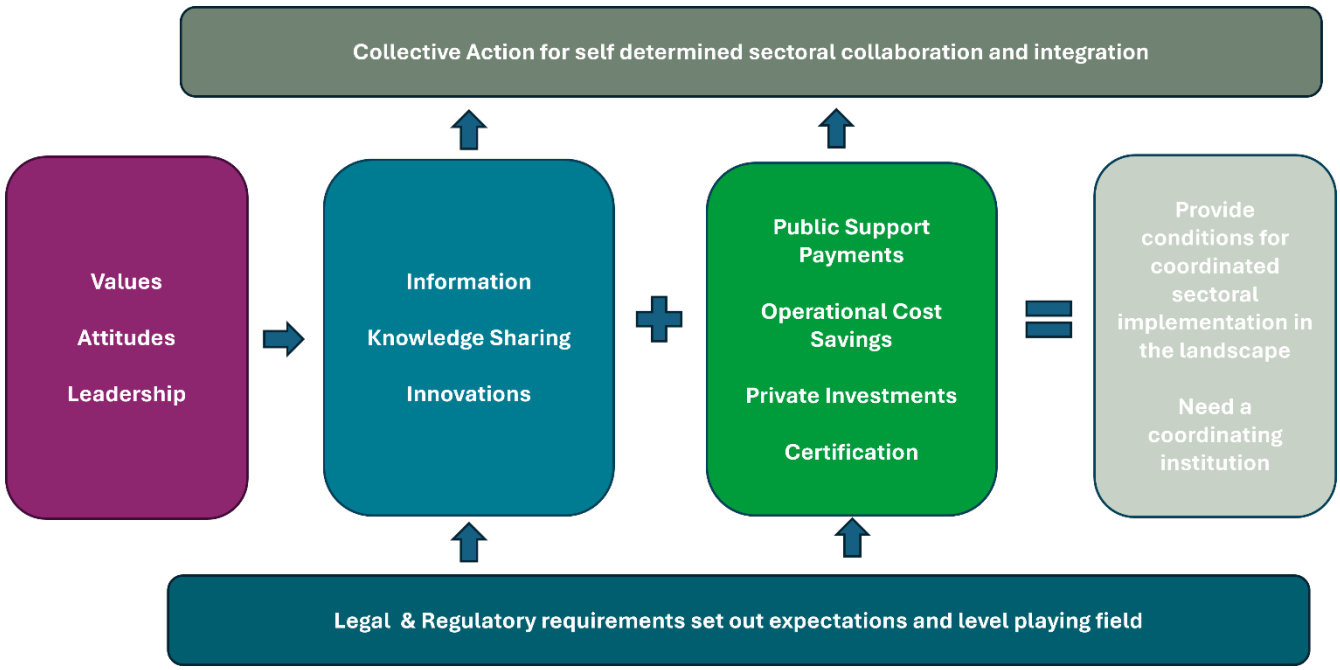


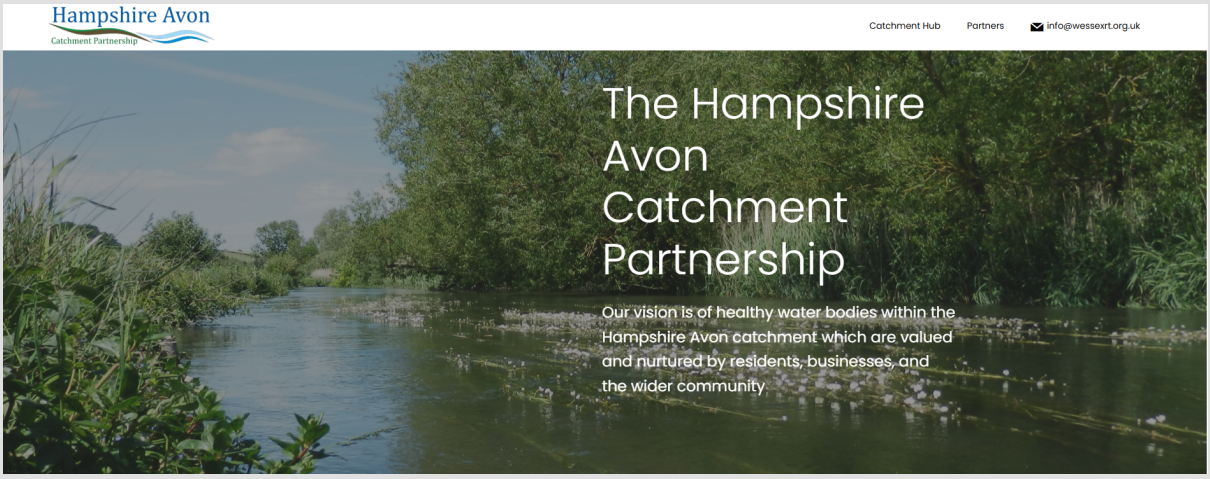
Figure 5: Cross Sectoral collaboration diagram

Focusing on actions allows us to understand how to outscale (get more resource managers (see Section 1.4) to allow NbS measures on their land); how to upscale (to get more installation capacity; to mainstream enabling activities); and to scale deep (to flip the blockers to enablers; and to get the beneficiaries to actively support resource managers and installers, rather than a free-ride from the public goods and services being delivered). How these general categories relate to the Sectors and the measures is illustrated by MERLIN case studies in Section 4.

Hampshire Avon Catchment Partnership (HACP), UK

Author: Kerry Waylen

- The Hampshire Avon Catchment Partnership (HACP) illustrates the evolving and complex mix of actions involved in mainstreaming NbS. The Hampshire Avon is a chalk stream catchment in the southwest of England. It hosts many rare species and provides many benefits to society but is degraded and faces increasing challenges such as seasonal water scarcity, invasive non-native species, flood risk and diffuse pollution, which hinders meeting policy targets for drinking water, flood risk, WFD and Natura2000.
- The HACP is an informal partnership including the Agricultural (e.g. the National Farmers Union); Conservation Sector (e.g. Wessex Rivers Trust); Fishery (e.g. the Wild Trout Trust) and Water Supply and Sanitation (e.g. Wessex Water) Sectors. Overall, there are dozens of partners, some linked to other Sectors such as transport (Highlands England).
- Conservation Sector organisations and Wessex water recognised that uncoordinated interventions were inadequate in the face of the challenges. Therefore, the partnership coordinates activities, including engaging land managers on reducing pollutant and sediment loading; implementing re-meandering, tree planting, and removing non-native invasive species. The coordination by the Wessex Rivers Trust is funded by Defra's Catchment-based Approach and Wessex Water. Partnership plans are based on a variety of local and national datasets and models, which are now linked and widely accessible.
- In summary, the HACP partnership supports implementation of freshwater NbS by **regulatory drivers** and **leadership** that are complemented by trusted **coordination** (including support to farm clusters) and **knowledge-sharing,** underpinned by a blend of public and private **funding.**



Box 2: Hampshire Avon Catchment Partnership

3. Routemap Destination: Future Vision

Whilst NbS have great potential not only to overcome current challenges, create new opportunities for economic Sectors and build on EU policies fostering integration and cross-Sectoral collaboration, there is a long way to go.

Despite the growing recognition of NbS, its uptake remains limited across economic Sectors. Common barriers in NbS implementation include a lack of awareness of NbS, limited long-term data on cost-effectiveness, and a shortage of Sector-specific knowledge and skills (Blackstock et al., 2023; Schulz et al., 2024). The MERLIN Sectoral Strategies (Bérczi-Siket et al., 2025) also stress that governance and financing beyond individual project sites – particularly in the context of integrated river basin management – remain difficult, as Sectors often lack the capacity to tackle these issues on their own without institutional support and a sense of equitable sharing of costs and benefits.

Achieving real change in the face of these challenges requires a fundamental shift in thinking and practice. This includes embracing social–ecological embeddedness in the economic system and fostering an interdisciplinary mindset that acknowledges complexity (Kenter et al., 2025). Such transformations take time.

MERLIN's Sector-specific visions offer a forward-looking perspective on how NbS can be embedded into long-term strategies (Bérczi-Siket et al., 2025). While each Sector faces distinct challenges, a shared direction emerged: integrating NbS into regular operations and governance frameworks – in other words, a commitment to mainstreaming NbS as part of normal practice embedded within coherent EU-level policy ambitions on biodiversity, climate resilience, and economic development.

These insights generated a cross-Sectoral vision for the future (see Figure 6 below). To align our vision with key EU policy objectives (See Annex 2), we selected 2030, 2040, and 2050 as milestone years, forming a pathway for freshwater restoration and the integration of NbS. These timelines reflect the long-term ambition and structure set out in major Green Deal policies, particularly the NRR and the CL.

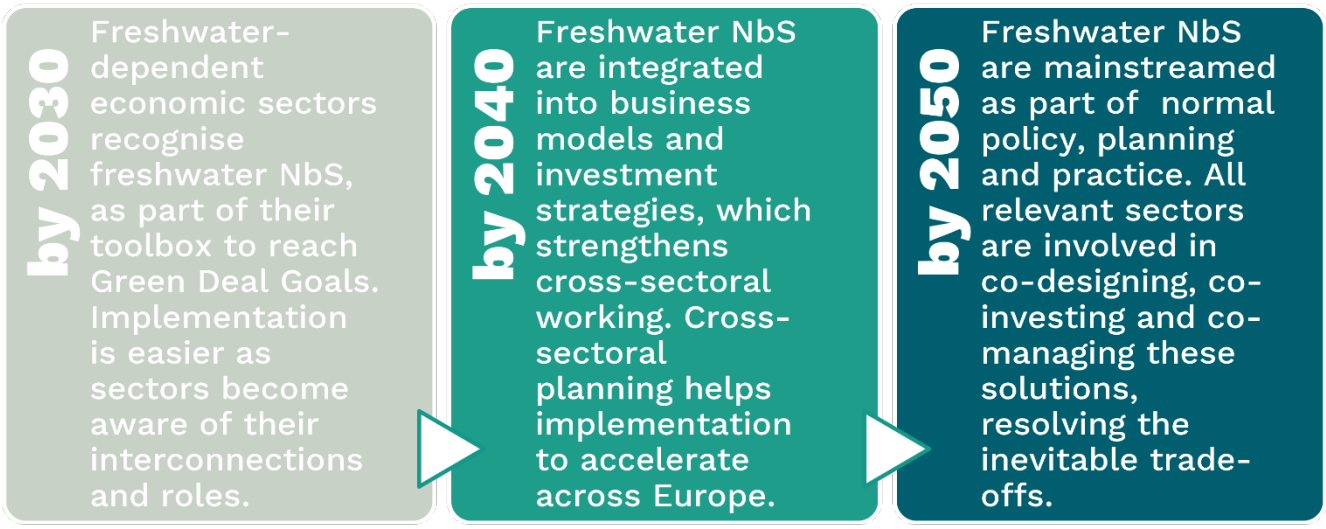


Figure 6: Cross Sectoral vision for the future

Detailed description of the vision:

Supporting Sectors to be more involved in freshwater NbS requires understanding how the different Sectors can play their part (Table 2).

Table 2: The role of supporting Sectors by 2030, 2040 & 2050

	2030	2040	2050
General Sectoral approach	Economic Sectors begin to recognise and adopt freshwater NbS as legitimate and effective tools within their existing toolkit to help meet climate and environmental goals. They have more awareness of how their practices intersect with each other and realise the importance of having a role in environmental policy implementation to identify coordinated action.	Economic Sectors have developed viable business models and long-term investment strategies around NbS (e.g. eco-tourism linked to wetland preservation, water companies investing in watershed restoration). Cross-Sectoral collaboration becomes more structured, NbS move beyond pilot or local implementation and are scaled up regionally and nationally.	Instead of working in silos, Sectors co-design, co-invest, and co-manage NbS as part of integrated planning processes at a large-scale level. NbS are no longer seen as "alternative" approaches, but as core infrastructure solutions.
Installers	Early adopters among restoration practitioners and contractors design, implement, and maintain freshwater NbS projects on the ground.	Professional networks of restoration practitioners have expanded and matured, with standardized methods, capacity building, and long-term maintenance programs in place.	Restoration and maintenance of freshwater NbS is a routine part of infrastructure and ecosystem management, performed by skilled professionals embedded in Sectoral and cross-Sectoral operations.
Resource managers	More landowners and waterway authorities to allow and facilitate implementation of NbS on their land or waterways.	Most land and waterway managers actively collaborate and integrate NbS into land management plans.	NbS are fully incorporated in land and water governance; resource managers play a proactive role in managing multifunctional landscapes to support ecological and social goals.
Beneficiaries	Communities, businesses, and ecosystems begin to experience initial benefits such as improved water quality or flood protection.	Wider populations, including marginalized or previously uninvolved groups, experience improved ecosystem services and social benefits, awareness and participation increase.	All Sectors of society benefit equitably from sustainable freshwater ecosystems; public awareness and stewardship (i.e. responsible management, engagement in protection and care) are widespread.
Enablers	Strong coalitions of governments, NGOs, private Sector, and community groups work together to secure funding, advocate for NbS-friendly policies, and share knowledge across Sectors.	Strong coalitions of governments, NGOs, private Sector, and community groups work together to secure funding, advocate for NbS-friendly policies, and share knowledge across Sectors.	Institutions, policy frameworks, and funding mechanisms consistently support NbS innovation, adaptation, and scaling at all levels across policy areas and economic Sectors.
Blockers	Some stakeholders will resist NbS implementation, fearing loss of land use options, economic disadvantage, or unintended consequences; their opposition can slow down or limit project uptake. This should be expected and will require conflict resolution and safe deliberation spaces to discuss the trade-offs.	While opposition remains from some, it is reduced due to evidence of benefits, fair compensation, and engagement efforts that address concerns.	Opposition to NbS is minimal or non-existent, as benefits are experienced, clear and shared, and governance mechanisms ensure that concerns are addressed proactively.

Having established the vision, we now present some examples of cross-Sectoral working in the MERLIN project to illustrate good practice (Section 4).

4. Examples of Cross-Sectoral Working from MERLIN

This Section introduces four in-depth MERLIN Case Study examples to illustrate the different approaches taken to cross-Sectoral working. The cases cover a transect from the Atlantic bio-geographic region to the Eastern Continental bio-geographic region (European environment Agency, 2016). The cases are in the Netherlands (CS04); Romania (CS08); Hungary (CS09) and the UK (CS17) (see Figure 7).

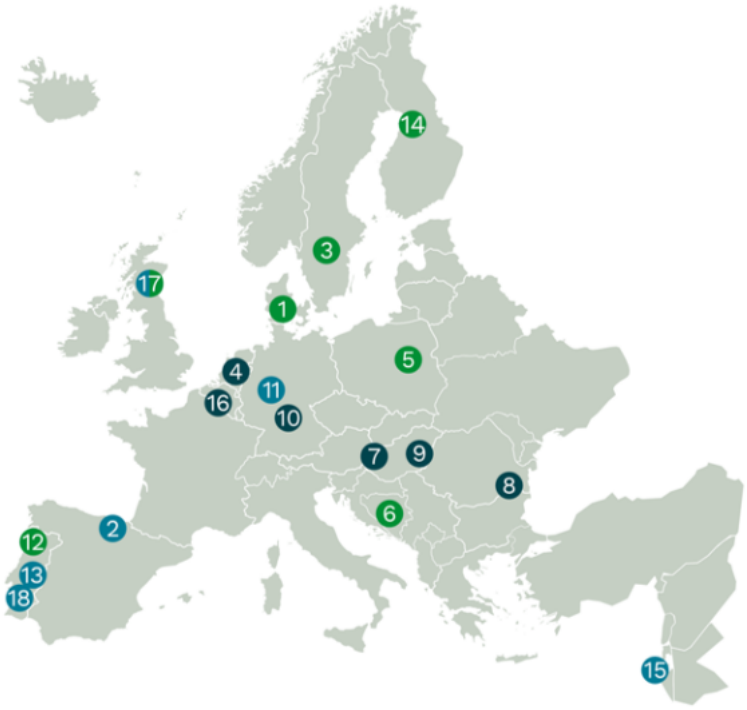


Figure 7: The cases in the MERLIN project. The green refers to peatland and wetland cluster; the light blue to small streams; and the dark blue to large transboundary rivers.

These settings represent different socio-economic contexts: densely populated Netherlands (526 people per Km^2) to the sparsely populated Romania (81 people per Km^2) and relatively high earnings: 19 euros per hour (Netherlands) to 5.7 euros per hour (Hungary). In the four cases, past human activity, often driven by the need for economic development and to protect human settlements from floods, has disrupted the natural functions of rivers, floodplains and wetlands. This has led to increased flood risk, lack of resilience to drought and the loss of biodiversity, affecting Agriculture, Fisheries and (in the Rhine case) the Navigation Sector.

In response to these challenges, the selected case studies have implemented NWRM, wetland and peatland restoration and floodplain reconnection measures. Therefore, these are good 'front-runner' examples for the upcoming NRPs - see the NRR freshwater ecosystems Articles 4, 9, 11, 12 (European Commission, 2024e); and information on preparing the NRPs Articles 14-17 (European Commission, 2025f).

Each case explains what measures were implemented, the drivers for implementing NbS and what benefits have been achieved. The sub-Sections introduce which Sectors were involved and what roles each Sector play (resource manager, installer, enabler, beneficiary and/or blocker). The cases describe how the five governance actions (see Figure 5 in Section 2.4) were utilised and the form of multi-level governance practiced. Section 4.5 provides a summary of what we have learnt from these cases in terms of cross-Sectoral working.

4.1 Case study 17: Forth Basin Restoration (Allan Water) UK

Authors: Kirsty Blackstock, Charlotte Neary, Niall Provan (James Hutton Institute Forth Rivers Trust)

Figure 8: Peatland restoration and community volunteers installing leaky barriers. Photo credit: Charlotte Neary

4.1.1 What restoration measures are being implemented?

The MERLIN project has provided match funding for existing and new projects to exemplify upscaling and attract alternative sources of funding from non-conservation sources. The funding covers source to sea interventions in peatlands and small streams (Allan Water, River Devon) involving:

- **Peatland restoration** at the top of the catchment (273 ha, ongoing)
- Re-meandering (4km) and **reconnection** of the 32ha **floodplain wetland** (completed)
- Invasive and Non-Native Plant Control (ongoing)
- Installation of leaky barriers on tributaries to slow the flow and allow more **water retention** in the landscape (completed)

These are characterised as NbS as they are trying to work with nature as much as possible (reducing reliance on chemicals for invasive control, using natural regeneration for riparian strips etc) whilst responding to societal challenges and working with the affected stakeholders. As this CS is part of the UK, the equivalent policies to those influencing the EU CS (see Section 2) are introduced within the relevant Sections.

4.1.2 Why is there a need for change (drivers); what is the goal(s)?

The Allan Water catchment is in the less developed part of the Forth Basin, the middle of the stream has good ecological status; although the top of the catchment is only moderate status and the downstream part has poor status, requiring action to meet the 2027 deadline or as soon as possible thereafter. The area has an active Allan Water Angling Improvement Association, which benefits from increased status and removal of barriers to fish migration. More generally, the area reflects the wider situation in Scotland and Europe where agricultural, industrial and urban development pressures have impacted the ecological functions in the landscape, with associated negative impacts on biodiversity. Scotland has committed to international obligations for 30% of habitats to be restored by 2030 (Scottish Government, 2024f); with ambitious targets to restore 250,000 ha by 2030 (Scottish Government, 2025b). Pressures in this part of the catchment stem from land use processes, with excess nutrient input and riverbank erosion caused by livestock poaching whilst peatlands were drained for forestry and Agriculture as part of the push for food security in the mid-20th Century.

Climate Change (Scottish Government, 2024b) is predicted to bring the area more extreme rainfall, with flooding occurring in the settlements downstream of the MERLIN intervention sites, impacting spawning sites for fish, increasing soil erosion and spreading invasive species. There is still uncertainty about the efficacy of natural flood management compared to grey infrastructure in the area. Climate change is also predicted to increase periods of water scarcity, making pressures from land use more intense on the freshwater ecology. These pressures will also affect the Water Supply and Sanitation Sector, creating costs in terms of removal of nutrients from private and public water supplies, and managing abstractions/discharge in times of low flows. At the same time, the land use and agricultural Sectors are expected to contribute the Scottish climate mitigation

targets of Net Zero by 2045 (Scottish Government, 2020) - increasing soil organic matter, tree planting and peatland restoration. The Agricultural and Rural Communities (Scotland) Act (2024a) sets outs ambitious objectives relating to food production, thriving businesses, nature restoration and climate action whilst sustaining a 'Just Transition'. The approximately 85 agricultural businesses in the catchment (dominated by livestock farming on rough grazing with feedstock arable cropping) are orientating themselves to this multiple benefits' political agenda – and to maximise existing public Sector support payments, nature market mechanisms and their social licence to operate. The Case Study illustrates many drivers for transformation by 2030 and the RSP highlights further ambitions to 2050. Whilst many of the drivers and goals are set out in terms of societal challenges like biodiversity and climate actions, the affecting and affected Sectors are described in Section 4.1.4.

4.1.3 What benefits come from the measure(s)?

To date, the implementation with the project has seen 32 ha of floodplain reconnected; and just over 4 ha of streams restored; creating small-scale but locally important reduced GHG emissions, flood mitigation and drought resilience. The project has increased awareness of, and investment in, natural flood management, increased educational activities, and the attractiveness of the area. This has been achieved without (at the time of reporting) any change in the land available for farming. During the recent months, the project has leveraged additional funding from infrastructure providers to do more restoration in the catchment. Additional information is derived from the SWAT+ and CBA modelling that provides an alternative perspective on the benefits arising from planned interventions, particularly for peatland restoration.

Climate Regulation (GHG emissions)

The restoration of peatlands in the whole Forth basin results in 7,380.40 tons of CO2e emissions avoided per year, corresponding to a total net present value of € 39.35 million (Kok et al., 2025). Currently, there is no use of the carbon market to monetize this sequestration by the land managers in the Allan Water. The proposed Scottish Government Ecological Restoration Code could provide more incentives for long term sequestration of 'blue' or 'teal' carbon in river corridors that are not designated as peatlands.

Flood risk & Drought resilience

The river and floodplain measures have increased peak flood storage in the floodplain, wetlands and river channels and the project has leveraged more support and funding for Natural Flood Management (primarily riparian tree planting). Modelling for the whole Forth River Basin suggests there was a 0.9% decrease in the probability of flooding across the Forth catchment resulting in monetary benefits of €300,000 per year (in 2024 prices) from river restoration and another 8.8% reduction (equating to €3.9million) from peatland restoration. Effects are especially visible in channels located downstream of the main peatland restoration areas (in the Northeast of the catchment) and monetary benefits are concentrated in the downstream parts of the catchment. The water retention and restored wetland is expected to help with water recharge and therefore drought resilience. However, how this translates to water users (agricultural, infrastructure, manufacturing and Water Supply and Sanitation abstractors) is not clear. Given there are major food and drink processors in the catchment that rely on reliable clean water supplies, having more information on this benefit could be important.

Health and wellbeing

Interventions were perceived to increase the attractiveness of the local environment which may translate to hedonic pricing for local housing development. The area is not part of any active travel or recreational activities but is an important recreational fishery breeding ground.

Farm to Fork (agricultural production)

The river, wetland and floodplain measures are estimated to affect 25 ha of agricultural land (rough grazing and permanent grassland) and there is no reported change to agricultural production from these measures. However, how measures affect land use is important in this mainly rural catchment, with important infrastructure routes (trunk road and main railway line) close to the river restoration site.

Zero Pollution for clean drinking water

Basin wide modelling (Kok et al., 2025) suggests that peatland rewetting and river restoration can retain nutrients (Nitrogen and Phosphorous) and decrease the amount reaching rivers and lochs, which could equate to reduced damage to ecosystems with a societal welfare benefit of €20million combined. This has implications for clean drinking water (Water Supply and Sanitation), bathing waters (recreation and tourism) and biodiversity, habitats and species (fishery, conservation).

Net Biodiversity Gain

The monitoring of the MERLIN interventions (specifically the floodplain reconnection and river restoration) suggests that there has been an increase in the extent of habitats supporting a range of freshwater species.

These benefits are mainly presented in terms of societal challenges or welfare, rather than reported in terms of distribution across economic Sectors. However, it is possible to start to infer some interdependencies.

4.1.4 Which Sectors are involved?

The Case Study identified strategic and local stakeholders to be involved in the site interventions and in the wider basin to raise awareness and replicate restoration processes using an NbS approach. The case study used an existing project governance structure, the Allan Water Steering Group, which consists of public Sector, NGO and community organisations, to guide the implementation of the measures. This is complemented by more strategic engagement with mainly public Sector and NGO organisations to share learning and inform national policy implementation.

These stakeholders equate to the following Sectors (see Table 3 in Section 4.1.5): Administration & Professional activities, Agriculture, Conservation, Education, and Fishery. Manufacturing was not identified but there is a distillery and mineral water factory in the catchment and Infrastructure was not identified but has become important due to their role in match funding and the proximity of road and rail to the site. Insurance is also not listed although the project is focussed on reducing downstream flood risk. Not all the Sectors identified in the case study would be involved in other restoration or NbS projects in the Forth Basin, as it depends a lot on the individual site. Other Sectors named in the RSP but not involved in the MERLIN interventions on the Allan Water and River Devon include energy and Peat Extraction, forestry Inland Navigation and Water Supply and Sanitation.

The Sector with the greatest involvement in implementing the measures is the Agriculture Sector; stakeholders include farming cluster groups, local farms and individual estates with farmland. The Administration & Professional activities Sector also have a high level of involvement; stakeholders range from local councils, high-level Government and public bodies. When considering the Education Sector; stakeholders are generally research institutions and universities.

4.1.5 What roles do the Sectors play? Are they affected by the measures? Do they affect the measures?

The table below highlights the specific roles played by those local, regional and national organisations directly involved in the measures described in Section 4.1.4 above. Here Resource managers own or manage the land/water used – they can refuse permission for NbS. The Installer is directly involved in the measure, e.g. drives the digger, makes the permit; the beneficiary uses the benefits that arise; the Enabler is not directly involved in installation but helps with implementation and the blocker is not directly involved but obstructs implementation.

Table 3: Forth Basin Sector involvement

Sector	Role	
Administration & professional activities (spatial planning, permitting etc)	Installer	Planning and permitting is an essential part of restoration design, installation and maintenance.
Agriculture	Resource manager	The area being restored is part of extensive upland estates with livestock grazing.
	Beneficiary	Other farmers may benefit from the flood risk & drought mitigation if they are downstream of the measures. Resource managers may benefit if they can harness payments for biodiversity and/or carbon in the future.
Conservation	Installer	Provision of skills, materials, engineering by Peatland action and Forth Rivers Trust.
	Beneficiary	The measures are helping habitat re-establish, creating an increase in invertebrates, amphibians and fish.

	Enabler	Other conservation bodies such as national environmental agencies or NGOs share advice and innovations.
Education (also advisors, researchers and scientists)	Enabler	The case has been helped by inputs from three research organisations, with expertise in natural and socio-economic data.
Fishery (including aquaculture)	Beneficiary	The Allan Water Angling Association will benefit from better spawning grounds and increased food webs.
Infrastructure	Resource manager	Some of the leaky dams and reconnection come close to the easements associated with the road and rail infrastructure in the area, and they had to agree to the interventions.
	Enabler	Rail and power network providers have invested in projects providing funding for riparian planting.
	Blocker	If the measures will compromise the safety of the train line and road, the Sectors would try to stop them.
Insurance	Beneficiary	The mitigation of floods (and droughts) should mean there are less claims from downstream settlements of Dunblane and Bridget of Allan.
Manufacturing	Beneficiary	The distillery and mineral water factory rely on plentiful clean water.

4.1.6 What is the form of cross-Sectoral work

The Forth Case Study builds on the existing Allan Water Partnership, which formed the 'case study board' for the project. However, this does not fully reflect all the stakeholders involved in the case, with limited representation of the private economic Sectors highlighted in Section 5 above.

The Forth Rivers Trust and Peatland Action officers have worked with individual land managers to assess suitable restoration sites and negotiate the types and sites from the measures. These required many 'kitchen table' meetings and walking the ground discussions, to understand the needs of the individual businesses and be able to coordinate these businesses for the overall goals of the Allan Water.

As part of the RSP development, a collective meeting of land managers in the area was held to raise awareness of the work and how it fitted into the wider national policy picture. Another meeting was held with national policy stakeholders from the agricultural, environment and Water Supply and Sanitation Sector to consider how the policies were promoting local action on the ground. Therefore, although an existing platform was used, further efforts were required to engage different Sectors and to understand the multi-level governance relationships.

4.1.7 What are the main actions to support the cross-Sectoral work taking place?

Attitudes & Leadership:

The Scottish policy environment has strong drivers towards NbS and this is leading to a general shift in discourse around working with Nature as part of protecting the range of capitals (natural, human, built and financial) on which businesses depend (Scottish Government, 2022, 2024c). This context might contribute to the willingness of other businesses to support local action (e.g. a local drinking water factory providing volunteers for riparian tree planting). The decision by the UK Government to exit the EU has created uncertainty around agricultural policy; and the trade-offs implied between the five strategic outcomes sought by the Agriculture and Rural Communities Act are still to be resolved. The alignment between 'nature' markets (particularly woodland and carbon codes) and proposed agricultural support payments is unclear. This sets an agenda that both stimulates and dampens innovation and change in the rural land use Sectors.

The measures in Section 4.1.1 are being implemented on privately owned land and therefore are dependent on the willingness of farmers. The decision to undertake agri-environmental actions seems linked to personal values and attitudes to nature, and to the overall business model and plan for the farm. For example, the peatland farm's choice to extensify stocking rates and the Estate's choice to switch from sheep to cattle, which are raised and finished differently. In both cases, the measures take up a small proportion of large enterprises.

Legal & regulatory requirements:

The land managers are required to cross-comply with environmental legislation such as controlling diffuse pollution and to keep their land in good agricultural and environmental conditions to receive agricultural support payments (see below). This includes new requirements for peatlands and wetlands introduced under Good Agricultural and Environmental Condition 6 for the maintenance of soil organic matter (Scottish Government, 2024e), which started in January 2025. However, this protects existing peatlands and wetlands but does not require restoration of degraded ecosystems. In 2026, farmers will be required to have 'whole farm plans' and to monitor their soils and biodiversity regularly – however, these audits do not highlight freshwater ecosystems very effectively.

Whilst there are a raft of legal and regulatory requirements affecting other Sectors involved such as administration, conservation, fishery, Insurance, infrastructure, manufacturing, and Water Supply and Sanitation, these do not directly require restoration or NbS. Instead, they may block NbS, e.g. the statutory guidance on how to justify funding for flood risk mitigation tends to favour grey infrastructure (Scottish Government, 2012). However, the national planning policy (Scottish Government, 2023) is increasingly highlighting the role for upstream interventions and the importance of natural capital to ensure our built environment can function well. The other actions associated with public or private policies are voluntary measures discussed below.

Information, Knowledge Sharing, Innovations:

FRT and other organisations work hard to raise awareness and engage local residents and stakeholders in their ecosystem restoration work, which is necessary as there is no visible self-organised knowledge sharing between Sectors or within Sectors in the area, although there may be informal discussion or benchmarking against peers. Ecosystem information is available at aggregated levels via the Water Environment Hub (2021) and the State of Nature Reports (NatureScot, 2023) but local information on how the ecosystem responds to measures is often hard to find. The monitoring efforts by scientific organizations e.g. through the ForthERA (University of Stirling, 2025) project can help with this although these data are not yet available. The MERLIN project has stimulated more educational activities in the area and provided local level data on initial outcomes of the interventions (Schwerk et al., 2025).

Funding & Finance:

The actual MERLIN interventions are currently 100% financed and the reported upscaling plans for the catchments are 85% financed. The funds are currently grants from the Scottish Government (Nature Restoration Fund, Peatland Action Fund and core funding for Natural Flood Management projects) matched with Horizon 2020 grants. More recently, the project has won further grants from Network Rail and Scottish and Southern Electricity Networks). There have also been in-kind contributions via volunteer labour from both communities and the local manufacturing businesses.

The land managers are mainly concerned with ensuring that their existing agricultural support payments are not jeopardized by rewetting their land or the re-meandering of the river once reconnected with the floodplain. There is no direct payment for ecosystem services reported for protecting water sources to the drinking water factory or whisky distillery nor for reducing flood risk downstream. Instead, the Agri-environment or peatland action payments create co-benefits for these Sectors.

There is a nascent landscape enterprise network (Graham, 2025) in the wider Forth Basin, where a local market in financing NbS to protect business critical assets is developing. The peatland and woodland codes allow potential payment for restored peatlands or riparian woodlands beyond agri-environmental payments but the case study examples are not currently involved in these markets. As far as has been reported, the land managers do not participate in any certification schemes or supply chains that require, or encourage, uptake of freshwater NbS.

Collective Action Institutions:

As described in Section 4.1.6 there is an existing trading platform in another part of the basin, but currently the interactions between the Sectors involved tend to be ad-hoc and mediated by NGO (FRT) or government organisations (Peatland Action). There are national cross-Sectoral working groups e.g. for RBMP or protected areas but these do not really engage at the level of this MERLIN Case Study. The Allan Water Project steering group provides a potential platform but is currently dominated by public and 3rd Sector bodies, with low involvement from the Sectors named in Section 4 above.

4.1.8 How does the multi-level governance work? Which level could help with mainstreaming?

The RSP highlights the importance of the Scottish policy context for encouraging voluntary action as well as creating legal requirements that support the peatland restoration and reconnection of flood plains reported here. The agricultural Sector is extremely important and therefore the transition of Scottish agricultural policy from the EU CAP to the new agricultural reform programme will influence how effectively climate and biodiversity benefits of NbS are supported by local land managers. As Sections 5 and 6 illustrate, a range of economic Sectors from 'for-profit' and 'non-profit' organisations are involved in the NbS implementation, spreading well beyond farming. Whilst Scotland has set out a vision for integrated land use (Scottish Government, 2025c) involving all those with a stake in land and water management, there are still few institutional arrangements that support such cross-Sectoral working at the regional or landscape scale (Peskett et al., 2023). Therefore action is needed by national (Scottish) Government to encourage and support local level governance institutions (such as the LENS model) that connect Sectors for mutually beneficial climate and biodiversity action through removing policy uncertainties and providing clear governance for nature markets (Scottish Government, 2024d). Whilst no longer a member of the European Union, both the Scottish and UK parliaments are maintaining some policy alignment with the EU to ensure smooth trading arrangements; and to share existing practice (e.g. through membership of the Horizon Programme). The proposed Natural Environment Bill (Scottish Government, 2025a) has many parallels with the EU Nature Restoration Regulation, particularly sharing the need to have legally binding targets to enforce the objectives in the Scottish Biodiversity Strategy.

4.1.9 Is this cross-Sectoral example typical for Scotland?

Whilst there are few formal institutions beyond the two national parks supporting regional cross-Sectoral working to protect nature whilst delivering for society, there are many regional or landscape organisations working to deliver such outcomes across Scotland. The Forth Rivers Trust is a very active trust but there are also active catchment, landscape and biosphere partnerships across Scotland. Therefore, the example is not found everywhere but it is not unique. What is special is the strong focus on river restoration as the way to deliver on local community needs (e.g. mitigation of flooding) and mainstreaming of climate and biodiversity action into multiple Sectors (infrastructure, manufacturing).

Sources: (Carvalho et al., 2022; Forth Rivers Trust, 2025; Ibrahim et al., 2025b; MERLIN, 2025a; Ojanen et al., 2024; Rouillard et al., 2025; Schwerk et al., 2025).

4.2 Case Study 04: Room for the Rhine (NL)

Author: Sien Kok

Figure 9: Demonstration of Room for the Rhine at landscape scale promoting discussion between stakeholders (credit: Alhassan Ibrahim)

4.2.1 What restoration measures are being implemented?

The Room for the River (RfR) programme implemented a suite of restoration measures aimed at improving flood safety and spatial quality along the Rhine and Meuse rivers. These measures include dyke relocation, excavation of floodplains, creation of river bypasses, and lowering of groynes, spanning a total of 34 projects. Overall, the programme is viewed as a NbS as the baseline alternative to this floodplain reconnection was reinforcement of existing dykes.

Currently, the 'Room for the River 2.0' programme (earlier called 'Integrated River Management) is under development, considering similar floodplain reconnection interventions as in 'Room for the river (1.0)', including interconnected side-channels and dyke relocation, although the Strategy development is in its early stages.

The MERLIN implementation project on the Rhine is set at the individual floodplain level: the creation of ecological flood retention by changing land use from (often) Agriculture to nature, reconnecting and rewetting floodplains by changing sluice management in summer dykes.

4.2.2 Why is there a need for change (drivers); what is the goal(s)?

For the first Room for the River programme, the need for change was driven by near-flood events in 1993 and 1995 and expected increase in high-discharge events under climate change. The traditional dyke-based approach was deemed insufficient to cope with future uncertainties. The goals of RfR were twofold: (1) to improve flood safety by accommodating higher discharge capacities (16,000 m^3/s for the Rhine), and (2) to enhance spatial quality through integrated river basin management (Roth et al., 2021; Zevenbergen et al., 2015).

Nowadays, the Rhine faces old and new challenges: The Rhine Branches currently face a disrupted sediment balance, leading to riverbed incision in some areas and limited sedimentation in others. This affects lateral connectivity, harming ecology, Agriculture, and increasing land subsidence. It also shifts discharge toward the Waal branch, raising flood risk and reducing the Ijsselmeer's refill capacity, which is vital for freshwater supply. Incision lowers water depth under low-flow conditions, impairing Navigation (reducing vessel load capacity). Climate change is expected to intensify these challenges as the Rhine transitions from a meltwater-fed to a

rain-fed river. Floodplain ecological quality is also declining due to habitat loss, reduced connectivity, and strict vegetation management. Against this backdrop, the Room for the river 2.0 program is currently at the phase of setting the goals, in particular related to the riverbed elevation (GD goal: Drought Resilience, Sustainable Transport) and discharge capacity of the floodplains (GD goal: Flood Resilience); additionally targeting Navigation, nature and the regional economy. In parallel, the Programmatic Approach Large Waters (PAGW), running from 2018 to 2050, is an investment program which focuses on ecosystems quality (connected to Habitat Directive and WFD). Goals set in the PAGW program may possibly be taken up in the Nature Restoration Plans under the NRR (linked to GD Biodiversity Net Gain).

Regarding Sector-specific challenges, issues of low-flow for Navigation are prevalent. For example, during the 2018 drought, Inland shipping Sector disrupted logistics, increased costs (ships could only sail with 1/3 to 1/4th of their normal capacity), which led to higher prices across the supply chain (Hekman et al., 2019).

For conservation, the PAGW has set goals for the number of ha of specific (wet) floodplain ecotypes required to support sustainable populations of target species (PAGW hotspot analysis).

Although there are no specific challenges for the mining/ resource extraction Sector (extracting clay, sand gravel), potential locations for extraction are scarce (due to spatial planning and spatial reservations for e.g. recreation or nature development); extraction therefore is often developed alongside/ in synergy with floodplain reconnection, nature development or other infrastructural projects (Kok et al., 2025)

4.2.3 What benefits come from the measure(s)?

In a study by (Kok et al. (2025), benefits from various strategies for floodplain reconnection and sediment management in the Rhine branches are assessed. One of those is the 'Living rivers +' Strategy based on ARK Natuurontwikkeling et al., (2018), with large-scale floodplain reconnection, including interconnected permanent side channels through the floodplains, restoration of the riverbed elevation to a former level and more room for nature in the floodplains. Table 4 gives an overview of estimated annual benefits.

Table 4: Estimated benefits of proposed measures under Strategy 'Living Rivers+ for economic Sectors based on Kok et al., 2025 (under review.)

Benefit	Order of magnitude (€/year)	Indicator	Sector/ beneficiary
Aesthetic value	€28	Property value	Property owners
Additional yield due to increased groundwater availability in and near floodplains	€15000/year	Net revenue	Farmers
Agricultural production in the floodplains	-€20 M	Farmgate-price/ gross revenue	Farmers
Agricultural production – prevented loss due to increased irrigation availability	€7 M	Net revenue	Farmers
Biomass production	-€0.7 M	Vegetation management net costs	RWS, landscape/nature organisations, energy producers from biomass
Construction material provision	Sand: + 16.6 M m^3 Clay: 2.5 M m^3 Gravel: 0.12 M m^3	Cubic m excess material	Material extraction industry
Carbon sequestration	€2.2M	Efficient CO2 prices	Ministry for climate and energy (contributes to goals on emissions from land use)
Flood mitigation	-€5M	Lifecycle costs of dyke infrastructure	Water authority – High Water Protection Programme

Habitat provision	110% PAGW policy achievement €68M	Policy achievement (area/habitat type) Willingness to pay by households	PAGW/ conservation Sector
Navigation support	€1.7M	Transport costs related to reduced load capacity	Inland shipping Sector
Recreation/ walking + cycling	€3173	Willingness to pay for additional local outdoor recreation capacity (function of supply/demand)	Local residents
Recreation/ sport fishing	€0.9M	Additional expenditure on fishing trips (function of changes in supply and demand elasticity * average expenditure/trip)	Sportfishing association (Sportvisserij NL)
Water filtration[2]	Nitrogen: - €23000 Phosphor: - € 93000	Marginal prevention costs	Water authorities
Yield from natural grassland	€4.3 M (farmgate-price/ gross revenues)	farmgate-price/ gross revenue	Farmers

4.2.4 Which Sectors are involved?

Key economic Sectors affected by interventions in the Rhine river and floodplains are Conservation (PAGW – program set within regional water management and local NGO's – with goals for preservation of species), Agriculture (floodplain farmers stand to lose from land use conversion; currently producing mostly grass, maize and crops; farmers downstream depend on sufficient water directed towards the Ijsselmeer reservoir for irrigation), Inland Navigation, Mining /Resource extraction, Tourism and recreation (including both sport fishing, represented by Sportvisserij Nederland, and hiking/cycling recreation in floodplains – birdwatching and water-based recreation are also common in floodplains), Infrastructure & Logistics (HWBP; dyke reinforcement program), Administration & professional activities. Biogas composters in the area which are used to process biomass from vegetation management would also be affected.

4.2.5 What roles do the Sectors play? Are they affected by the measures? Do they affect the measures?

The answers are shown in the table below.

Table 5: Room for the Rhine Sector involvement

Sector	Role	
Administration & professional activities (spatial planning, permitting etc)	Resource manager	Various public administrations are responsible for floodplain-river management planning and operational management, including issuing permits for economic activities.
	Installer	Water authorities (national and regional level) manage the river and land use planning and permitting of floodplain activities.
Agriculture	Beneficiary	If the Room for the Rhine 2.0 program plans to (re)direct more water through the Ijssel branch, this would increase the fill level of the Ijsselmeer, benefiting farmers that use this water for irrigation.
	Installer	If more natural floodplain management is required -e.g. a conversion from intensive grassland to extensive, more

[2] This result is sensitive to approach taken in quantification and may also be positive; in the literature, floodplain restoration generally leads to improved water quality.

		natural grassland, in many cases local farmers will be enlisted to manage this land.
	Blocker	Local floodplain farmers that own or lease the land can obstruct floodplain reconnection if their land or business is affected.
Conservation	Resource manager	Public-led conservation programs (PAGW, local initiatives) and NGO's owning or buying up land in the floodplains for restoration.
	Enabler	Lobby NGO's such as WWF can play a role in supporting implementation by conducting studies and reaching out to general public and policy makers.
Construction	Installer	Large-scale floodplain reconnection projects would provide a significant economic impulse to the construction Sector.
(Bio) (renewable) Energy	Beneficiary	Biogas producers could receive more organic matter from floodplain management if more floodplain land is converted to (managed) nature.
Infrastructure & logistics (including transport)	Beneficiary	Floodplain infrastructure managers stand to gain or lose from floodplain reconnection, depending on whether the project directly affects the infrastructure (requires a lot of logistics and investment to reroute and reconstruct) or indirectly – increasing the floodplains' discharge capacity lowers dyke lifecycle costs).
Inland Navigation	Beneficiary	The Inland shipping Sector contributes to Integrated River Management (IRM/RftR2.0) in the Netherlands by actively providing input through organizations like Koninklijke Binnenvaart Nederland (KBN), ensuring that the Sector's needs—such as navigability and water level management—are considered in policy development.
Mining/resource extraction	Installer	In some cases, resource extraction companies may be enlisted to undertake physical works in floodplain reconnection, in exchange for use of the excess raw materials.
	Beneficiary	If policy decisions are made that require floodplain reconnection and provide opportunities for resource extraction, resource extraction companies stand to benefit.
Tourism and recreation (including health benefits)	Beneficiary	Increased naturalness or nature and/ or fishing waters in the floodplains affect the capacity for outdoor recreation. This has health benefits for local inhabitants and increases or enables revenue generation by tourism/recreation or adjacent (e.g. fishing material) industries.

4.2.6 What is the form of cross-Sectoral work

Sectors worked together in the 'Integrated River Management Program (IRM) to prepare new policy on riverbed elevation and floodplain discharge and retention capacity; to be further developed and implemented in the 'Room for the River 2.0' program (planning deadline set at 2029). These are multi-level governance programs where national government, provinces, water authorities, and municipalities work together to create a climate-resilient river system. This collaboration is formalized and coordinated through joint planning, policy development, and implementation processes. The formal initiator and authority is the Ministry of Infrastructure and Water Management; alongside the ministries' implementing agency (Rijkswaterstaat) and other ministries, regional partners include provinces, water authorities and municipalities along the Rhine, working together within existing structures of the Deltaprogramme Rijn (also a partnership with national government, provinces and water authorities, targeted to guide spatial and water management decisions and coordinate research, policy and implementation), coordinating internationally (e.g. ICBR) and other national programs (PAGW – Programmatic Approach Large Waters, HWBP – High Water Protection Program, WFD – Water Framework Directive & Delta Program Freshwater).

In addition to public authorities, private Sector organizations and civil society groups—such as nature organizations, agricultural associations, Inland shipping representatives, and recreational users—are involved through consultations, participatory meetings, and formal feedback procedures during the design and execution of the program. As the room for the River 2.0 is still in its early stages, there has not yet been a large role for local stakeholders yet; coordination and participation has been mostly limited to public entities.

In the first Room for the River program, stakeholder engagement and cross-Sectoral work (especially between public agencies) has been generally recognized as a good example (Rijke et al., 2012), although Roth et al. (2021) point out that stakeholder involvement was often limited to consultation rather than co-decision making, sounding board groups has limited influence (having no formal mandate), narrow framing of initial objectives (prioritising flood safety over other values like biodiversity or local livelihoods including Agriculture) and unequal power dynamics, with economic and infrastructural interest dominating ecological or social concerns.

4.2.7 What are the main actions to support the cross-Sectoral work taking place?

Attitudes & Leadership:

Leadership in the Room for the River programme was shaped by a collaborative and adaptive mindset. The programme embraced a philosophy of "controlled trust", allowing regional governments to take the lead while the national programme office provided support and oversight. This approach encouraged openness, flexibility, and shared responsibility. Leaders at all levels—national, regional, and local—worked together in both formal teams and informal networks, fostering trust and mutual learning. The programme also invested in leadership development through training and regular exchanges, helping build a strong community of practice. This distributed leadership model enabled quick adaptation to challenges and supported innovation in both technical and governance aspects. Overall, the leadership style was inclusive, learning-oriented, and focused on building long-term relationships, which proved essential for the programme's success.

Limitations of these approaches is that the controlled trust and distributed leadership model were not fully embedded in the institutional culture of participating organisations, which means that after the program (and the coordinating role of the program office) ended, knowledge sharing and coordination efforts on integrated river management did not continue.

Information, Knowledge Sharing Innovations:

In the first Room for the River program, the programme office centralized knowledge management and quality control; this enabled learning from early projects, for example on interface management between project office and project teams, configuration of project teams, milestone management procedures and deliverables and technical guidance of projects, improved how risks were managed and how local communities were involved. The programme office had a flexible mandate – initially tasked with monitoring progress and quality of all project teams, it was also able to provide lacking expertise (e.g. on tendering, logistics, litigation). Also, the programme office actively built capacity in stakeholder management through training activities, and organized events for decision-makers, project managers, stakeholder and risk managers to share experiences in informal networks. While scientific research wasn't deeply involved in daily project work, evaluations at the programme level helped improve strategies. A system of regular monitoring and reporting ensured that projects stayed on track. These efforts helped different government levels work together and supported a shift in how water management is done in the Netherlands.

Limitations of these approaches were that informal collaboration among project leaders and decision makers were ad-hoc; much of the leadership success relied on individual experiences and relations – with many contributors working on temporary contacts, there is a risk that valuable insights and institutional memory has been lost.

Funding & Finance:

The funding and financial structure of the first Room for the River programme was designed to support its dual objectives: improving flood safety and enhancing spatial quality. The Dutch national government allocated a total budget of €2.2 billion, primarily earmarked for water safety measures. Spending criteria allowed for integration with spatial development investment, which had to be funded by regional and local governments. These contributed an additional €80 million to co-finance spatial improvements. Financial responsibilities were clearly defined in formal agreements between national and regional partners, including cooperation and realization contracts. The central programme office was tasked with monitoring expenditures and reporting progress biannually to Parliament, including tracking of budget spent on safety versus spatial quality. The programme was finalized within budget and on schedule.

Collective Action Institutions:

The Room for the River programme office acted as collective action institution, coordinating across multiple public institutions (national, regional/local). There were formal cooperation agreements established between the national government and decentralized authorities; the collaboration was structured through administrative agreements and working groups, such as the Administrative Guidance Group (ABG) and the Licensing Authority Working Group (AWBG). These groups included representatives from all levels of government.

4.2.8 How does the multi-level governance work? Which level could help with mainstreaming?

A lot still unclear, as Room for the River 2.0 – which in theory would significantly help or hinder setting the right boundary conditions for conservation/ restoration goals in the Rhine – is still in very early stages of development.

4.2.9 Is this cross-Sectoral example typical for the Netherlands?

The Room for the River program was considered a frontrunner in terms of cross-Sectoral and integrated river management and stakeholder engagement, although there were some critical voices on limited influence of especially non-public actors (e.g. Roth et al., 2021).

Sources: (ARK Nature Development, 2018; Den Boer et al., 2019; Ibrahim et al., 2025b; Kok et al., 2025; 2025; Kok et al., n/d; MERLIN, 2025a; Ministrie van infrastructuur en Waterstaat, 2025a, 2025b; Rijke et al., 2012).

4.3 CS09 – Tisza (HU) Floodplain Reconnection and Rewetting

Authors: Péter Kajner, Anna Bérczi-Siket, Fanni Nyírő (WWF HU)

Figure 10: Start of the Tisza -Bereg Reconstruction of the weir T39 in summer 2025 (credit: Peter Kajner)

Figure 11: The completed Tisza- Bereg reconstruction of the weir (credit: Peter Kajner).

4.3.1 What restoration measures are being implemented?

The MERLIN project supports water retention and floodplain reconnection measures in two pilot areas along the Tisza River in Hungary. The project **implementation site is the Bereg region** on the Upper Tisza. By 2018, a flood risk reduction reservoir and an internal canal system to support landscape management had been built here by the government with national and EU funding. The primary function of the reservoir is to reduce the level of potentially catastrophic floods by diverting part of the flood wave to the former floodplain, which has been reconnected to the river. However, the landscape management canal system is also suitable for diverting water from smaller flood waves to the floodplain and using it to combat drought. Nevertheless, this has not become a regular practice, as landowners have not provided land for inundation. The MERLIN project aimed to make the diversion of smaller flood waves, the retention of Inland waters, and the flooding of certain areas a regular practice. To achieve this, land use in many areas will have to be changed, with the involvement of the stakeholders concerned. (To ensure regular water replenishment, another project has designed a solar-powered pump system that would fill the canal system with water from the Tisza River. This could be built after the MERLIN project has been completed. Within the MERLIN project, the planned measures to be implemented in line with NRR Annex VII (European Commission, 2024e) were: regular inundation of landscape units from the Tisza River within the Bereg Flood Risk Reduction Reservoir System, transition in land use, floodplain reconnection and rewetting, introduction of floodplain farming, biodiversity enhancement.

The MERLIN demonstration site is in Nagykörű village, on the Middle Tisza. Between 2000–2005, WWF implemented an EU LIFE Programme supported wetland restoration project here. A sluice was built, which enabled partial inundation of wetlands from the Tisza, water retention, enhancing biodiversity. After the restoration of wetlands, between 2005–2010, traditional fishing, grazing was started, but local conflicts arose concerning the operation of the sluice after 2010. Now the sluice is not in use, no water retention measures are in effect, as several landowners oppose the idea of water retention. Nevertheless, the river can flood ‘Lake Anyita’ and part of ‘Dúdor’ areas for a shorter period of the year. The long term aim here is to lengthen the period of inundation from the Tisza by reconstructing the sluice and start nature friendly floodplain farming here. In the MERLIN project, we presented the impact of the wetland restoration project carried out until 2005 on local ecological, social, and economic systems to date, using the MERLIN systemic monitoring framework.

In the above-mentioned case study areas of MERLIN, a key objective is to involve water management, Agriculture, nature conservation, public administration, and civil society Sectors, and to organise their cooperation. The water management Sector must enable the technical drainage of water from the river, while the agricultural Sector must provide land for flooding. The public administration must assist the restoration work by creating the appropriate legal and support framework.

4.3.2 Why is there a need for change (drivers); what is the goal(s)?

The Tisza River Basin faces intersecting ecological and economic crises. Climate change is driving extreme weather events, prolonged droughts, and surface and groundwater scarcity, while the overexploitation of natural resources leads to biodiversity loss, pollinator decline, and soil degradation. Long-term measurements show that the amount of water arriving in the rivers of the Tisza catchment area decreased significantly

between 1951-2020, in some places dramatically. During this period, the (average) discharge in the Upper Tisza decreased by 28%. The groundwater table is falling by an average of 1-3 cm per year across the entire Great Plain, and in many places it has fallen by several meters in recent decades. According to measurements, the top 28 cm of soil, which is important for plants, has been getting dryer since the 1960s. These environmental pressures are eroding the very foundations of Hungary's Agriculture, which is predominantly based on intensive arable production for global commodity markets. Simultaneously, the Sector is destabilized by volatile input and output prices, dependency on industrial inputs such as fertilizers and energy, and intensified market competition, including from low-cost imports. These trends are accelerating farm abandonment and threaten the viability of rural livelihoods. The concentration of land use and the abandonment of agricultural production, as well as the aging of farmers, are problems throughout the Tisza River basin (and in Hungary as well).

Beyond environmental degradation, Hungary's Agriculture also struggles with structural challenges: the ageing rural population, labour shortages, and declining interest in farming further constrain the Sector's capacity to adapt. While precision farming technologies offer limited solutions, they are inaccessible to most and not always compatible with sustainable land management goals. Precision technologies can reduce certain types of pollution locally (e.g., the amount of excessively applied chemicals and fertilizers), but overall, the development, manufacture, and depreciation of the infrastructure of the machines and IT systems used is extremely capital-, material-, and energy-intensive. These technologies are very expensive (and becoming increasingly so), making them increasingly accessible only to large companies, which leads to further concentration of land use. In this context, natural water retention and landscape-scale climate adaptation offer an urgently needed alternative development path.

To answer these challenges, a cross-Sectoral Tisza Strategy (see more details at Section 4.1.7) is drafted, which main goal is to catalyse a paradigm shift in land use and agricultural Strategy across the Tisza Basin. This entails transitioning large-scale arable production towards extensive floodplain farming – water-retention based systems that regenerate soil and its water resources, retain water in the landscape, and promote biodiversity. The ambition is to introduce nature-based, sustainable floodplain management on at least 150,000 ha, supported by new value chains for eco-farming, land use diversification, and rural economic resilience by 2030. The change is also economically and socially beneficial: it offers exit strategies for aging farmers, new opportunities for sustainable production, and a long-term vision for viable, climate-adapted rural regions.

4.3.3 What benefits come from the measure(s)?

Key economic Sectors are Water Supply and Sanitation, Infrastructure, Agriculture (large farmers and agricultural companies have a dominant voice in local land use, producing mostly grain, maize, oil seeds and fibre crops), Forestry, and Fishery. The RSP divides these stakeholders by scale: national, sub-national, catchment, regional, local and municipal level stakeholders. The restoration measures are supported by coordinated stakeholder involvement. State land acquisition and planned management by the national park authority is planned at the Nagykörű site (Kajner et al., 2024).

4.3.4 Which Sectors are involved?

The measures implemented in the Bereg and Nagykörű pilot areas are expected to generate both short-term and long-term impacts, with their timing depending on the type and scale of interventions.

Short-term impacts (by 2028) are expected from initial gravity-fed inundation systems and the introduction of new land use practices, such as nature-based floodplain farming. These actions can already deliver early benefits during the project period, particularly in terms of habitat rewetting, biodiversity gains, and early-stage drought resilience. Farmers who begin transitioning to water-compatible crops may also start experiencing changes in production and improved soil conditions within a few years.

In the demonstration area in Nagykörű, monitoring for the period 2000-2025 found that the condition of ecological systems had improved as a result of regular water coverage, but farming practices had not adapted to this. This has created further tasks in order to establish land use that promotes water retention. The current goal here is to manage the area uniformly (through state buyouts) and to implement floodplain farming.

In the Bereg, water inundation, completed by the end of the MERLIN project period, mainly affects forest areas. Here, it is likely that water coverage will help the health of the forest struggling with drought and the regeneration of the forest in line with NRR Article 12 (European Commission, 2024e). However, flooding has only recently taken place here, so it is not yet possible to draw many conclusions from the monitoring results.

The more significant and systemic impacts, such as large-scale land use change, construction of solar-powered pumping systems (Bereg site), and broader adoption of water retention strategies will materialise after the end of the MERLIN project. According to the RSP, long-term impacts (by 2030–2040) include the creation of semi-natural habitats (grasslands, wetlands, forests), enhanced climate change resilience, and reduced damage from

inappropriate land and water management. In the long run, the ecological status of the Tisza region is expected to improve significantly, alongside the livelihoods of rural communities. This requires the implementation of policy objectives and changes to the Strategy and operation of the water management Sector and Agriculture (Kajner et al., 2024).

Besides the benefits, it is also important to mention here that of the MERLIN case studies, the Tisza reported the largest trade-off from the floodplain rewetting project. In Nagykörű, a 66% reduction in agricultural land was required to achieve a significant improvement of biodiversity habitat.

4.3.5 What roles do the Sectors play? Are they affected by the measures? Do they affect the measures?

Table 6: Tizsa floodplain rewetting Sector involvement

Sector	Role	
Administration & professional activities (spatial planning, permitting etc)	Resource manager	Government offices issue permits for investments and activities in virtually all Sectors.
	Installer	Water directorates manage the water system and allow some areas to be flooded.
Agriculture	Installer	The National Chamber of Agriculture is in contact with most of the farmers through the village advisers, and in the Bereg pilot area they are willing to cooperate in the awareness raising of farmers.
	Blocker	The national leadership of the National Chamber of Agriculture is rather dismissive on the issue of NWRM, making it difficult to get the necessary subsidies. They would rather develop irrigation.
Banking & Finance	Blocker	Banks and other organisations that finance Agriculture (e.g. integrator companies) prefer to finance industrialised agricultural production. Some of them have started to orient themselves towards sustainable solutions, but this is at an early stage.
Conservation	Resource manager	The national park authorities generally support the NWRM. They may set restrictions on the flooding of certain areas with regard to protected species. They only have an advisory role in the administrative procedures.
Construction	Resource manager	Works for water retention can be carried out by public or private companies.
Education (also advisors, researchers and scientists)	Enabler	The researchers carry out surveys in the sample areas to understand the situation, make recommendations for implementation and monitor and analyse the results.
(Bio) (renewable) Energy	Beneficiary	One possible use of biomass from restored floodplains that have been flooded is the use of organic matter to produce biogas.
Fishery (including aquaculture)	Beneficiary	Fishing is prohibited in the rivers, only for demonstration and ecological purposes is authorised, which can be used to develop tourism. However, there is considerable potential to develop angling tourism in newly created water bodies.
Forestry	Beneficiary	Forests suffer from drying landscapes, so temporary flooding can be beneficial for forestry. This was successfully tested in the Bereg sample area.
Infrastructure & logistics (including transport)	Blocker	Roads, railways and linear installations can be an obstacle to the flow of water. Their maintenance aspects should be taken into account in construction and maintenance.
Inland Navigation	Beneficiary	There is no large-scale shipping on the Hungarian Section of the Tisza. Small-scale boat and ship tourism could be a development option on the new waterways.
Insurance (risk Insurance, life Insurance covered in banking)	Enabler	Climate change increases weather-related risks in Agriculture and other Sectors. The prevention of water scarcity and the development of resilient economic activities may also be of interest to the Insurance Sector. We therefore see them as potential financiers and have started to engage with the Sector.

Sector	Role	
Media	Enabler	It has a very important role in sensitising, awareness raising and passing on information. WWF carries out local and national campaigns involving the media.
Manufacturing (especially food, drink, health products)	Beneficiary	NWRM-based floodplain management creates new types of raw materials (e.g. Élő Tisza products, fruits, fish reed, timber), which present new opportunities and challenges for processing. There is a need to develop innovative new products and to scale up local processing in the model areas.
Mining/resource extraction	Resource manager	In some cases, abandoned mine pits may also be suitable areas for NWRM.
	Enabler	Exploitation in the river basin that is damaging nature must be detected and stopped.
Tourism and recreation (including health benefits)	Beneficiary	One of the main ways of exploiting mosaic-like landscapes, rich in water, could be tourism. However, it is essential that successful development requires not only the development of a few businesses, but also a coherent approach to tourism development on a regional scale. Cooperation between service providers must be strengthened and clusters developed.
Water Supply and Sanitation	Beneficiary	In the long term, guaranteeing the recharge of aquifers is necessary to maintain water security. The planned floodplain NWRM will contribute to this. The water supply Sector is therefore a potential financier/collaborator. The implementation of territorial water recharge should take into account the need for wastewater treatment plants. Wetlands can also play a role in the near-natural treatment of wastewater under appropriate technological conditions.

4.3.6 What is the form of cross-Sectoral work

Cross-Sectoral collaboration in the Tisza River region takes place through **a combination of direct partnerships, coordinated platforms, and intermediary communication channels**. Previously, engagement with individual farmers occurred via intermediaries who facilitated dialogue and information flow between local producers and water management authorities. This approach has now been formalized through the development of a dedicated **digital application**, which allows farmers to communicate directly with the water authority ('Water for the Landscape Program')(Kajner et al., 2024).

During the **preparation of the RSP**, extensive cross-Sectoral cooperation was achieved by drawing on the rich field experience gathered through the MERLIN project. Input and guidance were provided by the **Case Study Board**, local farmers from pilot sites, and key representatives of major stakeholder groups such as the Upper Tisza Regional Water Directorate, the Network of Village Advisers, the National Chamber of Agriculture, and the Hortobágy National Park Directorate.

The concrete organisations (stakeholders) identified in the Tisza RSP are grouped into classification systems that help us understand their roles within the MERLIN project and the broader NbS framework - for more details, see the RSP (Kajner et al., 2024) and engagement analysis (A. Ibrahim et al., 2025b). For instance, based on their engagement and influence in the Tisza region, see the list below regarding Sectoral involvement in the adoption of the Tisza Strategy:

Empowerment: This group includes key actors from water management (e.g., VIZITERV Environ Plc [a major, state-owned water planning company], Upper Tisza Regional Water Directorate), NGOs (e.g., WWF Hungary, Association for Hungarians in the Carpathian Basin), Agriculture (e.g. small-scale producers), nature protection authorities (Hortobágy National Park Directorate), and municipalities (e.g., Municipality of Tarpa).

Cooperation: Examples include the General Directorate of Water Management, various county government offices, and the Hungarian Chamber of Agriculture.

Local economic development and tourism depend on strong collaboration among local actors, but such cooperation is weak due to a tradition of competition and Sectoral conflicts. Large-scale farmers sometimes dominate local decision-making, which can marginalize smaller stakeholders. To address this, the project engages existing local forums and institutions with organizational authority to foster coordination. Community consultation and decision-making mechanisms are being established, alongside support for accessing new funding opportunities and promoting local economic initiatives, such as the Living Tisza trademark for floodplain farming products. The Living Tisza trademark was created and is operated by the Association for the Living Tisza. Its primary goal is to label products (mainly food) produced in the Tisza River basin. Producers can

also voluntarily commit to quality requirements. In order for the trademark to function more effectively, it would be necessary to develop the certification system and, above all, to boost marketing.

4.3.7 What are the main actions to support the cross-Sectoral work taking place?

Realizing the vision for the Tisza Basin requires targeted public programmes, regulatory and financial incentives (e.g. through CAP instruments), and active involvement of farmers and local stakeholders.

Attitudes & Leadership

The development of the **Tisza Strategy**, scheduled for **completion by 2028**, brings together key stakeholders from water management, Agriculture, industry, spatial planning, municipalities, science, and civil society. This Strategy will establish a coherent framework for sustainable water management and land use, supporting a social and economic shift towards NbS and new water retention methods.

How does the government support the Strategy?

Within the government, it is mainly the management of the water Sector that supports the making of the Tisza Strategy. NGOs, experts, officials have jointly prepared and accepted a project plan and a concept which is expected to be supported by the Ministry of Energy[3]. On this basis, a detailed Tisza Strategy can be prepared, which will pave the way for the planning of complex water management facilities along the river and in the Great Plain. The Strategy will address the tasks of Agriculture in terms of land use change, increasing water resilience in other Sectors and awareness raising.

The National Directorate for Water has started implementing the **Water in the Landscape programme**, with a focus on water retention. In our implementation site, the Bereg, good cooperation with the local water board has been established. In Agriculture, the support scheme of the Common Agricultural Policy has changed somewhat in a positive direction. Area payments can now be granted for areas covered by water too and some other incentives have been introduced. Drainage from areas under agri-environmental schemes is prohibited.

Moreover, an **inter-ministerial committee for Water Management** was set up, participated by high level (ministers) leaders of the water, Agriculture, energy, public administration and regional development and conservation Sectors that enables quick, cross-Sectoral and high-level support for transformative decisions for answering the challenges of water management listed in Section 2 (see more details in Section 4.3.8.).

How does the government relate to restoration cases in the Tisza Strategy?

The National Directorate for Water is generally supportive of water retention, but only if the owner has voluntarily offered his/her land for this purpose. There is still greater opposition from farmers and agricultural companies, agencies, organizations. The offer of land for flooding is very few and scattered. The agricultural authorities (Ministry of Agriculture, Chamber of Agriculture) prefer to see irrigation as the main means of combating drought and are trying to implement such projects. Farmers are given free irrigation water during drought.

Costly projects (which seem to be rather unrealistic) are planned to pump water from the Danube and Tisza rivers up to the semi-desert landscapes higher than the rivers (Sand Ridge, Nyírség) and spread it there. Meanwhile, there is little talk of the urgent need to change land use in such areas, to stop growing water-intensive arable crops (e.g. maize) and planting closed forests. The drainage of Inland water should also be urgently stopped, but this has not yet entered the political mainstream.

The introduction of new Common Agricultural Policy (CAP) subsidies in 2025–2026 offers the potential to further accelerate the transformation. One such example, though recently put on hold by the government, is the **‘water premium’** based on satellite-detected water coverage. This results-based payment system could reward farmers for measurable water retention without the administrative burden of complex applications, helping overcome a key barrier to participation. Further lobbying is needed to ensure that this promising agricultural subsidy is introduced in 2026.

The most important subsidies to encourage land use change and water retention have been delayed, their budget is small (non-productive investments for habitat development, non-productive investments for water retention, water premium). The most influential Hungarian green NGOs (Hungarian Ornithological and Nature Conservation Association - Birdwatch Hungary, WWF Hungary, Hungarian Association of Nature Conservationists - Friends of the Earth Hungary, Alliance for the Living Tisza) are lobbying by the agricultural leadership and campaigning for the publication of the calls for proposals in 2025-2026. Once these are launched, NGOs will help farmers in the model areas along the Tisza to successfully apply for the subsidies.

[3] In the Hungarian national governance water management is currently in the competence of the Energy Ministry.

Legal & regulatory requirements

Regulation of water management and Agriculture is key to achieving sustainable water management and land use. Their current framework focuses more on protecting against water surpluses, i.e. how to drain floods and Inland water as quickly as possible without causing damage. However, to protect against droughts and water scarcity, it would be essential to store and disperse surplus water in the landscape. WWF Hungary has recently commissioned a non-public, decision supporting study entitled 'Analysis of the legal environment for climate-smart water management and land-use change', which analysed the legal situation. In addition to a thorough analysis of the situation, this study also made concrete legal proposals on how to establish a legal framework for sustainable water management and Agriculture based on the Hungarian Constitution.

The analysis of the legislation in the water management Sector shows that both the establishment and operating water permits, and even the operating rules and regulations, should be revised in order to avoid the existence of provisions and obligations that promote unnecessary water drainage and hinder water conservation. In the case of an *ex officio* modification of a water permit, if the modification is necessary in the public interest, no compensation should be payable for damages for the farmer by the state resulting from the *ex officio* measures. For instance, if the water level in water management channels is raised to prevent drought and this causes flooding of certain areas of a farmer's land, the farmer cannot sue the water management authority because water retention to combat drought is in the public interest.

To sum up, since 2023, there have been a number of positive policy changes in the water and agricultural Sectors. Since 2023, farmers do not lose CAP area-based payments if they retain water on their lands. Water drainage is banned in all agri-environmental schemes. In 2025, the General Directorate of Water has launched the 'Water for the landscape!' program – a new, voluntary water retention program for farmers. A high level inter-ministerial committee on water retention was set up. Formerly, new CAP subsidies were announced to come in 2025-2026 (incentives for land-use change, water retention investments, water premium) to incentivise water retention. However, as indicated above, their introduction has recently become uncertain and further lobbying is needed to get these grants announced.

Information, Knowledge Sharing, Innovations

Within the framework of MERLIN and with the support of other projects, WWF Hungary undertook to present the advantages and feasibility of NbS to local stakeholders, mainly those involved in the water and Agriculture Sectors, the local population, and the wider public. The aim is to ensure that water retention and water-friendly Agriculture are accepted as a concept and widely applied in practice. To this end, forums and workshops were organized and direct advice was provided to stakeholders. However, the goal is to use the state-run advisory and awareness-raising infrastructure to make water- and nature-friendly practices common in land use. To this end, we have also begun to involve the network of village advisers operated by the National Chamber of Agriculture and the Green Advisory System, which is involved in the implementation of the CAP. We are launching communication campaigns targeting the Bereg and Nagykörű areas, as well as nationwide campaigns.

Funding & Finance

Transforming water management infrastructure and encouraging farmers to adopt water retention-based farming practices require substantial public funding. Within the CAP Strategic Plan, under non-productive investments in agroecology, non-productive investments for water protection and habitat development, as well as the draft support program currently running under the working title Water Premium, are particularly suitable for beginning to reward water retention in low-lying areas threatened by Inland flooding, on a voluntary basis, to farmers who achieve community goals. NGOs are lobbying for the introduction of these measures. There have already been positive changes in the CAP support system. Farmers now do receive area-based payments even for waterlogged areas. Voluntary participants in the agri-environmental program are required to retain water in the area.

At the same time, attracting private capital is a priority, especially from younger farmers interested in environmentally friendly production methods and from green investors like the European Bank of Reconstruction and Development (EBRD) and European Investment Bank (EIB). Initiatives such as WWF's Bankable Nature Solutions are helping to develop investable projects, preparing bankable solutions that can channel these funds into landscape rehabilitation efforts along the Tisza. Cooperation with the Hungarian Sustainable Investment Forum (HUSIF), in which the largest national and international banks represented in Hungary financing the agricultural Sector are also participating.

Collective Action Institutions

Sustainable water management, land use and habitat restoration can only be effective at the landscape scale. Today, individual farmers decide for themselves (within the legal framework) what to sow on their plots. The legal, subsidy and market framework mainly encourages industrialised arable production. Today, cooperation between farmers on a landscape scale in the interests of sustainable landscape use is only organised on a project basis, possibly on a case-by-case basis (e.g. WWF Hungary is carrying out such work in the model areas along the Tisza, for example).

In 2024, a series of workshops were held on the planning of a Tisza Valley Strategy, with key leaders, planners and researchers in the Hungarian water Sector, representatives of major NGOs working on sustainability, experts of outstanding importance in agri-environmental research. Representatives participated in these meetings from the General Directorate of Water Management, VIZITERV Environ (the largest publicly owned water planning company), Budapest University of Technology and Economics Department of Sanitary and Environmental Engineering, Hungarian Hydrological Society, Research Institute of Agricultural Economics, National Environmental Council, National Society of Conservationists, Association for Hungarians in the Carpathian Basin, Alliance for the Living Tisza.

4.3.8 How does the multi-level governance work? Which level could help with mainstreaming?

EU policy frameworks (e.g. CAP, WFD and daughter Directives, Water Resilience Strategy, NRR, Climate law, Climate Adaptation policies) are implemented at national level through national legislation and permits.

As mentioned in Section 4.3.7 an inter-ministerial committee for Water Management was set up in 2024. Although the committee has an integrative cross-Sectoral membership the participation of more Sectoral organisations (e.g. landscape conservation, Chamber of Engineers) would enhance its role in cross-Sectoral cooperation (Gáspár, 2025).

Its main task is to promote the integration of water management considerations into other Sectoral policies, particularly in the areas of Agriculture, spatial planning, and environmental protection. It coordinates strategies related to water use, makes proposals for legislation and programmes, reviews government submissions related to water management, and participates in consultations between the government and the National Assembly. In addition, it monitors EU decision-making processes, supports the representation of national water-related interests, encourages the involvement of local communities, and facilitates the flow of information among the relevant stakeholders.

How is the Tisza Strategy considered by the committee?

The making of the Tisza Strategy has not yet been launched, only a conceptual plan of the areas it would cover has been prepared. The concept has been prepared with the participation of the leaders of the water Sector, large green NGOs, and research institutes (see above). If the government financially supports this planning process, it could be elaborated between 2025-2028. Overall, it can be said that the representatives of the water and nature conservation Sectors of the council members are rather positive towards the development directions set out in the concept (although there are still many points of disagreement between NGOs and the water Sector). The agricultural Sector leadership, on the other hand, is currently rather negative towards the development directions set out in the concept. The planning process of the Tisza Strategy could also serve to shape the planning at river basin level in consultation with the key players in the agricultural Sector (Ministry of Agriculture, Chamber of Agriculture, research institutes).

4.3.9 Is this cross-Sectoral example typical for Hungary?

The Tisza Strategy will be special in the sense that there is no national Strategy up to date for the Tisza river as the last sub Tisza river basin management plan was adopted in 2019. The currently valid (2021) 3rd National River Basin Management Plan of Hungary contains detailed plans for the Tisza sub-basin (Kormanya, 2021.). Its planned measures include a number of progressive ones, but it cannot be considered as a paradigm-shifting roadmap for the transition to sustainable water management and landscape use. However, this would be the aim of the Tisza Strategy to be prepared.

The joint Tisza survey was made in a project by the five countries on the Tisza river basin however this survey has no official legal status (Food and Agriculture Organisation of the United Nations, 2019).

Sources: (European Commission, 2024e; Food and Agriculture Organisation of the United Nations, 2019; Gáspár, 2025; A. Ibrahim et al., 2025b; Kajner et al., 2024; Kormanya, 2021.)

4.4 CS08: Danube Floodplain Reconnection (Gârla Mare)

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Figure 12: "Gruia–Gârla Mare" Special Protection Area. Photo credit: Dan Dinu

4.4.1 What restoration measures are being implemented?

Gârla Mare site, part of the "Gruia–Gârla Mare" Special Protection Area (ROSPA0046) under the Birds Directive and included in the "Dunărea la Gârla Mare–Maglavit" Natura 2000 Site (ROSCI0299), is located in a former side branch of the Danube River. Historically transformed into fishponds, the area was cut off from the river by dykes, fragmenting its natural marshland. Hydrological disconnection led to ecological succession: diverse wetlands became homogeneous reed beds, with increasing risk of an aquatic to terrestrial transition.

The restoration project aimed to counter these trends by reintroducing seasonal flooding and increasing habitat diversity across a 600 hectares target area, as part of a broader 2,380-hectare Natura 2000 site. One of the core interventions involved the installation of a new sluice system to regulate the inflow of Danube water into the Gârla Mare marshland. In parallel, the water supply channel from the river was re-profiled and deepened to enhance its conveyance capacity, allowing for more effective delivery of floodwaters during periods of high-water levels. This improved connectivity has also enabled water from Gârla Mare to reach the neighbouring Vrata site, thereby extending the ecological and hydrological benefits regionally.

To diversify habitats and arrest further succession, approximately five hectares of the reed bed were dredged to create open water bodies, reintroducing aquatic environments that had largely disappeared. Additionally, a smaller water body was created to serve as a designated community fishing area, offering both ecological benefits and social value to residents. These measures were complemented by the reinforcement of primary and secondary dykes, which now protect active fishponds and surrounding infrastructure from unintended flooding.

The increased flood storage capacity not only restores key ecological functions but also contributes significantly to local flood risk management. Hydrodynamic assessments indicate that the restored system can now buffer up to 5.2 million cubic meters of floodwater, a significant asset for enhancing climate resilience and protecting nearby settlements.

Before these interventions, a comprehensive baseline assessment was carried out to evaluate water quality and biological indicators. This included the measurement of physico-chemical parameters such as nitrogen and

phosphorus concentrations, as well as surveys of aquatic vegetation and bird species. A long-term ecological monitoring program was established to track changes and assess restoration outcomes under the MERLIN and Living Danube Partnership frameworks.

Planning and implementation were complex, requiring close cooperation with local stakeholders. Early in the process, WWF Romania, GeoEcoMar and their partners engaged with landowners, community members, and regulatory authorities to jointly assess land management options and restoration priorities. However, unforeseen challenges arose, particularly concerning legal inconsistencies within the Romanian land cadastral system. These complications delayed the permitting process and required revisions to the technical design. Despite this, continuous stakeholder engagement allowed for adaptive project management, ensuring that land-use conflicts were addressed and that restoration goals remained achievable.

In summary, the restoration measures at Gârla Mare serve as a model for integrated floodplain management, combining hydrological engineering, biodiversity conservation, NbS and participatory governance to rehabilitate a degraded wetland system. By re-establishing dynamic river-floodplain interactions and enhancing ecosystem services, the project contributes not only to the ecological integrity of the Lower Danube but also to the resilience and well-being of the communities that depend on it.

4.4.2 Why is there a need for change (drivers); what is the goal(s)?

The Gârla Mare site, like many former floodplain areas along the Danube River, has undergone significant ecological degradation over the past decades. Historically, this wetland was part of a dynamic fluvial system, shaped by seasonal flooding that supported diverse aquatic and terrestrial habitats. However, extensive human interventions, particularly the construction of dykes, conversion to fish farms, and disconnection from the main river channel, have fundamentally altered its hydrology and ecological character.

One of the main drivers for change is the progressive loss of wetland functionality due to ecological succession. With the marshland cut off from regular Danube flooding, natural processes have been interrupted, leading to the expansion of homogeneous reed beds at the expense of open water habitats and early successional wetland communities. Left unchecked, this would eventually result in the marshland transforming into terrestrial vegetation, causing irreversible loss of biodiversity, ecosystem services, and resilience to climate extremes.

At the same time, the site's disconnection from the Danube River has reduced its capacity to store floodwaters, weakening the natural flood protection function that such wetlands historically provided to surrounding communities. With increasingly unpredictable weather patterns and extreme flood events driven by climate change, the need to restore natural floodplain functions has become more urgent.

Additionally, the site's status as a Natura 2000 protected area brings a legal and conservation obligation to maintain or restore favourable conditions for habitats and species of European interest such as the Eurasian otter (*Lutra lutra*) and the fire-bellied toad (*Bombina bombina*), both of which are sensitive to changes in water dynamics and habitat structure.

At Gârla Mare, the project's aim is to re-establish controlled Danube–wetland connectivity, restore seasonal flooding and habitat heterogeneity, and strengthen ecological integrity. In short, it aligns ecological restoration with climate adaptation and conservation obligations, while supporting sustainable local use.

4.4.3 Who is involved?

Several key economic Sectors are directly involved in Gârla Mare restoration project due to their roles in land use, resource management, and local development.

Fisheries and aquaculture are important, given the site's history as a fish farming area. The restoration includes measures to protect active fishponds and even create new water bodies for local, small-scale fishing, balancing conservation with community livelihoods.

The water management Sector plays a critical role, as engineers and hydrologists design and operate infrastructure to regulate water flow from the Danube River. Their work ensures that restoration goals are met without increasing flood risks elsewhere.

Finally, **public Administration** and planning are essential, particularly in managing land-use policies, issuing permits, and integrating restoration into broader development strategies. These authorities also support coordination between environmental goals and socio-economic needs.

Together, these Sectors must collaborate to ensure the restoration enhances both ecological health and local economic resilience.

4.4.4 What benefits come from the measures(s)?

Restoration at Gârla Mare brings ecological, social, economic and community benefits.

In the short term, controlled flooding restores water availability and halts habitat loss, while dredged open-water areas support aquatic biodiversity and provide opportunities for recreational and community fishing. Reinforced dykes reduce uncontrolled flood risk, protecting fishponds, farmland and nearby settlements.

In the long term, the wetland increases flood storage and water purification, sustains Natura 2000 species, and contributes to climate resilience. Agriculture benefits through more sustainable land-use options such as extensive grazing or floodplain farming, improving soil health and opening access to agri-environmental funding. Community engagement in co-management builds local ownership and creates opportunities for eco-tourism and green jobs.

Overall, Gârla Mare becomes a replicable model for integrated floodplain restoration in the Lower Danube.

4.4.5 What roles do the Sectors play? Are they affected by the measures? Do they affect the measures?

The implementation of restoration measures at Gârla Mare involves multiple Sectors, each with distinct roles that influence or are influenced by the process. Some actors act as resource managers, controlling land and water use, while others are installers, enablers, beneficiaries, or blockers. The table below summarises the key Sectors and their functional roles in the restoration process.

Table 7: Sectors and their roles

Sector	Role	
Administration & professional activities (planning, permitting, cadastre)	Resource manager	National Administration “Romanian Waters” (NARW) & Water Directorates manage water flows and issue permits. County councils & municipalities (Mehedinți, Dolj; Gârla Mare, Vrata, Bechet) handle authorisations and cadastral issues.
Agriculture	Installer	Farmers implement land-use practices directly affected by restoration (flooding, crop rotation, irrigation).
	Blocker	Agricultural authorities (Ministry of Agriculture, Agency for Agricultural Payments, Agency for Land Reclamation) prioritise irrigation and subsidies for conventional crops; some farmers oppose reconnection for fear of losing productive land.
Banking & Finance	Blocker	Banks and integrator companies mainly finance intensive Agriculture.
	Enabler (emerging)	Some EU and international finance institutions (EIB, EBRD, Bankable Nature Solutions) are starting to support green investment models.
Conservation (ANANP, APM, WWF)	Resource manager	National Agency for Protected Areas & Environmental Protection Agencies safeguard Natura 2000 obligations and may set conditions for species protection.
Construction	Installer	Construction firms (public/private) manage implementation of sluices, channels, dyke reinforcement under contracts.
Education, Research, Advisors	Enabler	Universities (Bucharest, Craiova) and GeoEcoMar provide monitoring, modelling, and scientific advice.
(Bio) Energy	Beneficiary	Biomass from reed/forests could be harvested for bioenergy, though not yet developed at Gârla Mare.

Fishery & Aquaculture	Resource manager	Fishery operators (e.g. Caviar SA) and local fishing associations either own or lease (concession) land and ponds, which makes them resource managers in the site.
	Beneficiary	Caviar SA benefits from improved water management and ecological balance.
	Installer	Fish farm operators adapt practices in line with restoration measures (channels, water exchange).
Forestry	Beneficiary	Riparian forests benefit from improved soil moisture and biodiversity corridors.
	Resource manager	Forestry District oversees management of forest stands along the floodplain.
Infrastructure & logistics	Blocker	Dykes, roads, and irrigation canals restrict hydrological flows and complicate reconnection.
Insurance	Enabler (potential)	Could support adaptation and resilience through risk-sharing mechanisms, though not yet engaged.
Manufacturing (food, drink, health products)	Beneficiary (potential)	Potential for processing of fish, reed, or eco-products from restored wetlands.
Tourism & recreation	Beneficiary	Birdwatching, angling, eco-tourism, and cycling (EuroVelo 6) benefit from restored landscapes.
Water Supply & Sanitation	Beneficiary	Restoration contributes to aquifer recharge and water security.
	Enabler	Wetlands can complement natural wastewater treatment if integrated into local systems.

4.4.6 What is the form of cross-Sectoral work

The restoration project at Gârla Mare is built on strong cross-Sectoral collaboration.

From the beginning, WWF Romania and GeoEcoMar facilitated a participatory planning process that brought together stakeholders from nature conservation, water management, Agriculture, fisheries, urban and land-use planning, and public administration. This cooperation was essential for co-designing restoration measures that are both technically sound and socially accepted.

Water management authorities contributed hydrological expertise and infrastructure planning, ensuring that new sluices, channels, and flood storage measures could function safely and effectively. Environmental agencies ensured compliance with national and EU legislation and supported biodiversity monitoring and habitat planning. At the same time, agricultural and aquaculture stakeholders were consulted to adapt land use and protect economic activities such as farming and fish production.

Urban planning departments, especially at the county level, played a critical role in permitting and resolving land ownership and cadastral issues, helping to bridge legal and administrative gaps between different Sectors.

Throughout the process, joint meetings, technical workshops, and stakeholder consultations were used to share knowledge, co-design solutions, and align interests. This integrated, cross-Sectoral approach enabled the project to adapt to challenges and ensure that ecological restoration was balanced with local development needs and legal frameworks.

In essence, cross-Sectoral work at Gârla Mare has taken the form of coordinated planning, shared decision-making, and continuous dialogue between technical experts, policymakers, and local land users, creating a foundation for long-term, sustainable wetland management.

4.4.7 What are the main actions to support the cross-Sectoral work taking place?

At Gârla Mare, cross-Sectoral work is rooted in two decades of experience with floodplain restoration in the Lower Danube and benefits from ongoing initiatives such as MERLIN, the Living Danube Partnership, and (REXUS Project, 2025)

***Attitudes & Leadership**:*

The development of the Regional Scalability Plan (2024) has mobilised stakeholders from water management, Agriculture, aquaculture, forestry, Navigation, municipalities, academia, and NGOs. Leadership at the national level is strongest from the environment and water Sector (Ministry of Environment, Water and Forestry, National Administration "Apele Române"), while at the local level, municipalities (Gârla Mare, Vrata, Bechet) and County Councils (Mehedinți, Dolj) provide important governance anchors. WWF Romania plays a bridging role, ensuring alignment with EU strategies (Green Deal, Biodiversity Strategy, CAP reform).

How does the government support the Strategy?

The Romanian government supports restoration through integration in River Basin Management Plans (RBMPs) and Flood Risk Management Plans (FRMPs), where floodplain reconnection and wetland restoration are explicitly listed as measures. Demonstration projects at Gârla Mare and Balta Geraiului received EU and private co-funding, with political backing from the Ministry of Environment and local councils. However, support is uneven: while water/environment institutions are proactive, the Agriculture Sector remains focused on irrigation rehabilitation, with limited incentives for wetland-friendly practices.

How does the government relate to restoration cases?

Authorities generally support restoration if landowners or municipalities agree voluntarily. In Gârla Mare, this has been possible thanks to local support and partnerships with private operators (e.g. Caviar SA). However, on larger agricultural enclosures (e.g. Potelu, Greaca), resistance persists, as landowners fear loss of productive land. Agricultural agencies continue to prioritise irrigation, subsidies, while restoration is perceived as secondary. This shows the need for stronger policy coherence across ministries.

Legal & regulatory requirements:

The current legal framework recognises floodplain restoration as a valid measure under the EU Water Framework Directive and Floods Directive, as well as under Natura 2000 obligations. Moreover, the NRR (European Commission, 2024e) introduces compulsory targets of up to 30% of degraded habitats to be restored in all Member States, highlighting restoration as a legal obligation rather than an option.

However, contradictions persist. While the EU acknowledges the urgency of restoring freshwater ecosystems, subsidies still incentivise practices that undermine this goal. For instance, the EU provides subsidies for intensive Agriculture, even within designated natural protected areas. Such conflicting incentives illustrate the lack of policy coherence: restoration is mandated at EU level, but funding streams at CAP and national level still reinforce business-as-usual models.

- → Irrigation rehabilitation projects are promoted without assessing cumulative water availability;
- → Land cadastre and fragmented ownership complicate restoration;
- → Environmental permits are slow and sometimes restrictive.

Several studies (Economic and ecological resizing of Danube Floodplain, Management Plans for Flood Risk) have recommended updating permitting procedures to explicitly prioritise NbS and clarify the status of floodplain reconnection as an overriding public interest.

Funding & Finance:

Current restoration at Gârla Mare has been enabled mainly through EU funding (Horizon/MERLIN, LIFE, Interreg) and private contributions (Coca-Cola HBC Foundation). Public national funding is limited, and CAP instruments are not yet fully aligned with wetland restoration. Farmers can access subsidies for agri-environmental schemes, but incentives for water retention and wetland-compatible farming are weak. Going forward, scaling-up will require:

- → Redirecting CAP Strategic Plan measures towards water retention and extensive aquaculture,
- → Using climate adaptation funds under the EU Green Deal,
- → Mobilising private capital through Bankable Nature Solutions and green investors (EBRD, EIB).

Information, Knowledge Sharing, Innovations:

Knowledge is co-produced by universities (Bucharest, Craiova), GeoEcoMar, and WWF Romania. These institutions provide hydrological and ecological data, modelling, and monitoring. Awareness-raising activities

(public consultations, educational campaigns, and eco-tourism promotion) have helped increase local acceptance. Still, systematic integration into state advisory systems (e.g., agricultural extension services) is missing. Innovative monitoring tools (real-time water level stations, biodiversity indicators) are being tested to guide adaptive management.

Collective Action Institutions:

Sustainable management of the Lower Danube Floodplain requires cooperation at the landscape scale. At Gârla Mare, this is achieved through multi-stakeholder working groups coordinated by WWF and GeoEcoMar, where farmers, aquaculture operators, local authorities, and water managers sit together. While these mechanisms work at the pilot level, there is no permanent institutional framework for collective decision-making at the floodplain scale. Strengthening cross-Sectoral committees (involving environment, water, Agriculture, and local governance) could institutionalise cooperation and ensure long-term implementation beyond project cycles.

4.4.8 How does the multi-level governance work? Which level could help with mainstreaming?

The restoration project at Gârla Mare operates under a multi-level governance model, where decision-making and responsibilities are shared across local, regional, national, and international levels.

At the local level, landowners, farmers, and local authorities (such as municipal councils) are directly involved in discussions about land use, water management, and economic impacts. Their knowledge and approval are essential for implementing on-the-ground restoration measures.

At the county level, institutions like the Mehedinți County Council, particularly the Urban Planning Department, play a key role in issuing permits, resolving land ownership issues, and coordinating between Sectors such as spatial planning, environment, and infrastructure.

At the national level, government agencies responsible for water management, environment, and land registration ensure that restoration complies with Romanian legislation and aligns with national policies on flood risk, biodiversity, and rural development.

At the EU level, the project is supported by frameworks like the Natura 2000 network and the EU Water Framework Directive. These provide strategic direction, legal obligations, and resources for implementation and monitoring.

The coordination between these levels is managed through continuous communication, shared planning processes, and a flexible governance structure led by WWF Romania and GeoEcoMar. This allows for adaptive management, where decisions can be revised based on new data, stakeholder input, or regulatory changes.

In this way, multi-level governance ensures that restoration is not only ecologically effective but also legally supported, socially accepted, and institutionally integrated.

4.4.9 Is this cross-Sectoral example typical for Romania?

Gârla Mare restoration project represents a special case within Romania, though it reflects challenges and opportunities that are increasingly common across the country.

While Romania has many former floodplain areas along the Danube River with high ecological potential, large-scale, cross-Sectoral restoration projects like Gârla Mare are still relatively rare. This project stands out due to its complexity, the level of stakeholder engagement, the integration of ecological and technical planning, and the efforts to overcome legal and cadastral barriers.

It is also unique in the way it has been supported by the Living Danube Partnership, which provided the long-term flexibility and funding necessary to address unexpected administrative and legal delays, something that is not typical of most publicly funded restoration efforts in Romania.

However, the issues the project faced such as conflicting land uses, unclear land ownership, and the need for cooperation across Sectors and governance levels are typical challenges in Romanian environmental projects. In that sense, Gârla Mare serves as a demonstration case: while not standard practice today, it offers a replicable model for future restoration efforts in the country.

Sources: (Ibrahim et al., 2025b; Ojanen et al., 2024; REXUS Project, 2025)

4.5 Learning Across the Four Cases

This Section summarises what has been learnt about the context, processes and outcomes of the cross-Sectoral working in our examples.

4.5.1 What NbS measures were implemented and why?

In response to water resilience challenges (both too much and too little water in different seasons and across time), the four cases have implemented different NbS measures, often combining more than one type and in more than site. The large river examples focused mainly on land sparing measures, although the Tisza case combines NWRM with floodplain reconnection in a similar way to the Forth, although on a very different scale. These measures are also used to respond to climate change mitigation objectives (particularly in Case Study 17) and to protect or restore habitats and species. The amenity value of the NbS, for local residents and recreational users, was also important for most of the cases. The types of measures and benefits they generate are illustrated in Table 8.

Table 8: Types of measure and the benefits they generate

Case Study	NbS Measure	Benefits
CS17 Forth basin restoration (UK)	Natural Water Retention Measures Peatland restoration, Wetland restoration Floodplain reconnection	Biodiversity & habitat improvements Carbon storage Flood mitigation Drought resilience Awareness of nature Clean drinking water
CS04 Room for the Rhine (NL)	Floodplain reconnection	Biodiversity & habitat improvements Drought resilience Improved soil condition Clean drinking water
CS09 Tisza floodplain rewetting (HU)	Natural Water Retention Measures Wetland restoration Floodplain reconnection	Biodiversity & habitats improvements Drought resilience Flood mitigation Clean drinking water Food Production and local Fishery Recreation
CS08 Danube floodplain reconnection (RO)	Wetland restoration Floodplain reconnection	Biodiversity & habitats improvements Recreation Subsistence fishing Drought resilience Flood mitigation Clean drinking water

4.5.2 Which Sectors were involved and what were their roles?

The MERLIN cases illustrate the range of Sectors involved and their different roles; but as with the stakeholder analysis (Figure 3 in Section 1.4), no case involved the full suite of 19 Sectors. What is more important is that often Sectors can play multiple roles within the same case (see Table 9 below). For example, administrative organisations can manage land or water, be part of the installation process, enable or block the NbS implementation. This may be because of differences between the individual organisations, related to their location relative to the NbS implementation or their ability to access the benefits of the NbS. In other cases, involvement is emergent e.g. subsistence fishery in the Danube wetlands, which was a traditional use, and is now being re-established as the floodplains and wetlands are restored. This creates the potential for

mainstreaming NbS through their involvement, but it will take longer as their Sectoral governance mechanisms won't be as well-developed compared to those who have engaged with NbS measures over many years. Therefore, the roles played by different Sectors are also dynamic through time as well as specific to the context.

Table 9: Sector roles across the different case studies

Case Study	Resource managers	Installers	Beneficiaries	Enablers	Blockers
CS17 Forth basin restoration (UK)	Agriculture infrastructure	Administration conservation	Agriculture Conservation Fishery Insurance Manufacturing	Conservation Education Infrastructure	Agriculture Infrastructure
CS04 Room for the Rhine (NL)	Administration Agriculture Conservation	Administration Construction Mining	Agriculture Energy Infrastructure Mining Navigation Tourism & recreation	Conservation	Agriculture
CS09 Tisza floodplain rewetting (HU)	Administration, Conservation Construction Mining	Administration Agriculture	(Bio) Energy Fishery Forestry Manufacturing Tourism & recreation Water Supply and Sanitation	Education Insurance Media Mining	Agriculture Banking Infrastructure
CS08 Danube floodplain reconnection (RO)	Administration Conservation Fishery Forestry	Agriculture Construction Fishery	(Bio) Energy Fishery Forestry Manufacturing Tourism & recreation Water Supply and Sanitation	Banking Education Insurance Water Supply and Sanitation	Administration Banking Infrastructure

4.5.3 What made cross-Sectoral interaction work?

In all cases, there are trade-offs between continuing with commodity driven land and water uses which tend to reduce the ecological and social co-benefits; or shifting to a different approach, with more diversification from agricultural land use to land for nature conservation, restorative Agriculture and tourism. Table 7 also shows how many of those benefitting from the NbS implementation often are not directly involved in installation nor are their operations affected as they don't mange the land or water resources in question. This highlights the need for governance actions (see Section 2.4) to manage burden sharing between the Sectors.

In all cases, the MERLIN project was able to build on existing efforts to bring Sectors together and involve them in the planning and implementation of the freshwater restoration. The Room for the River case is most institutionalised, with multiple decades of cross-Sectoral engagement, whilst the other cases are more 'bottom-up' with NGOs creating opportunities for cross-Sectoral working on projects. In these cases, the NGOs have been able to stitch together multiple types of funding to allow engagement over a decade or more. This cross-Sectoral engagement is often at the level of consultation rather than active involvement, as the choices and abilities to intervene tend to reside both with choices by individual resource managers and with national governments and agencies controlling regulatory and financing processes. In these MERLIN cases, the cross-Sectoral working therefore tends to be a form of coordination, relying on the actions of the state or NGO organisations to bring Sectors together, rather than self-organised collaborations.

The Room for the River is famous for being large scale and long-term approach for water management, and therefore is a front runner compared to the other examples. In the other cases, there are opportunities for the approaches to be mainstreamed at a national level but for the HU Tisza, there are political and cultural reasons why this mainstreaming may be difficult. As noted, if the inter-ministerial committee for Water Management was broadened to include more Sectoral issues; and the Tisza Strategy was resourced and supported by the agricultural Sector, there are promising signs. In the Scottish case, the national context is more amenable, but the approach is not fully institutionalised and relies on the NGO and other partners winning more project funding. A similar situation is described in Romania – where the Living Danube

Partnership has provided this long-term platform for multi-level governance, but it is still taking time to embed a fully cross-Sectoral approach.

The cases illustrate that the full range of actions (see Figure 5, Section 2.4) were deployed to support cross-Sectoral working. In most cases, whilst there were promising legal instruments available, there were also suggested changes to the legal framework (around permitting, eligibility criteria or perverse incentives) to help mainstream NbS. There are also signs of champions in National governments and beyond helping to institutionalise freshwater NbS but in most cases, there is strong resistance from the conventional Agriculture lobby, as most NbS (beyond-on- farm NWRMs), requires a change in land use from intensive arable to extensive cropping, grazing or even to forestry. The cases show how good spatial and socio-economic data can support decision taking and the role for research in providing these data, although there are problems when data series are not long-term for ongoing adaptive management. What is equally important are the professional networks to share knowledge, and there is a need to embed new ways of thinking with agricultural extension officers who can help try to change the 'blocking' role by Agriculture, if this can be combined with public support (CAP schemes) and private finance. In all cases, the overall CAP or equivalent policies provide positive signals towards change, but perverse incentives and the slow implementation of NbS-friendly schemes show that the implementation gap persists. Finally, collective action is taking place but except for the NL case, there are no formal institutions available, making the processes vulnerable to change if the project funding ceases.

5. Relevant European & National Opportunities to Mainstream Cross Sectoral Working

Collaborative water governance is challenging, due to the problem of paying for common pool resources, mismatches in scale and fit between human and bio-physical defined units and different priorities between stakeholders. However, the MERLIN Case Study examples (Section 4) show there is potential for a combination of actions to be used to mainstream cross-Sectoral working across the EU. This Section explores how actions (implementing legal and regulatory frameworks, cultivating supportive values and attitudes, provision of funding and finance, and providing institutions for coordination and collaboration) can create the enabling conditions for cross-Sectoral working to mainstream freshwater NbS. Mainstreaming NbS requires both horizontal integration—across economic Sectors—and vertical integration—linking EU, national, and regional governance levels. This Section identifies opportunities to strengthen both dimensions and progress towards the vision (Section 3).

The Section summarises what we have learnt about cross-Sectoral working in MERLIN (Section 5.1); highlighting the importance of working with the heterogeneous agricultural Sector (Section 5.2) and what are the opportunities available to help achieve the vision (Section 5.3). We draw on our transformations framework (Carmen et al., 2024), considering what current practices need to be disrupted, where new approaches need to be created, and where there are existing good practices to maintain to mainstream NbS faster and in more places. This leads us to the recommendations in Section 6.

5.1 What have we learnt about cross-Sectoral working?

The process of engaging economic Sectors in freshwater NbS implementation has been a learning journey. Initially, although many case studies identified a range of Sectors (see Figure 3, Section 1.4.2); most of these economic Sectors were not actively engaged in the implementation of measures during the project (Ibrahim et al., 2025b) unless they were already project partners. Business opportunities emerged during discussions (see Table 1) (Nyírő et al., 2025) but there remained barriers to realising these opportunities. Meanwhile, strategic discussions with Sectoral organisations illustrated similar barriers (Schulz et al., 2024) around awareness, lack of evidence, policy incoherence and Sectoral silos that impede mainstreaming of NbS (Blackstock et al., 2023).

There seems to be a consistent set of enabling factors created or maintained that help Sectors work together, mapping to Figure 5 (Section 2.4).

- Integrated legal, regulatory and administrative processes – Joint planning procedures and one-stop permitting reduce barriers to cooperation.
- Shared objectives - often linked to risk reduction or capturing benefits build trust and form the basis for long-term collaboration, which require shared values and positive attitudes.
- Knowledge, innovation and transparency – Open data platforms, participatory monitoring, learning through doing and clear communication foster accountability.
- Flexible funding arrangements – Blended or multi-year financing allows adaptive management and experimentation.
- Facilitation and leadership – Dedicated intermediaries (river-basin coordinators, NGOs, CoPs) sustain momentum across Sectors.

MERLIN experiences confirm that governance innovation and relational capital are as decisive for success as technical restoration measures. However, the local context and national or regional governance processes explain the different experiences, so there is no 'one-size fits all'. There are many examples collaborative water governance is challenging, due to the problem of paying for common pool resources, mismatches in scale and fit between human and bio-physical defined units and different priorities. However, the examples in Section 4 show there is potential for a combination of actions to be used to mainstream cross-Sectoral working across Europe. This will be returned to in Section 5.3.

First, we explore the special role of the agricultural Sector in most rural NbS implementation, and how important it is to fully understand the Agricultural Sector needs in any cross-Sectoral relationship. Working across Sectors, with a more nuanced understanding of different Sectoral roles and responsibilities, is essential to mainstreaming. A common theme is the importance of the 'resource manager' who can enable or block the implementation of the NbS measures (Section 1.3), so Section 5.2 characterises what we have learnt about the Agricultural setting for MERLIN NbS and how the diversity of farm types offer opportunities to adopt NbS measures across Europe.

5.2 Agriculture as a Central Sector in Cross-Sectoral Implementation

Agriculture remains the most influential Sector for upscaling and mainstreaming freshwater NbS in Europe. Farmers are often the resource managers that need to directly support implementation. To upscale NbS at the pace and scale required, working with farmers will be required, whether to access the wetland or river through their land; allow changes to bank morphology, or enable conservation grazing or other practices. Finally, farmers and other land managers may fear negative consequences of land use or land management changes and block NbS implementation (Ibrahim et al., 2025a) Including agricultural representatives in the discussions enables a more accurate understanding of the benefits and risks of proposed measures and helps identify potential solutions. The rest of this Sub-Section illustrates the importance of understanding the differences within the Agricultural Sector, and the need to tailor the involvement of the Sector to the specific issues for the farm type, size or location (see Annex 1 for detailed methodology and Annex 3 for commentary). We focus on opportunities to encourage the agricultural Sector into discussions about mainstreaming freshwater NbS rather than addressing the pressures that Agriculture can create for freshwater ecology (Schürings et al., 2024). MERLIN's case studies demonstrate that when NbS generate tangible co-benefits for farmers —such as improved soil health, reduced flood risk, or alternative biomass income—cross-Sectoral working is more likely.

5.2.1 Characterising Agricultural Resource Managers

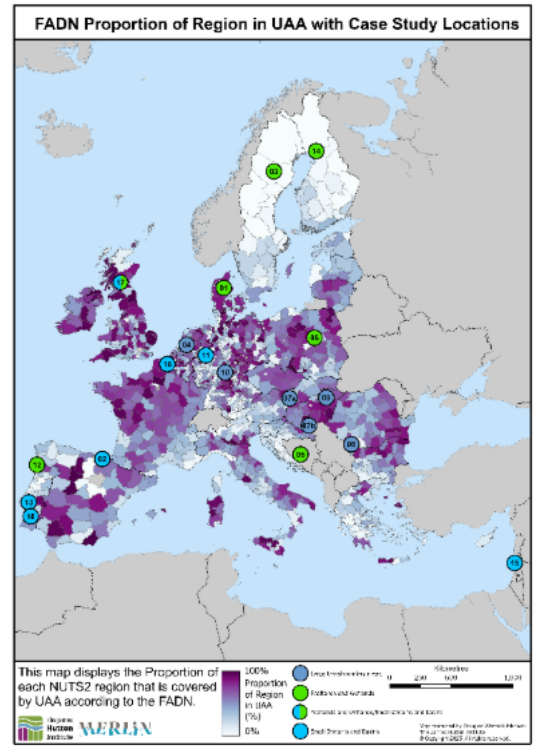
The agricultural context for the 18 MERLIN case studies was derived from the EU Farm Accountancy/Sustainability Data Network (FADN/FSDN) data and illustrates the differences across Europe (Table 10). Note that there was no data available for CS06 (Hutovo Blato peatland rewetting BiH) or CS15 (Tzipori basin restoration IL).

Table 10: Agricultural context for 18 case studies

MERLIN case study	Proportion of utilisable agricultural area (%)	Dominant Farm Type By Area	Farm Net Income / UAA (euros/ha)	Farm Density (farm/ km^2)
Kvorning wetland rewetting DK	64	Specialist milk	499.17	0.92
Deba barrier removal ES	24	Specialist cattle	1300.92	4.66
Beaver river engineering SE	1	Specialist milk	317.84	1.09
Room for the Rhine NL	36	Specialist milk	1812.23	3.92
Kampinos wetland rewetting PL	22	Specialist Cereals, Oilseeds & Protein crops (COP)	469.94	7.38
Danube floodplain restoration AT	49	Specialist COP	611.22	1.98
Danube sidearm reconnect HU	37	Specialist COP	340.68	2.16
Danube floodplain reconnect RO	55	Specialist COP	648.49	12.21
Tisza floodplain rewetting HU	46	Specialist COP	428.22	1.62
Blue Belt Germany DE	20	Specialist COP	351.29	1.17
Emscher basin restoration DE	44	Specialist other fieldcrops	927.42	1.29
Lima floodplain forest rehab PT	24	Specialist sheep and goats	1134.28	8.68
Sorraia river restoration PT	12	Specialist other fieldcrops	1042.36	4.79
Komppasuo peatland rewetting FI	5	Specialist milk	370.64	1.00
Upper Scheldt restoration BE	56	Specialist other fieldcrops	614.46	1.27
Forth basin restoration UK	68	Specialist sheep and goats	68.22	0.23
Ervidel river restoration PT	57	Specialist cattle	221.33	0.70

Figure 13 shows where Agriculture as measured by UAA (utilisable agricultural area) dominates areas of Europe, including the location of the MERLIN case studies. The number of farms involved in these regions also varies considerably (Figure 14) from more than 15 farms per km^2 to only one farm every 4.3km^2. This is very important when considering how to coordinate farmers and other land managers implementing measures in a

landscape approach - suggesting that coordination might be more challenging in areas of Southern and Eastern Europe with large numbers of small holdings (see CS12 discussion within (Ibrahim et al., 2025b).



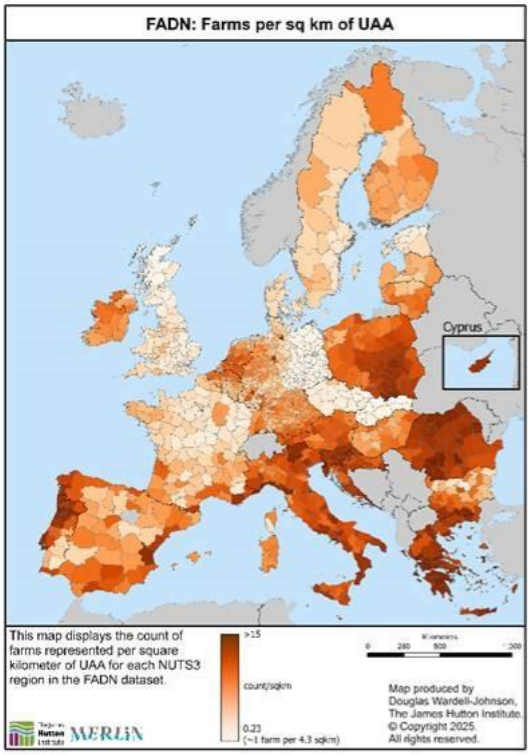
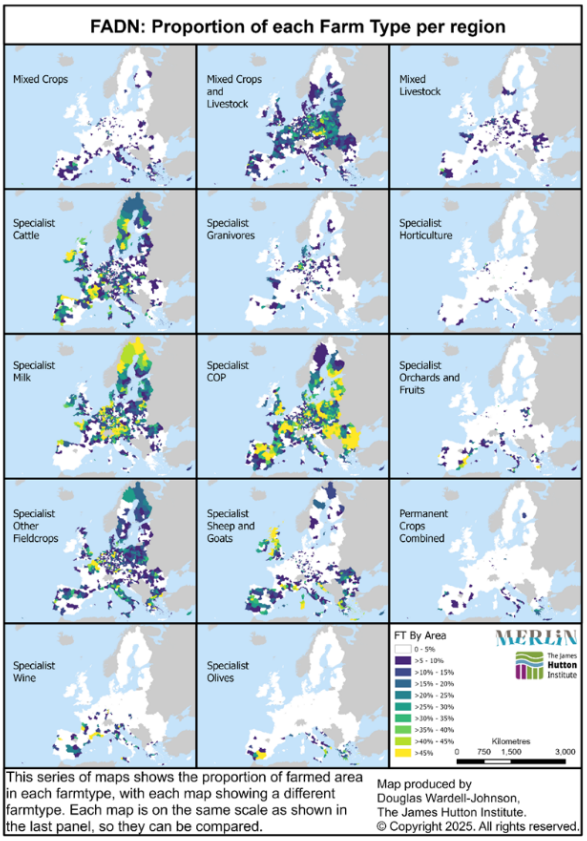


Figure 13: Proportion of Region in UAA with case study locations,

Figure 14: FADN: Farms per km² of UAA

Agriculture covers a range of farm types that produce different products (Figure 15). These different farm types are associated with different land management practices, investment in technologies and infrastructure, and supply or value chains that affect whether adapting land management or land use to co-exist with NbS is viable. The production profiles help to explain differences in Net Farm Income/ha (see Figure 15), where incomes vary from ~80€/ha to more than ~3,500€/ha. This illustrates the opportunity costs of enacting land sparing measures (any measure that temporarily or permanently takes land out of production such as peatland restoration; floodplain reconnection). For example, the Sorraira floodplain (CS13) estimated the opportunity cost of riparian buffers at 2,526 euros per hectare (Kok et al., 2025, p. 13). However, more profitable farms may have the capacity and capital to invest in regenerative farming approaches including NWRM (land sharing) or explore opportunities from potential nature markets. If the low-income farms are deliberately extensive and/or multi-functional, these might also provide opportunities for land sparing NbS.



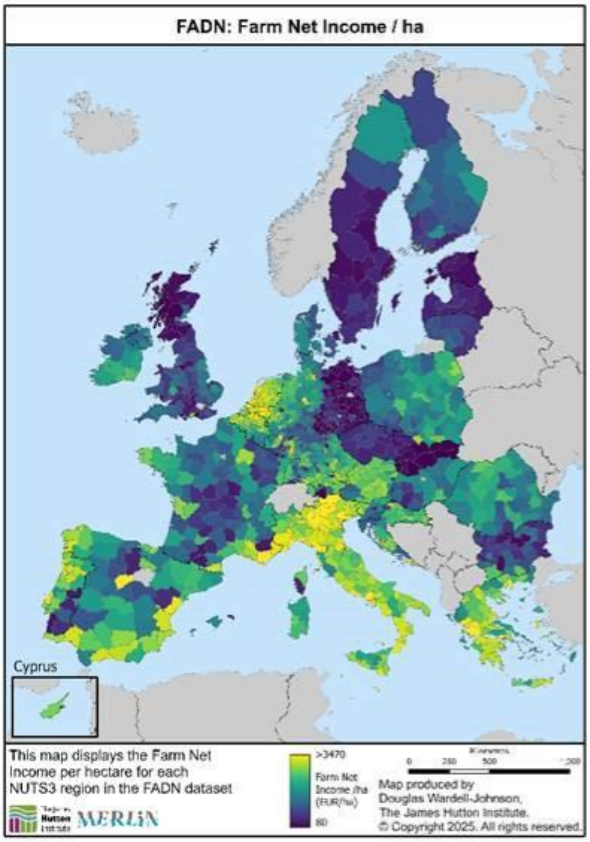


Figure 15: Proportion of each farm type per region and Figure 16: Farm net income

5.2.2 Agriculture offers Opportunities

There can be spaces for land sparing and land sharing NbS Figure 17)[4]. Of particular interest are the green areas where Agriculture is a large proportion of the regions' area yet there are also relatively large areas out of production, potentially offering space to implement land sparing NbS. Contrasting with this are the areas in blue with high UAA (utilised agricultural area) and low land out of production. Here the challenge is that any land sparing type NbS measures will be hard to be implement, although land sharing approaches like small scale NWRM may be possible. The white areas where UAA and land out of production are both low are like the blue but in this case, access to land for freshwater NbS might need to be negotiated with **non-agricultural** stakeholders. Where there is low UAA and high land out of production (orange) then this land may have higher value as a source of provisioning services (e.g. southern Sweden or southern Portugal) so any losses might well be undesirable.

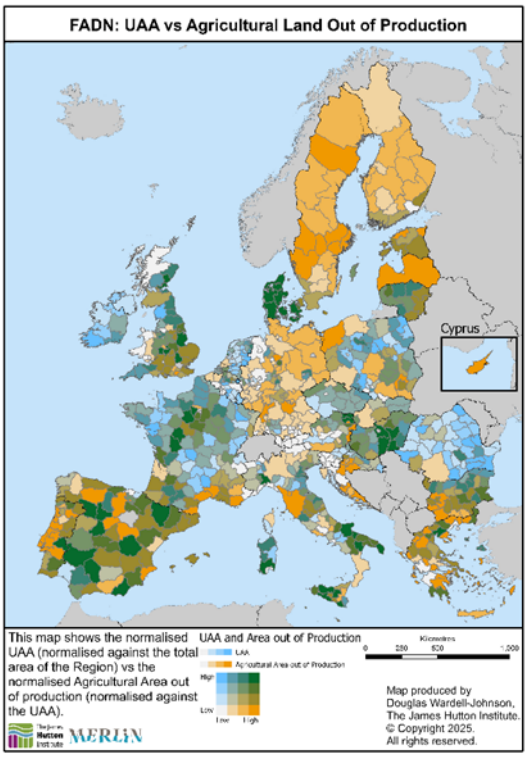


Figure 17: FADN: UAA vs Agricultural land out of production

[4] Normalised Land out of Production to the UAA in the NUTS region.

The CAP provides an important lever for freshwater restoration (Meier et al., 2025; Pereira Dos Santos et al., 2025) (see also Section 2.3) and at present, CAP is one of the main ways in which farmers are paid for the services they provide to beneficiary Sectors (e.g. WSS, tourism etc). Figure 18 illustrates the relative significance of farm subsidies for land managers. In blue areas, low Farm Net Income (NFI) and high subsidy, the subsidy has the potential to be highly influential if the payments support delivery of NbS. Low subsidy and high NFI (red) are systems where CAP subsidy may be less influential, but these businesses could have capacity to undertake land sharing for private gain (investing in soil health and water retention) or seek nature market opportunities for land sparing. Low subsidy and low NFI areas (white) include areas with extensive management and could be areas of opportunity. Finally, there are the high subsidy, high NFI areas (brown) where there is likely to be lock-in to existing commodity markets and therefore limited leverage to achieve change using subsidy without other signals (either via regulation or private quality certification from the supply chain).

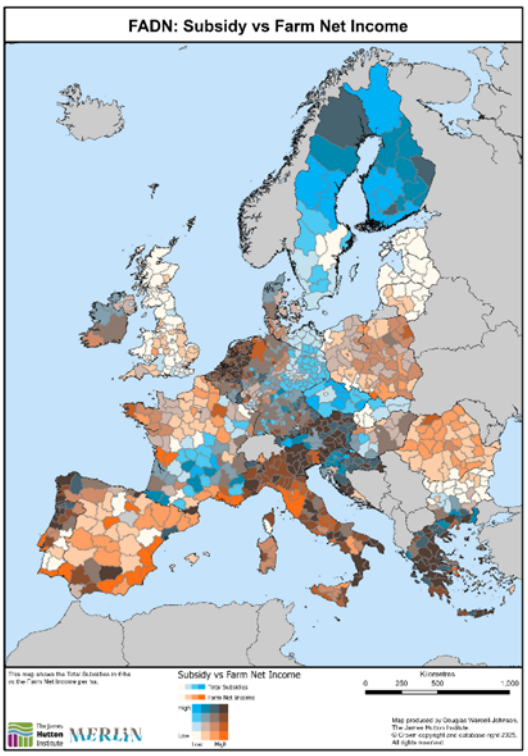


Figure 18: FADN: Subsidy vs Farm Net income

5.2.3 Agriculture within a Cross-Sectoral Approach

The involvement of the agricultural Sector should be part of a cross-Sectoral approach within a strategic landscape approach (see Box 3 below). This helps the Sector to see how the benefits of land sparing or land sharing associated with freshwater measures described in Section 4 and 5 are distributed. As often the benefits of these measures are shared between other Sectors, it is also important that these other Sectors are involved in supporting farmers through payment for ecosystem services or that all relevant public Sectoral policies recognise these spatial and Sectoral interactions. What the MERLIN experience suggests is that Agriculture should be part of a wider vision for rural development(European Commission, 2021a) involving all relevant economic Sectors, such as tourism or the bioeconomy (Publications Office of the European Union, 2023) to improve economic feasibility and manage trade-offs, (Cohen-Shacham et al., 2025). We now consider opportunities to create, maintain or disrupt actions to accelerate such cross-Sectoral working.

5.3 Implementation Actions

To embed cross-Sectoral working into policy and practice, five interlinked actions (see Section 2.4) need to be activated, for example when the Member States are writing their NRPs (European Commission, 2025b)[5]. Across all these actions (legal and regulatory instruments, values and attitudes, information, knowledge and innovations, economic incentives and collective action), the Section introduces relevant learning from both the MERLIN project and other examples of good practice.

5.3.1 Legal & Regulatory Instruments

A strong regulatory foundation is essential for mainstreaming into Sectors (Convention on Biological Diversity, 2016) and ensure the EU integration principle (European Commission, 2016) is operationalised across Sectors. Four different aspects are highlighted below.

Firstly, few legal instruments mandate cross-Sectoral working (Blackstock et al., 2023; European Environmental Bureau, 2023). The requirement for active involvement in RBMP under WFD (Preamble 14) provides the opportunity for strong cross-Sectoral dialogue around programmes of measures linking the installers and resource managers with beneficiaries. The WFD Article 9 (European Commission, 2000) on cost-recovery also provides a statutory basis for funding freshwater restoration, such as water fees implemented in France (Office International de L'Eau, 2019) (see Section 5.3.4). River Basin Commissions (ICPDR, 2025) also provide a statutory basis for cross-Sectoral collective action. These opportunities should be **maintained** and amplified. However,

5 see more in Annex 2 about NRP template

other directives, regulations or strategies (e.g. Climate Law) imply the need for cross-Sectoral working but there is no specific legal requirement for a cross-Sectoral engagement.

Secondly, there are regulatory requirements that encourage adoption of NbS measures, such as GAEC 2 under CAP to protect wetlands and peatlands, enforced from 2025 or Article 9 under NRR (European Commission, 2024e) to ensure free-flowing river stretches, implemented in NRPs by 2030. These **create** the need for stakeholder engagement around where to intervene and how to involve resource managers, enablers *and* beneficiaries in wetland and river management. These regulatory signals, such as strong conditionality for agricultural and forestry support payments (Meier et al., 2025) that encourage natural water retention measures, should be **maintained** post 2027. The lack of enforcement of EU legal principles, including slow implementation of environmental obligations, should be **disrupted** - here conservation NGOs play a catalysing role by taking laggards to the European Court of Justice to ensure implementation of EU legislation (European Commission, 2020a).

Thirdly, private finance opportunities require underpinning by strong regulation including measures such as the EU Taxonomy, Corporate Sustainability Reporting Directive, and sustainable finance standards; whilst contract law is essential for effective payment for ecosystem services markets (Zapata et al., 2024). Blended finances rely on 'codes' such as the Carbon Removals and Carbon Farming (CRCF) (European Union, 2024) to ensure the market functions.

Finally, reviewing licences or permits for water users, particularly Water Supply and Sanitation, Peat Extraction, Navigation or Hydropower operators, often acts as a trigger for businesses to engage in option appraisal for further investment cycles, allowing NbS to be considered. Discussing and selecting from strategic options as part of licence review could **create** opportunities for discussion between affected Sectors (Streit et al., 2025). Reviews of environmental conditions on permits or licences associated with water use, particularly abstraction, should be **maintained,** to achieve the goals of the EU Water Resilience Strategy (European Environment Agency, 2025b) or **created** in countries where some licences exist in perpetuity (e.g. in Finland) (Ibrahim et al., 2025a). The need to reach GES (or in future, achieve NRP objectives) can drive cooperation between Sectors, such as the interaction between State Agencies and the Hydropower Sector in Sweden (Carmen et al., 2025) or between the Water Supply and Sanitation and Agriculture in Germany (Chen et al., 2024). Private actors need **clear signals** that investments in NbS are viable and supported by coherent regulatory frameworks.

5.3.2 Values and Attitudes

Legal instruments both shape and reflect societal values and attitudes. In turn, there public opinion can motivate change in economic Sectors (Network Nature, 2024a). Here three different aspects are highlighted.

Firstly, European social attitudes to the environment remain positive and stable. For example, 84% of respondents to the Eurobarometer (European Commission, 2024a) agree that EU environmental legislation is necessary to protect nature in their country and 92% of respondents agreed that companies should pay for the costs of clearing up pollution. In terms of the freshwater environment, these respondents highlighted pollution, overconsumption of water, and climate change as the main threats across the EU, with water shortages a major issue for most respondents in seven MS. The analysis identified the main Sectors not doing enough to use water efficiently were [manufacturing] industry, energy, tourism and administration Sectors. These respondents also argued that there were insufficient public funds to protect the environment and that additional measures to address freshwater problems should be created. These results suggest that ecosystem services provided by freshwater ecosystems matter to citizens.

Secondly, there is a link between social attitudes and corporate responses, as the social licence to operate for water users requires addressing water quality and quantity issues (Hall, 2015). Corporate social responsibility (CSR) and environmental and social governance (ESG) are now institutionalised in the EU Corporate Sustainability Reporting Directive (2022), the Corporate Sustainability Due Diligence Directive (2024) and the Taxonomy Regulation (2020) (Article 8). Initial evidence suggests that CSR can improve ESG, resulting in improved ability to access finance and **creates** opportunities for businesses to re-evaluate supply chain relationships with a stronger focus on environmental and societal issues (Papafloratos et al., 2025). A focus on biodiversity restoration in CSR and ESG initiatives would **create** the normalisation of freshwater NbS as part of business practice, helping set the tone for cross-Sectoral engagement in freshwater restoration projects.

Finally, cross-Sectoral working will need to recognise different approaches to managing freshwater ecosystems (from framing water as an economic asset to be developed to seeing freshwater ecosystems as having legal rights to protection). These different motivations may drive stakeholders to engage in NbS implementation but create problems in finding common solutions (see Section 5.3.5). Therefore, attention needs to be paid to participants' world views; and their capabilities and capacities in any cross-Sectoral interaction (Stanberry et al., 2024).

5.3.3 Information, Knowledge and Social Innovation

Mainstreaming cross-Sectoral working requires reframing the narrative from 'environmental protection is a cost to business' to 'environmental protection is the foundation to economic resilience' (Network Nature, 2025) - creating a 'Nature Positive Economy' can create opportunities for economic development as well as safeguarding the natural capital on which the majority of the EU economies depend (Waylen et al., 2024). There are several areas of information and knowledge exchange needed, framed by a social innovation approach.

Firstly, Sectors do not yet fully understand how managing freshwater resources is related to mitigation of climate and biodiversity risks to their activities and need time to generate shared understanding of these issues, their different roles and what NbS mean for their business models (Salame-Rubin et al., 2024). Resources now exist to explain NbS, from the IUCN Global Standard (International Union for Conservation of Nature, 2020) to tools derived from European projects. It is vital to **create** and share success stories of cross-Sectoral involvement in NWRM, peatland restoration, floodplain restoration or transversal barrier removal to demonstrate how Sectors beyond administration, conservation and Agriculture, fisheries or forestry can benefit. Furthermore, there is a need for capacity building to ensure that knowledge can be turned into action; including financial literacy to recognise and realise business opportunities (Rouillard et al., 2025).

Secondly, a lesson from the MERLIN case studies (Ibrahim et al., 2025b) and Sectoral strategies (Bérczi-Siket et al., 2025) is that clear communication of co-benefits – especially in economic terms – is essential for attracting financing, building stakeholder buy-in, and identifying shared priorities. It is important that those implementing restoration measures as NbS monitor the outcomes holistically, including capturing impacts on economic Sectors (Carvalho et al., 2024; Schwerk et al., 2025). Capacity to measure these concepts needs to be created as part of the NRP processes. The monitoring needs to be long-term and regularly evaluated and the results communicated to all stakeholders (Glass et al., 2025). Involving local contractors (construction, conservation Sectors) can provide valuable local knowledge about how measures behave, and their installation and maintenance costs (Kok et al., 2025).

Thirdly, Cost-Benefit Analysis (CBA) is not designed to facilitate Sector-specific gains (Kok et al., 2025), but a framework (Battrup-Pedersen et al., 2025) that can quantify anticipated ecosystem service gains and appraise associated trade-offs and synergies, and can serve as a useful starting point for engaging Sectors. For example, wetland restoration in the Kampinos National Park (CS05) created flood mitigation benefits worth 0.53 million euros per year (Kok et al., 2025) but it is not clear how the beneficiary Sectors (Insurance, downstream Agriculture, tourism etc.) contribute towards the costs of this restoration. Therefore, approaches to CBA that trace the allocation of ecosystem services across businesses and Sectors need to be created, including avoided costs and damages adjusted for future climate risks. Here the (re)Insurance Sector can play a major enabling role in sharing risk data. Forums to translate existing knowledge into business-ready metrics and tools (European Commission, 2025e; World Business Council for Sustainable Development, 2025) and Natural Infrastructure for Business Platform (2017) should be **maintained**.

Finally, NbS are often not fully 'green' infrastructure but require some technical interventions e.g. seasonal pumping to control water levels for peatland restoration (Battrup-Pedersen et al., 2025; MERLIN, 2025b) which is why manufacturing Sectors should be involved in cross-Sectoral working, so that the needs and motivations of the installers, resource managers and enablers are understood (Schulz et al., 2024). Demonstration events and peer-to-peer learning networks help make NbS concepts tangible and transferable - illustrated by the achievements of EU funding streams such as LIFE and Interreg (Directorate-General for Research and Innovation, 2020). Sectoral stakeholders may need assistance navigating the plethora of information available on NbS to translate these data into implementable knowledge (Network Nature, 2024b), e.g. local extension advisors who can support the farmers and their networks through the green transition. Therefore, mainstreaming freshwater NbS requires creating social innovations and NbS project teams need to broaden their skillset to include social, economic and cultural aspects (Ibrahim et al., 2025b; Schulz et al., 2024) while maintaining a good knowledge of biodiversity and ecosystems functioning.

5.3.4 Economic Incentives

Cross-Sectoral working requires clear incentives for resource managers and implementers and an approach to funding and financing that accounts for the distribution benefits so that the Sectoral roles and responsibilities are clear. In particular, Member States' Nature Restoration Plans under the NRR must explicitly outline "the means of intended financing, public or private, including financing or co-financing" (Article 15.3 European Commission, 2024e).

Firstly, existing EU funding sources could enable the involvement of multiple Sectors (Battrup-Pedersen et al., 2025) by providing the financing to get different Sectors involved in NbS implementation. Potential changes to funding such as integrated national and regional partnership plans, which provide more freedom for Member

States to adapt CAP and other sources e.g. European Structural Funds to their context (WWF, 2025) should **maintain** a clear incentive for Sectors to collaborate to ensure water resilience. However, there remains the need to reform environmentally harmful subsidies; (Convention on Biological Diversity, 2016). For example, Member States could **create** incentives for Sectors to adapt to new climate conditions and therefore **disrupt** compensation that rewards those who do not adapt to the changing climate. Using hypothecated taxation could ensure that water users pay the true cost of resource use, whilst rewarding resource managers to produce public goods arising from NBS (Apostolaki et al., 2019). There are also some grants available from not-for-profit organisations e.g. the Open Rivers Programme is a good funding source for Article 9 of the NRR. As shown in Section 5.2, there needs to be particular attention to resource managers that take up land sparing measures (see commentary on CAP and WFD funding in the ESP). Compensation goes beyond offsetting losses or providing capital for restoration measures but should provide alternative routes for their future livelihoods including creating viable business models to support management of the NbS (e.g. rewetted peatlands). The Irish 'Farming for Water' Initiative is an example of a Water European Innovation Partnership where CAP funding catalysed a cross-Sectoral partnership including manufacturing, housing and infrastructure as well as agricultural Sectors.

Secondly, public funding can play a catalytic role in de-risking projects involving private investment and incentivising participation from landowners, farmers, or infrastructure operators (Rouillard et al., 2025). Very few NbS projects currently use private funding (EIB, 2023, cited in Rouillard et al., 2025) as limited mechanisms exist for blending public and private capital at landscape scale yet - promising initiatives include the 'Naturewise' incubation facility for climate adaptation. Alternatives include nutrient trading or reverse auctions; and such processes can encourage voluntary interactions between buyers (beneficiaries from multiple Sectors) and sellers (resource managers, generally from agricultural, forestry or other land use Sectors) (Kindu et al., 2022; Zapata et al., 2024). The ability to implement private or public financing of NbS measures will be dependent on the relative land values on which the measures are implemented. Therefore, financing for NbS will need to pay attention to the heterogeneous governance of land markets across the EU (Vranken et al., 2021).

Thirdly, shared dependencies by different Sectors on water resources could be a strong lever to mainstream cross-Sectoral working where multiple businesses rely on the same ecosystem. For example, the Coca Cola Foundation provided grants to WWF Hungary (CS07b) and WWF Romania (CS08) for restoration of the Danube to protect the natural assets on which their Food and Drink processing plants depend. Platforms like Landscape Enterprise Networks (2021) can link supply chains (e.g. in the Veneto and Friuli-Venezia Giulia regions of Italy a network of food and drink producers are working with farmers to safeguard soil and aquifer functions necessary to maintain wheat and wine production).

Finally, adopting regional, national or European quality marks can help nature-friendly enterprises gain market share or add a premium to their product pricing such as the EU Ecolabel for tourism accommodation. However, our review of existing standards (Chen et al., 2024) suggests that most focus on reducing pollutants and increasing water efficiency rather than directly requiring restoration of ecosystem functions. These standards should be **maintained,** as they reduce pressure on freshwater ecosystems, but additional aspects could be **created** that address biodiversity and ecosystem protection more explicitly.

5.3.5 Collective Action for Cross-Sectoral Working.

Multi-level interconnected collective action is needed, with strategic European and National activities steering place-based activities to generate system and Sectoral impacts (Sarkki et al., 2025). Cross-Sectoral working requires an integrated approach to the legal, attitudinal, informational and financial aspects covered above. Strategic NRP and other plan objectives are met by widespread uptake of measures 'on the ground' and anchoring the landscape level collaboration into regional and national planning and policy processes (Nesheim et al., 2021; Peskett et al., 2023; Rowbottom et al., 2022). Therefore, maintaining, or creating collective action processes to coordinate across policies, plans and implementation is essential to amplify and multiply intervention outcomes (Battrup-Pedersen et al., 2025; Blackstock et al., 2023; Ojanen et al., 2024). Cross Sectoral working can involve a specific organisation (often a public agency or NGO) coordinating individual businesses through to an ongoing formal structure to institutionalise collaboration (Malekpour et al., 2021). For an example of the former, The Irish Farming for Water Campaign (see Section 5.3.4) relies on Teagasc catchment coordinators to work with the Sectoral stakeholders, and the Box 3 below illustrates the latter.

Collaboration and coordination across borders are essential for effective water governance in Europe.

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- Existing institutions already provide regular platforms for knowledge exchange, backed by legal mandates. These include the International Commission for the Protection of the Danube River (ICPDR), the International Commission for the Protection of the Rhine (ICPR), the International Sava River Basin Commission (ISRBC), and the EU Strategy for the Danube Region (EUSDR). These transboundary platforms could be further developed to adopt a stronger NbS perspective, leveraging long-standing green diplomacy to identify strategic opportunities for cross-Sectoral integration. By involving a broader range of economic Sectors—such as Agriculture, energy, and tourism—NbS can be embedded into strategic planning processes, enhancing climate resilience, biodiversity, and sustainable development across shared river basins.
- In addition to these platforms that were established for transboundary large rivers another good example is the unique five country UNESCO Transboundary Biosphere Reserve Mura-Drava-Danube (Endangered Landscapes & Seascapes Programme, 2025) —spanning Austria, Slovenia, Croatia, Hungary, and Serbia—which is a pioneering example of cross-border biodiversity cooperation (involving Sectors such as nature conservation, water management, Agriculture, forestry, tourism, education, and local administrations), protecting 930,000 hectares of riverine landscapes and promoting joint conservation, sustainable development, and ecological connectivity across the “Amazon of Europe.”

Source: (Blueveki, 2021)

Box 3: Collaboration and coordination across borders

Spatial planning can provide the necessary procedures to identify multiple benefits and locate these within space (including Green and Blue Corridors initiative within the WRS). There is a large variation of land policy approaches across Europe. Some Member States lack institutional structures for cross-ministerial coordination. For example, the Flemish Blue Deal (2020) (European Environment Agency, 2025a) has implemented NWRM, river restoration and wetland restoration through a strategic programme that coordinates actions across Agriculture, construction, education, energy, infrastructure, manufacturing, transport and Water Supply and Sanitation Sectors to deliver water quality, flood protection and drought resilience. This coordinated approach relies on a funding programme underpinned by the policy memorandum the “Blue Deal decree”. Countries with integrated local authority mandates for different aspects of water, climate and land use help with these coordination approaches e.g. the French GEMAPI (Management of Aquatic Environments and Flood Prevention, 2018) law has allowed local authorities to work more effectively with upstream land managers to

manage water quality and quantity issues, benefitting the Insurance, Infrastructure and Water Supply and Sanitation Sectors.

Achieving benefits from the NbS measures often requires working at a landscape scale to generate significant benefits. Spatial tools (e.g. Water Web Tool, see ESP (Battrup-Pedersen et al., 2025) can identify 'hotspots' where NbS could be implemented but property rights and cultural practices affect how collaborative land and water management will be supported. NbS measure implementation may face challenges from adjacent resource managers if activities affect them (Ibrahim et al., 2025a). These could be overcome if 'land swaps' - to help land-based businesses retain land parcels of viable size and production capability (Gielen, 2016; Molema et al., 2008) - were implemented more widely. This requires creating a formal institution to coordinate and manage the legal and financial technicalities. The lack of coordination institutions can make voluntary uptake of NbS measures (floodplain reconnection, wetlands, NWRM) using a landscape approach more difficult, if willingness to uptake measures does not coincide with appropriate sites from a hydro-ecological perspective (Spray et al., 2022).

Many EU funded projects develop Communities of Practice, Living Labs or Multi-Actor Platforms to co-design effective NbS and implement co-governance at a landscape level – the Water Resilience Strategy promotes a Community of Practice to discuss "sponge landscapes". To mainstream cross-Sectoral working, these networks need to persist through time to allow long-term networks, particularly between installers, resource managers, enablers and beneficiaries, based on trust and mutual understanding to develop. The short-term funding associated with projects impedes this. At National level, developing strategic plans (CSP, NECP, AS, RBMPs, NRPs) on a regular cycle, can build connections between individuals seeking common solutions. Maintaining the formal plan evaluations by the European Commission creates opportunities to encourage further engagement of Sectoral representatives as resource managers, installers, enablers or beneficiaries in these planning processes.

However, engaging the range of Sectoral stakeholders can create some tensions, if stakeholders are engaged for a range of motivations (Wuijts et al., 2023). Issues may range from concerns over reputational risk and 'greenwashing' when working with banking and finance Sector (Rouillard et al., 2025) to fundamental value clashes between water as a resources for economic development and water as commons with legal rights (European Water Movement, 2025). Combining different Sectors with different roles will make trade-offs more explicit and attention to trade-offs and conflict resolution must be maintained (Cohen-Shacham et al., 2025; Giordano et al., 2020). Therefore, cross-Sectoral working requires strong governance principles (Fenten et al., 2024; Sullivan et al., 2025) which recognise and build on the different roles played by different Sectors.

The practicalities of cross-Sectoral working together can be difficult or frustrating (Domorenok, 2017). Facilitators can play an important role in managing these conflicts and strengthening relationships, promoting the need to understand different perspectives and facilitating deliberations over the problem, potential solutions and implementation processes is essential (Kapoor et al., 2025). This can build cross-Sectoral understanding of costs, benefits and their allocation at a landscape level (Cook et al., 2013). Skills and capacities to support difficult conversations between powerful stakeholders will be required (Convention on Biological Diversity, 2016; Sevä et al., 2017; Veisi et al., 2025). Many MERLIN cases involved organisations focussed on outreach and relationships – these roles should be **maintained**. Too often these individuals are reliant on short-term project-based funding making it difficult to sustain long-term progress and more stable institutions should be created.

5.4: From Opportunities to Action

Working cross-Sectorally, with a more nuanced understanding of different Sectoral roles and responsibilities, is essential to mainstreaming yet it is not commonly practiced. The opportunities outlined above show that the policy and financial foundations for mainstreaming NbS already exist within the EU system. The challenge is to operationalise cross-Sectoral working through coherent implementation, adequate resources, appropriate monitoring data, and targeted support for Member States' coordination capacity. Section 6 builds directly on these findings, translating the strategic actions into concrete Routemap recommendations for policymakers, and Sectoral representatives seeking to embed cross-Sectoral working into Europe's freshwater agenda.

6. Recommendations for Mainstreaming Cross-Sectoral Working

This Section translates the lessons from the MERLIN case studies and cross-Sectoral analyses (Sections 2, 4 and 5) into a set of strategic recommendations to help advance towards the Routemap destination. These recommendations are designed to help policymakers, Sectoral representatives and practitioners embed cross-Sectoral collaboration into mainstream governance and investment frameworks for freshwater Nature-based Solutions (NbS).

The intended audience comprises decision-makers at EU level (Commission services, agencies, Parliament), Member State authorities responsible for planning and implementing relevant policies (e.g. National Restoration Plans, River Basin Management Plans, CAP Strategic Plans), and regional and local stakeholders (catchment partnerships, NGOs, business associations) who translate policy ambitions into practice. Recognising the range of stakeholders involved in good governance of NbS, illustrates the importance of sharing the burdens and benefits, as required to make it a Just Transformation (Ibrahim et al., 2025b).

The recommendations address the five interconnected enablers presented in Section 5.3:

- Section 6.2: Legal and regulatory approaches – with a focus on immediate policy windows (see Section 2.3)
- Section 6.3: Values, attitudes and leadership – strengthening political will, cultivating stewardship, and promoting leadership that bridges Sectors.
- Section 6.4: Knowledge, information and innovation - improving access to reliable data, fostering learning networks, and scaling social and technological innovation.
- Section 6.5: Funding and financing - aligning public and private investment streams, removing perverse incentives, and developing blended-finance mechanisms for NbS.
- Section 6.6: Collective action - supporting collaborative institutions and partnerships that enable long-term coordination at catchment and landscape scales.

The recommendations build directly on MERLIN's vision of transformation (Carmen et al., 2024) which recognises that achieving systemic change requires creating new enabling conditions, maintaining effective existing practices, and disrupting unsustainable path dependencies. Each Sub-Section (6.1– 6.6) outlines specific actions under these headings, indicating what is needed and which actors should be involved. Together, these thematic clusters form a coherent cross-Sectoral transformation pathway, providing the means through which Member States and stakeholders can deliver the Nature Restoration Regulation and related EU policy goals in a durable and socially just manner. Unless otherwise stated, the recommendations refer to the vision by 2030 (focussing on upcoming policy windows) but some aspects, like shifting values and behaviours, may take longer to enact.

6.1 Overview of Why, Who and How to mainstream freshwater NbS

6.1.1 Why is Cross-Sectoral Working Needed?

MERLIN's analyses demonstrate that the successful mainstreaming of NbS and freshwater restoration is often hindered by persistent policy silos, short-term funding, and fragmented responsibilities across economic Sectors that leads to uneven implementation. At the same time, Europe's sustainability transitions are occurring in a context of deregulation, fiscal constraint, and competing Sectoral priorities. There is therefore a window of opportunity to strengthen the integration principle of the EU Treaty (European Commission, 2016) and reaffirm other core legal principles—precaution, polluter pays, and no net biodiversity loss—as practical foundations for cross-Sectoral decision-making.

6.1.2 How to Mainstream Cross-Sectoral Working

These recommendations respond to three main needs identified throughout the Routemap:

Urgency: freshwater ecosystems remain under severe pressure; restoration of ecosystem function must accelerate to meet 2030 and 2050 targets.

Coherence: existing EU and their national instruments e.g. Nature Restoration Regulation (NRR); Common Agricultural Policy (CAP); Water Framework Directive (WFD)/Water Resilience Strategy (WRS); Climate Adaptation Strategy (AS); Climate Law (CL) must work in together rather than in isolation.

Participation: economic Sectors and civil society actors need early, structured involvement in restoration planning to ensure legitimacy and shared ownership.

Addressing these needs will require both institutional coordination and shifts in governance culture, where ministries, agencies, and businesses alike view ecological restoration not as an environmental add-on but as a core economic and social investment – the philosophy of NbS.

6.1.3 Who can Help Mainstream Cross-Sectoral Working?

The Routemap recommends that action be organised at three interlinked governance levels, each with distinct responsibilities but a shared commitment to mainstreaming NbS through cross-Sectoral cooperation (see Table 11).

Table 11: Cross Sectoral Responsibilities

Gov-ern-ance level	Main Stakeholders & roles	Illustrative actions (What / How)
European level	Commission and Agencies (enablers) Parliament (enablers) Sectoral Associations (enablers)	Provide strategic coherence, align funding and legislation, support Member States by sharing good practice, and sanctioning poor practice Political leadership Participate in cross-Sectoral dialogues, provide strategic oversight and evidence (esp. Insurance), provide funding (esp. Banking)
National level	Parliament (enablers) Ministries & Agencies (enablers & implementers) Sectoral Associations (enablers & implementers)	Translate EU objectives into binding national and regional strategic plans Embed cross-Sectoral coordination mechanisms within plans; include NbS indicators in national monitoring systems Participate in cross-Sectoral dialogues, provide strategic oversight and evidence (esp. Insurance), provide funding (esp. Banking); provide specialist skills for NbS design and implementation
Regional / Local level	Agencies (enablers & implementers) Sectoral Associations (enablers & implementers) Individual organisations (resource managers, implementers and enablers)	Support catchment partnerships (funding, provision of data, support with navigating multiple policies, providing coordination authority) Participate in catchment partnerships and support implementation (co-finance, data, expertise); implement measures where appropriate. Learn about when and how NbS could be appropriate, participate in place-based partnerships, implement or allow others to implement NbS on their land.

Specific Sectoral guidance for Agriculture, Hydropower, Insurance, Navigation, Peat Extraction and Water Supply and Sanitation is available (Bérczi-Siket et al., 2025) to complement the Routemap cross-Sectoral recommendations.

6.2 Legal and Regulatory Approaches

This Section covers general principles that would embed the integration principle and the environmental aquis across a wide range of policies through specific policy windows up to 2030 (Water Dialogues and Water Resilience Strategy, National Restoration Plans, River Basin Management Plans, Climate Adaptation and Resilience Initiative CAP and integrated national regional partnership plans) across a wide range of policies.

6.2.1 General Legal and Regulatory Frameworks and Principles

6.2.1.1 Why does this matter?

Given the current context (see Section 2.3) when the EU is focussed on enhancing competitiveness and security (Directorate-General for Communication, 2025) of the European Members States - the principles of EU primary law (Publications Office of the European Union, 2016b) play an important role in in maintaining the highest level of protection of the environment within such a transformation. The current EU sustainability frameworks — such as the 8th Environmental Action Programme and the European Green Deal, along with their implementing measures — must not constrain the broader integrative policy mandate established by primary law and previous EAPs. These legal foundations call for systemic cooperation across Sectors to achieve the highest possible level of sustainability in all EU policies and actions. Ensuring that public support payments and private finance have strong environmental conditions will help ensure that these different approaches to financing restoration and NbS build on existing regulatory requirements. In particular, the integration principle (TFEU 11, Publications Office of the European Union, 2016b) and the need to strengthen the implementation of precaution, prevention, rectification at source and polluter pays principles are required to ensure that water users pay true cost of resource use. These recommendations stem from the recognition that Sectors are more

willing to work together where there a strong regulatory foundation that legitimises environmental protection and therefore a sense of fairness with all the relevant Sectors playing their roles. Sectors are unwilling to work together (within or between Sectors) if those who are not respecting regulatory obligations are not sanctioned, as this does not provide fair competition between different firms (within Sector) or burden sharing between Sectors. Therefore, when national governments or specific companies are not implementing the regulatory requirements, taking legal proceedings signals that there is no advantage from failing to follow the requirements. Furthermore, all the companies which were frontrunners in compliance are now disadvantaged due to the omnibus/stop the clock legislation with less reporting requirements for companies' corporate social responsibility (CSR) and environmental and social governance (ESG) concerns.

6.2.1.2 What should happen by 2030?

At EU level

- The Commission should apply the cross-Sectoral or integrational approach when adopting and adopting new policies like the Water Resilience Strategy and the European Climate Adaptation Plan and Resilience Initiative, while maintaining the WFD.
- The Commission and their agencies should consider the integration principle when assessing the national restoration plans (Autumn 2026 to Spring 2027), during the water dialogues (2025 to 2027) and the adoption of the EU Climate Adaptation Plan and Resilience Initiative (planned in 2026). In addition, in the assessment of the CSPs, 4th RBMPs; and NECPs during the later half of this decade.
- The Commission should integrate NbS targets into Green Deal and investment frameworks (2025–2030).
- The Secretariat Generale should establish a cross-DG coordination platform linking environment, Agriculture, energy, and cohesion portfolios.
- Relevant DGs should create or maintain strong conditionality in support payments & green finance to give certainty for business decisions.
- The Commission and European NGOs should disrupt slow implementation of environmental directives/regulations to reward those who do comply and level competition between businesses within EU through infringement proceedings for poor or slow implementation.

At Member State level

- Ministries should consider the integration principle when implementing environmental policies through adopting national legislation, policies, plans (e.g. NRPs and CSPs, 4th RBMP; NECPs and Climate Adaptation Plans) and programs, and enforcing or reviewing permits.
- The coordination of the creation of these different National Plans should be at the highest level of National government to show leadership, ideally in a cross Sectoral and intergovernmental body. This body should mandate cross-ministerial steering groups to ensure horizontal policy coherence and collective accountability for NbS outcomes.
- Member States should create a permanent institutional framework for collective, cross-Sectoral decision-making at the catchment and landscape scales and formally recognise river-basin or landscape partnerships as advisory or co-decision bodies within national water and biodiversity governance systems.
- Implementing ministries shall maintain or create strong conditionality in support payments & green finance to give certainty for business decisions.
- National NGOs or governments can challenge slow implementation of environmental directives/regulations in court to reward those who do comply and level competition between businesses.

At local level

- Sectoral associations, agencies and NGOs should take a cross-Sectoral approach to implementing NbS projects, helping to cement the legal principle of integration through multi-level governance (at local, regional, and European level).

6.2.2 Water Resilience Strategy, Water Framework Directive and Climate Resilience Initiative

6.2.2.1 Why does this matter?

The momentum to enhance cross-Sectoral cooperation arises from the Water Dialogues (2025-27). While the WRS Strategy highlights the role of NbS and calls for stronger integration with existing legislation, it currently lacks a truly cross-Sectoral approach, as it does not propose concrete measures to reduce harmful subsidies or limit rising water demand linked to industrial and digital transitions. Moreover, although the Strategy refers to the Insurance Sector's potential role, it does not include actionable steps to mobilise

investment in NbS. The Water Framework Directive is the toolbox for the delivery of the EU Water Resilience Strategy. The Strategy therefore depends on full enforcement of WFD provisions to achieve its objectives. Therefore, more could be done to mainstream NbS and involve all the relevant Sectors.

6.2.2.2 What should happen by 2030?

At EU level

- The Commission should check how the Member States involved the 19 Sectors in the adoption of the 3rd RBMPs, what were their challenges, how they could learn from these experiences to improve cross Sectoral working process during the adoption of the 4th RBMPs (due 2027) during the Water dialogues.
- The Commission should accelerate the WFD implementation and enforcement.
- The Commission should use upcoming policy initiatives to support WFD implementation, in particular the European integrated framework for climate resilience, to mainstream water protection and water resilience, and increase the uptake of nature-based solutions.
- The Commission should ensure coherence between management and conservation of water ecosystems and relevant Sectoral policies (most notably Agriculture, Energy, Climate adaptation and potentially Defence). The Commission should require that River Basin Management Plans (RBMPs) include named cross-ministerial coordination leads and define accountability for NbS delivery.
- The Commission must ensure that the Water Resilience Strategy is matched with appropriate funding in the upcoming Multiannual Financial Framework, so that its flagship actions can be delivered.

At Member State level:

- Member States should deliver all measures in the 2022-2027 river-basin management plans; and finalise robust, actionable plans for 2028–2033, addressing drought and over-abstraction, in ways that also restore ecological function.
- Member States should require that River Basin Management Plans (RBMPs) include named cross-ministerial coordination leads and defined accountability for NbS delivery.
- Sectoral Associations should participate in developing the 4th RBMPs and support any action plan arising from the Water Dialogues.

6.2.3 Nature Restoration Regulation Implementation and National Restoration Plan Elaboration

6.2.3.1 Why does this matter?

To effectively realise the European vision of integration, Member States and the EU decision makers must ensure the active involvement of all relevant Sectors that impact the environment or depend on natural capital and ecosystem services in the development of the NRPs. Tools like the Water Web tool (Battrup-Pedersen et al., 2025) can provide a way to involve all the Sectors in defining potential restoration areas and help raise the visibility of NbS options within national restoration plans: The NRR and its implementing NRPs have a clear integrative, cross-Sectoral approach as they offer the potential to boost the implementation of other European policies (see more details in Annex 2). The NRR refers to socio-economic benefits of nature restoration on many occasions, not only focusing on the environment itself, but - although not explicitly - more about society within nature. Therefore, the NRR's effectiveness will depend largely on how economic Sectors interpret and implement its provisions in practice (Hering et al., 2023) and cross-Sectoral cooperation is essential to dismantle persistent policy and Sectoral silos. Moreover, social aspects are mentioned several times in connection with restoration.

6.2.3.2 What should happen by 2030?

At EU level

- The Commission should ensure the early participation of Sectoral stakeholders in the elaboration of the plans to keep them on board with the implementation of restoration measures and to enable the delivery of a cross-Sectoral plan. In particular, Sectors beyond the Agriculture (including forestry) Sector, especially Sectors who benefit from restoration, should be involved as they play roles in implem enting or enabling restoration measures.
- The Commission should pay more attention to halting harmful activities that hinder biodiversity. The NRPs must indicate the amount of subsidies that negatively affect restoration measures (Article 15, paragraph 3/v, European Commission, 2024d). However, there is no target or deadline for minimising, let alone stopping these subsidies. Determining tangible objectives is required to complement restoration incentives.
- The Parliament and the Commission should maintain the existing level of ambition of global, European, national restoration targets, and implementation. The current alignment between the NRR and several

existing environmental and sustainability-related policies (e.g. the EU Biodiversity Strategy, the Habitats Directive, the Water Framework Directive and the CAP (Article 14(14), European Commission, 2023) should be maintained and enforced.

At Members State level:

- Member State authorities must ensure the early participation of all Sectoral stakeholders in the timely elaboration of the plans to enable the competent authority to write a cross-Sectoral plan. Member States are also urged to include social aspects in their NRP[6].
- National Governments should require that National Restoration Plans (NRPs) include named cross-ministerial coordination leads and define accountability for NbS delivery.
- Ministries leading the NRPs should maintain the existing level of ambition of global, European, national restoration targets in their plans and take these existing MS-level strategies into account.
- Member States governments should phase out the subsidies for activities that hinder biodiversity recovery.

6.2.4 Common Agricultural Policy & Integrated National Regional Partnership Plans

6.2.4.1 Why does this matter?

The ESP (Battrup-Pedersen et al., 2025) covers the role that CAP can play in upscaling freshwater restoration. Here we focus on the window of opportunity for integration through the move to coordinate or integrate the next Common Agriculture Policy Strategic Plans (CSP) with the National and Regional Partnership Plans. These plans will distribute the European Regional funds in the next Multi annual Financial Framework (MFF) (European Commission, 2025a) for the period 2028-2034, coming into force 1st January 2028. National and Regional Partnership Plans could provide more opportunities for cross-Sectoral working. The creation of integrated plans helps advance Agriculture as part of wider rural and regional development as highlighted in Section 5.2. However, if the new MFF structure allocates less money for green investment, it is essential to use non-environmental financial resources to create the pathways for farmers and other land-based resource managers to support the mainstreaming of freshwater NbS.

6.2.4.2 What should happen by 2030?

At EU level

- The Commission should maintain strategic reviews of the 'territorial agendas' to ensure that nature and environmental objectives remain prominent.
- The cross-ministry committees highlighted in Section 6.2.2 and 6.2.3 should be utilised to help with any coordination of CAP with national and regional partnership plans.
- DG Environment should support a rewetting business model in the forthcoming Bio-Economy Strategy.
- DG Agriculture should maintain the green architecture and improve it through:
    - Protective practices that support wetland restoration, riparian buffers, and peatland rewetting;
    - Agri-environmental and climate actions (AECA) linking biodiversity and flood-risk objectives;
    - Result-based payment schemes rewarding ecosystem service delivery;
    - Natura 2000 and WFD payments (current Article 72 of the CAP Plan Regulation) that compensates farmers affected by restrictions from the Nature Directives or the WFD; and
    - Collective implementation models involving farmer cooperatives and water authorities.

At the Member State Level:

- The Ministry making the CAP Strategic Plan (CSP) should involve all the Sectors benefiting from environmental and climate actions on farm and forestry land in the development of CSPs.
- The Ministry making the CSP could make more use of the Natura2000/WFD investment payments to provide support for the public goods provided by farmers.
- The cross-ministry committees highlighted in Section 6.2.2 and 6.2.3 should be utilised to help with any coordination or merging of CAP with national and regional integrated plans.
- The Ministry could support networks of agricultural advisors who are skilled in implementing NbS as part of a sustainable rural livelihoods approach.
- Sectoral Associations can attend and contribute to a more cross-Sectoral approach to CSPs and integrated plans.
- Banking and other investors from beneficiary Sectors can offer private finance to blend with the public support payments.

[6] For further information about the connection between the NRL and other policies, see Annex2 ("NRL and other European Policies").

6.3 Values, Attitudes and Leadership

6.3.1 Why does this matter?

Transformative change toward mainstreaming freshwater restoration depends not only on technical and financial mechanisms but also on cultural and institutional values. MERLIN's analyses reveal that even where funding and regulatory frameworks exist, progress is often constrained by different motivations, limited trust, and cultures that still prioritise Sectoral mandates, viewing ecosystem health as compliance burdens rather than assets to protect. This cultural inertia must be disrupted, while positive examples of cross-Sectoral leadership who can translate ecological objectives into shared social and economic narratives, must be created and maintained. Shifting values and attitudes—within public administrations, private companies, and communities—is therefore fundamental to achieving the integration principle of the EU Treaties and the long-term objectives of the Green Deal, the Nature Restoration Regulation, and the Water Resilience Strategy.

6.3.2 What should happen by 2030?

At EU level

- Parliamentarians, Media and Sectoral associations frame restoration as shared value creation.
- Commission integrates NbS and restoration narratives into major economic and industrial strategies (e.g. Green Industrial Plan, CAP post 2027, proposed integrated national and regional partnership plans).
- Commission-wide communication campaigns should highlight restoration as a driver of competitiveness, innovation, and rural vitality ensuring resilience of business by protecting natural assets for human and economic development.
- Commission establishes a Cross-Sectoral Leadership Forum on NbS under the coordination of DG ENV, involving DG AGRI, CLIMA, REGIO, and GROW, to support future policy coherence (see Section 6.2).

At Member State level

- Ministries embed integrative leadership in national planning, including Integration of NbS leadership modules into civil service training, agricultural advisory systems, and water management programmes.
- Ministries and Sectoral associations create national "NbS Leadership Awards" to recognise pioneering municipalities, businesses, and partnerships.
- Sectoral Associations promote curriculum and vocational/continual profession development training to include ecosystem restoration, water resilience to future proof their activities, and nature-based entrepreneurship to generate alternative livelihoods.
- Sectoral associations participate in cross-Sectoral discussions to understand how they are affected NbS, generating the awareness that may help encourage them to pay for these ecosystem services.
- Media and Sectoral communications normalise NbS as part of national development discourse.

At regional and local level

- State Agencies, local government and Sectoral associations support community-led leadership by provision of resources and recognition for local champions — farmers, conservationists, water managers — who can bridge institutional divides.
- Local media promote examples of NbS and opportunities to find out more about NbS in practice.
- Organisations from all the identified Sectors engaged with local NbS projects to find out more about how it affects them, getting involved where relevant.

6.4 Knowledge, Information and Social Innovation

6.4.1 Why does this matter?

Cross-Sectoral working depends on a shared evidence base and the ability of diverse actors to learn from each other. MERLIN learning suggests that barriers to mainstreaming freshwater NbS measures arise not from a lack of will, but from asymmetries in knowledge—for example, inconsistent data on costs and benefits, unclear metrics for ecosystem services, and fragmented communication between science, policy, and practice. While the EU and Member States have established numerous data platforms, these often remain under-used or inaccessible to practitioners and local authorities. Innovation in this context goes beyond technological tools. It also encompasses social and institutional innovation with Sectors — sharing reliable, comparable data, linking hydrology, biodiversity, land use, and socio-economic data and creating co-learning communities of practice that translate information from often isolated good practice projects into actionable knowledge by the different Sectors. More explicit and visible roles for the different Sectors, identifying business models and engaging them in adaptive management can help to mainstream support for NbS implementation.

6.4.2 What should be done by 2030?

At EU level

- Commission should create a European Knowledge Hub for Freshwater NbS that integrates existing data repositories (EEA, JRC, Copernicus, LIFE, Horizon, BioDiversa Hub and BioAgora) into a user-oriented interface providing open-access case studies, cost–benefit analyses, and guidance for NbS planning.
- Commission (EUROSTAT) should ensure interoperability with Member State monitoring systems through common data standards and metadata requirements.
- Commission should require Horizon Europe, LIFE, and Cohesion Policy projects to include explicit cross-Sectoral learning components and open-data deliverables.
- Commission should establish an EU "NbS Innovation Accelerator" linking research consortia with businesses and regional authorities to pilot financeable NbS models and feed results back to the NbS Knowledge Hub.
- Sectoral Associations should share consolidated knowledge and data into the data repositories and participate in the 'NbS Innovation Accelerator'. They should ensure that the NbS knowledge hub makes the roles and responsibilities of all relevant economic Sectors more explicit.
- Research organisations should adapt valuation approaches to include the full suite of costs and benefits of relevance to all the economic Sectors (i.e. beyond nature and climate risks). The research should illustrate how these costs and benefits are allocated across businesses and Sectors and use appropriate metrics and time series for business decision making. Furthermore, when dealing with long term business investments then it is important to add climate projections to show how NbS measures respond to changing climate conditions.

At Member State level

- Ministries and agencies should strengthen national data and reporting systems and develop national NbS and restoration dashboards integrating data from NRPs, RBMPs, CAP Strategic Plans, and spatial planning tools.
- Ministries, Agencies, and Sectoral associations (esp. conservation, education and Agriculture) should make monitoring results publicly available to build transparency and trust.
- Ministries and agencies and Sectoral associations should empower agricultural, water, and conservation advisory networks to act as intermediaries translating scientific and policy knowledge into locally relevant advice.
- Ministries and agencies and Sectoral associations should provide capacity-building grants for universities, NGOs, and SMEs offering training and technical assistance on NbS implementation.

At regional and local level

- Agencies, local governments and local Sectoral associations should share monitoring results, including relevant participatory mapping and citizen-science tools to foster collective stewardship.
- Organisations should link digital and social innovations to combine smart technologies and engineering with participatory processes to ensure that there are cross-Sectoral solutions that highlight the range of roles different Sectors can play and are tailored to different organisational needs.

6.5 Funding and Financing

6.5.1 Why does this matter?

Sufficient financial resources are essential to translate policy ambitions into lasting action. Across the evidence within MERLIN and beyond, a recurrent challenge was not the absence of funding per se, but the fragmented and short-term nature of existing funding programmes, that are not aligned with maintaining measures for sufficient time to achieve outcomes. Public budgets often remain confined to single Sectors, while private investors perceive NbS as high-risk and difficult to monetise. Any potential for less 'environmental' funding means other funding sources need to be harnessed effectively. Currently those installing NbS and those hosting the NbS on their property, rarely directly rewarded by the beneficiaries of the ecosystem services provided. Pilot schemes connecting suppliers and consumers of services are therefore important to support, and to widen them to involve the full suite of Sectors. Furthermore, there are still some perverse subsidies that degrade water and biodiversity, particularly in Agriculture and infrastructure Sectors and non-monetary values including ecosystem services, avoided costs, social wellbeing are not seen as legitimate investment returns. Bridging this divide requires a strategic diversified financing landscape combining public, private, and community-based financing, underpinned by coherent incentives and clear evidence of return on investment. Longer term funding and financing are therefore key levers for embedding cross-Sectoral working.

6.5.2 What should be done by 2030?

At EU level

- Commission should align existing non-environmental funding frameworks with restoration goals by ensuring that the Common Agricultural Policy, Cohesion Policy, and LIFE programmes (or the future national and regional partnership plans) explicitly include NbS-related eligibility criteria and performance indicators.
- Commission should use InvestEU, Horizon Europe, and Innovation Funds to de-risk large-scale NbS investments and pilot new financial instruments (e.g. green bonds, pay-for-performance schemes).
- Commission should maintain strong governance of payment for ecosystem services instruments, to ensure a level playing field, avoid greenwashing and protect the existing investments made in good faith.
- Commission should establish an EU NbS Finance Platform that can coordinate between DG ENV, DG CLIMA, DG AGRI, and DG REGIO to connect project developers, investors, and all Sectors involved in NbS implementation.
- Sectoral Associations should work with the Commission and its agencies to provide a pipeline of bankable NbS projects with transparent cost-benefit data relevant to beneficiaries, implementers and resource managers.

At Member State level

- Ministries should reform national subsidy and tax systems to redirect harmful subsidies (e.g. those encouraging water abstraction or Peat Extraction in inappropriate places) toward NbS implementation and ecosystem service payments; and introduce tax incentives for landowners and businesses adopting NbS measures that contribute to national NRR targets.
- Ministries should pilot carbon, biodiversity, and water-quality credit schemes with rigorous monitoring and social-safeguard standards.
- Ministries should ensure that their NRP includes life-cycle costing and sustainable maintenance and monitoring funding.
- National investment banks should create national guarantee or co-investment funds for NbS, combining CAP, Cohesion, and climate-adaptation budgets with private contributions.
- Private or public Sector funding (e.g. via banking Sector representing impact investors) should fund intermediaries — catchment partnerships, development banks, or NGOs — that can aggregate small projects into investable portfolios. These Sectors can also provide technical assistance to municipalities and SMEs to access EU and private financing opportunities.
- Sectoral Associations should ensure that any voluntary mechanisms such as quality marks or supply chain standards retain equivalence with regulatory standards and include criteria relevant to the restoration of habitats and species.

At regional and local level

- Local authorities should develop local investment ecosystems through spatial planning instruments to support cooperation between utilities, landowners, insurers, and conservation groups leading to co-financing for NbS that reduces shared risks (e.g. floods, droughts). This may involve adopting models such as Landscape Enterprise Networks.
- Where fiscal arrangements allow, Local authorities should create community-based financing models such as local water funds, recreation funds, charitable trusts, or hypothecated savings from reduced flood damage or water-treatment costs.
- Sectoral organisations should integrate NbS cost-benefit analyses into long-term planning including avoided costs, business resilience and measure effectiveness in a changing climate.

6.6 Collective Action for Cross Sectoral working

6.6.1 Why does this matter?

Even with adequate policies, knowledge, leadership, and financing, transformative change will not occur without collective action. Freshwater systems cross administrative boundaries and link diverse interests—Agriculture, Hydropower, Navigation, conservation, tourism, and urban development. Because no single Sector or institution can deliver NbS outcomes alone, the ability to coordinate, negotiate, and co-implement measures at landscape and catchment scales is decisive for success. MERLIN's learning show that where strong partnerships exist—such as river-basin platforms, catchment partnerships, or Communities of Practice—implementation accelerates, transaction costs fall, and conflicts are addressed. Conversely, where cooperation

is weak, even technically sound projects face delays, duplication, or social resistance. Thus cross-Sectoral working needs institutionalised co-governance frameworks that have shared objectives and mutually recognised benefits; clear mandates with agreed roles and responsibilities; predictable resources, and inclusive representation/conflict resolution processes. This should increase the legitimacy of NbS as an option for addressing business and societal challenges, creating collective capacity to maintain and adapt NbS, linking ecological objectives with sustainable livelihoods.

6.6.2 What should be done by 2030?

At EU level

- Commission and agencies should institutionalise cross-Sectoral governance in EU policy frameworks (see Section 6.2) including guidance on minimum standards for stakeholder involvement, equity, and transparency, aligned with the Aarhus Convention and provide funding for permanent institutional framework for collective decision-making at the catchment or landscape scale across EU.
- Commission should encourage appropriate delegated integrated spatial planning institutions or disrupt any legal barriers to their creation.
- Commission should fund European networks of partnerships through maintained support for existing Communities of Practice, Living Labs, and catchment-based platforms through Horizon Europe and LIFE programs; and promote systematic exchange between these networks and EU policy units (e.g. Water Directors, Green Deal Missions).
- Sectoral Associations should continue to participate in these strategic partnerships and share the learning through their networks.

At Member State level

- Ministries provide long-term operational support through:
  - Stable funding for coordination staff, facilitation, and evaluation for learning in catchment partnerships.
  - Develop national toolkits for participatory planning and conflict mediation to assist regional and local actors.
  - Create opportunities to co-locate restoration and resource manager and implementation needs such as through land banks or land swaps to resolve trade-offs.
- Ministries and Sectoral associations support multi-level partnerships by linking local initiatives to national and EU agendas through vertical integration mechanisms (e.g. reporting portals, joint funding calls, cross-scale learning events).
- National media should report good news stories to inform others of how partnership can deliver.

At regional and local levels

- State Agencies, local government and Sectoral associations should create catchment-based partnerships as vehicles for shared decision-making and structured dialogue between Sectors with competing interests (e.g. Hydropower vs. conservation, Agriculture vs. water supply) to co-design balanced restoration pathways.
- Local authorities, agencies and Sectoral organisations should strengthen and diversify existing local partnerships by seeking to be inclusive and inviting all relevant Sectors to participate.
- Local authorities, agencies and Sectoral organisations should encourage cooperative business models—such as watershed trusts, commons-based enterprises, or hybrid public–private entities—that embed NBS in local economies.
- Education (especially research) Sector should support shared accountability and co-benefit tracking by creating simple frameworks for partners to monitor ecological outcomes, socio-economic benefits, and fairness in cost–benefit distribution.
- Coordinating organisations should maintain public communication on progress and setback overcome within partnerships to maintain legitimacy and trust, giving due visibility to 'frontrunners' from all the Sectors.

6.7 What happens Next?

Cross-Sectoral working is the cornerstone of the MERLIN Routemap. When supported by aligned policies, progressive values, robust knowledge systems, and sustainable financing, collective action transforms NbS measures from a sequence of isolated projects into a shared societal enterprise. Such cooperation embodies the European integration principle in practice — delivering not only healthier freshwater ecosystems but also stronger, more resilient communities across Europe. As such the adoption of these recommendations across all relevant Sectors, and at each governance level, should accelerate NbS approaches to restore freshwater ecosystems. The recommendations will also support the uptake of the focal Sectoral strategies (Bérczi-Siket et

al., 2025), which provide their own set of recommendations to help these Sectors play their role. The Routemap will be disseminated to the champions supporting our work in European and national organisations (see Annex 1 on Methodology) and through events such as the Cluster Policy Event (March 2026), webinars and conferences.

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MERLIN

Deliverable D4.7: Annexes for Cross Sectoral Routemap for Mainstreaming Freshwater Nature-based Solution in Europe

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MERLIN

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Overview

This document provides some background information on the materials that are summarised in the main Cross-sectoral Routemap D4.7.

The document consists of three Sections:

- Annex One on Methodology for the Routemap
- Annex Two on Policy Analysis
- Annex Three on the Agricultural analysis based on the Farm Accountancy/Sustainability Data Network

1 Annex 1: Methodology

This annex records how the Routemap was created. The Routemap synthesises the information generated across the MERLIN (Mainstreaming Ecological Restoration of freshwater-related ecosystems in a Landscape context: INnovation, upscaling and transformation) Project to provide a strategic overview of what has been learnt about enabling cross-sectoral working. Therefore, it draws on material from across the different Work Packages (WP) from WP1 (case study monitoring results); WP2 (case study implementation results); WP3 (spatial and economic approaches to understand how to extrapolate from the cases to wider targeted actions at basin and national levels) and the work with the six focal sectors within WP4. This involved re-reading and re-analysis of these existing MERLIN materials - with weight on Regional Scalability Plans that provide a bottom up territorial view (Ojanen et al., 2024), and Sectoral Strategies (Bérczi-Siket et al., 2025) that provide a sectoral, top down view. These materials were co-produced or at least validated with MERLIN case study partners or Sectoral Round Tables. The Routemap is focussed primarily on the activities that allow the sectors to support measure implementation, whereas the European Scalability Plan (ESP) (Battrup-Pedersen et al., 2025) will focus on where the measures can be implemented and the benefits these achieve for the whole of society.

The sources were mainly secondary documents, combining published academic, policy and grey literatures with the MERLIN deliverables available at the time of writing. The methodology for the relevant deliverables can be found within these documents. However, some primary data were collected, to help check and peer-evaluate the emerging analysis from a cross-sectoral perspective. These sources have been reanalysed, evaluated and interpreted to assist the understanding of what has been learnt about cross-sectoral working with MERLIN. In particular, the Routemap analyses began from three main points emerging from the six MERLIN sectoral strategies (Anna Bérczi-Siket et al., 2025), which became the focal research objectives for the Routemap:

- How the six MERLIN sectors interact with other sectors managing or using freshwater ecosystems, leading to a focus on:
- How some sectors implemented Nature-based Solutions (NbS) Measures, others supported, some benefited, and some tried to block upscaling, leading to an interest in:
- How these barriers could be removed and the positive synergies further developed.

The material is structured as follows:

- Primary Data Sources
- Peer-review of materials
- Choice of NbS Measures
- Identifying Economic Sectors
- Finding the Starting Point
- Main Actions and Opportunities
- Policy Analysis
- Establishing the Vision
- Using MERLIN Case Studies
- Analysis of Farm Accountancy/Sustainability Data Network (FA/SDN) information

1.1 Primary Data Sources: Two Virtual Round Tables

A meeting about the approach to mainstreaming NbS provided our first roundtable discussion of what were the main issues to consider in the proposed Routemap. This meeting was held in October 2022. Participants from DG Research and Innovation, European Research Executive Agency, DG International Partnerships and DG Environment attended. The discussion noted that sectors were interested in NbS but need more evidence of the benefits. They noted that specific national policies are important, and we should focus on addressing policy incoherence. Overall, the discussions agreed that more work is needed to mainstream NbS within policy as well as the business sectors; and more focus is needed on the NbS beyond urban green-blue Infrastructure. They emphasised that working at a landscape (or catchment) scale connects sectors and habitats.

A second-round table was held in February 2025, attended by over 40 participants from policy, practice and academic across the relevant topics in the Routemap (see Table 1 below).

Table 1: Participants attending the 2nd Cross-sectoral Roundtable

Organisation	Number	Organisation	Number
DG Agriculture	3	Responsibly Produced Peat	1
DG Budget	1	DG JRC (Joint Research Centre)	1
DG Clima	1	**Total Non-Merlin Participants**	**21**
DG Env	2	Bundesanstalt für Gewässerkunde (Federal Institute for Hydrology)	2
European Angling Association	1	Deltares	1
European Centre for River Restoration	1	Helmholtz Centre for Environmental Research (UFZ)	1
European Environment Agency	3	I-Catalist	1
European Investment Bank	1	International Peat Society	3
German Directorate-General for Waterways and Shipping	1	James Hutton Institute	5
Institute for European Environmental Policy	1	National Institute for Research and Development on Marine Geology and Geo-ecology	1
International Network of Basin Organisations	1	University of Duisberg-Essen	2
Latvian National Peatland Society	1	WWF - CEE	4
Network Nature	1	**Total MERLIN participants**	**20****
European Research Executive Agency	1	** 11 were moderators or note takers	

Participants discussed how sectors might implement, affect or be affected by land use change, floodplain reconnection, peatland restoration and removal or bypassing transversal barriers. Some missing sectors were highlighted and useful examples provided. Participants then discussed four actions that may support cross-sectoral working, namely policy changes, knowledge sharing, funding and finance and partnerships. The discussions again added useful detail, examples and drew attention to the importance of working across silos (between policies, between types of funding) by sharing knowledge and having a mediating organisation to coordinate sectors. The participants highlighted that Agriculture was crucial, but all sectors must be involved in an integrated manner.

1.2 Peer-Review

The outline philosophy of the Routemap approach was presented at the all-partner meeting in November 2024 and discussed in several WP4 partner meetings during Spring 2025. The draft findings were presented and discussed at the Steering Group in person meeting, Norway June 2025, where the vision and overall approach was confirmed and we were advised to include case study examples. The relevance to our target audience was tested through a series of seven 'pitching' meetings in Brussels in October 2025, when the draft recommendations were presented and discussed with some of the champions who had supported the cross-sectoral roundtables or attended other MERLIN events (see Table 2). Furthermore, many of the deliverables on which we drew were peer reviewed by the case study or sectoral partners.

Table 2: Pitching Meetings in Brussels

Organisation	Remit and Interests
WWF European Policy Office	Water Framework Directive/Water Resilience Strategy (WFD/WRS) Common Agricultural Policy (CAP) Nature Restoration Regulation (NRR)
IEEP (Network Nature)	NRR Climate Adaptation
Copa Cogeca	CAP and agri-environment, Farmer Cooperation
DG Environment	Water Framework Directive Water Resilience Strategy
DG Climate	Adaptation Initiative Water Resilience Strategy
DG Agri	CAP
DG RTD	NbS and Nature Positive Economy Water Resilience Strategy

1.3 Choice of NbS Measures

Mainstreaming NbS measures through cross-sectoral working also depends on the specific interactions between measure, context and sectoral practices. Having some concrete 'entry points' allows a more focussed consideration of what actions might help to mainstream these across Europe. From the sectoral strategies and RSPs, we created a list of measures that were being implemented within MERLIN and involved sectors in some way. This was checked against a freshwater typology (Pott et al., 2025) and finally consolidated to four measures. This choice allowed us to focus the Routemap on some specific measures that relate to the main policies being addressed (see policy analysis, Annex 2). These measures were confirmed as relevant and useful at the 2nd Roundtable.

1.4 List of Economic Sectors

The analysis both created a list of relevant sectors and addressed the concept of 'roles'. MERLIN worked with six economic sectors which are described in D4.5 (Bérczi-Siket et al., 2025). The other sectors identified in Section 1.4 of the Routemap came from the following sources:

- Review of D4.5 and the individual sectoral strategies;
- Cross-sectoral Routemap roundtables;
- Case study data consolidated in D4.9 (Ibrahim et al., 2025);
- Regional Scalability Plans (Ojanen et al., 2024) and
- Case study implementation plans on the MERLIN case study portal.

The consolidated list was then checked against the literature reviewed for the starting point, policy analysis, actions and opportunities. The list is designed to draw attention to the diversity of potential 'stakeholders' rather than being definitive. The sectors span primary, secondary, tertiary and quaternary sectors; the latter sectors are often dominant at national level in Europe, even in rural areas in terms of employment share and Gross Value Added to the economy.

Several participants in the roundtable and internal MERLIN partners wanted to include the 'public sector' but strictly speaking the public sector is a *type* of institution but not an *economic sector* (the public sector is involved in multiple economic activities e.g. education). Likewise, the idea of a 'conservation' sector was questioned. Whilst the NACE typology does not use the label 'conservation', the MERLIN case studies, NbS literature and wider examples of implementation of NbS recognise that there are cases where land is managed for nature conservation as the primary product or service -see NACE 91.42 nature reserve activities (Eurostat, 2025).

We can broadly consider different potential roles for these sectors in terms of mainstreaming freshwater NbS. The analysis of case study stakeholder engagement considers four types of stakeholders depending on their location in the power-influence grid (Ackermann et al., 2011) as listed below:

- Crowd (Low power, low interest - monitor them in case they move categories)
- Context Setters (High Power, low interest - keep satisfied)
- Players (High power and High interest - manage closely)
- Subjects (Low power and High interest - keep informed)

Focussing on the 'players' we can think more concretely about what it means in terms of mainstreaming the NbS measures, we can also consider in what ways power and interest can be practiced. Role theory is complex, as roles vary over the project cycle and between individuals and organisations and can be analysed considering capability and capacity. There is no established or agreed typology for stakeholder roles in NbS implementation but there are a few sources from which to draw inspiration. Many focus on important institutional functions e.g. "decision makers, implementers, coordinators, knowledge providers, funders, lobbyists, mediators" involved in mainstreaming (Adams et al., 2023) or more political issues e.g. (2007) contrasting 'saviours' with 'saboteurs'. Therefore, we focus on the roles for stakeholders in measure implementation, focussing on those actively carrying out the measures, providing access to the land/water; and those supporting or blocking these actions. The roles therefore span a focus on the individual site to wider macro level enabling/blocking activities that can be taken at the national or EU level. We elaborate these categories in the main text (Section 1.4).

1.5 Starting Point

This material was based on a literature review on the need for NbS and the drivers for ecological restoration. These insights were combined with the information on the need for change arising from within MERLIN such as

the drivers for change in the Regional Scalability Plans, and the search for business opportunities conducted within WP3 (Rouillard et al., 2025).

1.6 Policy Analysis

Five policies (Nature Restoration Regulation (NRR), Climate Law (CL), Common Agricultural Policy (CAP), Water Framework Directive (WFD), Climate Adaptation Strategy (CAS) were identified in D4.3 (Blackstock et al., 2023), building on insights from D4.1 (Bérczi-Siket et al., 2022) and supporting desktop reviews. The policies were selected for their cross-sectoral relevance and potential to advance freshwater restoration. A literature review was conducted on existing relevant academic research, which was combined with expert analysis of the legislative documents (including their guidelines, checklists and impact assessments). As the policy agenda changed, further policies were addressed e.g. Water Resilience Strategy (WRS). The full information on policy analysis is described in Annex 2.

1.7 Actions and Opportunities

The actions described in Section 2.4 of the Routemap were consolidated from a literature review and then checked against the bottom-up strategies for our MERLIN case studies (RSPs) and the top-down strategies created for the six MERLIN sectors, aligned with our focus policies. The opportunities focussed on finding good practice examples to help the target audience inspire those working on strategic plans discussed in Annex 2 and Section 2.3 in the main text. The actions purposively reflect the range of policy instruments available to guide change e.g. regulatory, market-based (or economic), awareness raising (information and communication) (European Environment Agency, 2022); often these also include references to collective action on a voluntary basis (agreement based or cooperative instruments), and awareness is widened to include capacity building, knowledge exchange and evidence (Bouwma. et al., 2015). Currently the political approach of the Commission is to minimise legal instruments and increase economic and voluntary instruments (Von der Leyen, 2024) so it was important to have a wide range of actions available. The selection of actions in Section 5 of the main text is based on our expert opinions as to how to summarise the examples available that add value to the existing MERLIN evidence.

1.8 Vision

Having a vision is fundamental to the transformations framework used to structure the Routemap (Carmen et al., 2024). The vision was discussed in the February cross-sectoral Roundtable, internally by the Steering Group, and within WP4, and was subsequently confirmed as suitable for inclusion in the Routemap at the June Steering Group. It builds upon the good practice identified in the grey and academic literature reviews, tied to the main policy milestones identified in the policy analysis above. It also helps to build on the regional scalability plans that provide the 'bottom up' upscaling strategies for the MERLIN case studies.

1.9 Case Studies

Here a structured template (using the headings that structure Section 4.1. - 4.4 in the main text) were provided to the selected case studies. These case studies were selected due to their interest and enthusiasm for cross-sectoral working during the all-partner and WP4 meetings; and confirmed in the June Steering Group meeting. They were also willing to contribute to the process. Other cases, such as CS14 in Finland or CS05 in Poland were also approached but were unable to provide the information in the time available. The partners responded to the template, drawing on published material and their own experiences to fill in the Sections. The final draft was checked by them once it had been inserted into the Routemap.

1.10 Pan-EU Mapping of Agricultural Sector

Land based factors strongly influence both the need for aquatic restorations (impacts) and how easy it is for restoration measures to be enacted. For example, any measure that always reduces the area of land available for production (land sparing) implies a direct opportunity cost to the land manager and may also raise questions of spillover effects that undermine the viability of supply chains or increase the need for food/feed imports (that have their own environmental impacts). Restoration measures where multiple functions are delivered by the same land (land sharing) will usually have lesser opportunity costs (e.g. temporary flood storage may still be grazed). Yet even here the land management systems present may have very different tolerances for sharing, comparing covered horticulture with extensively managed livestock. Where cooperation and coordination between land managers is needed, the sizes of farms and thus their numbers per catchment can become a factor. Finally, agricultural subsidy can act both as a lever or barrier to change in practice. Indicators for all of these factors can be generated using information from the EU Farm Sustainability Data

Network and combined with data from previous analysis of the pressures exerted by Agriculture (Schürings et al., 2024) and other MERLIN outputs on the need and biophysical potential for restoration to highlight where opportunities and challenges are likely to occur.

The EU Farm Sustainability Data Network (FSDN) (before 2025 the Farm Accountancy Data Network, FADN) collates data on the biophysical, structure, management (e.g. crop areas and livestock numbers) and financial data (returns per ha and levels of subsidy) of a representative sample of farms across Europe. The FSDN data is a time series (from 1989) with data for 2011-21 used to generate the average values in the mapping. The annual sample for 2011-21 is large enough (n>90,000 holdings) for the results to be representative for the mix of farm system types present in FADN regions (combinations of NUTS3 and LAU1). There are in total >4,700 FSDN collected variables or calculated values, but these vary in their temporal and geographic coverage, and this analysis made use of only the standard results (n=108), with ~97M data values (see Table 3). The maps of the FSDN data were generated standalone and/or combined with those from other sources such as the UDE mapping of agricultural pressures (Schürings et al., 2024) and the MERLIN WP3 modelling of need and opportunity for aquatic restoration (Garcia et al., 2025).

Table 3: FSDN variables used

Label, Variable, Units	Description	Use
Total Output, SE131, £	Total value of output of crops and crop products, livestock and livestock products and of other output, including that of other gainful activities (OGA) of the farms. Sales and use of (crop and livestock) products and livestock + change in stocks of products (crop and livestock) + change in valuation of livestock - purchases of livestock + various non-exceptional products.	To assess the value generated per ha regardless of the profitability - used as a per ha value.
Farm Net Income, SE420, £	Remuneration to fixed factors of production of the family (work, land and capital) and remuneration to the entrepreneur's risks (loss/profit) in the accounting year.	To assess financial viability of farm businesses rather than just the value of their outputs.
Subsidy - excluding on investments, SE605, £	Subsidies on current operations linked to production (not investments), in €. Payments for cessation of farming activities are therefore not included. Entry in the accounts is generally on the basis of entitlement and not receipt of payment, with a view to obtain coherent results (production/costs/subsidies) for a given accounting year.	To assess the degree of leverage on farm practice that CAP subsidies could have.
Total Utilised Agricultural Area, SE025, ha	Total utilised agricultural area of holding. Does not include areas used for mushrooms, land rented for less than one year on an occasional basis, woodland and other farm areas (roads, ponds, non-farmed areas, etc.). It consists of land in owner occupation, rented land, land in share-cropping (remuneration linked to output from land made available). It includes agricultural land temporarily not under cultivation for agricultural reasons or being withdrawn from production as part of agricultural policy measures. It is expressed in hectares (10 000 m²). As from 2014, it includes kitchen gardens.	Used to assess the extent of agricultural land in FSDN regions and to generate per ha intensity values used in the mapping.
Total agricultural area out of production, SE074, ha	= Agricultural land not cultivated for agricultural reasons (fallow land) + Land withdrawn from production under compulsory agricultural policy measures + (since 2009). Areas of permanent grassland and meadows no longer used for production purposes but maintained in good agricultural and environmental condition and eligible for financial support.	Used to assess the degree to which there is land within agricultural businesses that is not being used for production and could thus potentially contribute to restoration activities
Stocking density, SE120, LU/ha	Density of ruminant grazing livestock: average number of LU of bovines, sheep and goats per hectare of forage UAA. Forage area includes fodder crops, agricultural fallows and land withdrawn from production (not cultivated, except in the exceptional cases of crops under set-aside schemes). Stocking density is calculated only for holdings with corresponding animals and with forage area.	Used as a measure to assess the intensity of production and more tentatively as a measure of numbers of livestock present on grazing land.
Number of holdings	Calculation	Used to assess the numbers of holdings present in each FADN region - normalised for region size. A measure of the need for coordination

		needed for basin or landscape level measures.

The map formats used are simple choropleth maps usually illustrating intensity variables (typically per ha) values. The other form of map used is the bi-variate map. This seeks to highlight correlations in space between phenomena, for example the need for restoration and the financial returns of farming per hectare. These maps use a four-level colour ramp (low to high) for each variable to generate a 4x4 (n=16) colour map. The breakpoints in the colour ramps are typically quartiles, but fixed intervals or equal-area breaks can also be used. A key limitation of the FSDN data is that they are not a census nor is the per farm data spatially explicit. Thus, the indicators generated are per typical values region, though with the potential to be more spatially explicit where other datasets such as land cover can indicate for example the locations of crops with known profitability per hectare.

2 Annex 2: Cross sectoral Policy Levers (foundations) – How could they better serve the integration principle?

Although the desire for integration and collaboration between sectors has been part of the European vision (see Article 11 of the Treaty on the Functioning of the European Union), most recently expressed in the Green Deal, this has not been achieved so far.

The Environmental Action programs (EAP) translated the integration goal to concrete measures. The 7th (2014-20) was more detailed about policies (e.g. foreign affairs, security, education and training etc.), where concrete actions are needed for achieving integration than the current 8th (2022-2030) which refers to the Green Deal as the main tool for integration. However, the European Environment Agency (EEA) in its recent report concluded that "*Europe is still far from achieving its 2030 8th EAP objectives despite progress being observed in many areas. The relevant exceptions to this slow progress are climate mitigation and air pollution*" (European Environment Agency, 2024a).

The Green Deal is a tool of the Commission for the Sustainable Development Goals implementation, but it has its limitations politically and content wise as well. The Green Deal is rethought and renewed by the new Commission (2024-29) however the adopted plans, strategies and laws are solid. Furthermore, the Green Deal has been criticised for not engaging all the relevant sectors that could play an important role in mainstreaming freshwater NbS/restoration into other related policies such as Tourism or education etc., (which could enjoy the benefits of such measures), and for rolling back on its ambition e.g. for Agriculture (e.g. cancelling plans to half pesticide use by 2030, or adoption of sustainable food system law - e.g. where sustainable fisheries could be enhanced as another ally for barrier removal).

Implementing the primary law and the EU's strategic documents (like the Green Deal or 8th EAP), the **secondary law** (which needs implementing legal acts at Member State level) has its integrative or cross sectoral tools like the Environmental Impact Assessment (EIA) and Integrated Pollution prevention control permit (IPPC) for project planning or the Strategic Environmental Assessment for plans and programs.

Besides these traditional integrative legislative tools, the EU also has new innovative policy instruments and measures like the Climate Adaptation Strategy (AS) or the Nature Restoration Regulation (NRR) which clearly have an integrative, cross-sectoral approach.

At the level of **national implementation**, the cross sectoral/integrative approach was highlighted in several reports and articles. For example: *"Working across spatial and institutional scales provides opportunity for bottom-up and top-down efforts to advance cross-scale coherence in policy and action. These integrative actions have a strong chance of truly reversing the freshwater biodiversity crisis for people and the planet"* (Cooke et al., 2024).

To achieve effective policy implementation and cross-scale coordination to reverse the freshwater biodiversity crisis, national implementation through national legislation, plans, strategies and programs is crucial, for both European and global biodiversity commitments.

For example WWF's 'breaking silos' report (Bakhtary et al., 2023) shows how aligning national climate goals, reported in the Nationally Determined Contributions (NDCs) (United Nations Climate Change, 2015) for the implementation of the Paris Agreement and National Biodiversity Strategies and Action Plans (NBSAPs) of the National Biodiversity Strategies (implementing the Global Biodiversity Framework) (Convention on Biological Diversity, 2022) can improve resource use, funding access, and outcomes. The report recommends integrating food system measures (like agroecology, reducing food waste, and shifting to sustainable diets) into climate and biodiversity strategies and plans to generate multiple benefits for people and nature. "*By promoting collaboration between sectors and stakeholders, integrated policy processes can help improve the allocation of resources, the alignment of budgets and capacities to national climate and biodiversity goals, and countries' access to public and private finance needed to achieve their targets.*" (Bakhtary et al., 2023)

Key actions in the report include:

- → Ensuring that national climate and biodiversity policy planning processes are integrated in the development of sectoral strategies
- → Integrating food systems measures (e.g., agroecological practices, addressing food waste and loss, and transitioning to sustainable, healthy, and culturally appropriate diets) in NDCs and NBSAPs can deliver

multiple climate and biodiversity benefits while improving food security and societal wellbeing. A shift to nature-positive food production and sustainable, diversified diets, as well as addressing food waste and loss, can alleviate pressure on ecosystems and biodiversity

→ NbS as an integrative measure in itself - NbS interventions have the potential to generate multiple mitigation, adaptation, biodiversity, and sustainable development benefits as they are specifically designed to address multiple societal challenges through ecosystem conservation, management, and restoration.

Although the NBSAPs are non-binding in several Member States at least until the National Restoration Plans (NRPs) are adopted, the NBSAPS serve as the main valid national action plans with financial commitments for the implementation of the Global Biodiversity Framework's biodiversity restoration targets (which are incorporated in European legislation through the NRR). In our opinion, after the adoption of the NRPs, the NBSAPs and their updates will still play an important role in restoration. Read more about the national implementation of important national strategies and plans and programs e.g. Climate Adaptation Strategies, National Energy and Climate Plans, Common Agriculture Policy Strategic Plans, and River Basin Management Plans etc. in D4.3 (Blackstock et al., 2023).

In summary, for the successful implementation of the European vision of integration, Member States should invite all the relevant sectors to the negotiation table and fulfil the requirements of the integration principle of the EU by cooperating with them, for example when constructing the CAS plans or the Nature Restoration Plans or in fact any sectoral plan which has effects on the environment and uses the natural capital and ecosystem services.

2.1 The Policy Environment

The text below gives more details on how the European and global biodiversity policies (Kunming-Montreal Global Biodiversity Framework, Treaty on the Functioning of the European Union, EU Environmental Action Programs, European Green Deal, Nature Restoration Regulation, Climate Adaptation Strategies and Water Resilience Strategy) relate to the European vision of integration (cross sectoral working) and towards mainstreaming Freshwater restoration and NbS into economic sectors.

Global biodiversity levers are a very strong push factor for changes and have significant influence on the European policy levers. In recent years the leaders of the world decided to fight the biodiversity crisis through legally binding new biodiversity targets. As the Aichi targets[1] were not fulfilled and were not specific enough following four years of development negotiations, Parties to the Convention on Biological Diversity (CBD) adopted the Kunming-Montreal Global Biodiversity Framework (Convention on Biological Diversity, 2022) on 19 December 2022, replacing the CBD's Strategic Plan for Biodiversity 2011-2020 and its Aichi Targets (Maney et al., 2024).

2.1.1 Treaty on the Functioning of the European Union (TFEU) Article 11

"*Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to promoting sustainable development.*" (ex Article 6 TEC, European Commission, 2016) This specific article of the European primary law (Publications Office of the European Union, 2016) calls for a permanent, continuous "greening" of all Community policies. However Article 11 does not give priority to environment over other requirements, rather, the different objectives of EU law rank at the same level and the policy must endeavour to achieve all of them. (Krämer, 2007).

2.1.2 EU Environmental Action Programs (EAP)

The Environment Action Programmes are not legally binding but provide **a general framework for the European Union's environment policy** in which the most important medium and long-term goals are defined and set out in a **basic strategy**, where appropriate including concrete measures. Eight Environment Action Programmes (EAPs) have been adopted so far, their duration ranging from 3 to 10 years.

The 6th EAP action program dealt in detail with the integration principle and proposed concrete actions to achieve the goal to integrate environmental concerns into other policies. These actions include establishing additional integration mechanisms; implementing the Treaty provisions on integration; and the further development of indicators to monitor the integration process.

1 https://www.cbd.int/sp/targets

More specifically the programme suggests the integration of climate change objectives into various Community policies - in particular Energy policy and transport policy, the integration of nature conservation and biodiversity into commercial and development cooperation policies, the integration of resource efficiency considerations into integrated product policy, eco-labelling schemes, environmental assessment schemes, etc, as well as the integration of environmental concerns into all aspects of the European Union's external relations (European Commission, 2001).

The 7th EAP listed among the priority objectives to improve environmental integration and policy coherence and formulated more concrete actions than the previous EAPs to achieve the goal in its Annex about program for actions to 2020 (see e.g. 7th EAP Annex point 11, 54, 55, 85, 88, 89,95,97). The 7th EAP among other policies (Annex point 11), lists foreign affairs, security, education and training as playing an important role in the enhancement of sustainability. Examples include the opportunities of green recovery after wars, green diplomacy and green education and training. New concepts are used, but not explained in the 7th EAP, such as:

- Better integration of natural capital objectives in the development and implementation of other policies (point 20),
- The integration of the economic value of ecosystem services into accounting and reporting systems at Union and national level (27), and
- The integration of land-use aspects into coordinated decision-making involving all relevant levels of government, supported by the adoption of targets on soil and on land as resource and land planning objectives (28).

The current **8th EAP** (2022-2030) does not focus on the integration principle but rather focuses on the precautionary principle, the principles of preventive action and of rectification of pollution at source and the polluter pays principle. (Article 1 point 5). However, it supports and strengthens an integrated policy and implementation approach, building upon the European Green Deal (European Commission, 2019).

Does this mean that the EU Green Deal currently represents the integration principle in the EU environmental action programs?

On 17 of June 2024 the EU Environmental Ministers approved conclusions as regards the mid-term review of the 8th EAP, paving the way for a green, just and inclusive transition for a sustainable Europe. Given the timing of the council conclusions, they were in practice **a message from the environmental ministers to the current Commission, on future priorities.** This set of conclusions underlines that the implementation of the European Green Deal will be crucial to reaching the priority objectives of the green transition. The conclusions address, among other things, climate resilience and risk preparedness, climate change mitigation, biodiversity protection, zero pollution and circular economy.

Member States also highlighted the need for social acceptance and just transition. This set of conclusions will guide the Commission on adjusting measures to effectively reach the 2030 objectives.

See more in Council Conclusions (European Commission, 2024c) on 8th EAP midterm review (especially point 5, 11, 27g, 28, 33, 42 and 51).

The EAPs, when giving guidance to the implementation of the integration principle, list several non-environmental sectors (e.g. in the mid-term review of the 8th EAP: diplomacy; trade and cooperation with partner countries and human health or in the former EAPs Energy policy, transport policy, Tourism policy, social policies, foreign affairs, security, education and training) **whose actors could and should play an important role in enhancing sustainability and in mainstreaming aquatic restoration into these sector's activities and value chains.**

2.1.3 The European Green Deal

"*All EU actions and policies will have to contribute to the European Green Deal objectives*" (European Commission, 2019). The EU has the collective ability to transform its economy and society to put it on a more sustainable path.

The Green Deal is an integral part of this Commission's strategy to implement the United Nations' 2030 Agenda and the Sustainable Development Goals, and the other priorities announced in President von der Leyen's political guidelines. As part of the Green Deal, the Commission will refocus the European Semester process of macroeconomic coordination to integrate the United Nations' Sustainable Development Goals, to put sustainability and the well-being of citizens at the centre of economic policy, and the sustainable development goals at the heart of the EU's policy making and action (European Commission, 2019).

The Green Deal uses a holistic and integrated approach through creating mainstream environmental policy coherence by bringing together, and improving, several existing policies, initiatives, and funding programs dedicated to addressing sustainability and climate change. The key elements of the Green Deal include zero pollution, climate neutrality, clean & secure Energy, industry & circular economy, ecosystems & biodiversity, food system (Farm to Fork), sustainable building & renovating, smart mobility; along with sustainable financing and just transition.

However, the Green Deal has its limitations. In the Green Deal for example, **Tourism** is not listed as a target sector, although this sector could play an important role in mainstreaming NbS as this sector could enjoy the benefits of them and create a potential revenue source for freshwater restoration (Connectology, 2023)[2]. At policy level so far, there has been a fragmented policy response across EU legislation to the sustainability challenges faced by the Tourism industry. This has led to a lack of data availability for the sector as a whole, especially on environmental impact. However, work is ongoing and, in cooperation with the European Commission (in particular Eurostat) and supported by a technical support instrument, Member States have set up methodologies to develop new indicators, new data sources and building capacities. In the future, the revised EU Tourism Dashboard[3] will gradually allow for better monitoring of environmental impacts at national, regional and local levels - see more in the working document on the 8th EAP (European Commission, 2024c)

The same is true for the **Fisheries** sector which benefits from wetland restoration or barrier removals. The sector is part of the Farm to Fork Strategy. However, critics say despite the ambitions of the Farm to Fork Strategy, Agriculture has also largely fallen off the Green Deal agenda. The Sustainable Food Systems Framework Law disappeared from the Commission's work programme for 2024 after huge opposition from the European Peoples Party at the end of 2023.

After the farmer demonstrations In Spring 2024 the European Commission withdrew the proposal on the sustainable use of pesticides and cancelled plans to half pesticide use in the EU by 2030 (European Commission, 2020b, 2021a). Delays to regulations on set-aside land intended to boost soil health and biodiversity in farmland across the continent were also announced (Freshwater Blog, 2024).

Critics also note the **social policy** aspect: The EU's current actions remain "*too limited to carbon-intensive regions and jobs"* and fall well short of acting as *"tools to transform the world of work*", says Ludovic Voet, who leads on climate and the just transition for the European Trade Union Confederation (Nuttal, 2023)

To sum up, although the main goals of the European Green Deal resonate well with Article 11 of TFEU (European Commission, 2016), the Green Deal has its limitations and a more specific focus concerning policies than the former EAPs.

In addition to this there is the political risk with the election of the new EU Commission, how they follow up with the Green Deal.

It is important to state that the EU policies and strategies (e.g. the EAPs and the Green Deal) shall not narrow down the broader policy context which have been established through primary law (TFEU Art 11.) and through the previous EAPs to enable cross sectoral cooperation in order to achieve the highest level of sustainability in all European policies.

The Annex now turns to the integration principle through secondary law examples.

2.1.4 The adoption of Nature Restoration Regulation one of the most tumultuous journeys in the history of EU legislation

EU law making is more open for environmental integration than it was before the Amsterdam Treaty (European Commission, 1997). However, the sectoral cautiousness and opposition is still very strong.

"Historically, prior to the Amsterdam Treaty of the European Union before the new Article 11 on the integration principle was born, there were negotiations incorporating environmental considerations into the Agriculture,

[2] Low levels of funding for biodiversity conservation and protected area management are a universal concern (UNEP-WCMC et al., 2016). Among potential revenue sources, Tourism and Agriculture activities stand out as two of the most promising endeavours. Tourism-user fees and agricultural royalties are the conservation finance mechanisms with perhaps the broadest application and highest overall revenue potential worldwide. This report outlines the increasing need for nature protected areas (PA) to move beyond traditional financing sources to achieve their conservation goals and describes how Tourism and Agriculture revenues can be generated in protected areas. It highlights the range of options available, how they work, and the requirements for implementation.
[3] In 2022, the Commission also launched the EU Tourism Dashboard, a tool to improve access to statistics and indicators for Tourism. In addition, the dashboard supports tourist destinations and public authorities in tracking their progress in the green and digital transitions. It includes statistical data on greenhouse-gas intensity from Tourism, bathing water quality, the share of trips by train, air-travel emission intensity, Tourism-Energy intensity and the use of sustainability labels.

Transport, Competition and so on chapters. However, this was objected by the sectors concerned as being too precise and thus led to the overarching Article 11" (Krämer, 2007).

Almost 30 years later during the negotiations of the Nature Restoration Regulation (NRR) the Agriculture and Fisheries lobbies almost stopped the adoption of the new law which is the first EU law to set legally binding targets to restore nature and a once-in-a-lifetime opportunity to tackle the biodiversity and climate crises.

The main opposing party in the Parliament, the European People's Party (EPP) suggested that the proposed law would threaten the traditional livelihoods of European farmers and fishers, disrupt long-established supply chains, decrease food production, push prices up for consumers and even wipe out urban areas to make way for green spaces.

Fortunately, the European negotiations ended with compromises and although critics say the compromised text (European Commission, 2024b) is watered down, the sectoral lobbies could not put the NRR back on the shelves of the Commission.

The NRR was proposed by the Commission (European Commission, 2024c) on 22 June 2022, two years after the publication of the EU Biodiversity Strategy for 2030 (European Commission Directorate-General for Environment, 2021). After a heated negotiation procedure for two years the Nature Restoration Regulation was formally adopted in June and entered into force in August 2024 with directly applicable legally-binding targets to restore degraded ecosystems in the EU, implementing the EU Green Deal (European Commission, 2019), the Global Biodiversity Framework (Convention on Biological Diversity, 2022) and the European Biodiversity Strategy (European Commission Directorate-General for Environment, 2021). This outcome is a huge win for Europe's nature, climate action, citizens and future.

Member States followed through with their commitments and with a majority of 20 countries, representing 66% of the population, the law was officially endorsed, thanks to Austria's Environment Minister Leonore Gewessler stepping up at the last minute, changing the country's previous stance and safeguarding the law.

A timely outcome to present at the UN Biodiversity Conference in 2024, showing that Europe is willing to lead the way in tackling the climate and biodiversity crises by owning up to its global commitments. It is also a very clear message to the new EU Parliament and Commission, to keep biodiversity at the forefront of their agenda.

This result accompanied by a massive public mobilisation. Over the past few years, over a million signatures and messages from citizens, repeated calls from 6000+ scientists, 100+ businesses, youth organisations, and civil society from across numerous sectors have been made to defend the law and the integrity of the EU Green Deal (European Commission, 2024c; WWF, 2024b).

2.1.5 Evaluation of the NRR Provisions

Does the new law have a cross-sectoral nature? Does the NRR bring together sectors like Agriculture, Hydropower, Peat Extraction, Insurance, Navigation, Water Supply and Sanitation to enhance biodiversity conservation through involving them in the text of the regulation?

The NRR is **a Regulation** - a legally binding act of the European Union - and it is **directly applicable in all Member States.** Regulations are like national legislation in terms of the impact and direct effect they generate. As such regulations are the most pervasive of all the legal instruments of the EU.

This law aims to put measures in place to restore at least **20% of the EU's land and sea** areas by 2030, and all ecosystems in need of restoration by 2050. It sets specific, legally binding targets and obligations for nature restoration in terrestrial, marine, freshwater, forest, agricultural and urban ecosystems. Specific measures include protecting pollinators and grassland butterflies, protecting urban green spaces and planting at least three billion additional trees by 2030 at the EU level.

Article 4 provides for the restoration of terrestrial, coastal, and freshwater ecosystems; Article 5 provides for the restoration of marine ecosystems; Article 8 provides for the restoration of urban ecosystems; Article 9 provides for the restoration of the natural connectivity of rivers and natural functions of the related floodplains; Article 10 provides for the restoration of pollinator populations; Article 11 provides for the restoration of agricultural ecosystems; Article 12 provides for the restoration of forest ecosystems. (European Commission, 2024b).

The goals of the Nature Restoration Regulation include:

- → To restore at least 20% of the EU land and sea by 2030, and all ecosystems in need of restoration by 2050.
- → To require Member States to develop National Restoration Plans taking account of national circumstances

- To build on EU nature laws, focusing on all natural habitats, and not just those protected under the Birds and Habitats Directives.
- To demonstrate EU leadership in protecting and restoring nature and set the bar for global action ahead of the Biodiversity COP15 in December 2022.
- To restore at least 25 000 km of rivers into free-flowing rivers in the Union by 2030.

The NRR sets **legally binding targets** to restore at least 20% of the EU's land and sea areas by 2030 and all ecosystems in need of restoration by 2050 (Article 1). Specific targets and obligations are defined for terrestrial, coastal, freshwater and marine ecosystems, stating that Member States should ensure that at least 90% of defined habitat areas are in good condition (Article 4-5). Restoration goals are set to increase green urban spaces in cities (Article 8), to remove river barriers (Article 9) and to reverse the decline of pollinators (Article 10). Targets to restore agricultural and forest ecosystems are also set for Member States to achieve an increasing trend for improving these habitats (Article 11-12). Additionally, Member States are obliged to contribute to planting at least three billion more trees by 2030 at the EU level (Article 13). (European Commission, 2024a).

The NRR also includes several **exemptions** that allow Member States to derogate from restoration targets. For instance, Article 4(2) permits a reduction to 80% (instead of 90%) by 2050 for restoring widespread terrestrial, coastal, and freshwater habitats covering more than 3% of their European territory. Additionally, Article 4(5) allows Member States to set lower restoration percentages between 90% and 100% if they consider achieving full restoration unfeasible by 2050, provided that they give adequate justification. Article 4(14-15) further outlines that non-deterioration of habitats can be exempted in cases of force majeure, including natural disasters, climate change impacts, projects of overriding public interest, or (in)action by third countries.

Other exemptions that are relevant to MERLIN sectors include Article 11(4), which specifies that the rewetting of peatlands under agricultural use may be reduced if it would negatively impact Infrastructure, buildings, or public interests. Reduction may also be applied if rewetting cannot be done on non-agricultural land. Moreover, it is also stated that the obligation for Member States to meet rewetting targets does not force farmers or private landowners to rewet their land. Therefore, rewetting remains voluntary for them, unless it is required by national law. Lastly, Articles 6 and 7 declare that actions for the purpose of renewable Energy production or national defence can override restoration obligations. (European Commission, 2024a).

The law contributes to the achievement of one of the key objectives of the EU Biodiversity Strategy for 2030, namely, the **restoration of at least 25 000 km of free-flowing rivers**, as compared to 2020 (the baseline for the inventory is when the EU Biodiversity Strategy for 2030 was adopted in 2020). Through the NRR this objective is now legally binding (Article 9[4] (1)), requiring Member States to create an inventory of artificial barriers, identifying those that need to be removed. This inventory and the measures planned to re-establish the natural functions of floodplains shall be part of the National Restoration plans (see in Article 15 paragraph 3 point i) - see more in the Commission's new methodology for assessing if a river stretch can be considered as free-flowing (Van de Bund et al., 2024).[5]

All these targets are based on scientific evidence and will require Member States to develop **national restoration plans** (NRPs) and targets to achieve these objectives (Article 14-15). The NRR aims to ensure that targets are met through legal accountability, and besides the Commission, the EEA (European Environmental Agency) will support Member States in preparing the NRPs and in monitoring their progress (Article 16-19). In

[4] Member States shall make an inventory of artificial barriers to the connectivity of surface waters and, taking into account the socio-economic functions of the artificial barriers, identify the barriers that need to be removed to contribute to meeting the restoration targets set out in Article 4 of this Regulation and fulfilling the objective of restoring at least 25 000 km of rivers into free-flowing rivers in the Union by 2030, without prejudice to Directive 2000/60/EC, in particular Article 4(3), (5) and (7) thereof, and Regulation (EU) No 1315/2013 of the European Parliament and of the Council46, in particular Article 15 thereof.

[5]The Commission's new methodology for assessing if a river stretch can be considered as free-flowing: criteria for identifying free-flowing river stretches for the EU Biodiversity Strategy for 2030 by EU COM JRC was introduced in a webinar July 3 2024 by the EU Commission. According to the EU Commission presenter in the webinar when the 2020 baseline for the free-flowing rivers was established no inventory was made about the proportion of free-flowing stretches of the European rivers. In addition to that the EU Commission clarified that all free-flowing river stretches can be accounted to the 25,000 km target that were restored after 2020, but not those which were already free-flowing before the baseline date. There needs to be an additional restoration activity after 2020 to be able to count a free-flowing section for the fulfilment of the 25, 000 km target. The Navigation sector representative highlighted that the sector will follow closely the application of the methodology. The Commission wants to further test the methodology by applying it to more cases. Then, they will adjust and finalise the methodology; and continue exchanges in ECOSTAT Working Group.

order to ensure an effective implementation, the Commission would support Member States through the Technical Support Instrument which would "strengthen the administrative capacity, harmonise the legislative frameworks, and share relevant best practices" (European Commission, no date, p. 15)

2.1.6 Preparation of the NRPs: Procedure

Based on Article 16, the deadline for the first draft NRPs is **1 September 2026.** The Commission will assess the draft NRP and may address its observations on the draft national restoration plan to the Member State within **six months** of the date of its receipt.

The Member States shall take account of any observations from the Commission in its final NRP. The Member State shall finalise, publish and submit to the Commission the NRP within **six months** from the date of receipt of observations from the Commission. (Article 17). The latest date when the national restoration plans will be final is **1 September 2027.**

Each Member State shall **review** and revise its national restoration plan, and include supplementary measures, by **30 June 2032** and subsequently **by 30 June 2042**. At least once **every ten years** thereafter, each Member State shall review its national restoration plan and, if necessary, revise it and include supplementary measures. (Article 19(1)).

2.1.7 Preparation of the NRPs: Content

When developing national restoration plans, Member States should refer to the various examples of restoration measures outlined in Annex VII, taking into account their specific national and local circumstances, as well as the most recent scientific data (European Commission, 2025c) and use the uniform template adopted by the Commission on the 19th of May in 2025 (European Commission, 2025a).

2.1.8 Preparation of the NRPs: Analysis of Relationship with NbS

Nature-based Solutions (NbS) are mentioned eight times in the adopted text of the NRR. For instance, it is stated that they are "*fundamental for fighting the climate crisis*" (p. 3, paragraph 16), and are highlighted in relation to other policy documents, such as the Adaptation Strategy (page 4, paragraph 18) (European Commission, 2024a).

However, many argue that NbS should have been more in the focus of the law. An international team of scientists (from MERLIN, SUPERB, WATERLAND, REST-COAST, and Ponderful projects) prepared recommendations about the proposed text, which are valid for the adopted text as well. They highlighted that despite NbS being mentioned in the text, they are only present in the preamble and never in the provisions. Moreover, they suggested that the text should include the UN definition of NbS, which puts a larger emphasis on societal benefits than the description of NbS in the NRR (Hering et al., 2022) – see Table 4 below.

Table 4: Comparison of NbS Definitions

Description in NRR (European Commission, 2024b, p. 4)	UN definition (UNEP, 2022)
Solutions that are inspired and supported by nature, that are cost-effective, and that simultaneously provide environmental, **social and economic benefits** and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions need to therefore benefit biodiversity and support the delivery of a range of ecosystem services.	Actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously **providing human well-being**, ecosystem services, resilience and biodiversity benefits.

Nevertheless, most of the restoration measures listed in Annex VII can be applied as NbS. These are the measures that Member States are encouraged to use, when preparing their NRPs (European Commission, 2025c). Therefore, it can be argued that the NRR does promote the application of NbS in its provisions, even if not explicitly. Box 1 explains how the measures relate to freshwater NbS.

What does the NRR say about supporting Freshwater restoration or NbS?

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- The NRR emphasises the importance of restoring and improving the condition of freshwater ecosystems (e.g. wetlands, rivers, lakes) as a key component of nature restoration alongside other biodiverse ecosystems, such as wetland or forests. It acknowledges that if degraded ecosystems are in good condition, the benefits far outweigh the costs of restoration, while providing a wide range of socio-economic benefits (page 3, preamble paragraph 14).
- Even more concretely, the law sets specific restoration targets and obligations for freshwater ecosystems (Article 4), urging Member States to put in place measures for freshwater ecosystems that are necessary to improve. The law also highlights the importance of preserving and restoring the connectivity of freshwater ecosystems, such as ensuring the free movement of fish and other aquatic organisms through rivers and streams (Article 9).
- However, scientists suggest that freshwater ecosystems are still largely underrepresented in the text (MERLIN et al, 2022). Although this suggestion addressed the proposal of the text, MERLIN scientists confirmed that the observation is still relevant for the adopted version. They highlight that freshwater ecosystems are not explicitly mentioned in the articles about preparing and monitoring the NRPs (Articles 15 and 20). Moreover, targets set about free-flowing rivers (Article 9) are not time-bound nor binding, and are vaguer than those about other ecosystems.
- Nevertheless, the NRPs are set to follow restoration measures listed in Annex VII, which does include several ones regarding freshwater ecosystems. Therefore, it can be concluded that even though the NRR could have included freshwater ecosystems more explicitly in its provisions, it does encourage Member States to take them into account when it comes to implementation.

Source: (European Commission, 2024b)

Box 1: What does NRR say about implementing freshwater NbS?

2.1.9 NRR and MERLIN Transformation Framework

Overall evaluation: In what way do the policies enable mainstreaming NbS? In what way do the policies prevent mainstreaming NbS? What do we need to maintain, create or disrupt? We suggest that the NRR will enable mainstreaming NbS through the NRPs.

The NRR holds considerable potential to operate at ecosystem levels, providing widespread societal benefits, particularly through the increased supply of ecosystem services (Hering et al., 2023). This is due to its broad coverage of ecosystems, which allows that the restoration of one to benefit another, thus multiplying the benefits. For example, enhancing landscape structure and rewetting peatlands can increase the resilience of agricultural ecosystems to droughts and pests, and restoring pollinator populations can have direct positive impacts on agricultural production (De Groot et al, 2013 in Hering et al., 2023).

These restoration measures have to be taken into account in the NRPs, which can contribute to large-scale and not just point-by-point restoration. In their NRPs, Member States have to consider connectivity needed between areas that have to be restored (European Commission, 2025c). They should also seek to optimise the ecological, economic, and social functions of ecosystems, considering their role in the sustainable development of the regions and communities involved (European Commission, 2025c). In other words, Member States are incentivised to consider the bigger picture and not just focus on individual measures.

Prevent - NRR doesn't prevent mainstreaming NbS but rather supports it. However, in line with the principles of environmental protection (especially non deterioration principle) the implementation of NRR shall avoid deterioration of existing level of national, regional, European level of protection for European habitats and species.

Maintain - existing level of ambition of global, European, national restoration targets, and implementation. The NRR refers to and is in line with several existing environmental and sustainability-related policies, which is an aspect that should definitely be maintained. These policies are for instance, the EU Biodiversity Strategy, the Habitats Directive, the Water Framework Directive and the CAP. Member States have already started the implementation of these policies and are applying their strategies in doing so. The NRPs have to take these

existing MS-level strategies into account. Moreover, social aspects are mentioned several times in connection with restoration. The NRR refers to socio-economic benefits of nature restoration on many occasions, not only focusing on the environment itself, but - although not explicitly - more about society within nature. Member States are also urged to include social aspects in their NRPs.

Create -National Restoration Plans that are in line with the policy and value chain levers suggested in the cross-sectoral Routemap. Out of the MERLIN economic sectors, only the Agriculture sector (including Forestry) is highlighted as an active participant of the proposed restoration processes. However, the other sectors, especially Water Supply and Sanitation, Hydropower and Peat Extraction and Insurance should be involved as having an important part to play in implementing and financing restoration measures. Flood risk reduction is not mentioned as a possible positive consequence of barrier removal, instead, it is stated that barriers should be removed to fulfil restoration targets. This is a gap in the NRR as one of the main benefits of removing in-river obstacles is to minimise flood risk, which can be an important incentive for investors.

Disrupt - While the NRR's focus is on restoring degraded ecosystems, it does not seem to pay enough attention to halting harmful activities that hinder biodiversity. It is mentioned that Member States should stop subsidising such activities and it requires them to indicate the amount of subsidies that negatively affect restoration measures (Article 15, paragraph 3, European Commission, 2024a). However, there is no target or deadline about minimising, let alone stopping these subsidies. Determining tangible objectives in this regard would be necessary to complement restoration incentives.

2.1.10 NRR and other European Policies

The NRR recognizes that previous EU legislation and policies have not successfully stopped biodiversity loss. Yet, its success will heavily depend on other European laws and policies concerning the environment, land, and water use, as an article states, co-written by MERLIN scientists (Hering et al., 2023). The NRR aligns with key directives such as the Habitat Directive, Water Framework Directive, and Common Agricultural Policy. Together, these directives span various targets, sectors, and methods, highlighting the broader policy framework that will interact with NRR implementation (Hering et al., 2023).

The article states that the NRR offers a great potential to boost the implementation of other European directives and policies. This is because despite its broadness, it targets specific ecosystem types with tailor-made approaches, and therefore it may have impacts beyond the targeted ecosystems. Scientists highlight that for instance, restoring peatlands can positively affect the landscape's water budget (Borrelli et al, 2020 in Hering et al., 2023).

In their earlier recommendations, MERLIN and its sister projects suggested improving the proposal's compliance with the **Water Framework Directive**, as the NRR has a great potential to improve the implementation of the WFD, which has not reached many of its goals yet (Hering et al., 2022). This recommendation was successfully considered in the adopted text: it now refers to the River Basin Management Plans concretely, that Member States have to take into account when preparing their NRPs (Article 14(14),European Commission, 2025c).

The NRR complements and builds upon existing environmental legislation, including the Birds and Habitats Directives, the Water Framework Directive (WFD), the Marine Strategy Framework Directive, and the Invasive Alien Species Regulation. The law also links directly with other environmental strategies such as the EU Forest Strategy for 2030, the Common Agricultural Policy, the EU Soil Strategy, and the EU Pollinator Initiative. Additionally, policy measures under other strategies, such as the circular economy action plan and the zero pollution action plan, will help relieve pressure on ecosystems by reducing various forms of pollutants (European Commission, 2022a, pp. 4–5). The NRR also aligns with the European Green Deal, the European Climate Law and proposals included in the Fit for 55 package (in particular the proposal for a Land Use, Land Use Change and Forestry Regulation) (European Commission, 2022a, pp. 5–7).

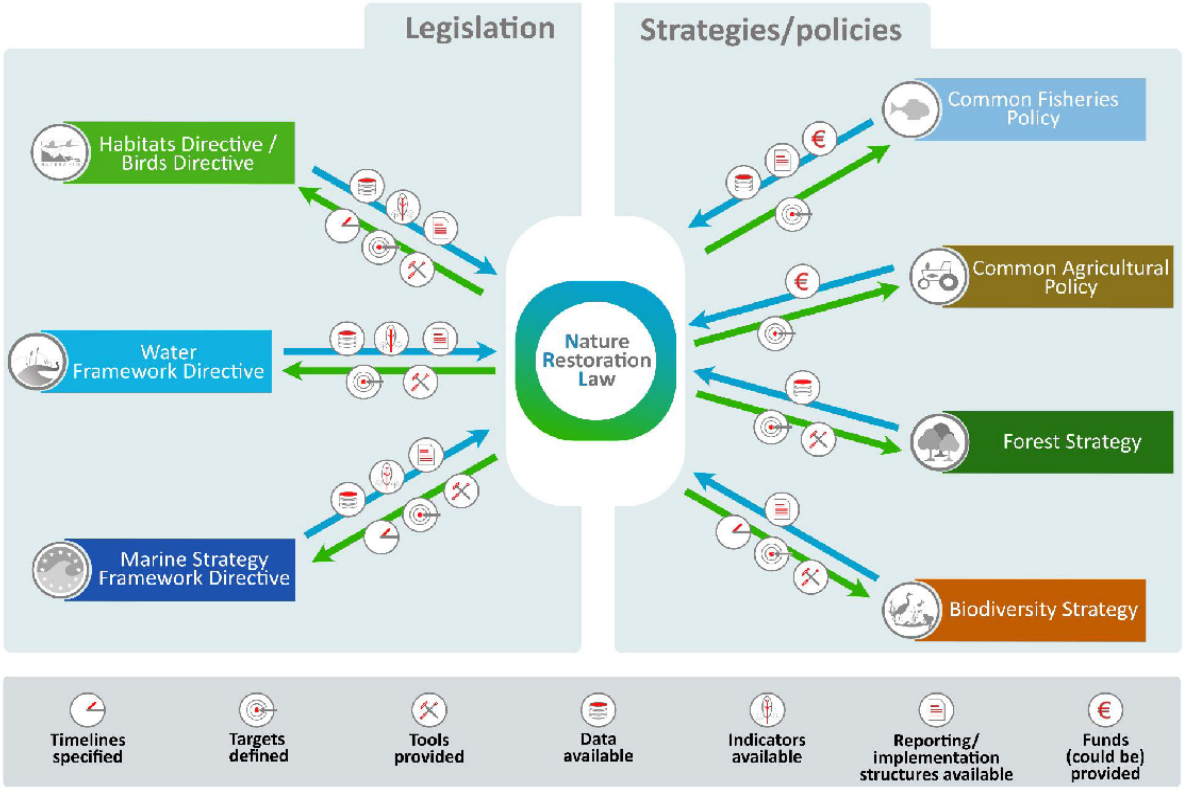


Figure 1: Possible relations between the Nature Restoration Regulation (NRR) and other European environmental legislation, strategies and policies (Hering et al., 2023).

The Nature Restoration Regulation refers to the **European Climate Law** on Nature-based Solutions. The Nature Restoration Regulation refers to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change on nature-based solutions. (Boulard et al., 2025).

Based on the uniform template of the **NRPs** (European Commission, 2025a) Member States have to include General co-benefits, related policies and financial information of their plans across the implementation of the targets (Part A point 4 of the template). The template lists several policies (e.g. national adaptation strategies or plans and national disaster risk assessment reports) with what the Member States shall find synergies in their NRPs, so all these connections to the other policies will be visible and known when the NRPs will be ready.

2.1.11 NRR and MERLIN Economic Sectors

Hering et al., (2023) provided a positive outlook for the NRR, but warn that ambitious national implementation and cooperation with economic sectors, such as Agriculture, will eventually determine the success of nature restoration in Europe.

For example, the Agriculture sector can use the “emergency brake” that was introduced in the compromised text of the regulation (and remained in the adopted text as well), which enables Member States to temporarily suspend NRR implementation in farmland, over their entire area, under exceptional circumstances that affect land availability for agricultural production (Article 27, paragraph 1) - see the compromises after the trilogue negotiations (Hering et al., 2023).

In addition to the most challenging Agriculture sector, the NRR has connections to the remaining 5 MERLIN sectors (Hydropower, Peat Extraction, Insurance, Water Supply and Sanitation, Navigation).

In general, the law highlights the need for **adequate private and public investments** in restoration to fulfil the obligations (page 15, paragraph 78) and requests a report from the Commission by 12 months from the regulation's entry into force on identifying any financial gaps in implementing the legislation (page 16, paragraph 81). Incentivising private finance mechanisms for nature restoration may be relevant for the sectors. Moreover, national restorations plans are to include "*the estimated financing needs for the implementation of the restoration measures, which shall include a description of the support to stakeholders affected by restoration measures or other new obligations arising from this Regulation, and the means of intended financing, public or private, including financing or co-financing with Union funding instruments*" (Article 15, paragraph 3, European Commission, 2024b).

Agriculture: The NRR acknowledges that sustainable, resilient and biodiverse agricultural ecosystems are essential to provide safe, sustainable, nutritious and affordable food. It states that biodiversity-rich agricultural ecosystems contribute to the sector's resilience to climate change, while it creates new jobs in rural areas linked to organic farming and rural Tourism (page 9, paragraph 54). Therefore, Article 11 of the NRR encourages Member States to implement restoration measures to improve biodiversity in agricultural ecosystems, in addition to the identified areas.

More concretely, Member States have to aim with their measures for an increasing trend in at least two of these indicators: grassland butterfly index, stock of organic carbon in cropland mineral soils, share of agricultural land with high-diversity landscape features (Article 11(2)). They have to put in place restoration measures to ensure a higher level of common farmland bird populations (Article 11(3)). Measures to restore organic soils in agricultural use consisting of drained peatlands shall also be put in place. This means that Member States should incentivise rewetting for farmers and private landowners and provide advice about its benefits and management options (Article 11(4)).

Hydropower, Navigation, Water Supply and Sanitation: These sectors are not explicitly mentioned in the NRR. Article 9 suggests that Member States should make an inventory of barriers to connectivity of surface waters and identify those that need to be removed to contribute to the achievement of restoring at least 25,000 km of rivers. The sectors are only mentioned in this context, as paragraph 2 highlights that Member States should primarily remove obsolete barriers which are no longer needed for renewable Energy generation, inland Navigation, water supply or other uses.

Insurance: The law does not mention the sector explicitly, but it does state in the preamble (page 4, paragraph 20) that the restoration of nature acts as an Insurance policy, therefore the restoration actions taken as part of the NRR can contribute to restoring ecosystem services that e.g. reduce flood risk, therefore having a positive impact on damage reduction as it ensures the EU's long-term sustainability and resilience The law does not create a link to Taxonomy or Solvency legislation either.

Peat Extraction: The sector is only mentioned in the context of drained peatlands where peat used to be extracted, and which is now used by Agriculture (Article 11). The law refers to peatlands on several occasions as important ecosystems and carbon storages that could contribute significantly to reduce the impacts of climate change, especially when properly restored. The provisions in the article were made effort-based though ("put in place measures which shall aim to"). It is clarified that there is no obligation for farmers and private landowners to rewet their land. However, Member States shall, as appropriate, incentivise rewetting to make it an attractive option for farmers and private landowner and foster access to training and advice to farmers and other stakeholders on the benefits of rewetting peatland and on the options of subsequent land management and related opportunities. Therefore, the opportunity is there for the sector to see themselves as a necessary part in the implementation of the law and apply for the incentives for rewetting.

To conclude, the NRR clearly has an integrative, cross sectoral approach and for its successful implementation, when constructing the Nature Restoration Plans, in our opinion Member States shall invite to the negotiation table all the relevant sectors and fulfil the requirements of the integration principle of the EU by cooperating with the sectors.

2.1.12 Climate Adaptation: Global Framework

At the international level, the Global Goal on Adaptation (GGA) was established in 2015 in the Paris Agreement (Article 7.1) with the aim of "*enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change*" (UNFCCC, 2015).

Adaptation is defined by the IPCC as "*adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts*" , i.e. measures and actions to better prepare for the already felt and increasing impacts of climate change (IPCC, 2001).

2.1.13 European and National Climate Adaptation

Adaptation in the EU has mostly been and still is mostly a local issue. The European Committee of the Regions estimates that local and regional authorities implement 90% of climate change adaptation policies in Europe. In order to be more effective, adaptation needs to be conducted in alignment with national or EU policies and plans (European Commission, 2022b), and supported by national or supranational governments (Baffert et al., 2024).

Member States are required by the European Climate Law (European Commission, 2020a) adopted in 2021 to adopt and implement national adaptation strategies and plans (article 5). According to the EU climate Governance Regulation (European Commission, 2018). Member States should also integrate adaptation goals in their updated National Energy and Climate Plans (or NECPs, whose updates are due in June 2024) (European Commission, 2022b) and in their national Long Term Strategies (LTSs). Today, all Member States have national adaptation strategies and/or plans but only eight Member States have embedded elements of their adaptation policy systems in domestic legal frameworks. This means that very often, the strategies have not yet translated into substantial progress in the adaptive capacity, they have omitted to effectively include adaptation in sectoral policies and plans, such as the Maritime Spatial Plans (WWF, 2024a), and the effects of climate change are still insufficiently taken into strategic decisions. Even though climate risks are better understood, the European Climate Risk Assessment notes that "*societal preparedness is still low*" mainly because policies are not implemented at the pace needed to address the quickly increasing risk levels. The European Commission also reports that national adaptation strategies and plans are so far failing to incorporate nature-based solutions in adaptation policies. The Commission notes that "*Nature-based solutions are included only to a limited extent at strategic level and in policy documents, especially sectoral strategies and plans. This may hamper their more systemic use and deployment for climate adaptation*."

At EU level, the first EU Adaptation Strategy was issued in 2013 with the goals of encouraging national action, informing decision-making and promoting adaptation in key vulnerable sectors. As it did not result in significant commitment by governments, the Strategy was revised in 2021 to make adaptation in Europe "*smarter, faster and more systemic*" and to boost climate adaptation on the international agenda. Still, the European Climate Risk Assessment notes that the current range of EU policies is not "specific enough" to ensure resilience against rapidly increasing risk levels and that "*stronger policy action or implementation is particularly urgent*". It notes that "*The EU should bolster climate adaptation actions further through regulatory and policy levers [... such as] the CAP, the CFP, the Water Framework Directive and the Nature Restoration Regulation*." (European Environment Agency, 2024b). The Maritime Spatial Planning Directive (MSPD) and the Maritime Strategy Framework Directive (MSFD) also show weaknesses in considering aspects of climate adaptation. Avoiding contradictions between sectoral policies is essential to bring coherence and avoid sectoral measures having negative impacts on climate adaptation measures.

In our D4.3 CAS conclusions (Blackstock et al., 2023) where we analysed the Romanian (Lower Danube) and the Dutch AS we have found out that although the Member States adopted their Adaptation Strategies (AS), their implementation is weak as Member States often don't use the given instruments and do not have a specified menu of actions. In addition to that the analysis has found a gap in coherence with CAP: The EU AS does not highlight CAP, even though Member States use CAP funding to implement adaptation interventions.

2.1.14 EU Water Resilience Strategy

The EU Water Resilience Strategy (European Commission, 2025b) sets out a strategic framework to strengthen the EU's capacity to address the mounting water-related challenges, such as scarcity, pollution, inefficient water use and extreme weather events. While it is not a binding legislative act, the Strategy proposes a wide range of actions across sectors, emphasising the need for stronger policy integration with existing EU legislation, such as the CAP, the WFD, and the Urban Wastewater Treatment Directive (UWTD).

A central message of the Strategy is that **enhanced action** is urgently needed to prevent unsustainable land and water management practices, which include over-abstraction (both legal and illegal), hydro-morphological changes, pollution and inefficient use by economic sectors (Section 2.1). The Strategy calls for a **systematic reduction of water demand across all economic sectors**, with particular focus on intensive water users. These sectors, such as Agriculture, Industry, and digital Infrastructure are both the largest consumers and the most

vulnerable to supply disruptions. To guide progress, the EU aims to **enhance water efficiency by at least 10% by 2030**.

NbS are prioritised in the Strategy, and their uptake is encouraged across sectors. **However, a cross-sectoral approach is not visible in the Communication,** it only mentions cooperation across country borders, but not across economic sectors. At the same time, the Strategy states that NbS alone may not be sufficient, and that a combination of natural and man-made solutions – including traditional water Infrastructure – will be necessary to achieve water resilience (Section 2.1).

While the Strategy highlights the importance of aligning water planning with the clean industrial and digital transitions, it falls short of proposing **concrete measures** to limit the associated increase in water demand. For example, beyond enhancing visualisation tools that integrate environmental and Infrastructure data, **no binding steps** are suggested to actively reduce water use in these sectors. Similarly, although the Strategy stresses the need to address unsustainable land and water management, it does not chart a clear course for phasing out harmful subsidies under the CAP, cohesion policy, or state aid schemes that contribute to over-abstraction and drainage. Furthermore, while the Communication refers to the ECB–EIOPA paper exploring potential solutions to address the Insurance protection gap through a) an EU public-private reinsurance scheme b) an EU fund for public disaster financing), it does not introduce concrete measures to incentivise the **Insurance sector** to invest in or promote NbS.

Table 5: Summary table of sectoral flagship actions in the Communication of the Water Resilience Strategy.

Flagship actions - Building a water smart economy that leaves no one behind, supports EU competitiveness and attracts investors	**Timeline**
Recommendations on the water Efficiency First principle, guidelines and EEA report on the untapped water efficiency potential	2025-2026
Supports the uptake of water reuse practices also beyond Agriculture and review the Water Reuse Regulation.	2026-2028
Public water supply: → Supports leakage reduction and Infrastructure modernization and deep data assessment.	2025-2028
Agriculture: → Maximise the use of CAP strategic plans for Water resilience through knowledge sharing and innovative solutions promoted by the EU CAP Network, the European Innovation partnership (EIP-AGRI), as well as improved and independent farm advisory services. → In the next programming period, continue to incentivize farmers to improve the environmental and climate performance of their holdings, including towards better water management.	2025-2026
Industry and Energy → Launce a pilot project to promote water efficiency, including waterless and closed cycle technologies, in selected industrial clusters. → Include water usage among the parameters of a common Union scheme to rate the sustainability of data centres and propose water consumption minimum performance standards. → Public-private initiative to achieve a technological breakthrough in feasible and affordable methods for dry cooling, if the right partners are found.	2025-2027

2.1.15 Aligning the Routemap Vision with EU Policy Windows

To align our vision with EU policy objectives, we selected 2030, 2040, and 2050 as key milestone years, creating a pathway for freshwater restoration and NbS integration. The selected timelines and the vision reflect key milestones set out in the Green Deal, particularly through the Nature Restoration Regulation and the Climate Law. Altogether, the five policies (NRR, CL, CAP, WFD, CAS) were identified in D4.3. Table X summarises the key targets and visions of these five policies.

Table 6: Summary of the key targets in our focus EU policies (based on original legislative texts)

	EU Green Deal				
	Nature Restoration Regulation	**Climate Law**	**Common Agricultural Policy**	**Water Framework Directive**	**Climate Adaptation Strategy**
Legal document	Regulation (EU) 2024/1991 (European Commission, 2024b)	Regulation (EU) 2021/1119 (European Commission, 2021c)	Regulation (EU) 2021/2115 (for CAP Strategic Plans) (European Commission, 2021d)	Directive 2000/60/EC (European Commission, 2000)	Communication COM/2021/82 final (European Commission, 2021b)
Key policy targets and timeline	→ Restore at least 30% of degraded habitats by 2030, 60% by 2040, 90% by 2050 (Article 4 and 5) → Restore 25,000 km of free-flowing rivers by 2030 (Article 9) → Restore 30% of drained peatland soil by 2030, 40% by 2040, 50% by 2050 (Article 11) → Further targets for urban green space (Article 8), pollinator populations (Article 10), biodiversity in agricultural (Article 11) and forest (Article 12) ecosystems	→ At least 55% less net greenhouse gas emissions by 2030, compared to 1990 levels → Set up a climate target for 2040 → Climate - neutrality by 2050	Same as objectives (see below), within the current period of 2023-27 (Article 104(4))	Article 4 (1): → Good ecological and chemical status for surface waters (a) → Good quantitative and chemical status for groundwater (b) → Achieve the objectives for protected areas (c) Timeline: by 2027[6](Client Earth, 2023)	Realise the vision of a climate-resilient Europe by 2050 (Section 2)
Key policy objectives	Article 1: To restore ecosystems, habitats and species across the EU's land and sea areas in order to:	→ Create a pathway towards climate-neutrality, which is socially fair and cost-efficient (Article 2)	10 objectives (Article 6): → To ensure a fair income for farmers → To increase competitiveness	Article 4: To protect and, where necessary, restore ground-, and surface water bodies in order to reach good status	4 key objectives (Section 2 and 3): to make adaptation → Smarter through the Climate-ADAPT platform → Swifter

[6] "These extensions are, however, limited to a maximum of two further updates of the RBMP except in cases where natural conditions are such that the objectives cannot be achieved within this period. This means that from the third update of RBMPs, which must be published by 22.12.2027 at the latest, Member States may only extend the deadline to achieve good status due to natural conditions. Accordingly, in the current RBMPs for the period 2022-2027, Member States were allowed to invoke technical feasibility and disproportionate costs for a deadline extension until 2027 for the last time."

	→ Enable the long-term and sustained recovery of biodiverse and resilient nature → Contribute to achieving the EU's climate mitigation and climate adaptation objectives → Enhance food security → Meet international commitments	→ Create a progress monitoring and review system (Article 6-8) → Provide predictability for investors and other economic actors (paragraph 30, p. 6) → Ensure the irreversibility of the transition to climate neutrality (paragraph 30, p. 6)	→ To improve the position of farmers in the food chain → Climate change action → Environmental care → To preserve landscapes and biodiversity → To support generational renewal → Vibrant rural areas → To protect food and health quality → Fostering knowledge and innovation	(both chemical and ecological), and to prevent deterioration.	→ More systemic through e.g. applying NbS for adaptation → To step up international action on adaptation to climate change, through scaling up of international finance and stronger global engagement
Main instruments	National Restoration Plan (NRP)	National Energy and Climate Plans (NECPs)	CAP Strategic Plan (CSP)	River Basin Management Plan (RBMP) The related policy - Water Resilience Strategy – was published in June 2025 (European Commission, 2025b).	Adaptation Strategies (AS)
Instrument's timeline	1 September 2026 (Art 16 of NRR) for submission of 1st draft NRPs. 1 September 2027 final Plans (Art 17 of NRR) Review by 2032, by 2042, and at least once every ten years thereafter (Article 19)	Regulation (EU) 2018/1999 Article 3 - Integrated national energy and climate plans By 31 December 2019, and subsequently by 1 January 2029 and every ten years thereafter, each Member State shall notify to the Commission an integrated national energy and climate plan.	Current period: 2023-27 (Article 104 (4) Next plans will be adopted until 1 of January 2028.	To be reviewed and updated 15 years after entry into force the latest, and every six years thereafter (Article 13(7)) Currently on the 3rd RBMPs (2022-2027) Consultations on the 4th RBMPs is ongoing, their drafting will begin in 2026 (The Energy & Water Agency, 2025).	EU Climate Adaptation Plan/Resilience Framework to be negotiated in 2026

3 Annex 3: Farm Sustainability Data Network (FSDN) Mapping Commentary

This Annex provides a fuller commentary and a wider range of maps to complement the materials in Section 5.2 in the main text of the cross-sectoral Routemap.

3.1 Agricultural Pressure Index

This map (Figure 2) by Schürings et al. (2024), is a sophisticated synthesis of the intensity of pressures exerted on the water environment by Agriculture. The map shows cumulative pressures from: nutrients, pesticides, water abstraction and hydro-morphological alterations, all of which can have influence on the WFD status of water bodies. The map has great value in highlighting that substantial areas of the EU have high pressures exerted by Agriculture. This emphasises the continuing need to consider how to reshape EU Agriculture to continue to deliver provisioning services (food and fibre) while not undermining the natural capital and ecosystem services on which both Agriculture and wider society depend. Note that the map does not include pressures from forestry or urban areas, so these are mapped out as separate classes.

The map also has value as an intermediary step between farm systems as represented in the FSDN data and their impacts for example the need for restoration as mapped by (Duarte et al., 2023) in MERLIN D3.1 within the MERLIN project. Comparting pressures and impacts can highlight where the same pressure may have differing impacts depending on the vulnerability of the system on which the pressure is exerted. The individual components of the Schürings et al. (2024) mapping would also permit assessment of the mix of pressures present that may also be diagnostic for prioritizing the kinds of nature based solutions implemented.

The Schürings et al. (2024) mapping is used here on its own to highlight the extent and intensity of Agriculture of pressures across the EU, but also in combined (bi-variate) mapping (see Section 3.2.7) to highlight where there are contrast between environmental pressures and socio-economic circumstances. It explores where there are cases of high financial returns from Agriculture but without high pressures on water systems, and conversely where there high pressures but low financial returns. The bi-variate mapping seeks to highlight these contrasting combinations as they imply different kinds of opportunities and challenges for the mainstreaming restoration of hydrological systems using nature-based solutions.

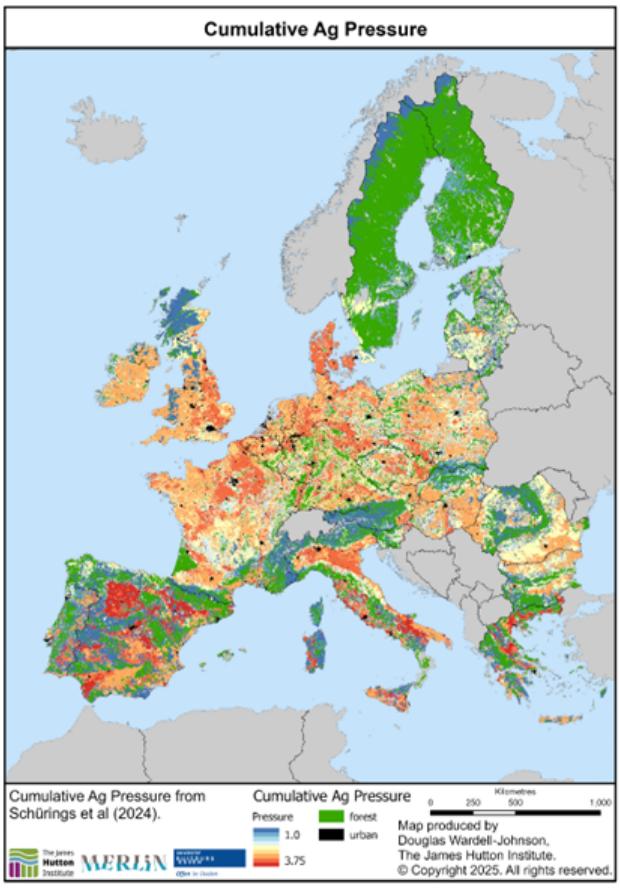


Figure 2: Map showing intensity of pressures exerted on the water environment by agriculture

3.2 Farm Sustainability Data Network maps

3.2.1 Utilised Agricultural Area (UAA)

Utilised Agricultural Area [FSDN Code SE131] formalises the share of land per region held within agricultural businesses. This approximates the non-urban, non-forestry area shown in agricultural pressures map. This presents another metric by which the significance of Agriculture to the state of the water environment might be judged. There is some question of whether UAA includes “abandoned” agricultural land, i.e. it is utilisable rather than utilised. The formal definitions would say no but there is some suspicion that it might (e.g. the case of Scotland rough grazing that is “maintained” in good agricultural and ecological condition by no more than weather).

3.2.2 Agricultural Land Out of Production

Within the agricultural area as defined by UAA above there is a subset of land defined as Out of Production [FSDN Code SE074]. This occurs for a variety of reasons, some based on need to fulfil EU requirements, for example fallow land within ecological focus areas for CAP greening, or in response to Member State schemes. The map presents the proportion of the UAA that is out of production. The significance of this is that the land out of production may represent an opportunity for enhanced management or implementation of nature-based restoration. What the mapping cannot yet show is the why the land is out of production. If driven by policy then there may already be nature friendly management practices (even if only fallows) present, but nevertheless there may still be opportunities to enhance the management or fully repurpose such land to deliver other outcomes. Where land is out of production because of financial limitations the lower opportunity costs may make such land particularly suitable for nature-based solutions.

The map shows that there can be relatively substantial shares of UAA out of production (up to 12%) and is associated with shares of land devoted to arable and horticultural cropping (and thus subject to CAP Greening). The Denmark example with ~8% perhaps reflects the use of wider buffer strips in managing losses of nutrients into coastal waters.

Note that when interpreting the map there are cartographical compromises in colouring the whole polygon using an intensity metric (i.e. per hectare) when the data applies to only a small part of the whole polygon, for example in Sweden the areas of UAA beyond the southern third are very small. The significance of metrics should thus be interpreted in the light the UAA map in Section 3.2.3.

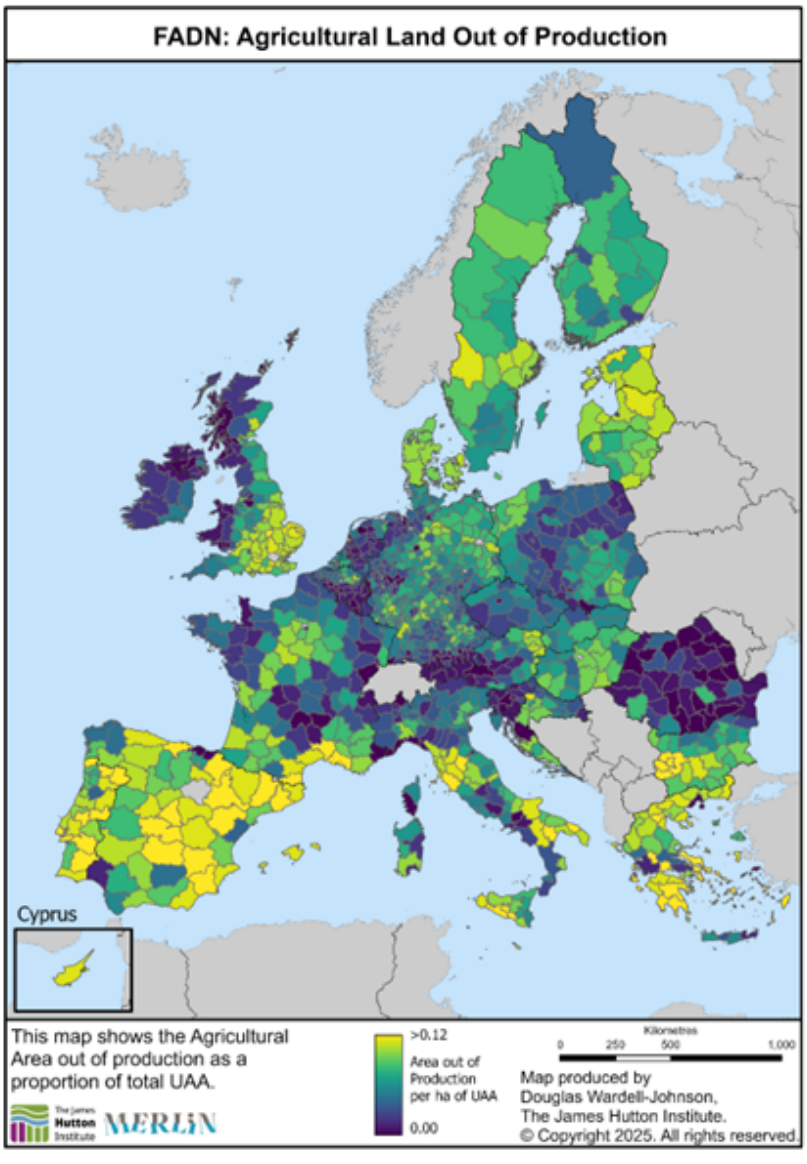


Figure 3: Map showing Agricultural land out of production

3.2.3 UAA Versus Land Out of Production

Figure 3 combines UAA and Land Out of Production to differentiate regions with low and high values for these metrics. The legend differentiates 16 combinations of the two metrics generated using two, four-level colour ramps. Cases of particular interest are the green areas where Agriculture is a large proportion of the regions area and thus likely to be highly influential on aquatic ecosystems yet there are also relatively large areas out of production. These regions may thus have both higher pressures but also space within which NbS could be enacted. Contrasting with this are the areas in blue with high UAA and low land out of production. Here the challenge is that any land sparing type NbS measures would seem likely to be much harder to be implemented as space would need to be "made" for nature. Where both UAA and land out of production is low (white) is similar to the above case but more care may need to be taken to account for the non-agricultural land present (often forest). This is true for such land both as a source of pressures (and potentially not mapped in Section 1) but also in interpreting how access to land for land-based NbS might be negotiated with non-agricultural users. The case where there is low UAA and high land out of production (orange) presents a case that is harder to interpret. Where there is more limited UAA share then this land may have higher value as a source of provisioning services (e.g. southern Sweden or southern Portugal) so any losses might well be seen as highly undesirable. The contrast between these regions in terms of pressures can be seen in Section 3.1, so the nature and intensity of production systems, not just their extent, needs to be borne in mind when interpreting this map. Nevertheless, while the degree of pressures may contrast with the space in which to address such pressures, within farms with similar higher proportions of land out of production, there are spaces that could be used for mitigating pressures or restoring aquatic ecosystems.

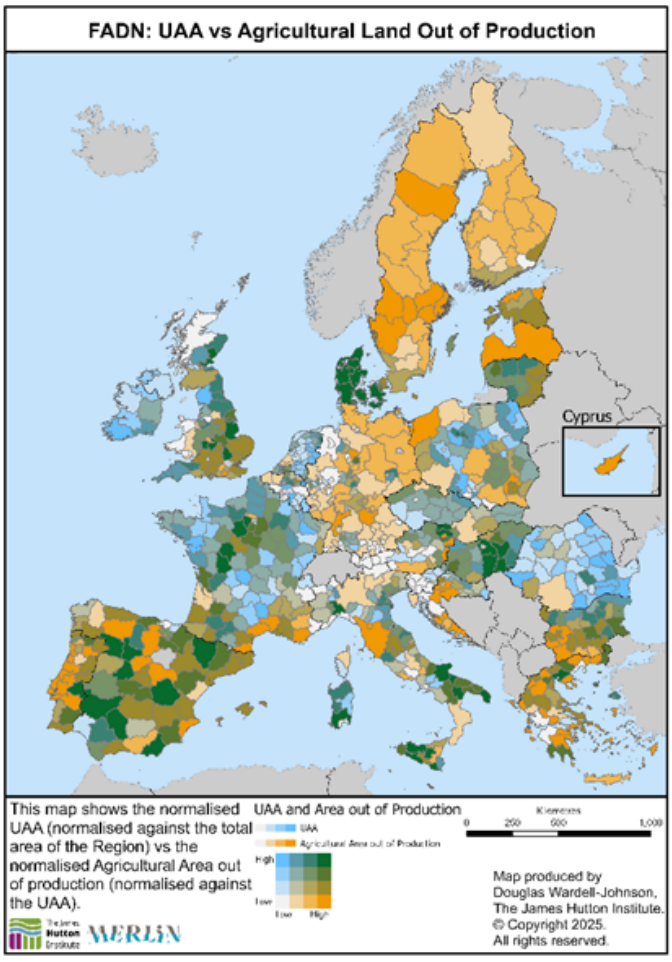


Figure 4: A comparison of UAA and land out of production

3.2.4 Rented UAA

Another important variable is whether land is owned or rented [FSDN Code SE030], with tenant farmers often unable or unwilling to invest in long term measures; and it may be important to engage both the landowner and

the land manager in these cases when discussing potential costs and benefits of a nature-based restoration intervention. FSDN analysis of rented agricultural land as a proportion shows strong between and within Member State variations, with rented land being the majority of most UAA in France, Bulgaria and Czech Republic, and with much lower rates in Portugal and Poland. These are likely to reflect historic path dependencies e.g. how any collectivised land was privatised. The tenure of land makes a difference to how many decision makers would be involved in adopting a transformational measure (especially where such a measure may affect the capital value of land). Where land is rented (even on secure, long-term tenancies) this may imply limitations on management, or land use within the property. In any event, rental means both a user and an owner's rights will need to be considered, and this is likely to complicate the adoption of any aquatic restoration NbS. The FSDN data does not indicate whether the rental is from private or public sector owners, and these could potentially have very different priorities and thus enhance or restrain adoption of NbS.

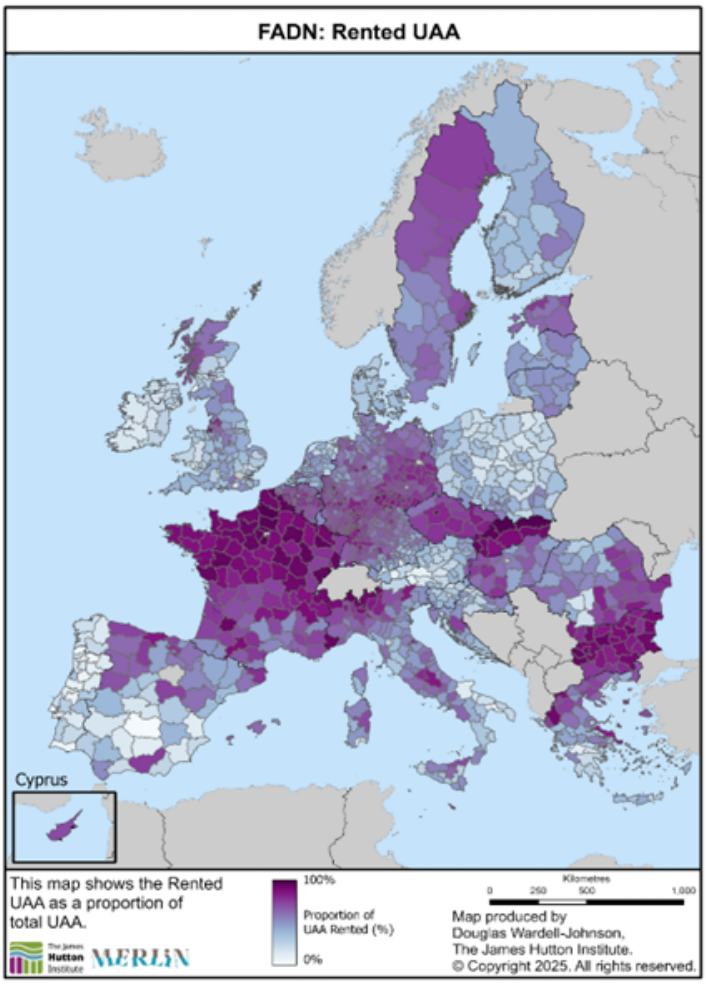


Figure 5: Illustrates land tenure across Europe

3.2.5 Holding Size and Counts

Beyond any financial implications (discussed next) the size and thus number of holdings per unit area in the regions is a factor in the potential for implementing NbS based aquatic restoration, especially where a coordinated approach across catchments is needed. Where participation is voluntary (the current norm for all but Statutory Management Requirements, Good Environmental and Agricultural Condition and CAP greening, and even here these greening measures are elective), large numbers of smaller businesses imply a substantial overhead in mobilisation and agreeing appropriate burden sharing even between participants. Consideration of how burdens sharing is enacted can also be complex – for example an area proportional approach ignores that larger businesses may have economies of scale for delivering environmental outcomes since they also have more staff expertise, machinery and Infrastructure and financial resources. The administrative burden, especially for elective public funding schemes or lack of scale for private finance may make participation in NbS impossible for small businesses unless there is support for third parties to emerge to generate cooperation or coordinate actions.

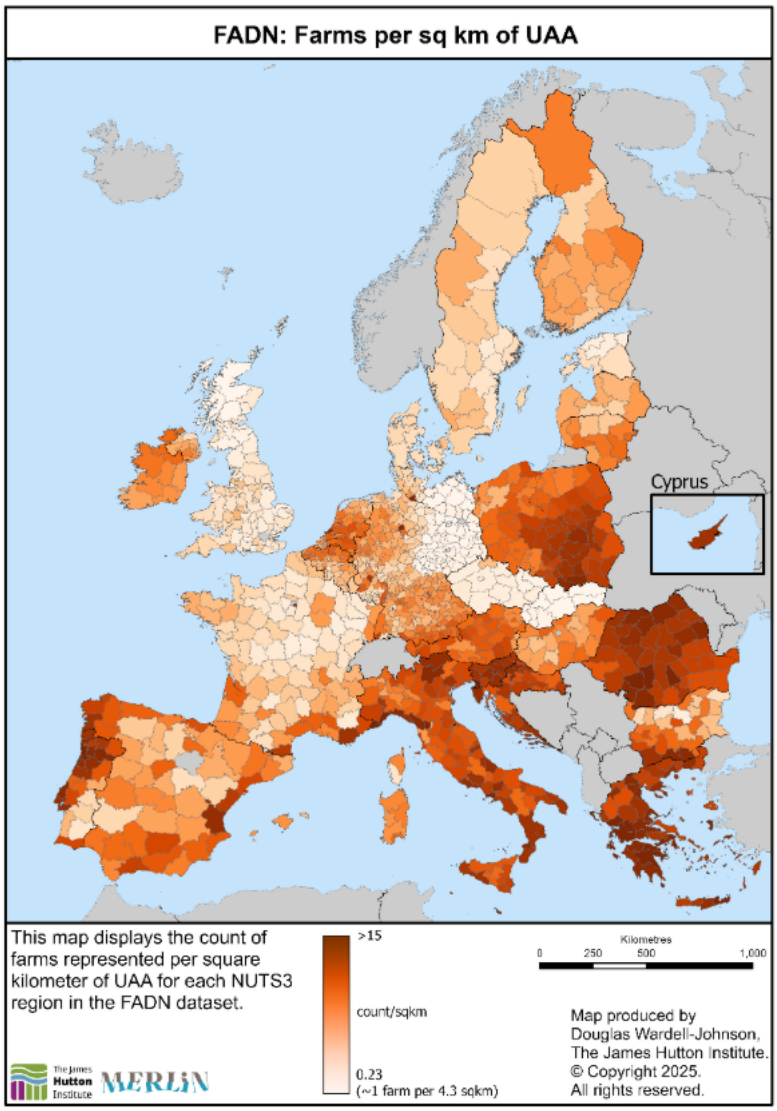


Figure 6: Count of farms per square kilometre of UAA

3.2.6 Total Output

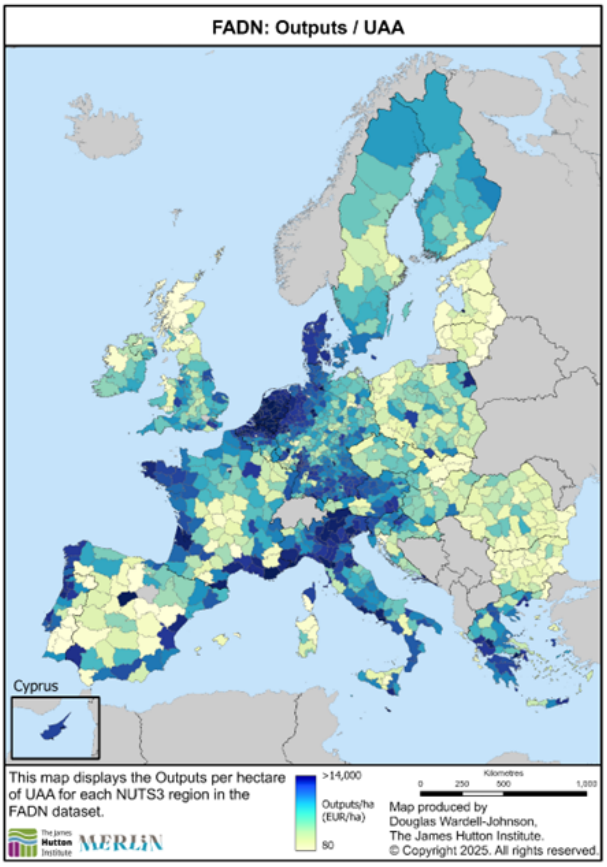
The unique value of FSDN data is in its ability to provide estimates of financial values for land use and management. This permits the quantification of the opportunity costs of enacting land sparing measures (any measure that takes land out of production). One key metric is Total Output [FSDN Code SE131] that quantifies the farm gate financial value of outputs. This metric does not account for variable or fixed costs and thus does not speak to profitability (see 3.2.7).

In the mapping. the values of outputs per business are used, with the mix of farm-types present used to generate a weighted average value for the region as a whole. FSDN data does provide the facility to make estimates of distributions of these values that could also be informative, but average values were sufficient for this scoping analysis. Where there is interest in specific farm-types or enterprises then FSDN can also characterise these, but mapping such values implies the challenge of how to identify the land on which such activities take place. These within-farm metrics have most value when, from case-study analysis, there are known associations between NbS implementation and subsets of land management types within a region. The FSDN data provides a way in which the "space" for mainstreaming NbS can be estimated either based on the presence of a land management type or for a financially defined subset of that area (e.g. where value of the enterprise is less that the income that would be generated by any funding associated with NbS implementation.

The Total Output mapping emphasises just how much of a range of activity the term Agriculture encompasses, with values from ~80€/ha to more than 14,000€/ha average value for all farm types present in a region, noting that for individual farm-types values per ha can be much higher – e.g. >100,000€/ha for horticulture in Netherlands. It is also worth noting that for some intensive livestock enterprises (e.g. granivores) the values per ha can very high, but this reflects their use of bought-in feedstuffs and the footprint of the "farm" and thus per

hectare metrics does not reflect this externalisation. Figure 7 highlights just how challenging any adoption of land sparing measures will be in the most intensively managed regions if their costs are to be fully offset by public or even private finance.

Yet comparing the Total Outputs maps with those of pressures from Agriculture, these high value areas are precisely those in which there are maximum pressures and thus the maximum need for NbS based interventions. This is articulated in the bi-variate map of Total Output and Accumulated Pressures, see Figure 7. The high pressure and high value areas (in black) are extensive and are associated with both cropping and intensive livestock systems (granivores, beef and dairy). Low value and low-pressure areas (white) are associated with more extensive grazing, semi-natural pastures or the absence of Agriculture (limited UAA shares) but these areas are limited within Europe. The other corner cases are of greater interest as they break the linkage of Total Output and agricultural pressures. Low pressures and high Total Output may reflect smaller areas of higher value production such as upland dairy where impacts are limited or diluted by the other land uses (forestry) or non-production uses. These regions are more extensive than the low-low case, but it may not be possible to extrapolate practice in such regions except in the sense of limiting the overall pressure from Agriculture by changes in practice (land sharing) or reductions in demand (e.g. through cutting food waste, or more controversially via diet change). The last combination represents the worst case with high pressures and low standard outputs (orange). These areas may be interpreted in as system locked-in to forms of agricultural practice that should be prioritised for change.



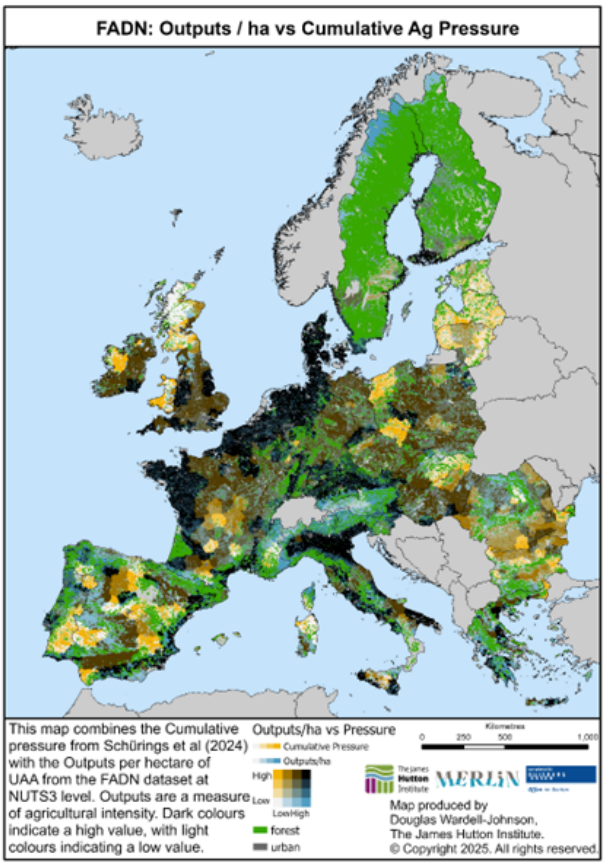


Figure 7: Standard output estimates and

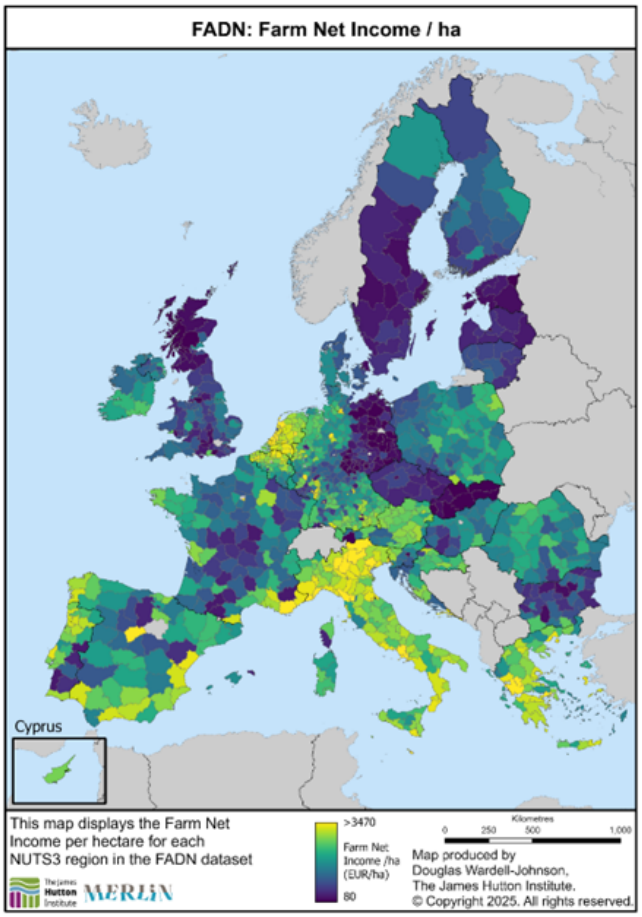
Figure 8: Standard output estimates vs Cumulative Agricultural Pressure

3.2.7 Net Farm Income (NFI)

Net Farm Income [FSDN Code SE420] is another key metric that can be used to assess financial barriers to adopting NbS. NFI is a measure of profitability and thus takes more factors into account, such as the costs of inputs, labour and farm Infrastructure. Given the challenge of allocating fixed costs like labour and Infrastructure across farm enterprises, NFI is most meaningful at whole business level not per enterprise. To be comparable across all the tenure types in the FADN population, NFI includes an imputed rental costs that is

applied to owner occupiers, reducing their NFI. Where rental is not the norm then NFI values per ha will be underestimated. Values for NFI per ha for each region were estimated as for Total Outputs, with comparable lowest values but as would be anticipated much reduced higher values (~3,470€/ha).

When combined with the agricultural pressures map a similar bi-variate map is generated with the interpretations of the corner cases be in the same as for Total Outputs – see Figure 9. Yet there is a contrast between the maps in the sense that there is a much larger apparent area where low return and high pressures occur.



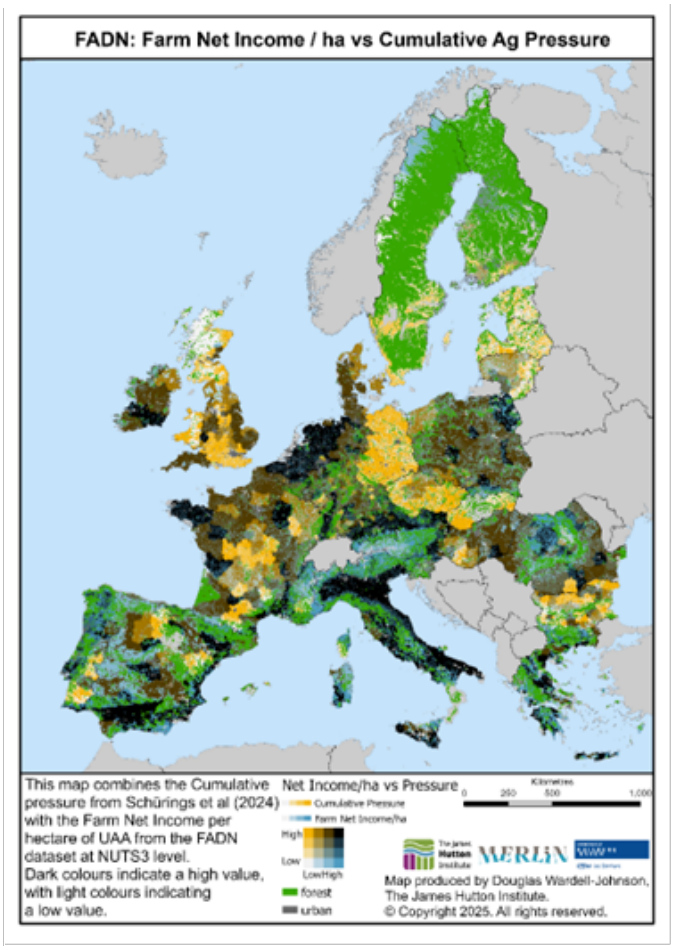


Figure 9: Farm net income and

Figure 10: Farm net income

3.2.8 Farm Subsidy

Farm subsidy [FSDN Code SE605] can be interpreted as a measure of the degree of influence that incentives based public policy can have on the practice of land management, particularly where such incentives are linked strongly to the provision of public goods. By combining farm subsidy with NFI it is possible to generate a metric for the relative significance of farm subsidies. This is a key measure that provides a quantification of how influential subsidy payments are likely to be for land managers. This is articulated by in the bi-variate map below - Figure 11. The four corner classes are:

1. Low NFI and high subsidy (blue) – in these areas, subsidy has the potential to be highly influential, but it may be very hard to move from income support to coupled payments for the delivery by NbS of environment positive farming.
2. Low subsidy and high net farm income (red) are systems where subsidy may be less influential, but profitability means that these businesses could have capacity to undertake management with extra costs or land sparing where it delivers substantive public goods e.g. via implementing NbS.
3. Low subsidy and low net farm income areas (white) include areas with low intensity, extensive management but not in all cases. These areas represent significant challenges since any loss of income would undermine business viability without some degree of redistribution of subsidy to compensate.

4 Finally, there are the high subsidy, high NFI areas where there is capacity to change but possibly less leverage to achieve it using subsidy. In these areas, their market orientation may mean that supply chain signals will be more influential.

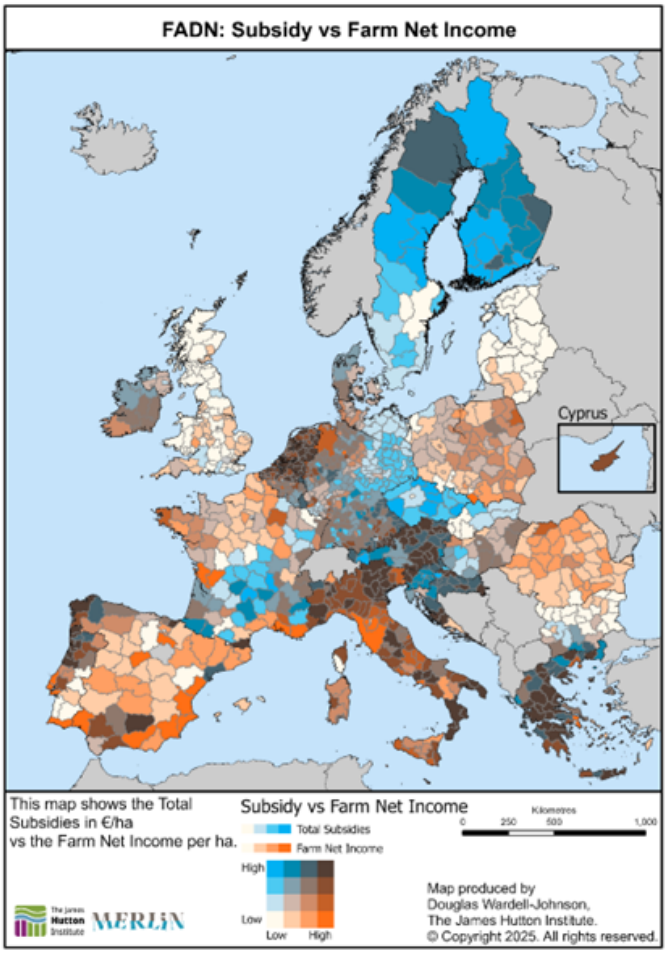


Figure 11: Subsidy compared to Farm Net Income

3.2.9 Farm Types

Farm types provide more specific information with which to interpret the compatibility of farming systems with aquatic restoration using NbS. For example, the presence of crops may mean some measures are more costly to implement or not feasible, and conversely the mobility and seasonal patterns of livestock movement may mean that their grazing systems are not a constraint (e.g. on flood plain reconnection). As categorical data farm types are harder to combine into a single metric and with 14 classes even the simplest categorisation would generate too many maps to be readily comparable. Using the degree of dominance of regions can be undertaken based on counts, areas or output value. An example of area-based dominance is presented below. Even with the limitations noted, the map makes clear the diversity of dominant farm types across the EU.

To inform interpretations of farm types, the degree of dominance by farm types is desirable as with so many classes the most extensive farm type may still be a small minority of the area. Mapping the diversity of farm types may also be a useful metric in assessing the complexity of farm systems within which any aquatic restoration using NbS would need to occur. Finally, it may be possible to simplify the classes and use a three-colour map to show the balance between livestock based, crop based and permanent crops (wine, olives etc).

Where farm types are associated only with subsets of the region then there could be useful disaggregation of land within the region using supplementary datasets such as classification of remote sensing data, though this tends to be more successful with crop-based systems where cover and farm type relationships are more easily discerned.

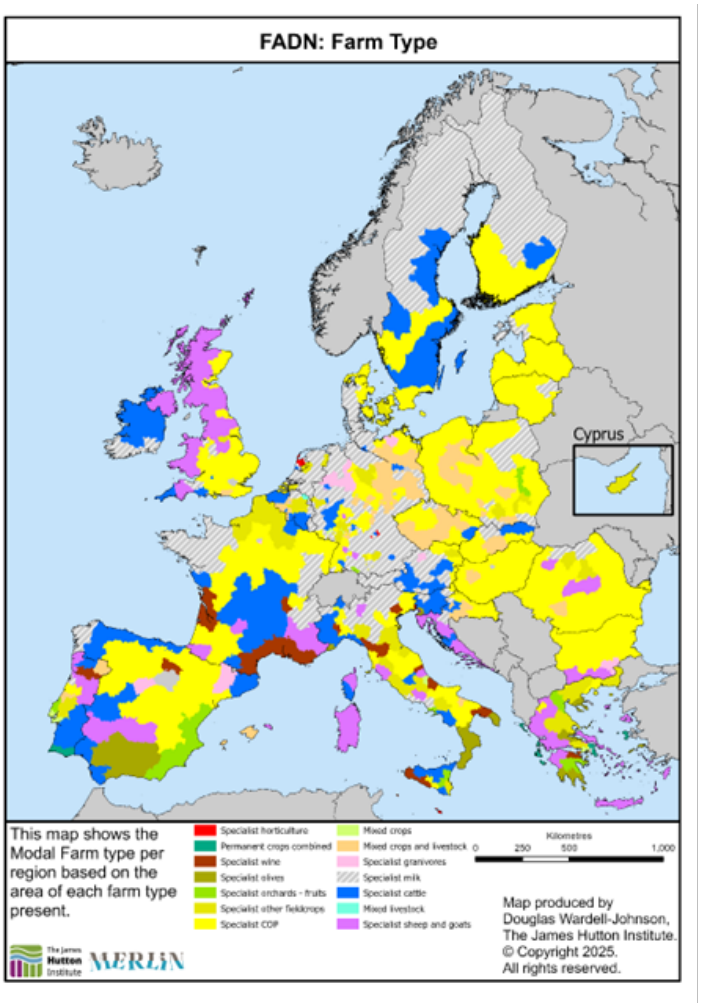


Figure 12: Distribution of Standard Farm types

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