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D 1.3

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Project Abstract

Biodiversity protection and restoration are critical for maintaining ecological balance and ensuring the planet's sustainability. In the absence of sustainable management and protection of natural resources, the negative impacts of climate change and other environmental issues will only increase.

Private investment can be a critical tool with the potential to play a transformative role in financing conservation and restoration efforts, as public financing alone may be insufficient to address the scale of these challenges.

By activating innovative sustainable finance solutions and incorporating technological advances within the field of geospatial analytics, private investment can be leveraged in a way that benefits the environment and secures investors' confidence.

BIO-CAPITAL is going to implement an interdisciplinary research and innovation endeavour by combining actions in the three fields of (i) biodiversity protection and restoration, (ii) biodiversity-friendly financing mechanisms and (iii) advanced space technology. Implementation will involve four key steps to leverage innovation:

- BIO-CAPITAL will analyse, understand and learn from use cases.
- BIO-CAPITAL will elaborate, monitor, and demonstrate through use cases.
- BIO-CAPITAL will co-develop, implement and amplify back to the use cases.
- BIO-CAPITAL will engage stakeholders, in order to reach shared views on these three steps and how they can be effectively combined to increase financial flows for biodiversity protection, restoration and sustainability.

Foreword

The BIO-CAPITAL project represents a pioneering initiative aimed at addressing the critical global challenges of biodiversity loss and ecosystem degradation. The project seeks to create innovative financial mechanisms that can support biodiversity protection and restoration by mobilising private investments and integrating advanced technologies such as geospatial analytics. In the face of climate change and the rapid depletion of natural resources, it has become clear that traditional approaches—relying primarily on public funding—are no longer sufficient to meet the scale of these environmental challenges.

BIO-CAPITAL is an interdisciplinary project that brings together experts from various fields to explore new ways to finance conservation efforts through mechanisms like Biodiversity Certificates (BC), Payments for Ecosystem Services (PES), and Nature-based Solutions (NBS). By focusing on the intersection of finance, technology, and environmental sustainability, the project aims to create a more resilient and ecologically sound future, ensuring that biodiversity-rich areas are not only protected but also sustainably managed.

The Use Cases Description deliverable plays a crucial role in the success of the BIO-CAPITAL project. It offers a detailed exploration of real-world scenarios where innovative financial mechanisms and advanced geospatial technologies are applied to support biodiversity conservation. These use cases serve as practical examples, illustrating the challenges, solutions, and outcomes associated with integrating biodiversity protection into sustainable forest management, land restoration, and conservation efforts.

The project can gain valuable insights into how different financial instruments and technological tools can be effectively utilised by analysing these use cases. The deliverable also outlines lessons learned from each use case, highlighting both the successes and challenges encountered. These findings will be instrumental in refining the project's approach and scaling up its impact, ultimately contribute to creating more robust financial frameworks for biodiversity protection.

The Use Cases Description is a key resource for policymakers, investors, and stakeholders, offering a roadmap for how financial and technological innovation can be leveraged to address the pressing issue of biodiversity loss. It emphasises the importance of collaboration across sectors and underscores private investment's role in fostering a sustainable and biodiverse future.

List of participating organisations

Participant No.	Participant Organisation Name	Country
1 (Coordinator)	CESKA ZEMEDELSKA UNIVERZITA V PRAZE	CZ
2	GEOSYS	FR
3	AGROSOLUTIONS	FR
4	PRATENSIS	SI
5	INSTITUTUL DE CERCETARE PENTRU ECONOMIA AGRICULTURII SI DEZVOLTARE RURALA BUCURESTI	RO
6	AGCURATE BV	NL
6.1	AGCURATE BILGI TEKNOLOJILERI ANONIM SIRKETI	TR
7	GND TECHNOLOGY	LT
7.1	GND ADVISORY	LT
8	ON YEDI SURDURULEBILIRLIK HIZMETLERI DANISMANLIK AS	TR
9	UNIVERSITE CATHOLIQUE DE LOUVAIN	BE
10	FORUM PER LA FINANZA SOSTENIBILE ENTE DEL TERZO SETTORE	IT
11	JSC ONE S.R.L.	IT
12	Carbone 4	FR
13	AGRI SUD OUEST INNOVATION	FR
14	AARHUS UNIVERSITET	DK
15	OIKOPLUS GMBH	AT
16	COLLABORATING CENTRE ON SUSTAINABLE CONSUMPTION AND PRODUCTION GGMBH	DE
17	WESTCOUNTRY RIVERS TRUST LBG	UK

Change Log:

Version	Date	Description
V1.0	23.08.2024	Creation of draft version
V1.0	18.09.2024	Improved version
V1.0	30.09.2024	Reviewed and finalised by all the respective Use Cases Managers
V1.0	02.10.2024	Final version
V2.0	03.08.2025	Creation of improved version
V2.0	1.10.2025	Submission for internal review
V2.0	16.12.2025	Reviewed and finalised

Table of Contents

Definitions and Abbreviations

Abbreviation	Meaning
CA	Consortium Agreement
CICES	Common International Classification of Ecosystem Services
CMS	Content Management System
CSS	Cascading Style Sheets
D.	Deliverable
DoA	Description of Action
EC	European Commission
EU	European Union
ESS	Ecosystem Services
GDPR	General Data Protection Regulation
HTML	HyperText Markup Language
IPBES	International Panel on Biodiversity and Ecosystem Services
PU	Public
SEEA	System of Environmental-Economic Accounting
SEO	Search Engine Optimization
KPI	Key Performance Indicator
WP	Work Package
UC	Use Case

1. Introduction

The Use Cases within the **BIO-CAPITAL** project serve as practical demonstrations of how innovative financial mechanisms, coupled with cutting-edge geospatial technologies, can be employed to address biodiversity protection and restoration challenges. These real-world examples are essential in testing and refining the project's approaches to creating sustainable financing models that align environmental objectives with economic viability.

Each use case explores a distinct scenario in which biodiversity-friendly financing mechanisms—such as Biodiversity Certificates (BC), Payments for Ecosystem Services (PES), and Nature-based Solutions (NBS)—are applied to tackle complex environmental issues. By examining the dynamics of these scenarios, BIO-CAPITAL aims to generate valuable insights on how private investment can be mobilised to complement public funding in efforts to conserve natural resources, restore ecosystems, and mitigate the impacts of climate change.

In addition to the financial innovations, the use cases incorporate advanced geospatial analytics and space technologies to enhance monitoring, evaluation, and decision-making processes. These technologies enable stakeholders to track biodiversity outcomes, optimise resource allocation, and assess conservation projects' ecological and financial impacts.

The Use Cases represent a holistic approach, emphasising the importance of collaboration between diverse stakeholders, including governments, private investors, conservation organisations, and local communities. Through this interdisciplinary framework, BIO-CAPITAL seeks to ensure that the financial tools designed are not only economically viable but also socially inclusive and environmentally sustainable.

The use cases provide a structured way to assess:

- Real-world challenges and opportunities in biodiversity protection.
- The effectiveness of financial and technological innovations in delivering ecological and economic outcomes.
- The scalability and replicability of these solutions across different regions and ecosystems.

By studying these use cases, the BIO-CAPITAL project will be able to validate its strategies, refine its financial models, and provide concrete recommendations for scaling up biodiversity-friendly investments worldwide.

2. Use Cases Description: 1

2.1. UC1: Alpine forests, Austria and Italy

2.1.1 Use Case Overview

UC ID and Title

UC1: Alpine Forests, Closer-to-Nature Forest Management in Austria and Italy

Lead Organisation(s)

JSC One

Duration and Timeline (phases of implementation)

Gantt diagram of UC1 (see Annex 1)

2.1.2 Location and Ecosystem Profile

Description of UC structure

Practice oriented

Geographic Coverage

UC1 refers to the Austrian and Italian Alps, in general, as a mountain range within the Alpine Biogeographical Region, as defined by EU legislation, e.g., UC1 does not refer to specific sites but, generally, to the Austrian and Italian Alps, whose orographic features determine the difficult accessibility of their forestry activities.

2.1.3 Environmental Context

Key Biodiversity Features

Alpine regional features include a relatively cold and harsh climate, high altitudes, and a complex topography. Such specific habitats host a wealth of biodiversity. Forests and semi-natural grasslands are found on the lower slopes (e.g., starting from approx. 600m asl), but, as the altitude increases and the temperature drops, trees become scarcer, giving way to alpine grasslands (e.g., at approx. 2000 m asl), fells and scrub heath communities. At their summits, amongst the rocks and snow, the vegetation is reduced to only a handful of highly adapted plants, able to tolerate such extreme conditions. Mountains have highly compressed life zones: habitats and species alter rapidly with altitude. The complex topography and differing exposures (sheltered south-facing slopes, snow pockets, wind-blasted crags and uneven rock screes) also create a myriad of different micro-climates. All this explains why the Alpine mountains host such a rich and diverse biodiversity.

Because mountains still harbour large unfragmented areas where human disturbance is limited, they are an important retreat for many species (also large carnivores, such as wolves, bears, lynx) and birds (such as many species of raptor: eagles, falcons, vultures). The region is inhabited by true alpine specialists, including rodent species, such as the snow vole (Microtus nivalis), ungulates, such as the alpine ibex (Capra ibex) and many invertebrates, side by side with species,

well adapted to the mountain environment, including the ptarmigan (Lagopus muta). Many birds also stop over during migration. The Alpine mountains also boast a particularly large variety of insects (e.g., beetles and butterflies).

Threats and Pressures (current and historical)

Apart from climate change, which presents a major threat (see below), the Alpine Mountain ranges are also facing specific threats and pressures.

Typically, these regions have always been poorly populated, due to their harsh climate, difficult access and short-growing seasons. Nevertheless, for centuries, activities such as pastoral farming and traditional wood extraction practices, significantly contributed to the region's rich biodiversity. These traditional practices have been disappearing rapidly, negatively impacting the environment and, specifically, biodiversity.

Other factors are heavily impacting this particularly fragile environment, e.g., the damming and channelling of alpine rivers, the construction of roads, mass tourism and the mechanisation of forestry.

Climate Change Vulnerabilities

Climate change presents in high-altitude regions a particular threat. Because of narrow ecological and climatic bands in the mountains, a small change has disproportionate effects on their ability to absorb and retain water. The fast shrinking of glaciers poses an existential threat to many species, typical of those ecosystems. Additionally, their retreat has a dramatic impact on the entire water cycle, which extends beyond the mountains to the lowlands, affecting natural ecosystems as well as human activities (e.g., droughts in agriculture).

2.1.4 Use Case Objectives

Overview of Objectives

The objective of the Use Case (UC1) is to identify innovative solutions for unlocking financial flows to improve sustainable Alpine-forest management practices that preserve and restore biodiversity according to the New EU Forest Strategy for 2030 and the EU Biodiversity Strategy for 2030. The UC would build on a few representative Case Studies for the Alpine region (see Annex 2), impacted by the climate and environmental crises, which pose unprecedented challenges to forest managers due to geophysical obstacles/limited accessibility of sites. Significant barriers impede the implementation of Closer-To-Nature / Sustainable Forest Management (SFM) practices for protecting and restoring biodiversity, according to the EU Guidelines, 27.07.2023 (EU-Guidelines 2023 – see Annex 3). These barriers result in economic constraints, which often lead to delays or failure in adopting the envisaged best practices for biodiversity. These depend, above all, on the fact that "Forests have a comparatively long-time delay between a management intervention and the response to that intervention. This makes it indispensable to adopt a forward-looking framework with a long-term vision" (EU-Guidelines 2023, p. 40).

The UC will examine the potential adoption of the most appropriate innovative financial tools for addressing the economic issues and constraints analysed in the Case Studies, considered independently and/or within initiatives of a broader scope (e.g., area-based conservation

measures). These will be selected from the tools identified within WP 2, 4 and 5 deliverables, such as Payments for Ecosystems Services (PES), insurance products, biodiversity certificates or credits.

Tasks and Implementation Approach

In the context of Alpine forests, sustainable forest management (SFMs) practices face a unique set of challenges. One of the most pressing issues is to balance the need for containing operational costs with the requirement to supply sufficient quantities of raw wood and biomass to the market. Forest management practices, such as those addressed in the Case Studies, directly influence production costs, impacting the overall financial viability of forestry operations.

To mitigate risks of environmental degradation, the deployment of ecologically rational forest-management practices is critical. However, implementing such practices often lacks a solid economic rationale, making it difficult for forest operators to adopt them without compromising financial viability.

On the one hand, UC1 will explore, also by engaging stakeholders, possible policy measures for aligning potential actions along the value chain.

On the other hand, to achieve this, appropriate and innovative financial solutions/approaches are essential, given that insufficient financial incentives would jeopardise the adoption of biodiversity-friendly practices.

Environmental Goals

The objective of the Use Case (UC1) is to identify innovative solutions for unlocking financial flows to improve sustainable Alpine-forest management practices that preserve and restore biodiversity according to the New EU Forest Strategy for 2030 and the EU Biodiversity Strategy for 2030. Economic Goals (including Investment Requirements and Financial Scope) The overall economic goal of UC1 is to make economically/financially viable the implementation of Closer-to-Nature forest-management practices.

Policy Alignment: UC1 is intrinsically aligned to the EU Green Deal policy. Inf fact, best practices for Forestry are formally identified by the EU in the Guidelines on Closer-to-Nature Forest Management (27.07.2023). These Guidelines endorse nature-positive measures which are generally accepted among researchers and forest practitioners and, as such, not usually disputed from the standpoint of their positive impact on nature. The main issues and concerns arise in terms of their operational and economic-financial viability, which, in fact, pose the main constraints to their deployment. These constraints refer to Forestry, in general, but, particularly, in Alpine Forestry, characterised by specific barriers in terms of accessibility and the use of existing techniques.

Expected Outcomes

The expected outcomes are twofold:

a) explore, also by engaging stakeholders, possible policy measures for aligning environmental and financial incentives along the value chain.

b) identify appropriate and innovative financial instruments/approaches to incentivise the adoption of biodiversity-friendly practices.

2.1.5 Beneficiaries

Primary Beneficiaries: The primary beneficiary of Closer-to-Nature forest-management practices the Nature.

Nature-positive outcomes are not impacting the core business goals of stakeholders in the Forest value chain, given that forest trees need many decades to grow to maturity. Therefore, costs incurred in a certain year to improve the qualitative features of a forest (e.g., improved sustainability) will, generally, show their effects in monetary terms (if at all) only over a very long time-span (many decades), which go far beyond business and financial planning periods. Instead, these outcomes relate to the conservation / protection / restoration of Nature as a common good (Global/Local Commons)

Secondary Beneficiaries: Given the answer/explanation above, the secondary beneficiaries of Closer-to-Nature forest-management practices are landowners as well as all the actors along the value chain.

Stakeholder Roles and Engagement Strategy: In order to address the expected outcomes, the stakeholders engagement strategy needs to build on the premise that, in a market economy, externalities resulting from the use of a common good should be reflected in market prices. This fact implies that the engagement strategy should aim to involve, when possible, all key stakeholder categories throughout the value chain, including public bodies (Ministries, Regional Forest Authorities, etc.) in their role as policy makers and implementors. The main stakeholder categories to be involved are a) forest owners/managers; b) afforestation and harvesting service providers; c) industrial transformation companies (essentially saw-mills) and/or wood industry associations; d) public bodies (such as Forest and Nature conservation authorities).

2.1.6 Methodology

Overview of Research & Stakeholder Engagement

Research and Stakeholder Engagement activities address the two expected outcomes: a) explore policy measures for aligning environmental and financial incentives along the value chain; b) identify appropriate and innovative financial instruments/approaches to incentivise the adoption of biodiversity-friendly practices. Research activities are initially based on comprehensive overviews (mappings) of the existing policy framework as well as of the financial instruments / approaches. The above-mentioned research activities are carried out within WP2 for both the existing EU policy and legal framework, related to biodiversity protection, and the potentially relevant financial instruments/approaches for UC1.

These research activities are carried out, first of all, through a desk research review of the scientific and grey literature, concerning both the policy and financial framework for biodiversity protection investments and for enablers/barriers to the market adoption and uptake of relevant financial instruments/approaches.

On the basis of the key findings and insights from the desk research review, WP2 identifies innovative and/or improved financial instruments/approaches, potentially relevant for enhancing biodiversity. Each financial instrument/approach is then evaluated to determine its potential effectiveness also within UCs (UC1), and so serve as the basis for the activities carried out together with the WP4 and WP5 teams in developing innovative and scalable financial instruments/approaches that support biodiversity enhancement.

Stakeholder engagement is carried out, building on the results of the above-described research activity and focusing on a few Case Studies for closer-to-nature forest management of specific relevance for the Alpine region (see EU-Guidelines 2023, pp. 44- 53).

The Case Studies examine the economic/financial barriers and potential policy shortcomings in the implementation of such closer-to-nature practices in order to drive uptake. Following these Case Studies, ideas for improvement opportunities will be collected from stakeholders along the wood value-chain (e.g., Forest and Nature conservation authorities, land owners/managers, logging companies and wood industry associations) and discussed within working sessions (one-to-one meetings and a final workshop).

2.1.7 Innovative Financial Mechanisms

Nature-based Solutions (NbS) will play a pivotal role in financial mechanisms. By promoting solutions that work with nature to address environmental challenges—such as enhancing forest ecosystems' natural ability to sequester carbon or regulate water cycles—NbS can create measurable outcomes, attractive to investors. This opens the door for more substantial private investment in sustainable forest management, shifting some of the financial burden away from public funds.

Typology of Instruments:

The most appropriate, innovative and scalable financial instruments/approaches for supporting biodiversity enhancement for UC1 are selected on the basis of the key findings/ insights from the desk research review in WP2 and then evaluated together with the WP4 and WP5 teams. Potentially relevant financial instruments/approaches include the following:

- Payments for Ecosystem Services (PES)
- Blended Finance
- Biodiversity (Carbon) credits / Biodiversity Certificates
- Green Bonds
- Insurance Schemes

Some of these could be of greater relevance for financing biodiversity projects in the Alpine mountains, with a broader scope (e.g., area-based conservation measures) than the implementation of single closer-to-nature forest management measures (see Annex 2).

Alignment with Triple Capital Accounting (Natural, human/social, financial capital) For Alpine Forestry, TCA could be of relevance only in its Natural capital component. Natural capital scarcity

will inevitably increase and therefore its potential market value could become explicitly considered also for specific large-scale environmental projects, aiming to monetise the intrinsic value of natural assets. Given the administrative costs of such systems, their implementation needs to be supported by a clear economic rationale.

2.1.8 Risk Management Strategies

In Alpine Forestry, risk-management strategies are essentially of an operational kind. Generally speaking, insurance companies do not currently offer products covering relevant risks in Alpine Forestry (e.g., Heavy storms, causing windthrows; Pests-bark beetles; Droughts). That said, it would be very positive if insurance companies could offer coverage with affordable premiums.

2.1.9 Implementation Roadmap

Phase / Milestone	Description	Related WP(s)	Due date	Notes
Phase 1 Setting up UC1				
	UC1 description	WP1	M3 M16	D1.3 D1.3 – Revised
Phase 2 Mapping policy/legal framework and financial mechanisms for biodiversity uplift				
UC1-MS1	Integration of key findings on biodiversity financing mechanisms	WP2 WP4 WP5	M24	D2.1, D2.2, D2.4
Phase 3 Developing financial solutions for protecting and restoring biodiversity				
UC-MS2	Co-design of financial solutions (incl. Biodiversity certificates and credits)	WP4 WP5	M42	D4.2, D4.3, D4.4, D5.4

Supporting Material

- Annex 1 - Gantt diagram
- Annex 2 – Case Studies
- Annex 3 – Guidelines on Closer-to-Nature Forest Management (27.07.2023) *https://environment.ec.europa.eu/publications/guidelines-closer-nature-forest management_en*

3. Use Cases Description: 2

3.1. UC2: Agricultural land (arable crops, pastures and vineyards), France

3.1.1 Use Case Overview

UC ID and Title

UC2: Agricultural land (arable crops, pastures and vineyards), France, Regenerative agriculture

Lead Organisation(s)

Agri Sud-Ouest Innovation (ASOI)

Duration and Timeline (phases of implementation)

Gantt diagram of UC1 (see Annex 1)

Supporting partners

AgroSolutions (AS)

3.1.2 Location and Ecosystem Profile

Occitanie, France

LILAS4SOILS Project (HE proposal #101157414): LILAS4SOILS is a European project which aims to foster Carbon Farming Practices (CFPs) through Living Labs in the Mediterranean and Southern EU for the healthy future of European Soils. In the French Living Lab, 6 demonstration sites have been identified in the Occitanie region of France (Figure 1). They are representative of common agriculture profiles in southern France (dairy cow farms, vineyards, orchard or field crop farms). Each demo-site will implement CFP, among a non-exhaustive list of CFPs (table 2), depending on the context and the pedoclimatic conditions of the farm.

The Occitanie region, in the south of France, enjoys a diverse climate ranging from Mediterranean along the coast to oceanic and mountainous in the inland and Pyrenean areas. This climatic diversity supports a rich and varied agricultural landscape, including vineyards, olive groves, fruits and vegetables, cereals, and livestock farming. The Mediterranean climate, with its hot, dry summers and mild, wet winters, is particularly well-suited to viticulture and arboriculture, making Occitanie one of the leading wine-producing regions in Europe. However, the region is increasingly affected by climate change, with rising temperatures, prolonged droughts, and more frequent extreme weather events such as hailstorms, heavy rains, and wildfires. These pressures are pushing farmers to adopt agroecological approaches, irrigation management, and climate-resilient crop varieties to safeguard yields and natural resources. Despite these challenges, Occitanie remains a dynamic agricultural region, blending tradition with innovation to adapt to an evolving climate.

Aube, Grand Est, France

APAD is the Association for the Promotion of Sustainable Agriculture. It's a French NGO that works to promote sustainable and regenerative agricultural practices—especially conservation agriculture—among farmers, policymakers, and the broader public. Farmers who are members of APAD have volunteered to take part in the Bio-Capital project and make a plot or patch of land available for the study. These are farmers have been specialists in regeneration agriculture for several years.

La SCARA, which stands for Société Coopérative Agricole de la Région d'Arcis, is a farmers' cooperative also in the Grand Est region of northeastern France. Some SCARA farmers have also expressed a desire to take part in the project and make a plot of land available for the Bio-Capital study.

The Aube department, located in the Grand Est region of northeastern France, benefits from a temperate climate with continental influences, which creates favorable conditions for a wide range of agricultural activities. The region experiences cold winters and warm, often dry summers, with annual rainfall ranging between 650 and 800 mm, distributed relatively evenly throughout the year. These climatic conditions support the cultivation of key crops such as wheat, barley, rapeseed, and sugar beet, which are central to the local economy. However, agriculture in Aube also faces challenges linked to climatic variability, including late spring frosts, summer droughts, and occasional hailstorms that can affect crop yields. To adapt, many farmers are turning to sustainable practices such as conservation agriculture, which helps improve soil health, increase resilience to climate extremes, and reduce environmental impact. The plots under study in Bio-Capital are not located in a Natura 2000 area.

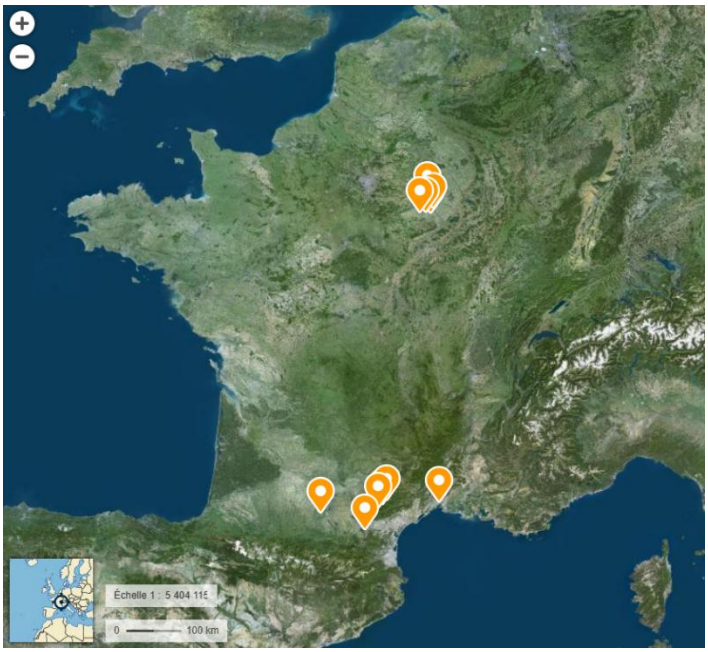


Figure 1: localization of plots in the French UC

Table 2. CFP implemented in in LILAS4SOILS (excerpt from LILAS4SOIL project)

	CARBON FARMING PRACTICES (CFPs)	CO-BENEFITS FOR FARMERS AND SOCIETY
Peatland manage-ment	(1) Keeping existing peatlands wet to avoid emissions (either for nature conservation or through paludiculture)	Potential for paludiculture. Biodiversity, flood regulation, water quality.
	(2) Rewetting and restoring previously drained peatlands (to avoid emissions from degrading peatlands)	
Agro-forestry	(3) Increasing silvoarable and silvopastoral systems	Diversification of outputs protects against single crop failure. Improved water retention, soil health, biodiversity.
	(4) Hedgerow or field boundary tree cover	
Maintaining SOC on mineral soils	(5) Cover cropping	Improved water retention capacity, productivity, reducing ecological footprint. Soil health, biodiversity, improve landscape.
	(6) Improved crop rotations	
	(7) Maintaining grassland without ploughing up (no till)	
	(8) Conversion from arable land to grassland	
	(9) Organic farming	
	(10) Management of grazing land and grassland	
Livestock management	(11) Directly reducing enteric methane (including feed additives and improved feed digestibility/efficiency)	Lower input costs, soil health, productivity. Decreased nutrient runoff and leaching, decreased N emissions.
	(12) Reducing NO emissions through manure management (including manure storage and processing, anaerobic digestion and bio methane, and cover cropping)	
	(13) Efficiency improvements including animal management to improve productivity (through herd management and feed management)	
	(14) Animal fertility improvements	
	(15) Grazing and grassland management	
Nutrient management	(16) Improving nutrient planning	Lower input costs, recycling resources, minimizing pollution. Decreased nutrient runoff; decreased N emissions, improving sustainability.
	(17) Improving timing and application	
	(18) Use of nitrification inhibitors	
	(19) Combination with agronomic practices (legume crops, residue management/incorporation, or inclusion of temporary leys/grasslands in the crop rotation)	

3.1.3 Environmental Context

Agricultural biodiversity refers to a wide range of elements like crop diversity, livestock diversity, soil biodiversity, pollinators, natural pests, etc. The ones we are interested in in Bio-Capital are the ones which are measurable by geodata

- diversity of crops and livestock breeds thanks to the technical itineraries of farms and plots
- semi-natural elements like hedgerows, flower strips, and wetlands which increase habitat complexity and support wildlife. Diverse farming landscapes also enhance ecosystem services such as water regulation and carbon storage.

Agriculture has faced numerous historical and current threats to biodiversity. Historically, the shift toward monocultures and intensive farming reduced crop and livestock diversity. Widespread pesticide and fertilizer use degraded soil health and harmed non-target species like pollinators. Land-use change, including deforestation and wetland drainage, destroyed natural habitats. Today, climate change adds pressure, altering growing conditions and stressing ecosystems. Water overuse for irrigation affects aquatic biodiversity. The loss of hedgerows and field margins reduces habitats for beneficial insects and birds. Invasive species introduced through global trade can outcompete native ones. Overgrazing by livestock depletes vegetation and soil life. Urban

expansion continues to fragment farmland. Together, these factors reduce ecosystem services and resilience in agriculture.

Climate change vulnerabilities

Climate change poses several vulnerabilities to biodiversity in agriculture, affecting both ecosystems and food production. Key impacts include:

- Shifts in species distribution: many plants, pollinators, and pests are moving to new areas, disrupting ecological balances. Rising temperatures and habitat loss reduce populations of bees, butterflies, and other vital pollinators.
- Soil degradation: increased droughts, floods, and heatwaves reduce soil biodiversity and fertility.
- Water stress: scarcity of water affects both crop health and aquatic biodiversity in agricultural landscapes.

Baseline biodiversity status

The baseline biodiversity status before interventions refers to the initial condition of ecosystems and species diversity in an agricultural area before any restoration or conservation actions are taken. It serves as a reference point to measure progress and the effectiveness of future interventions.

In agriculture, this baseline typically includes:

- Species richness and abundance: in the case of Bio-Capital, this kind of data can be explicated by the technical itinerary of the plot (i.e..Associated crops, cover crops, …). Existing pressures such as pesticide use, monocultures, erosion, and pollution could also be indicated.
- Habitat quality and landscape diversity: presence or absence of natural features like hedgerows, flower strips, wetlands, or wooded patches, which can be easily measured by geodata.
- Soil biodiversity: microbial activity, earthworm populations, and overall soil health indicators. These indicators would be difficult to measure in the case of Bio-Capital project.

Alignment of current agricultural policies in France with regenerative agricultural practices

France has progressively aligned its agricultural policies with regenerative agriculture principles, particularly through the promotion of agroecology and sustainable farming practices. Since the early 2000s, the country has recognized agroecology as a key component of its agricultural strategy, emphasizing the integration of ecological principles into farming systems. This approach was institutionalized with the 2014 Law for the Future of Agriculture, Food, and Forestry, which aimed to promote agroecological practices by supporting economic and environmental interest groups and incorporating agroecology into agricultural education. The Economic and Environmental Interest Groups (GIEE) are a central pillar of France’s agroecological policy and are closely aligned with the principles of regenerative agriculture. Created under this same law, these collectives bring together farmers and other stakeholders around projects aimed at

simultaneously improving the economic, environmental, and social performance of farms. They promote technical, organizational, and social innovation through collaborative and place-based approaches.

The CAP encourages the establishment and maintenance of agro-ecological infrastructure (AEI) on farms (hedges, fallow land, permanent grassland, ponds, ditches, isolated trees, etc.). To be eligible for the CAP, a farm must have at least 4% of its Utilised Agricultural Area (UAA) in agro-ecological infrastructure.

The CAP also favours farms with the Organic Farming or High Environmental Value labels.

France has been a frontrunner in promoting agroecology, which shares many principles with regenerative agriculture, such as minimizing chemical inputs, enhancing biodiversity, promoting crop rotations, and increasing soil organic matter. The Loi d'Avenir pour l'Agriculture (2014) formally introduced agroecology as a national objective, encouraging farmers to shift toward more sustainable practices. Under the CAP, France implements eco-schemes (éco-régimes) that provide financial incentives to farmers adopting practices like cover cropping, extensive pasture-based systems, and hedgerow maintenance—all of which align with regenerative principles.

Strategic frameworks to promote regenerative agriculture in France

One of the key strategic anchors is France's Agroecology Policy, officially launched with the Law for the Future of Agriculture, Food, and Forestry (2014). This law positions agroecology—closely aligned with regenerative agriculture—as the reference model for French agriculture. It promotes farming systems that enhance soil health, reduce chemical inputs, restore biodiversity, and build resilience to climate change. Through this law, tools such as the Groupements d'Intérêt Économique et Environnemental (GIEE) were created to foster collective projects for agroecological transition, often implemented at the landscape or watershed level.

Another significant framework is the Plan Stratégique National (PSN), which is France's implementation of the EU Common Agricultural Policy (CAP) 2023–2027. This plan allocates subsidies toward practices that support climate and environmental goals. It emphasizes support for crop diversification, permanent grasslands, agroforestry, and organic farming—core practices of regenerative systems. Within this structure, eco-schemes (écorégimes) reward farmers adopting sustainable practices beyond the regulatory baseline.

A particularly innovative instrument is the Label Bas Carbone (Low-Carbon Label), launched by the French Ministry for Ecological Transition in 2019. This voluntary certification scheme allows farmers to earn carbon credits by implementing practices that sequester carbon or reduce emissions—such as cover cropping, hedgerow planting, reduced tillage, and pasture management. These certified reductions can be monetized through carbon finance, attracting private investment in regenerative agriculture. The methodology is science-based and increasingly incorporates biodiversity and soil co-benefits, aligning well with regenerative goals.

France is also part of the international "4 per 1000" initiative, which promotes increasing soil carbon stocks by 0.4% per year as a climate mitigation strategy. The initiative, launched during COP21 in Paris, serves as a scientific and policy platform to encourage regenerative practices globally.

Impact of National Policies on agro-ecological initiatives

To better support agro-ecological initiatives, national policies in France could benefit from a fundamental shift in their underlying approach: moving from a predominantly regulatory and constraint-based model to one that emphasizes voluntary engagement supported by attractive incentives and fair remuneration.

Currently, many agricultural policies are built around regulatory compliance, often requiring farmers to meet strict environmental standards under penalty of losing subsidies or facing sanctions. While these regulations serve important environmental goals, they can also create a sense of burden or limitation for farmers, especially when the administrative workload is high and the financial return uncertain. This dynamic risks alienating farmers who might otherwise be willing to engage in agro-ecological transition.

A more effective approach would be to reframe agro-ecological practices as opportunities rather than obligations, by designing policies that reward rather than impose. This could be achieved by expanding and enhancing voluntary schemes—such as eco-schemes, agro-environmental measures (MAECs), and mechanisms like the Label Bas Carbone—that provide financially meaningful and stable remuneration for farmers who choose to adopt regenerative or agro-ecological methods. Instead of requiring compliance with top-down rules, these programs would offer clear environmental and economic value in exchange for measurable outcomes such as improved soil health, carbon sequestration, biodiversity restoration, or reduced pesticide use.

To further support this shift, policies could also invest in simplified access to certification, reduce administrative complexity, and prioritize locally adapted incentives developed in consultation with farmers and rural stakeholders. This would strengthen trust and engagement while ensuring that payments reflect the true cost and long-term benefit of agro-ecological practices.

2.1.4 Use Case Objectives

Environmental goals

Restoring biodiversity in agriculture is vital for creating sustainable farming systems that support ecosystems and improve resilience. It enhances essential services like pollination, soil fertility, and natural pest control, reducing the need for harmful chemicals. Diverse agricultural landscapes also improve water regulation and soil health, helping to sequester carbon and mitigate climate change. Biodiversity fosters genetic diversity in crops and livestock, ensuring greater resilience to pests, diseases, and extreme weather events. By incorporating practices like agroforestry and crop rotation, biodiversity restoration helps create more resilient, environmentally friendly agricultural systems that support both nature and food security.

Regenerative agriculture

Regenerative agriculture is a holistic approach to farming that focuses on restoring and enhancing the health of ecosystems, particularly soil, biodiversity, and water cycles, while maintaining or even increasing agricultural productivity. Core practices include cover cropping to prevent erosion and build soil organic matter, crop rotation and diversification to break pest cycles and enrich biodiversity, and minimal or no tillage to preserve soil structure and microbial life. The application of compost and organic amendments boosts soil fertility and carbon content, while agroforestry

and the integration of perennial species foster more complex and resilient ecosystems. Holistic grazing systems mimic natural patterns to regenerate pastures, and efforts like wetland restoration or the planting of hedgerows create habitats for pollinators and wildlife. Reducing synthetic inputs and promoting natural pest control further supports ecological balance. These practices are intrinsically linked to biodiversity, as they increase species richness both above and below ground, improve habitat connectivity, and create more stable and resilient agricultural landscapes. In essence, regenerative agriculture not only sustains but actively enhances biodiversity, making it a powerful tool for ecological restoration and climate resilience in farming systems.

Social and economic goals

The social and economic goals of biodiversity restoration focus on improving community well-being and ensuring sustainable livelihoods. By restoring ecosystems, biodiversity can support local economies through enhanced agricultural productivity, ecotourism, and sustainable resource management. Healthier ecosystems improve food security, offering a stable supply of diverse crops and resources. Furthermore, biodiversity restoration can reduce long-term costs by mitigating the impacts of climate change and environmental degradation, ensuring economic stability for future generations. This approach promotes social equity by supporting marginalized communities in achieving sustainable development.

Policy Alignment

Biodiversity restoration in agriculture aligns with several key policies and frameworks designed to promote environmental sustainability and agricultural resilience. These include:

1. EU Biodiversity Strategy for 2030: This strategy aims to protect and restore biodiversity across Europe. It emphasizes the restoration of ecosystems, promoting nature-based solutions in agriculture, and enhancing biodiversity through the establishment of protected areas and ecological corridors.
2. European Green Deal: Aiming for a climate-neutral Europe by 2050, the Green Deal supports biodiversity restoration by promoting sustainable agriculture, reducing pollution, and encouraging practices that restore ecosystems, such as agroecology and agroforestry.
3. Common Agricultural Policy (CAP): The CAP includes measures to promote environmental sustainability in agriculture, such as green direct payments, eco-schemes, and agro-environmental measures, which incentivize biodiversity-friendly practices and help restore habitats and ecosystems in agricultural landscapes.
4. Water Framework Directive (WFD): This EU directive focuses on the protection and improvement of water quality. Biodiversity restoration in agriculture supports the WFD by reducing water pollution from agricultural runoff, improving water retention, and maintaining healthy wetlands and riparian zones.
5. Farm to Fork Strategy: Part of the European Green Deal, this strategy emphasizes sustainable food systems. It promotes biodiversity restoration in agriculture by

encouraging sustainable farming practices, reducing pesticide use, and supporting organic farming, all of which enhance biodiversity.

6. UN Sustainable Development Goals (SDGs): Biodiversity restoration in agriculture aligns with SDG 15 (Life on Land) and SDG 2 (Zero Hunger), fostering sustainable land management, food security, and conservation of biodiversity.

3.1.5 Beneficiaries

Primary beneficiaries

In the French UC, primary beneficiaries of financial mechanisms for biodiversity restauration would be landowners and Farmers. They would benefit from financial support to implement biodiversity-friendly practices, such as habitat restoration, sustainable land management, using remote sensing data to optimize land use and minimize environmental impact.

Secondary beneficiaries

- **Investors**: Private investors are secondary beneficiaries as they can achieve financial returns through sustainable projects that enhance biodiversity and ecosystem services, such as carbon credits, biodiversity credits, and other market-based mechanisms.
- **Public Institutions and Governments**: Local and national governments would benefit from the improved ecosystem services resulting from biodiversity restoration, such as enhanced flood control, water quality, and climate change mitigation. They may also see improved alignment with environmental regulations and international biodiversity commitments.
- **Consumers**: In the long run, consumers may benefit indirectly from the positive environmental outcomes of biodiversity restoration, such as better food security, healthier ecosystems, and reduced environmental risks.
- **NGOs and Environmental Advocacy Groups**: These groups benefit by gaining funding and data (e.g., from remote sensing technologies) to monitor and advocate for biodiversity conservation, habitat protection, and ecosystem restoration efforts.
- **Supply Chain Stakeholders**: Companies involved in agriculture, forestry, and natural resource management may benefit through increased access to sustainably sourced products, potentially leading to better market positioning and enhanced corporate social responsibility (CSR) profiles.

3.1.6 Methodology

The methodology linked to this Use Case will focus on the monitoring of various agroecological practices across farms (WP3). The implementation of practices promoting biodiversity is quite variable among the pool of farms. Our methodology includes:

- Engaging farmer groups to adopt agroecological infrastructure and transition agriculture. Agroecological infrastructures that farmers can adopt include hedgerows and buffer strips for habitat and erosion control, agroforestry, and crop diversification to enhance biodiversity and soil health, and cover crops to improve fertility and prevent erosion.

Ponds, wetlands, and wildlife corridors support wildlife, while integrated pest management reduces chemical pesticide use.

- Experimenting with biodiversity-enhancing practices such as crop diversification, hedgerows, and no-till farming. These practices help maintain ecosystems' balance, improve resilience to climate change, and support essential ecosystem services such as pollination, pest control, and soil fertility.
- Evaluating the relevance of various financial mechanisms to support farmers during their transition phase. Different financial mechanisms will be assessed, such as payments for ecosystem services (PES), triple accounting or mutual insurance funds. The evaluation will focus on the deployment potential of each mechanism regarding:
- Evaluation and monitoring mechanisms
- Organisation between stakeholders: contractualisation, governance, certification and audit processes.
- Match between the cost of implementing the practices and the funder's willingness to pay.
- Replicability (different agricultural and local contexts, larger areas)
- Promotion of the initiative among partners and in the value chain.
- Thinking of financial mechanisms such as mutual insurance funds to support farmers during the transition phase, after analysing biodiversity policy directions and investments opportunities (WP2).
- Integrating advanced technologies like remote sensing to monitor biodiversity and ecosystem services, including soil carbon sequestration, water quality, and pollination (WP3).

Each initiative within this UC adopts tailored approaches depending on the regional needs, land types, and farming systems. Monitoring and evaluation rely on both ground-level data and geospatial technologies, while socio-economic and ecological impacts are tracked to ensure long-term sustainability.

3.1.7 Innovative Financial Mechanisms

In a research project aiming to mobilize private investments for the restoration of biodiversity in agriculture through teledetection, several financial instruments can be applicable.

Biodiversity certificates and biodiversity credits can serve as tradable units that represent measurable ecological gains, which can be verified and monitored using remote sensing technologies. These instruments offer a way to channel private funding into agricultural practices that restore habitats or improve ecosystem functions, such as agroforestry, hedgerow planting, or regenerative farming.

Payments for Ecosystem Services (PES) are another suitable approach, where landowners are financially compensated for maintaining or enhancing ecosystem services; teledetection enables consistent and scalable monitoring of land use and biodiversity indicators to justify such payments. Green bonds, particularly those aligned with sustainability-linked targets, can be structured to fund large-scale agricultural biodiversity projects, with teledetection providing the data necessary for reporting and accountability.

Similarly, result-based payments are well-suited to biodiversity-focused projects when financial returns or incentives are disbursed only if certain biodiversity outcomes—validated via remote sensing—are achieved. Carbon credits, and increasingly biodiversity credits, may also be applied in agricultural contexts where co-benefits between carbon sequestration and biodiversity restoration exist, with teledetection used to quantify changes in vegetation cover, biomass, and landscape structure.

The enabling financial conditions for these instruments include the availability of reliable and standardized metrics for measuring biodiversity gains, which is where remote sensing offers strong potential. Clear regulatory frameworks, such as biodiversity offset policies or green finance taxonomies, are also critical to build investor confidence. The presence of demand from corporate actors seeking to meet environmental, social, and governance (ESG) commitments, or to offset biodiversity impacts, supports the development of such instruments. However, there are also significant barriers. One of the main challenges is the complexity of valuing biodiversity, which is multi-dimensional and context-specific. The lack of mature markets for biodiversity credits and the absence of widely accepted methodologies for biodiversity accounting can hinder investor interest. Additionally, in some cases, teledetection may not capture all relevant ecological changes, particularly for species-specific or micro-habitat data, limiting its applicability as a sole verification tool.

3.1.8 Risk Management Strategies

To manage financial risks, several strategies can be adopted. Blended finance mechanisms, which combine public or philanthropic funds with private capital, are often used to de-risk biodiversity investments and provide guarantees or first-loss capital. Insurance products linked to environmental outcomes or performance-based contracts can also be employed to share risk between actors. In addition, robust Monitoring, Reporting, and Verification (MRV) systems, like Label Bas Carbone in France, enabled by teledetection help reduce uncertainty for investors by providing transparent and consistent data on project outcomes. Financial risk is further mitigated through diversification of funding sources and the use of adaptive management approaches that allow projects to adjust based on environmental or financial feedback. Overall, while the integration of teledetection into biodiversity finance is promising, successful implementation depends on a combination of technical robustness, regulatory clarity, and innovative financial structuring.

3.1.9 Implementation Roadmap

What are the main phases and milestones? How does the use case integrate with other Work Packages?

- WP2: Financial Instruments
    - T2.1: see how the EU policy landscape and legal framework affects activities in the UC2
    - T2.2: participate in two working groups, four meetings, and one-to-one interviews and surveys, to elicit ASOI position on the future implementation of financial policies to counteract biodiversity loss

    - T2.3: /
    - T2.4: evaluate the probable effectiveness of each proposed financing mechanisms in regard to the French UC.

- WP3: Biodiversity baselines and metrics
    - T3.1: give area delineation and give pilot site for the FRUC. write the descriptive report of UC area. Validate the report with EDA.
    - T3.2: Organize field visits and workshops to validate the geospatial data with ground validation in the PS.
    - T3.3: /
- WP4: developing innovative financial solutions
    - T4.1: Identify business dependencies for French UC on ecosystem services, sustainable alpine forest management practices and agroecological practices. Then assess social environmental and economic impacts. Then estimate the costs and benefits of developing business cases. Contribute to the French business case: evaluate and rank the financial mechanisms of D2.4 in regard to French UC
    - T4.2: support AS in developping a range of PES indicators for French UC.
    - T4.3: support GND in developping a triple capital accounting and biodiversity with PES framework for French UC.
    - T4.4: Supporting 17S in co-designing and developing multiple insurance products for French UC

- WP5: Co-building biodiversity certificates
    - T5.1: give UCL data and feedback regarding clustering
    - T5.2: /
    - T5.3: support Carbone4 in the implementation of certificates in the French UC
    - T5.4: participate in the methodological developments in order to be involved in the process of issuing biodiversity certificated
    - T5.5: /
- WP6: Stakeholder engagement and communication
    - T6.1: /
    - T6.2: organize filed visits and stakeholders workshops
    - T6.3: /

4. Use Cases Description: 3

4.1.UC3: Agricultural land, Romania, agroecological practises

4.1.1 Use Case Overview

UC ID and Title

(UC3) Agroecological practices

Lead Organisation(s)

Institute of Agriculture Economy and Rural Development from Bucharest (ICEADR)

Duration and Timeline (phases of implementation)

4.1.2 Location and Ecosystem Profile

Description of UC structure

Practice oriented, based on two complementary agricultural interventions:

- Certified organic farming
- Arable crops with forest belts around the plots

Geographic Coverage

Romania, South Muntenia Region, Bucu-Ialomita: forest belts farm: The farm is located in an intensively cultivated agricultural plain area, specific to South Muntenia region, where the land is dominated by arable crops such as wheat, corn and sunflower. In such a landscape exposed to wind erosion, drought and habitat uniformity, the introduction of forest curtains transforms the farm into an example of efficient green infrastructure essential for agricultural resilience. Located a few hundred meters from a forest and in the vicinity of a lake that functions as a wetland, the farm benefits from a valuable natural context, which the forest curtains amplify by creating local ecological corridors. The planted trees and shrubs provide microhabitats for birds, beneficial insects and micromammals, reduce wind speed and contribute to soil protection and moisture maintenance. Thus, the farm becomes a model of integrating natural elements into plain agriculture, contributing both to long-term productivity and to the conservation of biodiversity in an otherwise intensely exploited area.

Romania, South Muntenia Region, Valcele-Calarasi: certified organic farm

In an agricultural landscape dominated by traditional and intensive farms, the organic farm in Vâlcele functions as a true oasis of biodiversity and regenerative agricultural practices. Here, land management is based on principles that put nature at the center of production: vegetation cover, diversity strips, complex rotations, and the elimination of synthetic chemical inputs. These practices allow the restoration of soil biodiversity, the attraction of pollinators and beneficial insects, and the stabilization of the agricultural ecosystem in an area affected by severe drought.

Despite the fact that the nearest forest is several kilometers away, the farm itself creates a core of biodiversity and functions as a strategic point of ecological connectivity in an otherwise simplified landscape.

Agro-environmental description

Ialomița – Bucu:

- Fertile chernozems and alluvial soils, but sensitive to wind erosion and pedological drought
- Low precipitation, continental climate with drought episodes
- Dominated by arable crops (wheat, corn, sunflower)

Călărași – Vâlcele:

- Cambic chernozem, fertile soils but affected by severe pedological drought
- Strong continental climate
- High potential for regenerative-ecological practices (mulching, plant cover, various rotations)

Ecosystem Type(s):

Ialomița – Bucu: Ecological corridor landscape.

Călărași – Vâlcele: Agroecological biodiversity hotspot

4.1.3 Environmental Context

Key Biodiversity Features

Ialomița – Bucu: Ecological corridor landscape;

Forest curtains introduced into the intensive agricultural landscape generate a complex agroecological structure, which supports valuable biodiversity. Vegetated edges and planted shrubs attract numerous pollinating insects, essential for the health of the agricultural ecosystem. Trees and shrubs provide support for insectivorous birds, such as starlings or sparrows, which contribute to the natural control of pests. In the transition areas between crops and shade curtains, a diverse spontaneous vegetation develops, which increases the resilience of the agroecosystem. Small mammals, such as hedgehogs, rabbits or useful rodents, which help to aerate the soil and maintain the ecological balance, also find shelter here. Overall, these elements transform the farm into a vital habitat and a biodiversity corridor in an area otherwise dominated by conventional agriculture.

Călărași – Vâlcele: Agroecological biodiversity hotspot

The organic farm in Vâlcele represents a valuable agroecological nucleus in an intensified agricultural landscape, where soil biodiversity is particularly high, due to the presence of earthworms, microorganisms and mycorrhizal fungi. The practices applied favor the emergence

of beneficial insects, such as ladybugs, hoverflies and parasitoid wasps, along with numerous spontaneous plant species that contribute to the resilience of the ecosystem. Permanent plant cover, diversified rotations and buffer zones with flowering vegetation create ideal conditions for the restoration of pollinators and for the formation of microhabitats that support small fauna, such as insectivorous birds or hedgehogs. The lack of chemical inputs allows for the gradual improvement of soil structure and increased water infiltration, making the farm more drought-resistant

Threats and Pressures (current and historical)

- Intensive agriculture in surrounding areas leads to ecological isolation
- Pesticides used in neighboring farms can induce risk of drift and insect reduction
- Increased wind erosion in the Ialomița plain together with extreme drought for both areas
- Mortality of forest canopy seedlings
- Competition for land: perception that canopy “takes away from arable land”
- Weeds/pests in the absence of herbicides for the organic farm

Climate Change Vulnerabilities

The UC areas of Romania (Ialomița, Călărași) are among the most vulnerable to climate change:

- severe water deficit
- summers with +40°C
- strong wind phenomena
- torrential rains that lead to crusting and erosion
- exposed soils and rapid water loss

In this context, forest curtains are an excellent adaptation solution becouse they reduce wind speed, increase soil moisture, protect crops and can generate habitat for biodiversity. In the same time, ecological practices are complementary because they increase organic matter, water infiltration and soil resilience.

Baseline Biodiversity Status

Before the implementation of the interventions, the arable was characterized by a completely exposed arable land, with low biodiversity and no functional habitats for birds or pollinators, in the absence of any green infrastructure. The area was strongly affected by drought and water stress, conditions that reduced soil vitality and increased crop vulnerability

The organic farm in Vâlcele presented a moderate level of biodiversity, but on an upward trend due to the conversion to agroecological practices. Before the transition, the soil had low biological activity and production depended on external chemical inputs, which limited the development of natural processes of restoration of the agricultural ecosystem.

4.1.4 Use Case Objectives

Overview of Objectives

The objective of this Use Case is to identify and design innovative financial mechanisms that can support the uptake and scaling of agroecological practices and green infrastructure (such as forest belts) in lowland agricultural landscapes in Romania.

The Use Case focuses on demonstrating how financial instruments can incentivise farmers to adopt biodiversity-enhancing practices. The two pilot farms in Ialomița and Călărași will serve as representative case studies for assessing the ecological benefits and financial feasibility of agroecological approaches within intensively cultivated lowland agroecosystems. Insights from this analysis will be used to propose scalable financial solutions that can be replicated across similar farms in the region.

Tasks and Implementation Approach

The implementation of this Use Case is structured around a set of analytical, technical and stakeholder-driven tasks designed to identify financial mechanisms that can effectively support agroecological practices and green infrastructure in lowland agricultural systems. Building on the two pilot farms in South-Muntenia (Vâlcele – Călărași and Bucu – Ialomița), the Use Case will examine how biodiversity-enhancing measures such as agroecological field management and the establishment of shelterbelts can generate measurable ecological outcomes that are suitable for financial valuation.

A core component of the approach is exploring the feasibility of a biodiversity-linked financial instrument, such as a biodiversity-linked bond or performance-based payment scheme. These instruments would tie financial returns to the achievement of specific ecological targets — including improved soil health, enhanced pollinator activity, increased habitat connectivity, and strengthened climate resilience. By doing so, they create a direct and transparent link between financial performance and biodiversity outcomes. Use Case will map existing financial initiatives available in Romania, including CAP ecoschemes, compensatory payments for organic farming, agri-environment-climate measures, and emerging private-sector mechanisms. Stakeholders (farmers, authorities, investors, NGOs and financial institutions) will be engaged to identify practical barriers and opportunities for scaling up financial instruments that reward biodiversity benefits. Insights from the two farms will inform the design of financial mechanisms that can be replicated across other commercial farms in the region, ensuring both ecological relevance and financial viability

Environmental Goals

- Increase soil and pollinator biodiversity.
- Reduce soil erosion and increase water retention.
- Increase drought resilience through agroecological practices and green infrastructure elements

Social Goals

• Improving farmers' perception of agroecological practices and the role of forest curtains.

• Strengthening the sharing of good practices at the local level.

• Creating replicable models for other farms in South-East Romania.

Economic Goals

• Demonstrate the economic feasibility of agroecology and forest curtains by developing financial instruments that cover implementation costs.

• Increase the long-term stability of agricultural production.

• Identify new financial flows (biodiversity credits, habitat payments, insurance, etc.).

Policy Alignment:

• EU Biodiversity Strategy 2030

• Green Deal

• New Common Agricultural Policy (CAP) — eco-schemes, environmental and climate measures

• National Strategy for Sustainable Development of Romania

• Natura 2000 Directives (where applicable)

Expected Outcomes

The Use Case aims to identify financial instruments adapted to the specificities of lowland agroecosystems, so that farmers can easily adopt agroecological practices and green infrastructure. Based on the two pilot farms, a replicable framework for small and medium-sized farms will be created, which can be expanded at regional level. Through dedicated evaluations, the project will estimate quantifiable benefits on biodiversity, from soil improvement to increased habitats for pollinators and birds. All conclusions and proposals will directly integrate feedback from farmers and relevant authorities, thus ensuring the feasibility and acceptance of solutions at a practical level.

4.1.5 Beneficiaries

Primary Beneficiaries:

Farmers

Secondary Beneficiaries:

- ✓ Local communities (microclimatic benefits, dust reduction, soil stabilization).
- ✓ Investors in green projects.
- ✓ Local and county administrations.
- ✓ Agri-food sector (more stable production over time).

4.1.6 Methodology

Overview of Research & Stakeholder Engagement

For this UC, activities will include bibliographic analysis on agroecology, CAP eco-schemes and the role of forest belts in agro-ecosystems, followed by discussions to the two pilot farms to understand the local context and practical implementation conditions. The process will be supported by iterative consultations with other farmers, to collect relevant information, as well as by constant dialogue with project partners, who will contribute with technical expertise in defining and testing the proposals.

4.1.7 Innovative Financial Mechanisms

Enabling Financial Conditions and Barriers

In Romania, the implementation of financial instruments to support agroecological practices and green infrastructure is supported by the existence of eco-schemes under the CAP and the growing interest in nature-based solutions, as well as the considerable potential of lowland agricultural landscapes to integrate elements of high ecological value. However, these opportunities are accompanied by important structural barriers, such as the lack of incentivised funds for the maintenance of green infrastructure elements in the early years, the perception of farmers that agroecological practices may reduce the overall production and the absence of functional markets for biodiversity credits at national level. In this context, for this UC it was proposed to analyse how these constraints can be overcome through appropriate financial instruments and through continuous dialogue with farmers and institutional actors.

4.1.8 Risk Management Strategies

The implementation of financial instruments dedicated to agroecology in lowland agroecosystems in Romania faces a number of structural risks and challenges. First, there are operational risks related to high climate variability, especially severe drought, which can affect both farmers' motivation to adopt new practices and their efficiency in the first years. There are also institutional risks, generated by the complexity of administrative procedures and the limited level of integration of innovative financial instruments into existing agricultural policies.

At a social and economic level, some agroecological practices are perceived as potentially risky or costly, especially in commercial farms oriented towards maximum productivity. The lack of mature markets for biodiversity credits or other mechanisms for financial valorisation of ecosystem services represents an additional challenge, which may limit the interest of private investors. At the same time, the existence of limited administrative capacity at local and regional level may make it difficult to adopt and monitor the proposed financial instruments.

To overcome these challenges, the Use Case will focus on continuous dialogue with farmers, authorities and institutional partners, as well as on realistic assessment of the financial feasibility of the analysed mechanisms. In addition, close collaboration with experts and project partners will allow for gradual testing of the proposed solutions and their adjustment before potential larger-scale implementations.

4.1.9 Implementation Roadmap

Expected Replicability Potential

The Use Case has a high replicability potential across lowland agricultural regions in Romania, particularly in areas dominated by conventional arable farming where agroecological practices and green infrastructure remain limited. The financial mechanisms explored—such as payments for ecosystem services, blended finance solutions or performance-based instruments—are designed to be adaptable to a wide range of farm sizes and operational contexts. Since the two pilot farms reflect common challenges in Romanian agriculture, including exposure to drought, limited habitat diversity and economic constraints related to the adoption of nature-based practices, the lessons learned can be easily transferred to other farms within the South-Muntenia region and beyond. Through clear guidance, practical insights from farmer consultations, and scalable financial structures, the Use Case is expected to provide a replicable framework that can support broader uptake of agroecological approaches in similar agricultural landscapes.

5. Use Cases Description: 4

5.1. UC4: Species-rich grasslands, Slovenia

5.1.1 Use Case Overview

UC ID and Title

UC4: Species-rich grasslands, Slovenia, Nature-based solutions for pollinators

Lead Organisation(s)

Pratensis

Duration and Timeline (phases of implementation)

5.1.2 Location and Ecosystem Profile

Description of UC structure (e.g. Practice or Parcel oriented)

Practice oriented

Geographic Coverage (country, region, locality)

UC4 refers to Slovenia, which is one of the most biodiverse countries in Europe despite its relatively small size. Due to its location at the junction of three biogeographical regions (the Alpine, Pannonian and Mediterranean biogeographical regions) with different ecological conditions and so forming a large variety of eco-regions and habitats, is Slovenia a biodiversity hotspot in terms of the number of species per square kilometre of territory. According to some biodiversity indicators, Slovenia is among the richest even in the world. Slovenia covers a modest 0,004 % of the earth's surface, but at the same time is home to more than 2 % of known terrestrial animal species. Scientists have so far recorded about 24.000 living species, among them are 3.200 species of higher plants, 1.200 species algae, 3.000 species of fungi and 15.000 species of animals.

In UC4 we will work on 9 Natura 2000 sites (Figure 6) and mainly focus on Nature park/N2000 site Goričko and N2000 site Osrednje Slovenske gorice (Figure 7):

- SI3000302 Osrednje Slovenske gorice
- SI3000221 Goričko
- SI3000117 Haloze – vinorodne and SI3000118 Boč - Haloze - Donačka gora
- SI3000311 Vitanje – Oplotnica
- SI3000224 Huda luknja
- SI3000313 Vzhodni Kozjak and SI3000337 Zahodni Kozjak
- SI3000335 Polhograjsko hribovje

The **Goričko** Nature Park was formally declared on 9 October 2003 by the Republic of Slovenia and it covers approx. 46.200 ha (462 km²) of low hills in northeastern Slovenia, at the transition

between the Alps and the Pannonian Basin. The park lies in the border region with Austria and Hungary and is part of the trilateral “Three Countries Park” (Goričko-Raab-Őrség) with cross-border ecological linkage. The landscape is a mosaic of meadows, arable fields, traditional high-trunk orchards, hedgerows, woody patches, forests and streams.

The area is recognized for its biodiversity and cultural landscape value: it retains many semi-natural habitats and species associated with low-intensity agriculture. Within the Natura 2000 framework, the park is designated as a site protecting certain habitat types and species. It lists 7 habitat types under the Habitats Directive for the Natura 2000 area. The habitat list includes 3 grassland habitat types:

- HT 6210 – Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)
- HT 6410 – Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- HT 6510 – Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)

The site also lists 14 bird species (common kingfisher (*Alcedo atthis*), little bittern (*Ixobrychus minutus*), white-tailed eagle (*Haliaeetus albicilla*), black stork (*Ciconia nigra*), european honey buzzard (*Pernis apivorus*), black woodpecker (*Dryocopus martius*), white stork (*Ciconia ciconia*), eurasian hoopoe (*Upupa epops*), eurasian scops owl (*Otus scops*), grey-headed woodpecker (*Picus canus*), red-backed shrike (*Lanius collurio*), sedge warbler (*Acrocephalus schoenobaenus*), quail (*Coturnix coturnix*), woodlark (*Lullula arborea*)), 2 amphibians (yellow-bellied toad (*Bombina variegata*) and Italian crested newt (*Triturus carnifex*)), 3 fish species (Danubian spined loach (*Cobitis elongatoides*), Ukrainian brook lamprey (*Eudontomyzon spp.*) and European bitterling (*Rhodeus sericeus amarus*)), 6 mammals (Greater mouse-eared bat (*Myotis myotis*), lesser horseshoe bat (*Rhinolophus hipposideros*), common bent-wing bat (*Miniopterus schreibersii*), barbastelle (Barbastella barbastella), Bechsteins bat (*Myotis bechsteinii*), Eurasian otter (*Lutra lutra*)), 11 invertebrates (hermit beetle (*Osmoderma eremita*), cinnabar flat bark beetle (*Cucujus cinnaberinus*), ground beetle (*Carabus variolosus*), common stag beetle (*Lucanus cervus*), Jersey tiger (*Callimorpha quadripunctaria*), large copper (*Lycaena dispar*), marsh fritillary (*Euphydryas aurinia*), scarce large blue (*Phengaris teleius*), dusky large blue (*Phengaris nausithous*), Danube clouded yellow (*Colias myrmidone*), Balkan goldenring (*Cordulegaster heros*)) and 1 plant species Carniolian spikerush (*Eleocharis carniolica*) as protected under the Natura site for Goričko.

The area has been subject of restoration projects to improve conditions for three habitat types and ten species (butterflies, bats, beetles, birds) within the site. According to project documents and monitoring results, the site has experienced declines in habitat condition (especially meadows) due to intensification or abandonment. Although there is active management, the presence of pressure means that some habitats remain in unfavourable conservation status and require ongoing intervention.

Main pressures and threats are agricultural intensification, land abandonment and woody encroachment, habitat fragmentation and loss of connectivity, alien invasive species, hydrological changes, loss of traditional management practices, climate change impacts and socio-economic pressures.

Osrednje Slovenske gorice lie in the region of the Slovenske gorice (Slovene Hills) in northeastern Slovenia - a hilly, agricultural-landscape zone characterised by vineyards, orchards, semi-natural grasslands and hedges. The terrain is undulating with a mosaic of arable fields, meadows, small woods and field margins. The site has been identified in Slovenia's Natura 2000 network for its grassland habitats of European importance.

It is in the continental biogeographical region of Slovenia and covers 2.076,09 hectares. According to the Slovenia's Natura 2000 Management Programme 2023–2028 the focus on this site are meadows and butterflies.

The following grassland habitat types are present:

- 6210 – Semi-natural dry grasslands and scrub (*Festuco-Brometalia*) (important orchid sites)
- 6410 – Molinia meadows on calcareous/peaty/clayey-silt soils
- 6510 – Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)
- 6520 – Mountain hay meadows

It is also valued for its butterfly diversity: one study mentions that in the area of Osrednje Slovenske gorice they recorded 105 butterfly species, representing "almost 60 % of all species found in Slovenia".

Target/indicator butterflies are on the site are:

- Scarce large blue – *Phengaris teleius*
- Dusky large blue – *Phengaris nausithous*
- Large Copper – *Lycaena dispar*

National monitoring reports show that all three butterfly species are in declining trend.

It is somehow a forgotten Natura 2000 site, with no projects and decreasing biodiversity due to agricultural intensification, land abandonment and woody encroachment, fragmentation and habitat loss, loss of traditional management practices and climate change impacts.

Agro-environmental description and Ecosystem Type

UC4 focuses on studying and preserving biodiversity in **semi-natural grasslands** in Slovenia, particularly those rich in species diversity. Semi-natural grasslands represent the most species rich agricultural landscape and are critical for a variety of ecosystem services, including pollination, climate regulation, soil fertility and water regulation. Semi-natural grasslands represent a cultural landscape that has been forming in Europe for the last thousand years and can be defined as a relic of the European traditional cultural landscape.

Semi-natural, secondary or anthropogenic grasslands have developed in areas with primary forest vegetation. They were created by man to obtain fodder (by mowing or grazing) and litter for livestock. These are all grasslands below the natural forest line, with the exception of natural salt grasslands and wetlands with herbaceous plants, where there are no conditions for forest growth.

Grasslands provide a wide range of ecosystem services, which are the direct and indirect contributions of ecosystems to human well-being. In other words: humans concretely get something from grasslands. Ecosystem services are all the benefits that humanity derives from

nature and the environment. This will balance human need for resources with the production of other services and goods, including the habitat needs of grassland-dependent organisms. Ecosystem services are divided into three groups: provisioning, regulation and culture. These services include both biotic (related to living organisms) and abiotic (not related to living organisms) ecosystem outputs. Some examples of key ecosystem services are biodiversity development and conservation, carbon sequestration, watershed services (protection and enhancement of water supplies), soil conservation, recreation and cultural values, social and economic benefits for communities, and high conservation value.

Grasslands cover up to 34% of the EU's agricultural area, around 20% of Slovenia's area and around 58% of Slovenia's agricultural area. Slovenia is among the countries with the highest share of permanent grassland in the structure of agricultural area. But it needs to be noted, that in Slovenia a significant share of this is also represented by meadows in the highlands and those that are being abandoned, so the actively mowed or grazed grasslands are actually much less.

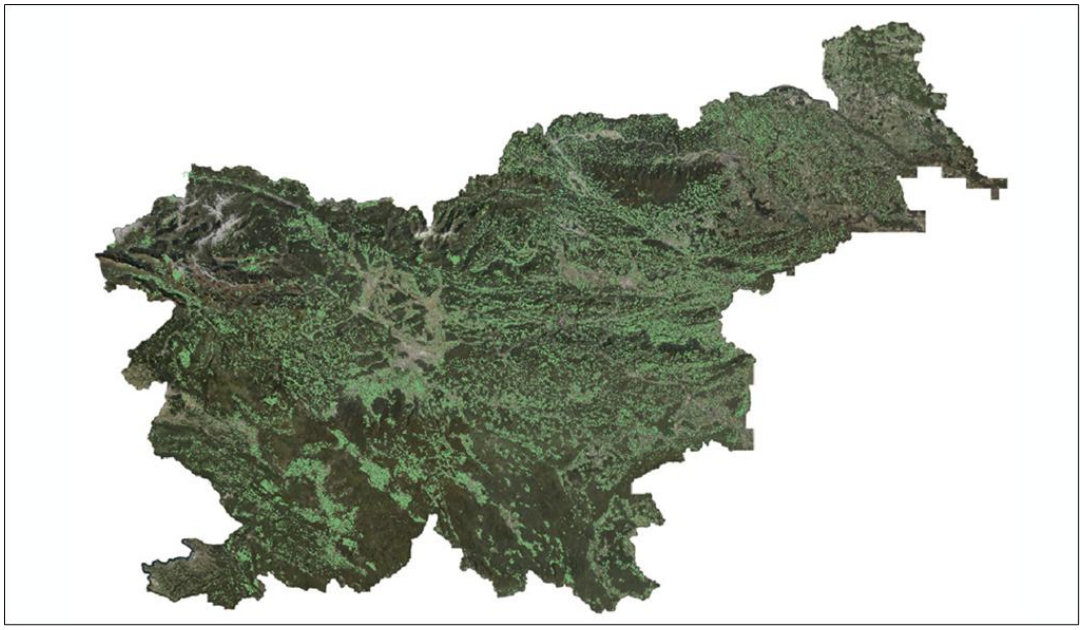


Figure 2: Spatial distribution of grasslands in Slovenia (https://rkg.gov.si/vstop/)

Protected Areas/Natura 2000 status

37,50% (Figure 3) of Slovenia's area is currently classified as Natura 2000, which is the highest share among the 27 EU countries (EU average cca 18%). In Slovenia 20% of Natura 2000 is on agricultural land and 26% of all agricultural land is in Natura 2000.

A third of Slovenia's Natura 2000 sites overlap within the large-scale protected areas like national, regional or landscape parks or small-scale protected areas like natural monuments, strict nature reserves or nature reserves. Together, Natura 2000 sites, protected areas and areas of special protection create an important network of biodiversity rich areas with nature conservation status, which covers more than 56 % of Slovenia's territory. There are a total of 2.259 (Figure 4) protected areas in Slovenia, 355 Natura 2000 sites - 31 Special Protection Areas (Birds Directive) and 324

Sites of Community Importance (Habitat Directive) - as well as 1904 sites designated under national laws. Natura 2000 sites in Slovenia cover 208 species and 60 habitats from the nature directives. The number of species and habitats protected in each site varies depending on the location of the site, the biodiversity in the region, the designation being used, and the features the site is being created to protect. For 125 sites there is only 1 feature being protected with 23 sites having more than 20 features.

In UC4 we will work on 9 Natura 2000 sites (Figure 5) and mainly focus on Nature park/N2000 site Goričko and N2000 site Osrednje Slovenske gorice (Figure 6):

- SI3000302 Osrednje Slovenske gorice
- SI3000221 Goričko
- SI3000117 Haloze – vinorodne and SI3000118 Boč - Haloze - Donačka gora
- SI3000311 Vitanje – Oplotnica
- SI3000224 Huda luknja
- SI3000313 Vzhodni Kozjak and SI3000337 Zahodni Kozjak
- SI3000335 Polhograjsko hribovje

Map and Spatial Reference

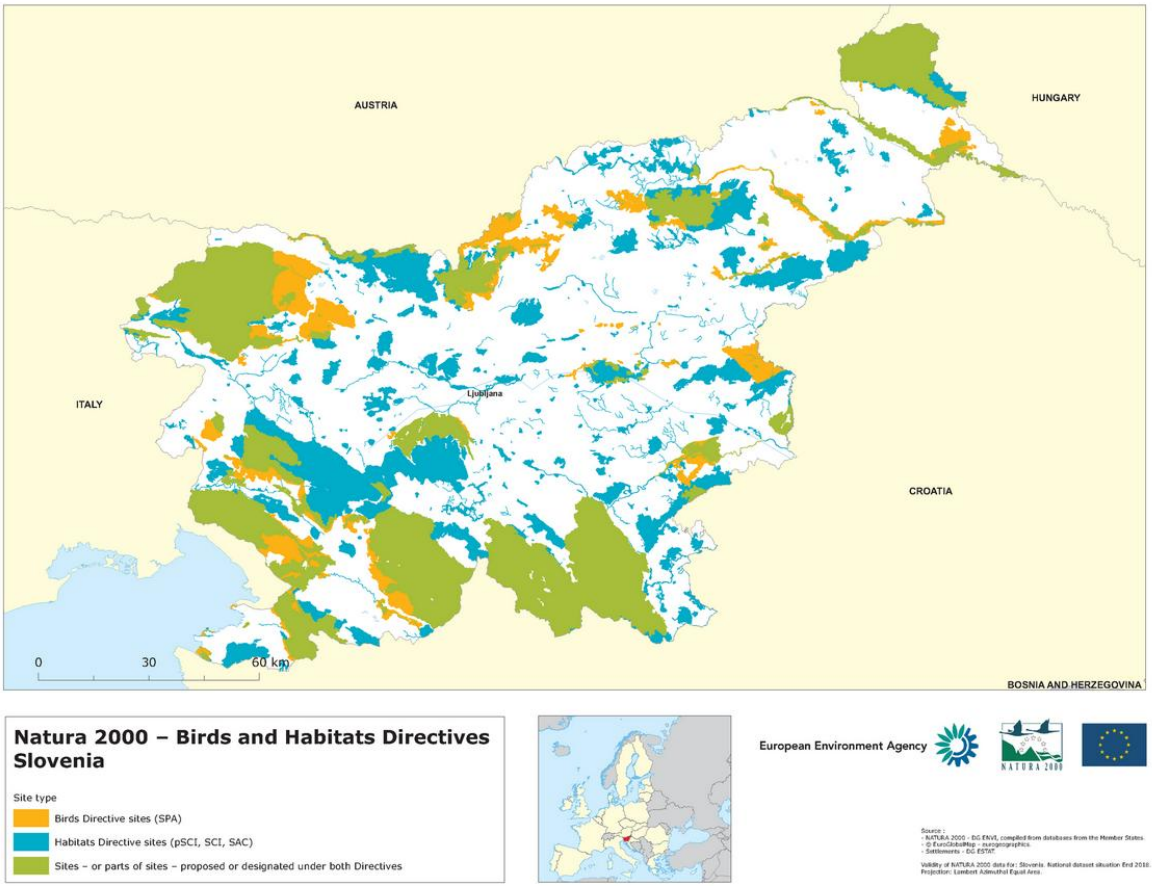


Figure 3: Natura 2000 - Birds and Habitats Directives in Slovenia (https://www.eea.europa.eu/data-and-maps/figures/natura-2000-birds-and-habitat-directives-10/slovenia)

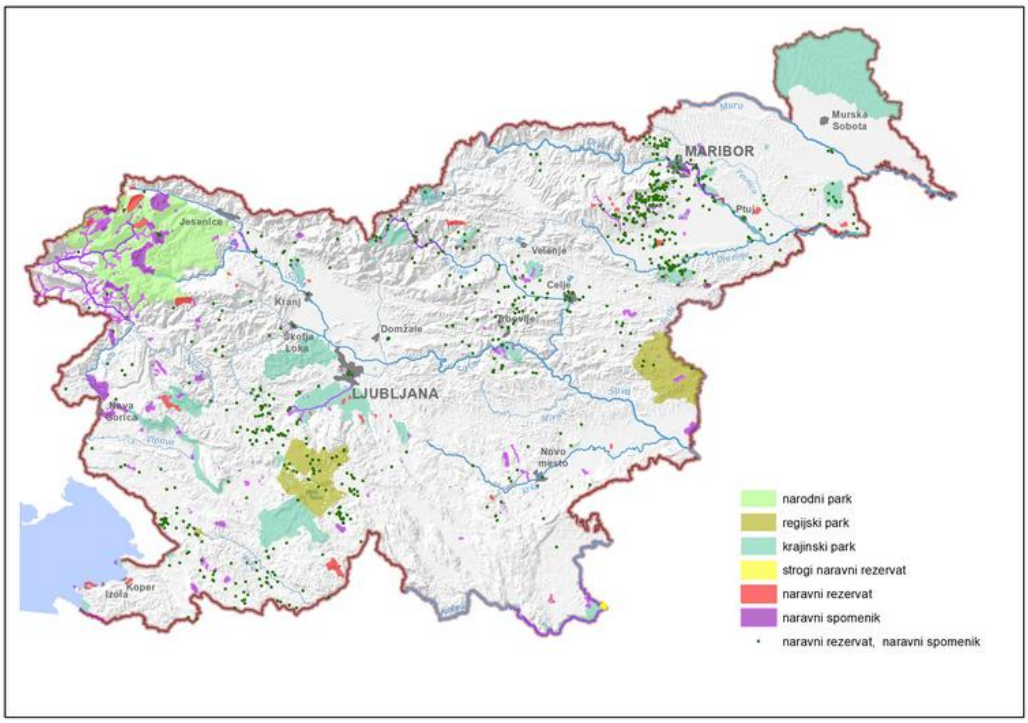


Figure 4: map of all the protected areas in Slovenia (https://kazalci.arso.gov.si/sl/content/zavarovana-obmocja-5 *)*

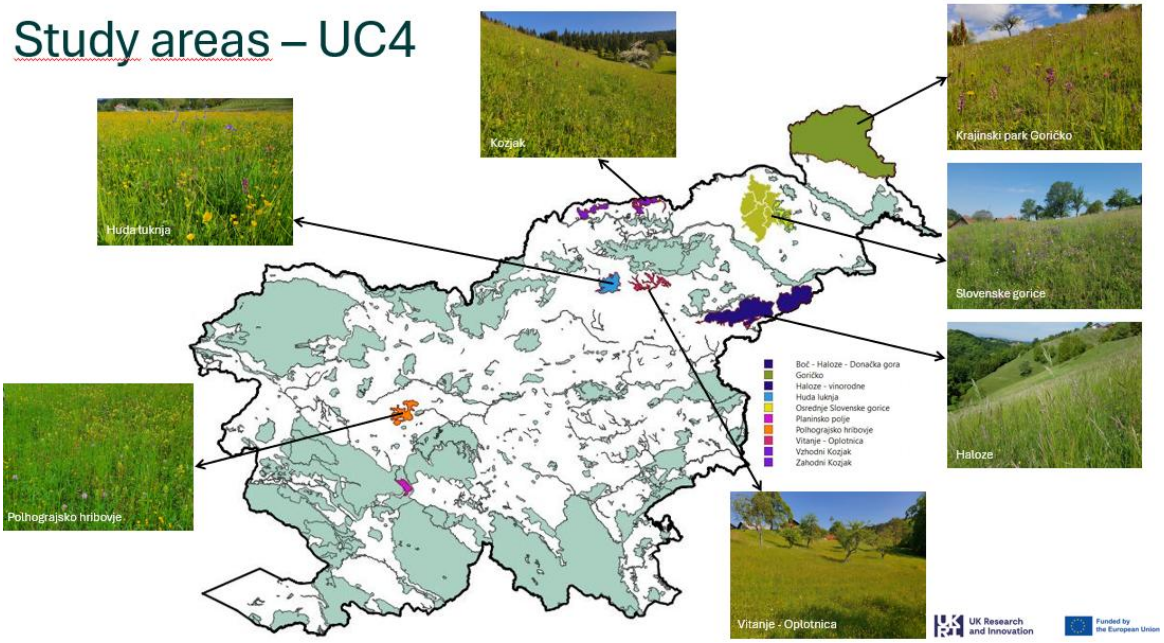


Figure 5: map of the UC4 study areas

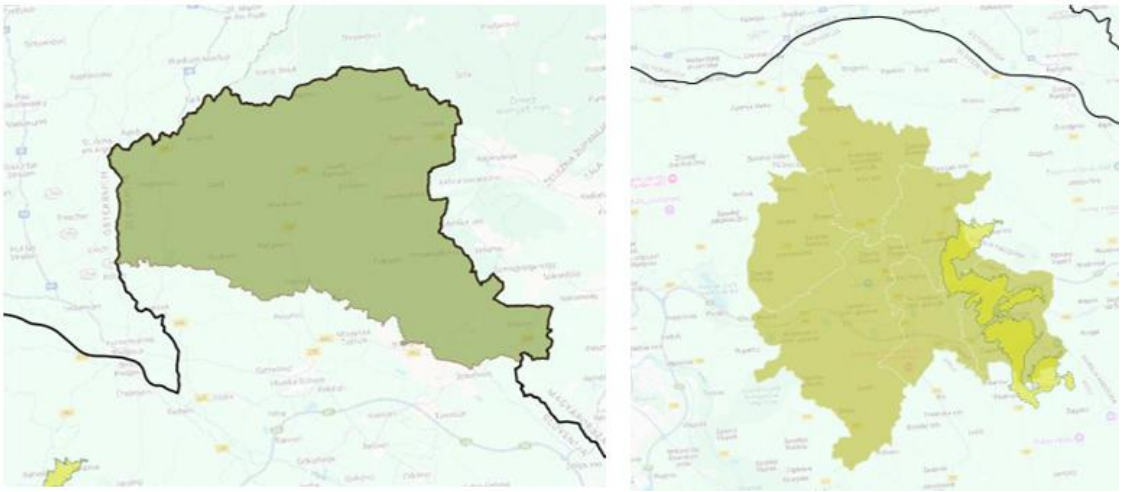


Figure 6: map of the 2 most important UC4 study areas – Nature park/N2000 site Goričko (on the left) and N2000 site Osrednje Slovenske gorice (on the right)

5.1.3 Environmental Context

Key Biodiversity Features

The key biodiversity feature are semi-natural grasslands, particularly those rich in species diversity. Semi-natural grasslands represent the most species rich agricultural landscape and are critical for a variety of ecosystem services, including pollination, climate regulation, soil fertility and water regulation. Semi-natural grasslands represent a cultural landscape that has been forming in Europe for the last thousand years and can be defined as a relic of the European traditional cultural landscape.More details under section 2.

Threats and Pressures (current and historical)

The species-rich extensive semi-natural grasslands have declined in Slovenia, the EU and worldwide during the last century, mainly due to shifts in agricultural practices. The reasons are found at both extremes of the spectrum; agricultural intensification on the one hand and the lack of management and abandonment of former agricultural lands in marginal areas (which are often characterised by lower productivity and negative socio-economic trends) on the other. The area of forests in Slovenia has been increasing for over 120 years as a result of the abandonment of agricultural land and the reduction of rural population. The share of forest thus increased from 36% in 1875 and 48% in 1961 to 56% in 2000 and to 58% in 2024. This means that the forest cover has increased from a good third of the territory of Slovenia to almost two thirds of the national territory in 150 years. To a large extent at the expense of the overgrowth of semi-natural grasslands, namely the least productive ones (e.g. on steep slopes and remote and flooded areas), which are generally the most biodiversity diverse.

Due to these changes in management, grasslands are now considered to be among the most endangered ecosystems in the EU. Currently, the majority of species-rich Slovenian grasslands

have an unfavourable conservation status (Figure 7). Based on the available data from habitat type mappings, the surface of species-rich grasslands is decreasing.

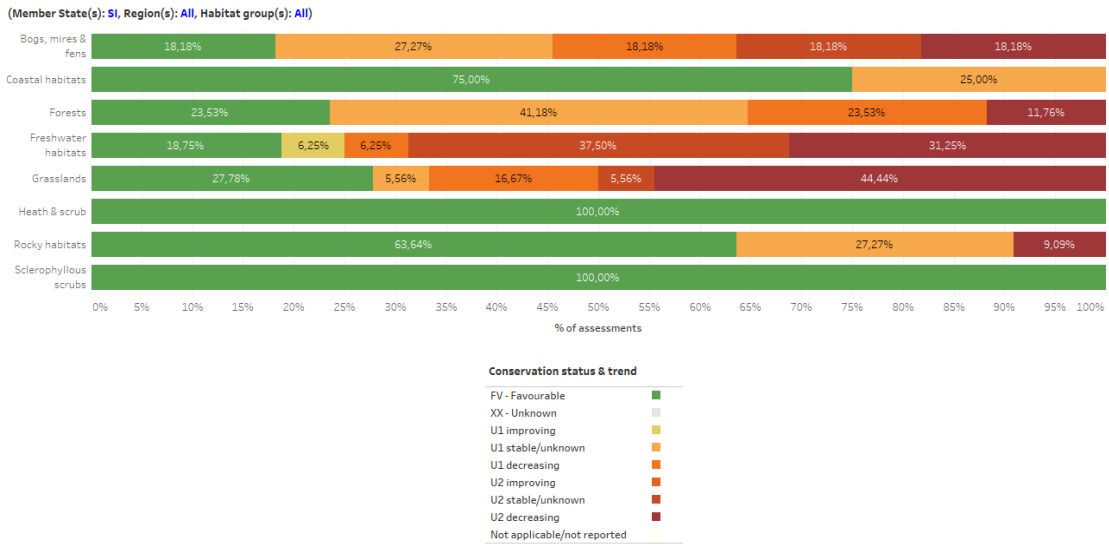


Figure 7: Conservation status and trends of habitats in Slovenia (https://www.eea.europa.eu/en/analysis/maps-and-charts/conservation-status-and-trends-article-17-national-summary-dashboards-archived)

Agriculture has been identified as one of the main pressures on grassland biodiversity in Slovenia. Biodiversity is affected by:

- intensification of agricultural systems (fertilisation, intensification of mowing systems),
- conversion into arable land,
- land abandonment and abandonment of traditional management systems and practices,
- inappropriate techniques or timing for mowing grasslands,
- inappropriate application of natural or inorganic fertilisers,
- removal of hedgerows, tree lines and field margins and larger field consolidation,
- pollution from agriculture,
- drainage of land.

The result is the impoverishment of the plant species composition and biodiversity in general, but it is also reflected in the decline of ecosystem services of grasslands. In many Natura 2000 sites and protected areas, the implementation of appropriate agricultural activity is a condition for maintaining a good conservation status of species, their habitats and habitat types. Consequently, conservationists have been struggling to establish suitable approaches to preserve the extensive use of grasslands and integrate it into modern farming systems.

This pressures and threats also translate into economic and livelihood losses for local communities and farmers:

- land abandonment – grasslands are being overgrown, and this results in habitat loss for various plant and animal species. From the economic point of view this means reduced livestock production.
- intensification – this leads to biodiversity loss, habitat loss, degraded soil, water pollution. From the economic point of view this results in decline in crop pollination (lower yields), higher fertilizer and pesticide costs (reduced net farm income), water utilities face higher treatment costs (passed on to communities).
- fragmentation of the mosaic landscape - removal of hedgerows, tree lines and field margins and larger field consolidation – this causes ecological loss – reduced habitat for various species. Economic/livelihood impact - fewer natural pest controllers (more reliance on costly pesticides), reduced eco-tourism potential (less diverse, less scenic landscape), less resilience to wind/soil erosion (long-term yield declines, …
- climate hazards – more frequent droughts, extreme rainfall - ecological loss - stressed forests, invasive species spread, crop failures. Economic/livelihood impact - lower crop yields (drought-sensitive crops, vineyards, fruit trees), forest pest outbreaks, more frequent flood damage to farmland and infrastructure.
- socio-economic and demographic pressures - depopulation and aging farmers, low profitability of small farms - ecological loss - abandonment of meadows, orchards, hedgerows. Economic/livelihood impact - decline in active farms (shrinking local economy), fewer young farmers to innovate and adopt new technologies, loss of cultural identity and tourism appeal.
- water-related pressures - pollution from agriculture, drainage of wetlands and wet grasslands – ecological loss – biodiversity decline. Economic/livelihood impact: higher municipal costs for drinking water treatment, reduced flood retention (higher damage risk for villages and farmland).

Climate Change Vulnerabilities

Semi-natural grasslands — especially semi-natural hay meadows, dry calcareous grasslands and wet Molinia meadows — are climate-sensitive ecosystems that depend on regular mowing/grazing and balanced water availability. They are among the most climate-vulnerable habitat groups in the country because their condition is determined by both land management and weather variability.

Key climate trends affecting grasslands:

- Hotter and drier summers and more heatwaves which results in longer growing seasons, but higher evapotranspiration and drought risk.
- More frequent extreme weather events which results in damaged vegetation, shortened hay window and soil compaction.
- Rising drought risk which results in reduced biomass, species loss and higher invasion risk.

The region of highest concern is northeastern Slovenia (Goričko and Osrednje Slovenske gorice) because of high drought exposure, sandy soils and low retention capacity.

Semi-natural grasslands on shallow or sandy soils (e.g. in Goričko) are highly exposed. Drought reduces productivity and shifts species composition toward thermophilous, stress-tolerant, and ruderal species, at the expense of orchids, legumes and forbs. Lower water tables threaten Molinia meadows (6410) and wet alluvial meadows, which rely on seasonal inundation. Earlier spring onset advances flowering and mowing periods, creating mismatches with traditional hay-making schedules. Increased risk of nest and invertebrate mortality when mowing coincides with peak breeding/feeding periods. Warming and nutrient mobilization favour aggressive grasses (*Arrhenatherum, Dactylis*) and invasive thermophilous species (e.g. *Solidago canadensis, Erigeron Anuus*), which leads to floristic homogenisation and decline of characteristic meadow flora. Farmers respond to climate stress through intensification (irrigation, reseeding) or abandonment (when yields drop). Both pathways degrade habitat quality. Heavy rain after drought causes erosion on steep hay meadows. Drought and vegetation change reduce nectar supply, altering insect and bird populations and causes loss of pollinators.

The most significant natural hazards in the last 5 years are flooding, frost, severe storms with strong winds, downpour and large hail, drought and heatwaves. In recent years the frequency and severity of these extreme weather events is escalating. The risks that already affect Goričko and Osrednje Slovenske gorice are projected to worsen under climate change. Summers are expected to become hotter and drier, with longer dry spells. Goričko is already one of Slovenia's driest regions, so vulnerability is high. Higher summer temperatures and longer droughts are increasing risk of wildfires, even in areas not traditionally fire-prone. Warmer winters and drier summers enable faster spread of pests.

Baseline Biodiversity Status

Due to these changes in management the majority of species-rich Slovenian grasslands have an unfavourable conservation status (Figure 7). Based on the available data from habitat type mappings, the surface of species-rich grasslands is decreasing.

Multiple Annex I grassland types show unfavourable status and/or deteriorating trends:

- 6230 (Species-rich Nardus grasslands), 6510 (Lowland hay meadows), 6520 (Mountain hay meadows): **deteriorating**.
- 6410 (Molinia meadows): **negative trend**.

Large nominal coverage by Natura 2000/protected areas, but management-dependent grassland habitat types (6510, 6520, 6230, 6410) still degrade without appropriate mowing/grazing regimes.

In the case of Goričko there are several existing monitoring systems (birds, butterflies, habitat types, water quality) and datasets that track aspects of biodiversity health and risk, though they are fragmented and not always up-to-date and integrated into land management. However, pollinators, soils, orchards, small wetlands,… remain under-monitored.

5.1.4 Use Case Objectives

Overview of Objectives

Objective of UC4 is to understand main drivers of loss of grassland biodiversity, detect main barriers for conservation and define measures to unlock financial flows for the conservation and restoration of biodiversity-rich grasslands. The target is to improve sustainable grassland

management practices that preserve and restore grassland biodiversity. Within UC4 we will study biodiversity of grasslands on three levels: national, regional and local, with the focus on 9 Natura 2000 sites, where grasslands are predominant.

Environmental Goals

Conserve and enhance biodiversity

- Protect and improve the condition of the habitat types listed under the Habitats Directive (Annex I) that occur in selected Natura 2000 sites, e.g. semi-natural dry grasslands (6210), Molinia meadows (6410), lowland hay meadows (6510).
- Protect and improve the living conditions of key species) within the Birds Directive (Annex I) or under national protection.
- Maintain and restore the mosaic of habitats (meadows, orchards, hedges, forests, wetlands) that support high nature value farmland and associated species.

Maintain the cultural landscape and sustainable agriculture

- Preserve the traditional extensive (low-intensity) small-scale farming landscape - fields, meadows, orchards, hedgerows - that is characteristic for the selected Natura 2000 sites and contributes to biodiversity.
- Encourage land-use practices that are compatible with nature conservation (mowing/grazing of meadows, management of orchards, maintenance of hedges, avoidance of abandonment or too-intense intensification).

Restore degraded habitats and support ecological connectivity

- Restore abandoned or degraded meadow habitats (e.g., by mowing, grazing, removing invasive woody vegetation) so that they once again support their target habitat types and species.
- Improve connectivity of habitats within the Natura 2000 sites and across borders so that species can move and the mosaic remains viable.

Raise awareness, engage stakeholders and support sustainable development

- Increase awareness among residents, farmers and local communities about the value of biodiversity and cultural landscapes, and the practices needed to maintain them.
- Support ecotourism, educational trails, sustainable economic activity aligned with conservation.

Ensure long-term protection and management of key areas

- Secure land or management agreements to protect key habitat patches and species populations.
- Monitor habitat status, management effectiveness, and species trends to adaptively manage within the Natura 2000 sites.

Social Goals

Because grassland conservation in the selected Natura 2000 sites cannot succeed through ecological measures alone, as it depends heavily on social, cultural, and economic drivers - the people who live, farm and manage the land.

The social goals in the selected Natura 2000 sites aim to keep people on the land, make traditional management worthwhile and connect community identity with biodiversity. Only by aligning ecological, economic and social wellbeing can the semi-natural grasslands remain both alive and managed.

Economic Goals

The main goal is to maintain and diversify farm incomes while keeping low-intensity management viable. It is key to ensure that extensive mowing and grazing remain economically sustainable so farmers can continue managing grasslands, as many grasslands are at risk of abandonment because traditional systems generate low income.

Innovative Financial Mechanisms could play a transformative role in sustaining the semi-natural grasslands that depend on continuous low-intensity management but suffer from chronic underfunding and weak market incentives.

Policy Alignment

The actions are very well aligned with the EU Green Deal, EU Biodiversity Strategy for 2030, CAP Strategic Plan 2023–2027, the Nature Restoration Regulation and the Natura 2000 Management Programme for Slovenia.

Slovenia has established a robust legislative framework to support the conservation of species-rich grasslands, integrating national laws with EU directives (Birds and Habitats Directive). The primary national legislation include:

- Nature Conservation Act
- Environmental Protection Act
- Decree on Ecologically Important Areas
- Decree on special protection areas (Natura 2000)
- Natura 2000 Management Programme
- Decree on protected wild plant species
- Decree on protected wild animal species
- Decree on habitat types
- Agriculture Act
- Agri-Environmental Measures (AEMs) under the Common Agricultural Policy (CAP) – CAP Strategic plan for Slovenia 2023-2027

Expected Outcomes

The main outcome would the unlocking of financial flows for the conservation and restoration of semi-natural grasslands in the selected Natura 2000 sites. One important outcome would be to improve sustainable grassland management practices that preserve and restore grassland biodiversity.

KPIs

- Stabilized or increased area of semi-natural grasslands - Hectares of Annex I habitats (6210, 6410, 6510, 6520) maintained/restored.
- Improved habitat quality and biodiversity - species richness index, butterfly and bird populations, % favourable habitat status.
- Enhanced ecological connectivity - connectivity index, mapped habitat corridors.
- Operational innovative finance mechanisms - number of active mechanisms, funds mobilized (€).
- Leverage of private and community investment - € leveraged per € of public investment.
- Long-term financial sustainability of management - annual operational funding secured, proportion from self-generated sources.
- Improved governance and partnerships - number of formal partnerships, co-managed projects.

5.1.5 Beneficiaries

Primary Beneficiaries

- farmers,
- landowners,
- Goričko Nature Park Authority,
- Institute of the Republic of Slovenia for Nature Conservation
- Ministry of Natural Resources and Spatial Planning

Secondary Beneficiaries

- Ministry of Agriculture, Forestry and Food,
- Agency for Agricultural Markets and Rural Development,
- Chamber of Agriculture and Forestry of Slovenia,
- Slovenian Farmers' Union,
- Slovenian Rural Youth and Young Farmers Association,
- Farmland and Forest Fund of the Republic of Slovenia,
- Slovenian Hunting Association,
- Slovenian Beekeepers' Association,
- Research and Academic Institutions,

- Environmental NGOs,
- potential investors,
- banks,
- insurance companies,
- rural entrepreneurs,
- local communities,
- municipalities,
- other public institutions

5.1.6 Methodology

Overview of Research & Stakeholder Engagement

UC4 focuses on studying and preserving biodiversity in semi-natural grasslands in Slovenia, particularly those rich in species diversity. The biodiversity of grasslands is critical for a variety of ecosystem services, including pollination, climate regulation, soil fertility, and water regulation. The project aims to monitor and restore grassland biodiversity, using remote sensing, which will be validated with on-site ground data to ensure accuracy, with a focus on both regulating and provisioning ecosystem services. Sentinel data, though valuable, will be supplemented with higher-resolution data and private economic data as necessary.

The project will focus on biodiversity-rich semi-natural grasslands characterised by the variety of plants and animals, particularly pollinators, with the "colourfulness" of the grassland serving as a key indicator of biodiversity. These landscapes provide both regulating services (e.g., pollination, biological pest control, carbon sequestration) and provisioning services (e.g., fodder, food, raw materials), as well as cultural services (e.g., tourism, recreation).

The Slovenia use case aims to demonstrate how spatially explicit ecological data and innovative financing tools can be integrated to mobilise investment for biodiversity protection and restoration in multifunctional agricultural landscapes.

Primary study areas are Goričko Nature Park (Natura 2000 SI3000273) – large, mosaic low-intensity agricultural landscape with extensive semi-natural grasslands and high habitat connectivity and Osrednje Slovenske gorice (Natura 2000 SI3000302) – smaller, compact cluster of species-rich meadows and vineyard–orchard mosaics representative of Slovenian HNV farmland. Together, they provide a dual-scale laboratory for testing the data–finance–policy interface:

- Goričko → landscape-scale investment and governance model
- Osrednje Slovenske gorice → parcel-level results-based monitoring and analytics

The main research objectives:

- Map and quantify natural-capital assets (habitats, species, ecosystem services).
- Develop advanced geospatial analytics and indicators for biodiversity-linked investment (digital MRV – Monitoring, Reporting & Verification).
- Model financial instruments (PES, biodiversity credits, blended finance) tailored to landscape characteristics.

- Evaluate socio-economic feasibility through stakeholder co-creation, governance mapping and investment-readiness assessment.

Within the stakeholder engagement framework we identified the following engagement goals:

- Co-design biodiversity-finance mechanisms that are technically sound, socially legitimate and economically viable.
- Strengthen cooperation among national and local authorities, protected areas, Natura 2000 sites, researchers, NGOs, farmers and finance and investment partners.
- Build long-term governance capacity to sustain post-project financing flows.

Technical Tools

- Remote Sensing / GIS
- Field Data Collection

Monitoring Indicators (Ecological, Financial, Social)

- Grassland habitat type index;
- Percentage of grassland habitat types with stable or increasing conservation status and trend;
- Share of biodiversity-rich grasslands under supported commitments (various financial mechanisms) supporting grassland biodiversity conservation or restoration;
- Colourfulness (number of different flowering colours) of grasslands;
- Share of colourful (extensive, species-rich, biodiversity-rich) grasslands;
- Plant species richness of grasslands;
- Share of agricultural land with high diversity landscape features;

5.1.7 Innovative Financial Mechanisms

Financial mechanism and stakeholder involvement

The key financial stakeholders are the Ministries, who are responsible for the distribution and oversight of EU funds:

- Ministry of Finance: Oversees the allocation of national funds for biodiversity, including the issuance of Sovereign Sustainability Bonds.
- Ministry of Cohesion and Regional Development for the Cohesion Policy for the 2021–2027,
- The Ministry of Agriculture, Forestry and Food is the central authority responsible for the development, implementation, and oversight of the CAP. Its role encompasses strategic planning, financial management, stakeholder engagement, and monitoring to ensure that CAP objectives align with Slovenia's agricultural, rural development and environmental goals.

- The Ministry of Natural Resources and Spatial Planning coordinates the National Environmental Action Programme (NEAP) 2020–2030, which estimates a need for €47–53 million annually for biodiversity preservation. The Ministry is also responsible for coordinating, financing, and implementing LIFE-funded initiatives. The Ministry co-finances LIFE projects alongside the EU. The Ministry develops and updates strategic documents like the Natura 2000 Management Programme and the Prioritised Action Framework (PAF). The Ministry also oversees the monitoring of project outcomes and ensures compliance with EU reporting requirements. This includes tracking the effectiveness of conservation measures and the proper use of funds.

But there are also other very important stakeholders:

- Institute of the Republic of Slovenia for Nature Conservation plays a central role in promoting and safeguarding species-rich grasslands across Slovenia. Established under the Nature Conservation Act, the Institute is the country's primary professional institution for nature conservation and are managing the Natura 2000 network in Slovenia.
- Protected Area Public Institutions, especially Public Institute Goričko Nature Park, which is the official body responsible for managing the Goričko Nature Park. The Public Institute implements conservation measures for grasslands, monitors species and habitats, promotes sustainable agriculture practices and supports local farmers and landowners through advisory services and participation in agri-environmental schemes.
- Agency for Agricultural Markets and Rural Development (ARSKTRP), which administers CAP funding, including grassland-related measures and are key interface with farmers on compliance, payment, and reporting.
- Chamber of Agriculture and Forestry of Slovenia (KGZS) plays a vital role in supporting the conservation of species-rich grasslands, acting as a bridge between policymakers, farmers and environmental institutions. Its influence lies not in direct land management, but in its advisory, advocacy and capacity-building functions, which are essential for implementing biodiversity-friendly practices. They provide technical advice and on-the-ground support to farmers on sustainable grassland practices, help farmers prepare complex applications and navigate complex agri-environmental-climate schemes (AECMs) under the Common Agricultural Policy (CAP) and represent farmers' interests in national policy debates.
- Slovenian Farmers' Union serves as a pivotal organization representing the interests of Slovenian farmers, particularly concerning policies that impact agricultural practices and rural livelihoods. While not directly managing conservation projects, the Union plays a significant role in shaping the discourse around agricultural and environmental policies, including those related to species-rich grassland conservation. They are voicing farmers' perspectives on agricultural and environmental regulations, negotiating with Authorities, organizing demonstrations (in response to biodiversity policies perceived as restrictive), advocating for policies that consider farmers' needs and seeking to ensure that conservation efforts do not unduly additional burden farmers.
- Slovenian Rural Youth Association (ZSPM) plays an increasingly important indirect but strategic role in promoting species-rich grassland conservation in Slovenia by engaging and empowering young farmers, future land stewards. Species-rich grassland

conservation in Slovenia depends heavily on generational renewal and cultural continuity in land care. By helping young farmers see these landscapes not as “burdens” but as opportunities for innovation, resilience and community identity, ZSPM plays a transformational role in conservation. ZSPM represents young farmers and rural youth, work to bridge generational gaps, helps young farmers explore income diversification, organize training programs, competitions and innovation challenges that integrate biodiversity themes.

- Farmland and Forest Fund of the Republic of Slovenia, which manages state-owned agricultural land, much of which includes grassland habitats. They can prioritize leasing to environmentally minded farmers or conservation projects.
- Slovenian Hunting Association (LZS) plays a role in promoting species-rich grassland conservation through its multifaceted approach to wildlife management, habitat preservation and public engagement.
- Slovenian Beekeepers’ Association (ČZS) also plays a role in promoting the conservation of species-rich grasslands in Slovenia. While primarily focused on apiculture, the association's activities inherently support and enhance biodiversity within grassland ecosystems. Through advocacy, education and collaboration, ČZS plays a vital role in promoting sustainable practices that benefit both pollinators, species-rich grasslands and the broader environment.
- Municipalities and Local Authorities, as they influence spatial planning, support eco-tourism and co-fund conservation activities. They are important for zoning, infrastructure planning and maintaining cultural landscapes.
- Farmers and Landowners are the primary stewards of semi-natural grasslands. Their land-use choices directly affect grassland health and biodiversity. They need to be engaged, incentivized and supported to adopt or maintain traditional practices (e.g., extensive grazing, late mowing).
- Research and Academic Institutions, like National Institute of Biology (NIB), Agricultural Institute of Slovenia (KIS), University of Ljubljana (Biotechnical Faculty), University of Maribor (Faculty of Natural sciences and Mathematics), Centre for Cartography of Fauna and Flora (CKFF) play an important role in conservation of species-rich grasslands, as they conduct biodiversity assessments, develop monitoring tools, evaluate policy effectiveness and support innovation in result-based payments and restoration.
- Environmental NGOs like DOPPS – BirdLife Slovenia, Slovenian Butterfly Research and Conservation Society, Institute Symbiosis, play a vital role in public education, habitat restoration, farmer engagement and pilot projects. They often manage or co-manage LIFE and Interreg initiatives targeting dry or wet grasslands

Currently funding for biodiversity preservation and restoration is sourced from a combination of EU programs and national budget. By far the main source of financing is the CAP with the Agri-Environment-Climate Measures (AECMs), Eco-schemes, Organic Farming Support and Non-Productive Investments. Other important funding sources are the EU Cohesion Policy, LIFE Programme, Interreg Programmes and European Maritime and Fisheries Fund (EMFAF). A small share is being financed through national funding.

We plan to check and analyse existing financial incentives that are available to farmers for practicing sustainable grassland management and build on them.

In Slovenia, farmers practicing sustainable grassland management can access financial incentives primarily through the Common Agricultural Policy (CAP) 2023–2027, which includes eco-schemes, agri-environment-climate measures (AECMs) and the intervention Habitat types and species in Natura 2000 areas.

Financial Instrument Development Process

Still under development.

Typology of Instruments

Biodiversity Certificates (BC): Within task 5.3 a robust biodiversity certificates mechanism for UC4 will be developed. The biodiversity certificates mechanism will be developed through the following steps:

I. Taxonomy and protocol design
II. Stakeholder identification
III. Stakeholder engagement
IV. Deployment of the mechanism

Payments for Ecosystem Services (PES): In UC4 we are identifying how PES can be designed to support conservation and restoration of semi-natural grasslands and aiming to align PES design closely with the real-world needs and opportunities. There is a long list of ecosystem services that semi-natural grasslands provide, but through PES UC4 would like to focus on biodiversity conservation and pollination services.

Currently there aren't any measures that are labelled as PES in Slovenia. There are only CAP payments – AECM that to some extent follow the logic of PES. In Goričko and Osrednje Slovenske gorice are only action-based payments implemented. In Haloze are action-based as well as a result-based payment implemented. But the result-based payment scheme is small-scale (100 hectares) and was introduced in 2025. The CAP AECM payments are calculated on the basis of the income foregone, additional costs incurred by a farmer to comply with the AECM commitment concerned and transaction costs and are not allowed to go beyond this (concrete ecosystem service provided or enhanced cannot be added).

UC4 is focusing on semi-natural grasslands, and the PES would therefore target the following environmental services:

- provisioning services, including producing fodder for animals, food production (dairy, meat, wool, leather, honey), water (drinking water and irrigation), raw materials (fodder, fertilizer, bioenergy, biochemical products, medicinal plants, wild food, plants for decoration) and genetic material of sources (drugs);
- regulating services, including climate regulation, carbon sequestration, erosion prevention and control, water regulation (quantity, quality and water flow regulation), flood prevention, air quality regulation, soil formation, soil fertility, pest control, waste treatment, habitat

function (including maintaining genetic diversity and the life cycle of migratory species), pollination services, biological control of pests, ecological connectivity;

- cultural services, including source of the aesthetic landscape, tourism, recreation areas, hunting, heritage, spiritual experience, social cohesion, research opportunities and cognitive development.

Based on the experience of programming and implementing CAP AECM payments, the following challenges are expected to be encountered in implementing PES on semi-natural grasslands: land fragmentation, unclear and complex land ownership, short-term and only verbal agreed leases, low trust and engagement from farmers, limited farmer advisory support, knowledge gaps, social acceptance, complexity of schemes and additional administrative burden, technical and monitoring complexity, policy uncertainty and inconsistencies and insufficient financial compensation relative to opportunity costs.

One other challenge will be to define, monitor and evaluate indicators to assess the effectiveness of PES in delivering environmental services, as currently the effectiveness of CAP AECM is not being assessed. Only compliance with requirements is being checked and controlled. The only indicators that are being used are number of hectares enrolled and under contracts.

Designing a PES scheme in UC4:

PES could play a transformative role in financing biodiversity-related ecosystem services in UC4, as they would act as direct financial incentives for farmers and land managers. Farmers managing semi-natural grasslands would receive payments tied to measurable ecosystem services and for income foregone and additional costs occurred. PES could complement existing and well-established CAP Agri-Environment-Climate Measures (AECMs) and eco-schemes by rewarding outcomes such as bird populations or presence of flower indicator species rather than just practices.

PES in UC4 could bridge conservation and rural development by making biodiversity a marketable service. Especially in case of combining public and private financing, PES could create long-term, self-sustaining mechanisms that support farmers while enhancing biodiversity.

PES has huge potential but is at this point only partially adapted to our UC4. Goričko has high biodiversity value, there are existing conservation frameworks (Natura 2000 and protected area) and existing CAP AECM schemes, that already provide a baseline that PES could build upon. With the Regional Park Goričko (managing the protected area) and Institute for nature conservation (managing Natura 2000 site) the institutional anchors for piloting financial tools are present. But on the other hand there are some limitations: fragmented farm structures, small parcels, ageing farmers, weak local market, data gaps, financial literacy and capacity.

There is a long list of ecosystem services that semi-natura grasslands provide. But through PES UC4 will focus on biodiversity conservation and pollination services. In order to enhance and ensure the delivery of the selected environmental services, the following practices need to be implemented: low-intensity (late and up to 3 cuts) and mosaic mowing, low-intensity (conservation) grazing, no mineral fertilizers, no mulching, uncut grass strips and restoration of abandoned and overgrown grasslands.

UC4 aims to pilot a PES scheme that would be financed through mixed public + private funding. Public side would be the CAP and the private side could be food retailers, eco-tourism operators, green finance institutions, carbon/biodiversity credit buyers,….

The payment calculation would be done with a hybrid model combining result-based indicators (measurable outcomes like orchid abundance, bird populations, pollinator diversity) and practice-based indicators (mowing dates, grazing density, no-fertiliser commitments). After some years only the result-based approach would stay. The distribution would go through local governance structures - Goričko Regional Park Authority - as a trusted intermediary. UC4 will explore the possibility to use digital payment platforms, smart contracts and blockchain linked to verified monitoring results.

The biggest challenges in designing and operating PES schemes in UC4 are the following:

- Low farmer engagement, as they are reluctant to take on risks without clear financial incentives.
- High monitoring costs – result-based schemes require robust verification (field surveys, bioacoustics, remote sensing).
- Land fragmentation – many small parcels.
- Equity concerns – balancing payouts between smallholders and larger landowners.
- Market volatility – risk if private funding sources (retail, credits) dry up.

One of the most important aspects is monitoring and evaluation indicators to assess the effectiveness in delivering ecosystem services. In order to assess effectiveness, indicators should link directly to ecosystem services – in UC4 biodiversity conservation and pollination services. The following biodiversity indicators seem suitable:

- Species richness and abundance (plants, pollinators, farmland birds, butterflies).
- Presence/absence of indicator species (e.g., orchids, …).
- Habitat quality indices (flower cover, structural diversity, presence of shrubs/trees, indicator species)

In order to monitor and assess the effectiveness in delivering ecosystem services the appropriate tools, methodologies and technologies need to be first tested and later implemented. There is a very long list of tools, methodologies and technologies that could be used for data collection and analysis. To name a few:

- field-based surveys: vegetation quadrats, soil sampling, bird/insect counts;
- bioacoustics: sensors for birds, bats and insects;
- DNA metabarcoding: eDNA for biodiversity monitoring;
- farmer self-reporting/assessment apps: recording practices (mowing dates, grazing intensity, fertiliser use, presence of indicator species,…);
- remote sensing;

In BIO-CAPITAL project remote sensing plays a vital role and is highly relevant for scaling monitoring, especially for PES. Within the project this approach will be tested.

Stakeholder engagement:

Farmers, landowners, land managers, local authorities (municipalities), NGOs, cooperatives, farm advisors, producer groups, protected area bodies, researchers and other users of ecosystem services have been identified as key stakeholders. As the farmers are the main stakeholders, their active participation from the beginning and at all stages of the PES framework – design (co-creation of schemes, defining eligibility and payment levels, assessing logic and feasibility of the schemes), implementation (farmer-led initiatives, supported by cooperatives and advisors) and evaluation (participatory evaluation, with farmers involved in defining success indicators.) needs to be ensured.

- Blended Finance / Green Bonds / Insurance Schemes

In Goričko and Osrednje Slovenske gorice (and more broadly in Slovenia), insurance exists but is not the main tool for biodiversity-related risks. Farmers in Slovenia can insure against hail, drought, frost, flood and storm damage to crops and orchards. Insurance typically covers direct crop/livestock losses, not ecosystem services or biodiversity assets (e.g., pollinators, hedgerows, meadows). Premiums are often too costly for smallholders, especially in regions like Goričko where margins are low. Uptake is low and uneven; many farmers rely on EU/national disaster relief instead.

Public disaster relief: the Slovenian government compensates farmers for extreme weather events (droughts, floods, hail). These are reactive, not preventive and payments can be delayed.

CAP pillar II offers risk management support (co-financing of insurance premiums, income stabilization tools). Agri-environment-climate measures (AECMs) reduce risk indirectly by supporting more resilient practices.

Are they actively used? Insurance: Actively used by some commercial farmers (especially in orchards and vineyards where hail risk is high), but uptake is low among smallholders. Disaster relief: Widely relied on; but it creates dependency rather than resilience. Risk management under CAP: exists in theory, but Slovenia has limited uptake of income stabilization tools compared to Western EU countries.

Insurance schemes have big potential in UC4 and it will be further investigated under WP4. Insurance payouts could effectively sustain conservation continuity if they would be linked to AECM/PES contracts (farmers commit to ecosystem restoration as payout condition), fast and simple (so mowing/planting can be done in time) and aggregated where needed (cooperatives, municipalities, Park Authority use part of payouts for collective ecosystem restoration).

There is also huge potential to combine parametric insurance with existing agri-environmental (AECM) schemes. AECM schemes have a long tradition in Slovenia and farmers are very familiar with them. Farmers that are enrolled in CAP AECM schemes already receive 400€/ha/year for extensive grasslands, late mowing and so managing Natura 2000 grassland habitats - a portion could be earmarked to cover premium payments and so making insurance enrolment automatic for AECM participants or insurance could be tied to these parcels and so guaranteeing continuity of habitat management even after shocks.

- Result-based Payments

Slovenia is actively exploring and trying to implement innovative financial tools to promote biodiversity in grasslands. These tools aim to align economic incentives with conservation goals, ensuring that farmers and agribusinesses are rewarded for sustainable practices.

But unfortunately, not much is implemented. There are 2 result-based payment schemes programmed in the Slovenian CAP Strategic plan 2023-2027 within the AECM intervention.

The first scheme is Conservation of Dry Grasslands (Operation BK.15). The scheme was introduced in 2025 and is using a results-oriented approach, allowing farmers and land managers to choose the most suitable management method to achieve the set outcome. Financial compensation for achieving good results will be based on the level of habitat preservation of the dry grasslands. Interested farmers who wish to actively participate can voluntarily join the scheme. The scheme "Conservation of Dry Grasslands" cannot be implemented just anywhere, but only on areas with the qualifying habitat type EU_6210(*) Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) in the Natura 2000 areas of Boč – Haloze – Donačka gora, Haloze – wine-growing, Kum, and Gorjanci – Radoha.

The second scheme is Habitats of Birds in Humid Extensive Meadows (Operation BK.14 - VTR) and is a semi-result-based scheme. It has a management component, where payment depends on the implementation of certain requirements. The management part is enhanced with a results-based component, where payment depends on the outcome.

- Carbon credits

There are no carbon farming initiatives in Slovenia. But this initiative has huge potential in Slovenia. Slovenia is ~58% forest, ~57% of agricultural land grasslands and ~37% Natura 2000, with Goričko's 46.200 ha dominated by permanent grasslands, mixed arable, orchards and extensively managed forests.

Alignment with Triple Capital Accounting (Natural, human/social, financial capital)

Natural: The most critical natural assets in Goričko and Osrednje Slovenske gorice are its mosaic farmland and high landscape heterogeneity, traditional high-trunk orchards, extensive grasslands and forests, which together sustain biodiversity, pollination, water regulation, carbon storage and cultural identity.

The multifunctionality of grasslands offers great potential for providing a number of ecosystem services, such as:

- provisioning services, including producing fodder for animals, food production (dairy, meat, wool, leather, honey), water (drinking water and irrigation), raw materials (fodder, fertilizer, bioenergy, biochemical products, medicinal plants, wild food, plants for decoration) and genetic material of sources (drugs);
- regulating services, including climate regulation, carbon sequestration, erosion prevention and control, water regulation (quantity, quality and water flow regulation), flood prevention, air quality regulation, soil formation, soil fertility, pest control, waste treatment, habitat function (including maintaining genetic diversity and the life cycle of migratory species), pollination services, biological control of pests, ecological connectivity;

- cultural services, including source of the aesthetic landscape, tourism, recreation areas, hunting, heritage, spiritual experience, social cohesion, research opportunities and cognitive development.

Human/social: The human/social backbone of Goričko and Osrednje Slovenske gorice lies in its family farms, cooperatives, farm advisory service, the protected area authority and strong local identity and traditions. Together, these actors sustain the practices (low-input agriculture, orchard upkeep, biodiversity-friendly farming) that make the region's ecosystem services viable.

Financial capital: If mosaic farmland and extensively managed grasslands get abandoned or intensified this leads to loss of pollinators, birds and biodiversity in general and results in reduced ecosystem services (pollination, soil fertility, erosion control,…). Farmers may also lose value-added opportunities (eco-tourism, premium branding).

If depopulation continues human and social capital will deteriorate. Traditional knowledge will get lost and grasslands will get abandoned and this will result in biodiversity loss. There will be fewer stewards to maintain the mosaic landscape.

If cooperatives and producer groups get weakened the farmers will lose bargaining power and access to markets, collective action for landscape-scale management will be reduced and higher costs and lower competitiveness of small farms will occur.

How TCA could strengthen UC4:

Triple Capital Accounting (TCA) would strengthen the Goričko use case by linking ecological, social, and financial data into one system, showing how preserved species-rich grasslands directly support farmer livelihoods and community well-being. It would make PES schemes more transparent and trusted, while also unlocking access to green finance and insurance. To implement TCA, there is a need for practical training for farmers and advisors, simple monitoring tools, advisory and institutional support for data management, and stable funding to cover the costs of long-term tracking and independent verification.

The identified main barriers to collecting or using capital-related data in UC4 are high monitoring costs, limited budgets, short-term projects, lack of expertise, limited advisory support, data fragmentation, complexity, uncertainty, limited access to digital tools, connectivity gaps, data privacy concerns, low trust in institutions, perceived extra workload, administrative burden and missing standard methods at the farm scale.

Enabling Financial Conditions and Barriers

Implementing measures for grassland conservation in Slovenia faces several policy-related challenges. These challenges stem from historical shortcomings in agri-environmental measures, institutional constraints, lack of expertise, administrative barriers, favouring conventional "grey" solutions, limited integration of measures into broader policy frameworks, lack of adequate financial incentives and support mechanisms and resistance of farmer society.

The primary barriers to adopting sustainable grassland management practices in Slovenia are low profitability and insufficient compensation; labour intensive; aging farmers, lack of successors, cultural change and social perception; depopulation of rural areas; lack of training, tools, or adaptive management skills; no feedback loop or reward for biodiversity improvements; complex applications and additional administrative work; fragmented land ownership and small parcels.

Local farmers in Slovenia recognize the ecological importance of species-rich grasslands but encounter several obstacles that hinder the adoption of sustainable management practices. Their perceptions are shaped by economic, institutional and socio-cultural factors.

Many farmers find that current agri-environmental subsidies do not adequately compensate for the additional labour and reduced yields associated with biodiversity-friendly practices. This economic shortfall makes it challenging for them to justify the transition to or maintenance of such practices. Furthermore, smaller and semi-subsistent farms often lack the financial resilience to absorb these costs, making them particularly vulnerable to economic pressures that discourage sustainable grassland management. Many agri-environment-climate measures (AECMs) offer insufficient compensation compared to the income forgone from more intensive land uses (e.g., silage production, crop conversion). Grassland in Natura 2000 sites often comes with mowing restrictions, but payments don’t fully offset lost yield or labour costs.

The aging farming population in Slovenia presents a significant barrier. Older farmers may be less inclined to adopt new conservation practices or participate in training programs. Additionally, the absence of successors to continue farming operations leads to land abandonment, resulting in the overgrowth of grasslands and loss of biodiversity.

While awareness of the importance of species-rich grasslands has increased, especially among farmers involved in targeted conservation projects, there remains a gap in translating this awareness into practice. Farmers express a preference for personalized, on-farm advisory services and small group training sessions over general lectures. However, access to such tailored support is limited, hindering the practical implementation of sustainable practices.

Farmers often perceive conservation regulations, such as those associated with Natura 2000 sites, as complex and burdensome. The administrative requirements and perceived rigidity of these policies can discourage participation. Moreover, a lack of trust in institutions and concerns about the fairness and transparency of policy implementation further exacerbate these challenges.

Collective management approaches, which can be effective in conserving large areas of grassland, face obstacles due to fragmented land ownership and varying levels of commitment among farmers. While some farmers are open to collaborative efforts, others are sceptical about the benefits or concerned about potential conflicts, making coordinated action difficult.

Another problem are the administrative delays in processing payments and applications through the Slovenian Agency for Agricultural Markets and Rural Development. Complexity of application requirements discourages participation, especially for elderly or part-time farmers.

Many schemes are input-based, prescribing fixed actions (e.g., mowing after a certain date), rather than outcome-based, which would allow farmers to innovate. This rigidity can conflict with local weather, terrain or farm systems, leading to frustration or low compliance.

Current incentives mainly target individual parcels, not landscape-scale coordination needed for pollinators, grassland birds and mobile species. There's limited support for cooperative or collective action among farmers.

While Natura 2000 areas receive some prioritization, many species-rich grasslands outside protected areas remain unsupported. Spatial targeting is not always refined enough to direct payments to the most ecologically valuable grasslands.

Many conservation contracts are limited to 5-year commitments, which may not be sufficient for restoring degraded grasslands, building trust and behavioural change and securing habitat for long-term species viability.

Most current schemes lack feedback loops: farmers do not get ecological monitoring results or technical advice tied to performance. There is limited support for adaptive management based on changing climate, species trends or local knowledge.

Financial incentives are often not tailored to the needs of younger or start-up farmers, who lack upfront capital, may lease rather than own land face complex entry barriers into CAP schemes.

Despite these challenges, participation in targeted conservation projects has led to positive shifts in attitudes among some farmers. For instance, involvement in the "Life to Grasslands" project resulted in 58% of participating farmers changing their views on the importance of preserving species-rich grasslands, and 43% reported adjustments in their agricultural practices. These findings suggest that well-designed, participatory projects can effectively engage farmers and promote sustainable practices.

Land tenure plays a critical role in the adoption of sustainable grassland management in Slovenia. Whether land is owned, leased or informal arranged significantly affects how it's managed - especially when it comes to investing in long-term, biodiversity-friendly practices.

One other important aspect is the high fragmentation of farmland. Slovenia’s rural landscape is highly fragmented, with many small plots and mixed ownership (individuals, state, municipalities, cooperatives). This makes it difficult to coordinate landscape-scale approaches (e.g. corridor creation, shared grazing systems), which are crucial for sustaining species-rich grassland ecosystems.

5.1.8 Risk Management Strategies

In Goričko and Osrednje Slovenske gorice there are already some risk management strategies in place, though they are fragmented and not always tailored to climate change. Current risk management relies on traditional practices, CAP measures, forestry monitoring, municipal flood/drainage management and community-based fire brigades. However, strategies are piecemeal and reactive, not yet integrated into a forward-looking climate resilience framework.

Slovenia has implemented some strategies to mitigate risks in agriculture arising from natural hazards, climate change, pests and diseases. These strategies are integrated within national policies and especially the EU’s Common Agricultural Policy (CAP) Strategic Plan for 2023–2027 and before in the CAP Rural Development Programme 2014-2022. UC area stakeholders use these strategies, as they are implementing different Agri-Environment-Climate Measures (AECMs) like conservation tillage, crop diversification, use of drought- and flood-resistant plants. They are also investing in infrastructure (irrigation systems, flood control, anti-hail nets) and implementing climate change adaptation and mitigation measures. They are also implementing Integrated Pest Management (IPM). Also, insurance schemes are available - subsidized insurance products to protect against yield losses due to adverse weather events. Farmers in the UC area can insure their crops through various agricultural insurance schemes. These programs are designed to protect against losses from natural hazards, pests and diseases, and are supported by both national policies and the European Union's Common Agricultural Policy (CAP).

The most widely used tool are the crop insurance schemes, that that cover a range of risks, including adverse weather events (e.g., hail, frost, drought, floods), plant diseases and pest infestations and other natural disasters affecting crop yield. These insurance products are typically provided by private insurance companies. To encourage participation in crop insurance programs, the Slovenian government provides financial support to farmers by subsidizing a portion of the insurance premiums. This co-financing approach reduces the financial burden on farmers and promotes risk management practices in agriculture.

Environmental Risks

- Climate variability, climate extremes and drought - reduced grassland productivity on one hand and loss of floral and fauna diversity on the other.
- Invasive and encroaching vegetation - biodiversity loss and higher management costs.
- Hydrological alteration - drying of wet meadows and consequently loss of amphibian/butterfly breeding sites.
- Nutrient and pesticide drift from adjacent fields
- Loss of traditional management - decline in habitat quality and species richness due to abandonment and intensification.

Operational Risks

- Institutional fragmentation - overlapping mandates (ministries, park authorities, municipalities) and slow decision-making.
- Low stakeholder engagement or trust - Weak adoption of new financial mechanisms.
- Data gaps or low interoperability - difficulty in verifying biodiversity outcomes (affects payment triggers).
- Limited capacity for monitoring - inconsistent habitat/species data undermines performance-based finance.
- Land-tenure complexity - delays in contracting or restoration work.

Financial Risks

- Insufficient investor appetite / delayed capital mobilisation - limited scale of pilot finance mechanisms.
- Revenue volatility from ecosystem-service markets - unstable cash flow for farmers or park funds.
- Currency / interest-rate changes - affect return calculations for private investors.
- High transaction / verification costs - reduce net benefits to land managers and farmers.
- Dependence on CAP or public subsidies - policy changes could reduce co-funding.
- Financial mismanagement or fraud risk - reputation and compliance risk.

Mitigation Measures

- Establish a multi-level steering group (ministries + parks + finance + research).
- Define KPIs and reporting schedule.
- Deploy geospatial dashboards for real-time habitat monitoring (Sentinel-2, drones).
- Use third-party scientific audits to validate ecological performance.
- Build a risk-buffer fund (5–10 % of portfolio) to cover underperformance.
- Adopt transparent benefit-sharing rules for land managers.
- Provide training for park staff and farmers on contracts, finance and monitoring.
- Offer peer-learning exchanges with other use cases.
- Develop a crisis communication plan (environmental incidents, financial delay).
- Annual adaptive-management review to adjust measures.

5.1.9 Implementation Roadmap

Integration with Other WPs:

- WP2: Financial instruments
- WP3: Biodiversity baselines and metrics
- WP4/WP5: Demonstration and upscaling
- WP6: Stakeholder engagement and communication

Expected Replicability Potential

UC4 is designed as a proof-of-concept for mobilising biodiversity investments through measurable, spatially explicit grassland biodiversity indicators, multi-source financing (public + private + community) and participatory governance via protected area and Natura 2000 frameworks. Its replicability potential therefore lies in demonstrating that small-scale, mosaic European landscapes can attract capital and deliver measurable ecosystem returns when backed by sound data and local stewardship.

The approach can be replicated horizontally across other Central-European HNV landscapes and vertically within Slovenia’s national biodiversity-finance system.

6. Use Cases Description: 5

6.1. UC5: River corridors and wetlands buffers, UK

6.1.1 Use Case Overview

UC ID and Title: UC5: River corridors and wetlands in UK

Lead Organisation(s): Westcountry Rivers Trust

Supporting Partners: Engaged Landowners

6.1.2 Location and Ecosystem Profile

Description of UC structure: Practice oriented

Geographic Coverage

The southwest of England, with demonstration sites located in Devon and Cornwall. These sites represent typical lowland agricultural catchments and valley systems, where historical modification and land drainage have reduced habitat diversity and connectivity.

The sites represent typical small-scale farming landscapes, characterised by traditional hedge-bank systems and integrated water management practices. Each site exemplifies different aspects of nature-based solutions implementation, from wetland restoration to invasive species management and riparian buffer enhancement.

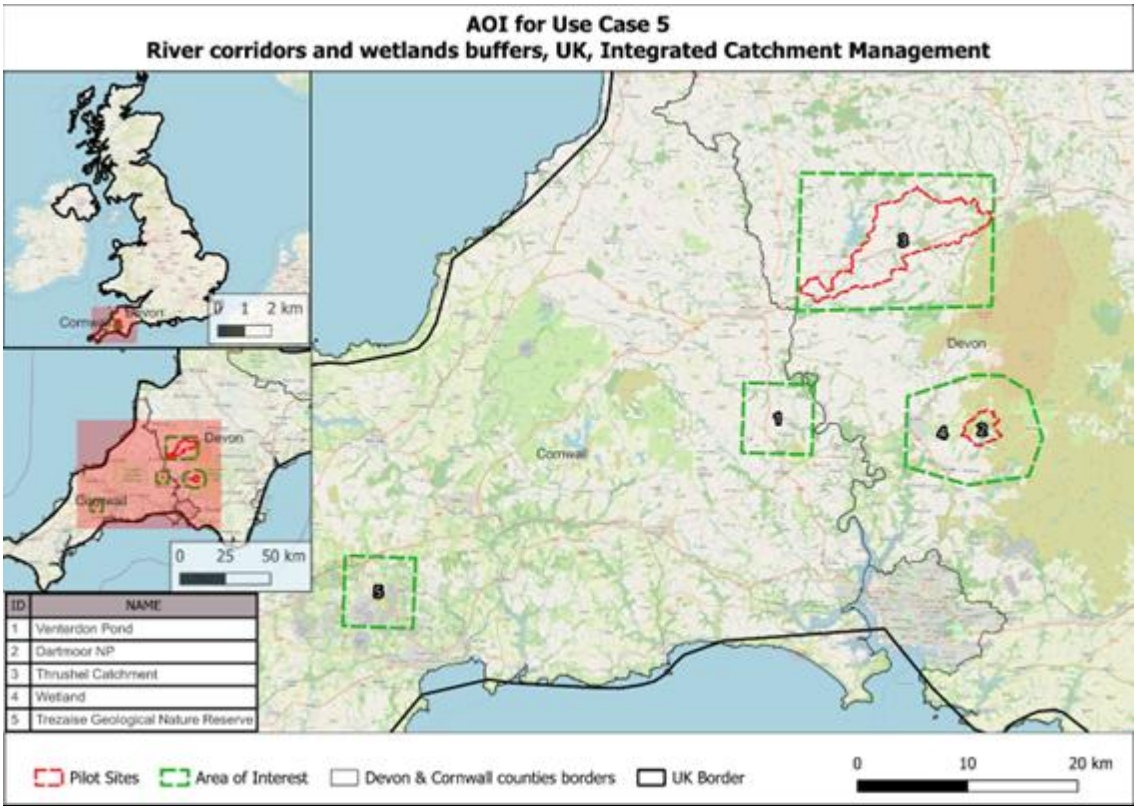
Agro-environmental description

Agricultural activity has a strong influence on the condition of river corridors and wetlands. In many areas, livestock have unrestricted access to watercourses, leading to bank erosion, poaching, and nutrient enrichment. Intensive cultivation and drainage have often extended right up to the river edge, reducing riparian vegetation, increasing sediment and nutrient runoff, and disconnecting rivers from their floodplains. The use of fertilisers and pesticides further contributes to water quality pressures, while the loss of buffer strips and wetland margins limits habitat connectivity and resilience. However, well-managed farmland can also play a positive role. Agri-environment schemes that promote buffer zones, reduced stocking densities, and the rewetting of floodplains can help restore natural processes, improve water quality, and support biodiversity within agricultural landscapes.

Ecosystem Type

The project focuses on the restoration of river corridors and associated wetland habitats to enhance biodiversity, improve water quality, and strengthen climate resilience.

Map and Spatial Reference



As part of this work, WRT are engaging with a multitude of sites and landowners to understand the nuances of different interventions, scale and scope.

6.1.3 Environmental Context

Key Biodiversity Features

Wetlands and river corridors in the UK are rich in biodiversity and form vital natural networks that span and connect habitats across the landscape. Shaped by dynamic hydrological and geomorphic processes, they exist in a state of quasi-equilibrium, constantly adjusting to changes in flow, sediment, and climate while maintaining their overall ecological balance. This dynamism creates a mosaic of habitats, including riffles, pools, backwaters, fens, reedbeds, and wet woodlands, which support species such as salmon, trout, otter, water vole, white-clawed crayfish, and kingfisher. Riparian vegetation provides shading, stabilises banks, and facilitates species movement between habitats, while floodplains, scrapes, and ponds offer key breeding and feeding areas for birds and amphibians. These systems also deliver essential ecosystem functions such as nutrient cycling, water purification, flood storage, and carbon sequestration, making them among the most valuable and ecologically active habitats in the UK.

Threats and Pressures (current and historical)

Rivers and wetlands in the UK have been heavily shaped by both past and present human activity. Historically, land drainage, channel straightening and embankment building were carried out to improve agriculture and control floods, but these actions disconnected rivers from their natural floodplains. Industrial waste and untreated sewage also left long-lasting pollution in sediments. Today, water quality remains under pressure from agricultural runoff, urban drainage and combined sewer overflows. Flow regulation, abstraction and barriers such as weirs continue to alter natural hydrology and block species movement, while development, intensive land use and invasive species contribute to further habitat loss. Hard engineering and bank erosion have reduced the ability of rivers to adjust and form diverse habitats.

Climate Change Vulnerabilities

Climate change adds to these challenges, bringing more frequent floods and droughts, warmer water temperatures and rising sea levels that threaten coastal wetlands. Together, these pressures have simplified river systems, reduced connectivity and weakened their ecological resilience.

Baseline Biodiversity Status

The baseline watercourse unit values represent the existing biodiversity value of each assessed river reach prior to any restoration. Most of the sections surveyed show low baseline values (generally below 1 unit), indicating short or degraded reaches likely in moderate to poor condition. A few higher values, such as 3.71 and around 0.9, suggest longer or better-quality sections within the surveyed area. Overall, the dataset indicates a river system with relatively low baseline ecological value, offering good potential for biodiversity enhancement and measurable uplift through habitat improvement.

6.1.4 Use Case Objectives

Overview of Objectives

Restoration and protection of riparian and wetland ecosystems through conservation covenants and nature-based solutions.

Tasks and Implementation Approach

In the context of river and wetland restoration in the UK, River Condition Assessment (RCA) and Biodiversity Net Gain (BNG) provide a structured, evidence-based framework for planning and delivering habitat improvements. RCA identifies pressures and prioritises actions to restore hydromorphology, connectivity, and ecological condition. BNG ensures that these actions are linked to measurable biodiversity gains and supported by financial mechanisms, making restoration economically viable for landowners and developers.

Practical interventions may include riparian planting, floodplain reconnection, barrier removal, and creation or enhancement of wetland habitats, all designed to improve habitat quality and

landscape connectivity. Engaging stakeholders across the catchment is essential to align ecological objectives with financial opportunities, for example through conservation covenants, habitat banking, or environmental investment schemes.

Together, RCA and BNG provide a framework that guides evidence-based ecological restoration and secures the necessary funding plus incentives to ensure long-term implementation, maintenance, and measurable biodiversity outcomes.

Conservation Covenants through 'Responsible Bodies' (such as WRT) are routes to protecting conservation interventions through a legal contract formed between the landowner (the seller) and the Responsible Body, with established Habitat/Environment Banks acting as brokers with potential buyers.

Environmental Goals

To identify and implement innovative solutions for the restoration and protection of riparian and wetland ecosystems, enhancing habitat quality, connectivity, and resilience. This includes the application of conservation covenants, nature-based solutions, and Biodiversity Net Gain mechanisms to deliver measurable biodiversity improvements. To understand if BNG and Conservation Covenants as well as novel Biodiversity Certificates can be real routes to leverage finance for river restoration ambitions.

Economic Goals

To make the restoration and protection of riparian and wetland ecosystems economically and financially viable. This involves identifying and mobilising investment flows, funding mechanisms, and market-based instruments such as Biodiversity Net Gain, conservation covenants, and environmental investment schemes to support the implementation of nature-based solutions. By aligning ecological objectives with financial incentives, the approach aims to enable landowners, developers, and stakeholders to adopt restoration measures without compromising economic feasibility, while ensuring long-term maintenance and measurable biodiversity outcomes.

Policy Alignment:

By linking ecological restoration to financial incentives and investment flows, these approaches aim to make habitat enhancement economically viable, encourage stakeholder participation, and secure long-term ecological benefits. The work aligns with the EU Biodiversity Strategy for 2030/ UK Biodiversity Strategy and the 25 Year Environment Plan, which set targets for ecosystem restoration, species recovery, and the creation of nature networks. It also supports objectives under the Water Framework Directive, which remains part of UK law and promotes good ecological and chemical status in water bodies, and is reinforced through Environmental Land Management (ELM) schemes, which provide funding for biodiversity-friendly land and river management. Additionally, these interventions contribute to climate adaptation and Net Zero objectives, promoting nature-based solutions that enhance flood resilience and overall ecosystem function. BNG is now a legal route in the UK for leveraging biodiversity improvements linked to development.

Expected Outcomes

To understand if BNG and Conservation Covenants as well as novel Biodiversity Certificates can be real routes to leverage finance for river restoration ambitions. Formalise the mechanism to deliver measurable improvements in the ecological condition of riparian, river and wetland habitats, including enhanced biodiversity, restored hydromorphology, and increased habitat connectivity via conservation covenants, Biodiversity Net Gain or other mechanisms. The project will provide financially viable pathways for landowners and stakeholders to adopt restoration measures. Overall, the approach aims to create long-term, sustainable benefits for ecosystems, people, and the wider landscape, aligning with national and EU biodiversity targets.

6.1.5 Beneficiaries

Primary Beneficiaries: Nature, landowners, farmers, and river corridor managers

The primary beneficiary of river and wetland restoration is Nature. Positive ecological outcomes, such as improved habitat quality, enhanced biodiversity, and restored hydromorphology, do not usually generate immediate financial returns for landowners or managers. They contribute to the conservation and protection, providing long-term benefits for society and the environment.

However, landowners, farmers, and river corridor managers are also primary beneficiaries in that they may receive financial incentives for implementing restoration measures, as well as intrinsic benefits such as enhanced landscape quality, stewardship, and long-term resilience of the land they manage.

Secondary Beneficiaries: local communities, recreational users, public institutions, and investors.

Secondary beneficiaries include landowners and stakeholders (ie flood authorities) across the catchment, who may gain indirect benefits such as improved flood resilience, water quality, and access to natural spaces. Wider communities benefit from enhanced environmental resilience, including climate adaptation, natural flood management, and mitigation of the detrimental effects of degraded ecosystems. Investors, public bodies, and conservation organisations also benefit from measurable biodiversity gains and evidence-based monitoring. By protecting and restoring ecosystems, these interventions contribute to both planetary and human health, demonstrating that safeguarding nature ultimately supports people, society, and long-term sustainable development through ecosystem services.

6.1.6 Methodology

Remote Sensing:

- Enables scalable assessment of habitat condition, vegetation cover, and landscape changes over time.

GIS:

- Supports detailed spatial mapping of riparian zones, wetland margins, and habitat connectivity.

- Helps identify priority areas for intervention and informs the design of nature-based solutions that deliver Biodiversity Net Gain (BNG).

Indicator Development:

- Ecological and hydromorphological indicators support schemes such as Upstream Thinking.
- Aligns with the Water Framework Directive (WFD), providing a framework for monitoring, evaluation, and adaptive catchment management.

Overall Purpose:

- Facilitates evidence-based, data-driven decision-making.
- Links habitat restoration with measurable biodiversity outcomes and long-term ecosystem resilience.

Field Data Collection – MORPH BNG RCA

River Condition Assessments (RCA):

- Conducted on Cartographer to evaluate river and wetland habitat condition.
- Identifies ecological pressures and prioritises restoration interventions.

MORPh Framework:

- Standardised hydromorphological surveys of channel form, sediment, and flow dynamics.

Biodiversity Net Gain (BNG) Frameworks:

- Quantifies habitat enhancements.
- Supports development of offset requirements and monitoring of long-term ecological gains.

Ground-level measurements:

- Soil testing, water quality analysis, and pesticide modelling.
- Provides complementary data to support evidence-based restoration planning.

eDNA Sampling:

- Collects environmental DNA from water, sediment, or soil to detect and monitor species presence, including rare or elusive aquatic organisms.
- Supports biodiversity assessments and complements traditional field surveys, providing rapid, cost-effective, and non-invasive data.

Sensor-Based Monitoring:

- Includes automated sensors for water level, flow, temperature, turbidity, and nutrient concentrations.
- Provides continuous, high-resolution data to track hydrological and water quality changes over time.

6.1.7 Risks and Challenges

Environmental Risks:

- Natural disturbances, including floods, droughts, and extreme weather events, which may affect restoration outcomes.
- Climate change impacts altering hydrology, water quality, and species distributions.
- Invasive species or unexpected ecological responses.

Operational Risks:

- Stakeholder resistance or uncertainty, particularly among landowners, farmers, and river corridor managers.
- Land tenure complexities or access restrictions.
- Coordination challenges across multiple sites or catchments.
- Specific BNG-related risks, including landowner uncertainty around financial returns, fluctuating demand for off-site Units.
- Responsible Body risks of long term agreements, ability to enforce breaches in covenant

Financial Risks:

- Insufficient or short-term funding to implement or maintain measures as BNG agreed implements must be maintained for 30 years.
- Situations where financial incentives for interventions (e.g., weir removals) may not score high enough in calculations to support transactions or cover costs.
- Dependence on emerging BNG markets, with price and demand uncertainties.
- High upfront costs of restoration interventions without immediate financial return.
- Uncertainty around legal responsibilities surrounding conservation covenants, long-term management, and resource requirements.
- Complexity surrounding stacking of credits.

Mitigation Measures

- Transparent communication and engagement with landowners and organisations to manage expectations.
- Capacity building and guidance on legal and management obligations for conservation covenants.

- Emphasising ecological co-benefits, resilience, and long-term ecosystem gains alongside financial incentives.
- Prioritising stacked interventions to maximise both ecological and financial outcomes.
- Adaptive management informed by monitoring, eDNA, sensor data, and RCA/MORPH surveys.
- Only take on low- risk responsibilities surrounding conservation covenants with minimal management expectations.
- Diversifying funding sources, including BNG credits, environmental investment schemes, and public funding.

6.1.8 Implementation Roadmap

- **Integration with Other WPs**

WP3: Biodiversity baselines and metrics

The baseline watercourse unit values represent the existing biodiversity value of each river reach, forming the foundation for assessing Biodiversity Net Gain (BNG). Under the BNG metric, each section of watercourse is assigned a numeric value based on its length, habitat condition, and strategic significance within the wider landscape. These values together provide a quantifiable measure of the river's current ecological quality.

Most of the baseline values that have been surveyed are below one unit, suggesting that the surveyed reaches are in moderate to poor condition, with limited habitat diversity or connectivity. A few higher values, such as 3.71 and around 0.9, correspond to those already supporting better-quality habitat.

Overall, the baseline results indicate that the river reaches that have been surveyed currently provides a relatively low biodiversity value, highlighting opportunities for significant ecological uplift. Through restoration actions such as regrading banks, reinstating natural processes, and improving in-channel habitat, the post-intervention condition scores would increase, resulting in measurable gains in biodiversity units. These gains, when compared to the baseline, form the basis for demonstrating compliance with Biodiversity Net Gain requirements.

Preliminary Results & Insights

Early-stage findings, pilot feedback, stakeholder responses

Watercourse BNG units are currently valued around £95,000 to £205,000, there is very scarce availability of these units available on the market to buy and highly complex to parcel up as a sale, due to complex landownership of rivers and watercourses in UK, reduced availability of expertise able to design and assess watercourses.

7. Conclusion

This deliverable presents a comprehensive overview of various use cases aimed at advancing biodiversity conservation and ecosystem management across different regions and ecosystems. Each use case highlights unique approaches and methodologies tailored to specific environmental challenges and objectives, reflecting the diversity of strategies needed to address complex ecological issues.

Overall, these use cases collectively highlight the multifaceted nature of biodiversity conservation and ecosystem management. They demonstrate the need for diverse and context-specific approaches to address environmental challenges, integrate ecosystem services, and promote sustainable practices. The experiences and findings from these use cases offer valuable insights for replicating successful strategies in other regions and for developing innovative solutions to emerging environmental issues.

As we progress, it is crucial to continue fostering collaboration among stakeholders, leveraging technological advancements, and ensuring that financial and policy frameworks support effective conservation and restoration efforts. By building on the knowledge and experiences presented in these use cases, we can advance our understanding of biodiversity dynamics, enhance ecosystem resilience, and contribute to the sustainable management of natural resources across Europe and beyond.

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9. Annex

Annex 1 – UC1 Gantt diagram

Gantt - UC1		YEAR 1				YEAR 2				YEAR 3				YEAR 4	
Activity	Integration with WPs	01.06.24 Q1 30.08.24	01.09.24 Q2 30.11.24	01.12.24 Q3 28.02.25	01.03.25 Q4 31.05.25	01.06.25 Q1 30.08.25	01.09.25 Q2 30.11.25	01.12.25 Q3 28.02.26	01.03.26 Q4 31.05.26	01.06.26 Q1 30.08.26	01.09.26 Q2 30.11.26	01.12.26 Q3 28.02.27	01.03.27 Q4 31.05.27	01.06.27 Q1 30.08.27	01.09.27 Q2 30.11.27
		M1-M3	M4-M6	M7-M9	M10-M12	M13-M15	M16-M18	M19-M21	M22-M24	M25-M27	M28-M30	M31-M33	M34-M36	M37-M39	M40-M42
		Phase 1		Phase 2						Phase 3					
Setting up and general coordination of UC1	T1.2	D1.3		D1.3-rev											
Mapping policy/legal framework for biodiversity protection/restoration investments	T2.1														
Identifying biodiversity-related financial mechanisms, barriers and enablers	T2.2														
Integrating key findings on biodiversity financing mechanisms	T2.4								UC1-MS1						UC-MS2
Developing financial solutions for protecting and restoring biodiversity	T4.1														
Understanding and co-designing PES Schemes	T4.2														
Integrating Natural Capital Accounting into PES Schemes	T4.3														
Understanding and co-designing Biodiversity Insurance Products	T4.4														
Understanding and co-designing Biodiversity certificates and credits	T5.3														
Engaging stakeholders to endorse Biodiversity certificates and credits	T5.4														
Ongoing Communication and Exploitation	T6.2, T6,3														

Annex 2 – UC1 Case Studies

UC1 examines a few case studies based on the list of closer-to-nature forest management interventions described in the Eu-Guidelines 2023. These case studies relevant for the implementation of the biodiversity strategy 2030 are considered independently and/or within initiatives of a broader scope (e.g., area-based conservation measures).

Case Study 1. Ensuring respectful harvest conditions - Logging techniques.

“When planning harvesting operations, it is necessary to take account of the need to preserve all the functions of the forest” (EU-Guidelines 2023, p. 22). This preservation goal in Alpine forestry is often very difficult to apply in practical operations. One key factor is the difficult accessibility of sites, which requires the use of machinery and methods with limited flexibility (such as cableways). A second key factor is wood extractions following disturbances such as wind throws and pest outbreaks: during the last decade, in many locations, these unwanted/unplanned extractions have become the rule. The combination of these two factors poses a high barrier for implementing closer-to-nature harvest conditions. Certainly, an “undue use of unsuitable machinery” and working methods also depends on the challenge of extracting wood at economically viable rates. This can often “cause negative environmental impacts such as soil compaction”, whereas “Soil properties and soil ecosystem services must be protected as the very foundation of healthy and productive forests” (EU Forest Strategy).

Case Study 2 - Mixed-species forests.

“The composition of forest species and the genetic diversity of populations of a given species are largely determined by the type of forest management practiced”, and as a matter of fact “for centuries, forest management was built on optimising or even maximising tree growth and yield measured by the production of wood. Formerly diverse forest landscapes were progressively

replaced by less diverse plantations, with reforestation often reduced to a limited number of high-yield species harvested well before their longevity potential, leading to the simplification and homogenisation of European forests" (EU-Guidelines 2023, Part I). Management practices that support biodiversity, such as diverse forests, can help to limit the outbreak and spread of bark beetles and increase a forest's physical reliance. Successful mixed reforestation requires increasing the capacities of the whole forest reproductive-material supply-chain (seed collection, storage, transport, nurseries), which is vital for both SFM and coping with disturbances. Barriers to effectively implementing these strategies in Alpine environments include the costs of fencing off afforestation areas or the individual protection of saplings from grazing cattle, sheep and wild animals. These costs of establishing and maintaining, over the first few years, the protection of young trees can be very high, given their geophysical characteristics and, often, the limited accessibility of sites.

Case Study 3 - Deadwood management.

The long-term environmental viability of forests requires that standing and fallen dead wood should be left in quantities and distribution, necessary to safeguard biological diversity as deadwood plays an important role "by serving as a natural habitat, a nutrient pool, water storage and a precursor of soil organic matter for several thousand species" (EU-Guidelines 2023, p. 26). The optimisation of deadwood retention is also critical for the objective of "Preserving and restoring forest soils and water ecosystems", among others, because it can be an effective NbS against erosion in steep Alpine slopes. On the one hand, current forest management practices, driven by productivity and cost-reduction needs, often conflict with this evidence, especially when costly and inflexible machinery needs to be used and doesn't have viable alternatives. On the other hand, frequent large scale pest break-outs encourage practices for hygiene purposes that lead to the extraction of large quantities of wood that could have otherwise been left in the forest stands (see EU-Guidelines 2023, p. 27).

Annex 3 – EU Guidelines 2023

Guidelines on Closer-to-Nature Forest Management (27.07.2023) *https://environment.ec.europa.eu/publications/guidelines-closer-nature-forest management_en*

Annex 4 – UC5 Case Studies

Case Study: Riparian Buffer Strips – Tamar Valley

A site was forecasted with 10m riparian buffer strips, with a total of 0.67 km of watercourse to be enhanced. Baseline habitat units were 6.03, with a target of 9.75, and the project delivered 3.72 units, representing a 61.7% uplift. Based on the BNG Pricing Report (2025) value of £153,750 per unit, the projected habitat units correspond to a biodiversity value of approximately £571,950, or roughly £854 per metre of enhanced buffer. The intervention includes several cost components: the development phase for establishing Conservation Covenants is estimated at £3,000 (Finance Earth), the Habitat Management and Monitoring Plan (HMMP) development costs £10,000, and tax/broker fees are approximately 5% of the development expenditure. Delivery and maintenance costs, including planting, fencing, and habitat upkeep, are expected over the project lifetime, while monitoring costs (e.g., five-yearly RCA surveys, advice, and reporting) provide ongoing oversight of condition and BNG performance. When considered alongside these costs, the riparian buffer intervention demonstrates a strong potential return in ecological value, highlighting its effectiveness as a cost-efficient measure for generating BNG credits.

Other interesting case studies from other similar projects:

Weir Removals

Case Study: Large Weir

Our largest baseline (pre-intervention) value came from a main watercourse at 3.7 units running through a manged woodland. The forecasted intervention, of the site achieved 5.94 units, delivering 3.53 BNG units. The design assumed a partial weir removal, improving the condition class from moderate to fairly good and located within the Local Nature Recovery Strategy (LNRS) area.

Interestingly, the forecasted partial weir removal produced the same unit uplift as a full removal, as neither scenario resulted in significant impoundment. The Biodiversity Metric Guide allows partial removal of encroachments when full removal of engineered structures (e.g. bank revetment or in-channel structures) is not feasible. In such cases, the encroachment multiplier can be reduced from major to minor within the enhancement tab. Cost estimates for the partial weir removal were £475,000 compared with £300,000 for full removal. Based on a valuation of £153,750 per BNG unit (BNG Pricing Report, 2025), the 3.53 units delivered equate to approximately £543,000 in biodiversity value. Therefore, this means the BNG units would just cover the cost of removal but not necessarily setting up a Conservation Covenant and maintenance.

Figure 1. Photograph of weir (Case Study One).

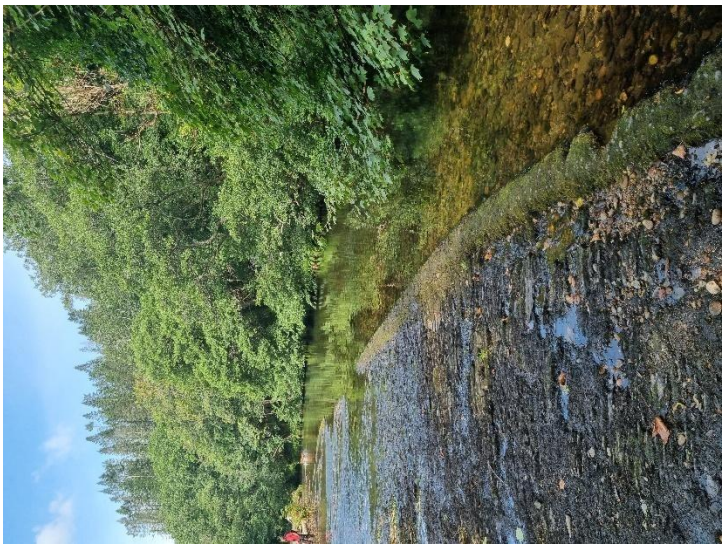

Figure 2. Photograph showing the span off weir to be removed.

Case Study: Small weir removal

Another site focused solely on a weir removal, with no stacked interventions. The RCA produced a preliminary condition score of 1.182 and a baseline biodiversity value of 0.16 units. Post-intervention modelling using the BNG Calculator and RCA Cartographer predicted an uplift to 0.29 units (a gain of 0.13 BNG units). One month after removal, monitoring recorded a post-intervention score of 1.895, corresponding to 0.24 BNG units delivered, exceeding forecasts. The modelled condition score was 1.619, showing an improvement from moderate to fairly good.

A riparian buffer strip could further enhance this site, adding an estimated 0.30 BNG units if bank-top encroachment is reduced, subject to landowner agreement, as the left bank is currently farmed to the water's edge.

Costs for the weir removal were at £36,650. Using the 2025 BNG Pricing valuation, the 0.24 units delivered equate to approximately £36,900, excluding any additional uplift from buffer creation. However, both cases have not taken into account setting up a conservation covenants agreement within this fee.

Both pilot sites demonstrate that larger weirs with extensive impoundment can deliver just enough uplift to justify removal costs, while smaller or medium-sized structures (baseline values around 0.2–0.3 units) produce lower forecasted gains of 0.1–0.3 BNG units. Based on the BNG Pricing Report, this equates to £15,000–£46,000 per site, depending on site condition and design extent. Therefore, often not covering costs.

Figure 3 & 4. Chipley weir before removal (Case Study Two).

Figure 5. Chipley weir directly after removal.

Figure 6. Chipley weir downstream view around 1 month post removal.

Figures 7-10. Photographs showing poaching from cattle and sediment incentivising riparian buffer strips (Case Study Three).

Insights

Early BNG metric calculations indicate that interventions such as reducing watercourse encroachment, establishing riparian buffers, and reconnecting floodplains generate the greatest predicted habitat condition uplift and biodiversity unit gains. In contrast, standalone weir removals generally produced lower BNG uplifts unless combined with complementary measures.

Preliminary cost analyses, covering implementation, monitoring, and maintenance, suggest that stacked interventions, such as combining riparian buffer creation with targeted channel restoration, deliver stronger ecological outcomes per unit cost and significantly increase potential BNG credits. Findings also highlight that reducing encroachment is particularly valued within the BNG metric, especially where interventions enhance connectivity and restore natural channel form.

Baseline monitoring demonstrates that sites with reduced watercourse encroachment are particularly effective at generating BNG units. Large weir removals that alleviate extensive impoundment deliver substantially higher uplifts than smaller structures, as they restore longer reaches of natural flow and habitat diversity. This relationship emphasises that primarily weirs impounding sufficient water volumes can achieve just enough habitat uplift to make removal financially viable.

Weir removals often require detailed design planning for example, determining whether to remove the full structure, the bank face only, or the entire width to estimate potential BNG units accurately. Without this information, forecasting uplift is challenging, which can increase upfront costs during feasibility stages when assessing whether the expected habitat gains justify removal, stakeholder engagement, and associated works. Moreover, often maintenance of the original weir structure (if retained) imposes ongoing safety, repair, and liability costs, which can make removal more cost-effective in the long term and therefore can be seen as incentive for removal.

Stakeholder feedback reflects interest in financial incentives linked to BNG outcomes but emphasises the need for transparent communication regarding costs, maintenance responsibilities, and the long-term ecological value of restoration works.

Conservation Covenant / Costs to be Considered within Unit Price

Phase	Cost	Notes
Development phase cost: Cost of Establishing Conservation Covenant	£10,200	Estimate taken from quotes acquired by Finance Earth *
Development phase cost: Creation of HMMP and baselining activities	£3,000 (HMMP) + baselining costs £700 (WRT to estimate)	Pre-survey prep (£205), RCA surveys (£477) Data Analysis BNG Calculations, Reporting (£2,454) = £2,934 Estimate for HMMP only, taken from quotes acquired by Finance Earth *
Development phase cost: Landowner tax, legal advice and other costs	£10,000 + tax	Estimate taken from quotes acquired by Finance Earth *
Broker costs	5% (low?)	Estimate from Finance Earth*
Delivery phase cost: Capital for initial habitat works	£1,749	Structure Removal (from medium weir removal Craig)
Maintenance and management cost: Ongoing materials and maintenance costs including contingency	£10,000	Maintenance in case something blows out.
Monitoring cost: 5-yearly RCA monitoring, advice and reporting over 30-year period	£25,000 (from Craig's 30-year costing sheet)	Finance Earth est = covenant monitoring costs @ £850 p/y for 30 years, AND £2k every 5 years for 'verification' = £37.5k)
Total Cost of Project Delivery:	**£61,844** (excluding tax on legal/landowner costs)	