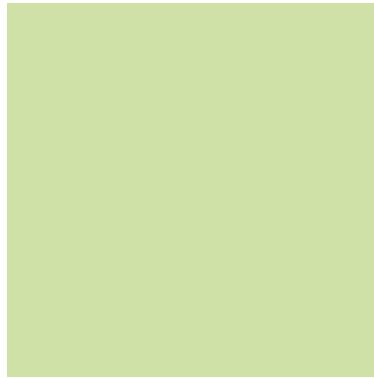




**Interreg
Sudoe**



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ECOSPHEREWINES



GREEN INFRASTRUCTURE FOR THE FUTURE OF VINEYARDS IN THE SUDOE AREA

Strategy for the Implementation of Green
Infrastructure in High Ecological Value
Viticultural Landscapes in the SUDOE Area



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During the last few decades in Europe, biodiversity and ecosystem services (EESS) have been progressively and more firmly integrated into policies on land use and agriculture. For example, the *EU Green Infrastructure Strategy*¹ and, more recently, the *EU Biodiversity Strategy for 2030*², emphasise the need to plan and manage productive land areas by incorporating Nature-Based Solutions (NBS) that can make a contribution to ecological connectivity, resilience in the face of climate change and provision of ecosystem services. These strategic frameworks explicitly recognise that agricultural systems, including permanent cropping systems such as those used for vineyards, play an important role in terms of biodiversity preservation and the sustainability of rural landscapes.

Within the region of cooperation known as the Sudoe space, which includes mainland Portugal, Spain (except the Canary Islands), southwestern regions of France and Andorra³, a wide range of national and regional strategies have been used to make progress on the promotion of green infrastructure (GI), and on ecological restoration of agricultural environments. However, these developments have been uneven and, in many cases, there are no specific adaptations to wine-growing landscapes. This situation highlights the

need for coordinated approaches and operational tools that can make it possible for these strategic principles to be translated into the design and management of vineyards in areas of high ecological value.

The purpose of this document is to present the strategy that will be used to implement GI in vineyard landscapes with high ecological value, located in the region covered by the Sudoe space. This strategy has been developed within the framework of the Interreg Sudoe ECOSPHEREWINES project entitled “Improving ecosystem services and green infrastructure in wine-growing areas with high ecological value” (ref. S1/2.7/E0010). The main objective of this strategy is to provide guidance to stakeholders in the wine sector, as well as to governmental bodies and private entities that are responsible for managing recognised wine-growing areas. The aim is to make it possible for all of them to identify, design, and implement a GI network that is focused on improving the ecosystem services provided by vineyards. To this end, a shared, coordinated framework is proposed for the entire Sudoe space, by taking advantage of the knowledge developed during execution of this project, while also considering the specific characteristics of each particular territory.

1. INTRODUCTION



The wine-growing landscapes of the region covered by the Sudoe space can be understood as **complex socio-ecological systems** that have been configured by the interaction of not only biophysical factors (agricultural practices and traditional land-use structures), but also by the historical and cultural value linked to the vineyards and their surrounding landscapes⁴. Although these landscapes have a high **productive, environmental, cultural and land-use value**, they are at the same time increasingly exposed to **climatic, ecological and socio-economic risks**, which are derived from the intensification or abandonment of agriculture, fragmentation of the territory and the progressive loss of structural elements of the landscape^{5,6}.

The approach to green infrastructure presented here has been conceived as a planned, functional network of natural, semi-natural and cultural elements that are interconnected at a variety of scales^{7,8}: vineyards, hedges, boundaries, tree groves, watercourses, living soils and natural spaces. In this context, GI represents a strategic approach that makes it possible to integrate conservation of natural capital with viticulture and winemaking activities, in a manner where the environmental and socio-economic resilience of the land area and regions are strengthened, while also enhancing their ecological connectivity, multifunctionality of the landscape and the provision of essential ecosystem services^{1,9}.

At the **European level**, the Strategy proposed in this document aligns with the *EU Green Infrastructure Strategy*¹, the *EU Biodiversity Strategy for 2030*² and the frameworks associated with the restoration

of ecosystems, and it is also in line with the guidelines of the EU's *Common Agricultural Policy (CAP)*¹⁰ with regard to ecoregimes, enhanced conditionality, and agri-environmental measures. These planning instruments recognise the value of agricultural systems in terms of their role in conserving natural capital and promoting the integration of natural resource systems, ecological connectivity and the multifunctionality of the rural landscape, which are all principles that have been fully incorporated into the Strategy presented here.

At the national and regional levels, analysis of the existing viticulture and winemaking sector in the Sudoe space demonstrates the existence of solidly established frameworks on biodiversity, GI, climate change, landscape, and rural development, which provide a solid basis for the integration of GI in wine-growing landscapes.

In **Spain**, these frameworks have been implemented by means of the *Spanish Strategy for GI and Ecological Connectivity and Restoration*¹¹, *Spanish Strategic Plan for Natural Heritage and Biodiversity Until 2030*¹² and *Spanish Climate Change Adaptation Plan*¹³, with the *EU Common Agricultural Policy* also implemented at the national and regional levels^{10,14}. These instruments recognise the role played by agricultural systems in terms of the conservation of natural capital and promotion of practices aimed at enhancing landscape multifunctionality, functional biodiversity and resilience in the face of climate change, with increasing attention given to wine-growing landscapes in the main producing regions. The Spanish wine sector has its own strategic frameworks that have addressed



2. CONCEPTUAL FRAMEWORK



the structural, economic and environmental challenges of vineyards, including the *Spanish Wine Sector Strategy*¹⁵ and the subsequent *Support Programs for the Spanish Wine Sector*¹⁶. These frameworks have contributed to the modernisation of vineyards, improvement of the sector's competitiveness, and gradual incorporation of sustainability criteria, adaptation to climate change and creation of value. In the Spanish wine-growing regions included in this strategy (Galicia and Castile and León), there are regional regulatory and strategic frameworks designed to strengthen the integration of biodiversity, green infrastructure, landscape development, and agricultural sustainability into wine-growing systems. In **Galicia**, the regional framework for natural heritage and biodiversity is primarily established through *Law 5/2019 of August 2, on the Natural Heritage and Biodiversity of Galicia*, with its section 17 establishing the planning and coordination for actions involving conservation, connectivity and ecological restoration of the territory, and including the development of a specific green infrastructure and connectivity strategy in accordance with national and European regulations on the subject. Chapter VIII of this Law expressly provided for drafting of the *Galician Strategy for Green Infrastructure and Ecological Connectivity and Restoration*, which was implemented by a regional ministerial order on 4 October 2024 and published in the Official Gazette of Galicia. In this case, the strategy defines the key environmental elements for the provision of green infrastructure and territorial connectivity. At the same time, the *Galician Landscape Guidelines (Decree 238/2020)*¹⁹ incorporate guiding principles for identification, conser-

vation, and restoration of landscape elements, as well as for the planning of green infrastructure and ecological connectivity within the landscape management performed. These are all instruments that recognise the value of traditional agricultural landscapes, including wine-growing areas, as components of a region's natural and cultural heritage, and they promote measures to preserve ecological corridors and other structural elements of the landscape, and to advance adaptation to climate change. Furthermore, the Galician wine-producing Designations of Origin and their sectoral strategies constitute a key operational framework for integrating territorial and environmental sustainability criteria in wine-growing areas. The *Strategy for Economic, Land-Use and Tourism Development of the Wine-Producing Regions of Galicia (2021-2026)*²⁰, promoted by the regional government of Galicia (*Xunta de Galicia*) in collaboration with the Juana de Vega Foundation, outlines measures aimed at strengthening the competitiveness, territorial identity and value of the natural and cultural heritage of Galicia's five Protected Designations of Origin (PDOs): Rías Baixas, Ribeiro, Valdeorras, Ribeira Sacra and Monterrei. To do this, it encourages cooperation among stakeholders, integration of vineyards as landscapes of high ecological value and progressive incorporation of climate change adaptation criteria into rural development practices. In **Castile and León**, the regional framework for natural heritage, biodiversity and land-use planning is established through *Law 4/2015 of 24 March, on the Natural Heritage of Castile and León*²¹. This statute updates and completes the legal regime applicable to the conservation

WINE-GROWING LANDSCAPES OF THE SUDOE: BETWEEN CONSERVATION AND ADAPTATION FOR THE FUTURE

of natural heritage in that region of Spain, in accordance with national and European regulations on biodiversity and protected ecosystems (the Natura 2000 Network and its obligations arising from the Birds and Habitats Directives), as well as other regional provisions on environmental planning and biodiversity conservation. In addition, Castile and León is developing planning and management instruments that address habitat and species conservation, ecological connectivity, and the integration of environmental values into land-use planning. These instruments include the *Master Plan for Implementation and Management of the Natura 2000 Network*²². The aim in this region is to ensure conservation of the natural habitats and wild fauna and flora of Castile and León, through consolidation of a network of areas and coordinated management of these natural assets. Regarding agricultural production and its sustainability, Castile and León has specific regulations on vineyards, including *Law 8/2005 of 10 June, on Vineyards and Wine in Castile and León*²³, and its implementing regulation govern aspects of wine production, management of wine-growing potential and control and registration mechanisms for agricultural holdings

within the regional context (including ordinances that define wine production potential). Regarding sectoral strategies and support for wine development, the wine sector in Castile and León is recognised as a strategic pillar of the regional economy, with important designations of origin (such as Ribera del Duero, Rueda, Bierzo and others) that contribute to competitiveness, employment and territorial enhancement for traditional and modern viticultural practices (including promotional measures, internationalisation and financial support from the regional government)²⁴. Furthermore, regional planning within the framework of *Rural Development 2023-2027 and the EU's Common Agricultural Policy*²⁵ includes support mechanisms for sustainable agricultural practices, as well as environmental and climate-change interventions that promote the conservation of natural resources, improvement of ecosystem services (EESS) and adaptation to climate change in the rural environments of Castilla y León.

Taken together, these regional regulatory and strategic frameworks provide a robust context for integrating GI, biodiversity conservation, and landscape multifunctionality into wine-growing areas with high ecological value, in alignment with

the European and Spanish ecological sustainability objectives.

In **Portugal**, nature conservation, biodiversity, and land zoning practices are structured through a set of sectoral strategies and plans, which promote the integration of ecological and sustainability criteria into agricultural landscapes, including high-value wine-growing areas. The *National Strategy for Nature and Biodiversity Conservation 2030*²⁶, which was approved by a resolution passed by Portugal's Council of Ministers, in coordination with the Institute for Nature and Forest Conservation, defines long-term objectives for the protection, restoration and sustainable use of natural resources and biodiversity throughout the country. It also encourages the integration of these criteria into the pertinent policies, including those on agriculture, land-use planning, and management of protected ecosystems. The *National Reference Framework for Sustainability Certification in the Wine Sector*²⁷ establishes a certification system that recognises and promotes good practices in habitat management, biodiversity conservation and provision of ecosystem services in vineyards, including measures for the restoration of hedgerows, tree groves, and cover crops, along with the introduc-



tion of infrastructure to support beneficial fauna. Finally, Portugal has a *Guide to Biodiversity in Viticulture*²⁸, which underscores the importance of conserving and improving structural elements of the landscape (such as hedges, borders, stone walls and tree groves) as a way of promoting pollination in vineyards, as well as their biological regulation and ecological balance. In the Alto Douro region, the vineyards are also protected as a UNESCO²⁹ World Heritage Cultural Landscape, and this establishes specific obligations for landscape conservation, including the maintenance of traditional terracing of slopes and the associated natural features. Together, these instruments form a solid regulatory and strategic framework that allows for the integration of sustainability, biodiversity conservation, and ecological connectivity in Portuguese wine-growing landscapes, while also producing alignment with European and Portuguese objectives for preserving natural capital and enhancing the multifunctionality of rural landscapes.

In **France**, biodiversity conservation and the integration of sustainable practices into agricultural landscapes, including vineyards, are supported by a robust strategic and regulatory framework.

For example, the *Regional Biodiversity Strategy of the Occitanie Region*³⁰ establishes regional guidelines for the protection and restoration of ecosystems, and it encourages participation by local stakeholders to ensure effective implementation of conservation actions. In addition, the *Guide to Agroecological Transition and Climate Change*³¹ is focused on ways of adapting agriculture to climate challenges, through agroecological practices that improve soil health, promote functional biodiversity and reduce the environmental impact of vineyards. In the commune of Gaillac, for example, these strategies translate into specific actions to preserve biological diversity and landscape identity in the wine-growing areas, with support for management practices that can combine wine production and environmental conservation, while strengthening connections between vineyards and their surrounding natural ecosystems.

Across all the strategies analysed, there is a common need to move towards more resilient agricultural management models, based on conservation of functional biodiversity, soil and water improvement, climate risk mitigation and understanding the value of these

landscapes as environmental, cultural and socioeconomic assets. However, this type of analysis also reveals some fragmentation in terms of how these principles are being applied. There also seems to be a lack of approaches that are specifically adapted to wine-growing landscapes, especially with regard to identification and integrated management of biodiversity in vineyards.

To address these needs, the Strategy presented here acts as an integrating framework, to connect and translate the various regulatory and strategic instruments that now exist, so that they will be able to present shared operational criteria for the entire area covered by the SUDOE programme. It strengthens the consistency of the existing policies, facilitates the transfer of best practices among the participating territories, and promotes coordinated implementation of GI in wine-growing landscapes. It also presents a cooperative governance model that encourages the active involvement of winegrowers, wineries, the public sector and local residents, in the transition towards a multifunctional, transnational, and sustainable wine-growing sector^{32, 33}.



**GREEN INFRASTRUCTURE:
A SHARED STRATEGY TO
STRENGTHEN THE SUSTAINABILITY
OF EUROPEAN VINEYARDS**

3. SCOPE OF APPLICATION

The scope of this Strategy is limited to the regions of southwestern Europe covered by the Interreg Sudoe programme, which consist of mainland Portugal, Spain (except the Canary Islands), Andorra and some southwestern regions of France. This is the geographical area that has eligibility to participate in the programme, which now covers 26 regions and autonomous cities (NUTS II), representing approximately 18.3% of the European Union's total land area and benefiting more than 68.2 million people³. These areas are characterised by significant biophysical and socioeconomic heterogeneity, and by a significant presence of agricultural landscapes, especially those developed for wine growing. Therefore, to remain consistent with the Interreg Sudoe program-

me's approach, which is preferentially focused on inland and rural areas, the analysis presented here is centred on wine-growing mosaic landscapes and their structural elements (hedges, field boundaries, riverbanks, pastures and other ecological infrastructure)¹.

This strategy has been designed in the context of the development of GI in Europe, with the aim of **providing a shared frame of reference for transnational action in the wine-growing areas within the Sudoe space**. This includes promoting the use of Nature-Based Solutions (NBS) and shared criteria for land-use planning and management, in order to strengthen ecological connectivity, resilience in the face of climate change and the provision of ecosystem services.



4. BACKGROUND

The strategy presented here is based on the accumulated experience gained and results achieved through implementation of a variety of actions in the two pilot study areas of the ECOSPHEREWINES project (Figure 1):

- » Pilot Area 1 (France): AOP Gaillac (Gaillac-Tarn, Occitania).
- » Pilot Area 2 (Iberian Peninsula):
 - » Portugal: Douro DOC | PDO Porto (Alto Douro Vinhateiro).
 - » Spain: PDO Arribes (Arribes del Duero) and IGP Betanzos (Betanzos).



Figure 1. Distribution of the selected pilot study areas from the ECOSPHEREWINES project.

**TRANSNATIONAL COOPERATION TO
ADVANCE THE SUSTAINABILITY OF
VINEYARD LANDSCAPES**



Figure 2. Representative landscape in Gaillac-Tarn pilot area (AOP Gaillac).



Figure 3. Representative landscape in the Alto Douro Vinhateiro pilot area (Douro DOC | PDO Porto).

These pilot study areas were selected for their representativeness, in terms of the biophysical, climatic, productive and landscape diversity existing within the Sudoe space.

Taken together, these pilot study areas show the great heterogeneity of the wine-growing landscapes covered by the Sudoe programme: mosaic agricultural landscapes with vineyards and polycropping systems, on gentle hills and river terraces in the Gaillac-Tarn area (AOP Gaillac; Figure 2); vineyards on steep terraced slopes in the Douro river valley, in the Alto Douro Vinhateiro area (Douro DOC and/or Porto DOC; Figure 3); traditional vineyards on terraces and small plots along granitic river canyons, in Arribes del Duero (PDO Arribes; Figure 4); and Atlantic vineyards scattered in humid valleys and on steep slopes in the Paderne area (IGP Betanzos; Figure 5).



Figure 4. Representative landscape in the Arribes del Duero pilot area (Arribes PDO).



Figure 5. Representative landscape in the Paderne pilot area (IGP Betanzos).

In each of these areas, ‘land-use laboratories’ have been established, with various biosystems implemented, evaluated, and demonstrated there. The aim has been to strengthen their functional biodiversity, improve their ecological connectivity and increasing the resilience of viticultural systems to the effects of climate change. Taken together, the interventions developed have resulted in the effective improvement of 14 ecosystem services (1 provisioning service, 10 regulating services, and 3 cultural services) that are relevant in relation to the vineyards in the Sudoe space and their ecological functionality and production sustainability (Figure 6).

-  Crops for human consumption.
-  Enhanced biodiversity: habitats that support diverse types of flora and provide food and shelter for wildlife.
-  Soil conservation: stabilisation of slopes to prevent erosion.
-  Improvement of soil structure and increase in organic matter.
-  Regulation of the water and nutrient cycles: improved water retention and increased soil moisture.
-  Filtration of pollutants and improvement of air and water quality.
-  Regulation of temperature and humidity, and mitigation of climate change.
-  Carbon sequestration.
-  Pollination.
-  Pest and disease control.
-  Protection against fires.
-  Preservation of cultural identity.
-  Research and knowledge transfer (education, outreach).
-  Recreational activities to improve physical and mental health.

Figure 6. List of ecosystem services (EES) improved in the Sudoe space after development and study of the pilot study areas during the “ECOSPHEREWINES” project.

In the case of **Gaillac-Tarn (AOP Gaillac)**, a total of 12 ecosystem services have been enhanced, through actions aimed at improving landscape quality and reducing the climatic vulnerability of the vineyards, and a series of additional practices have also been implemented with the objective of improving biodiversity (Figure 7).

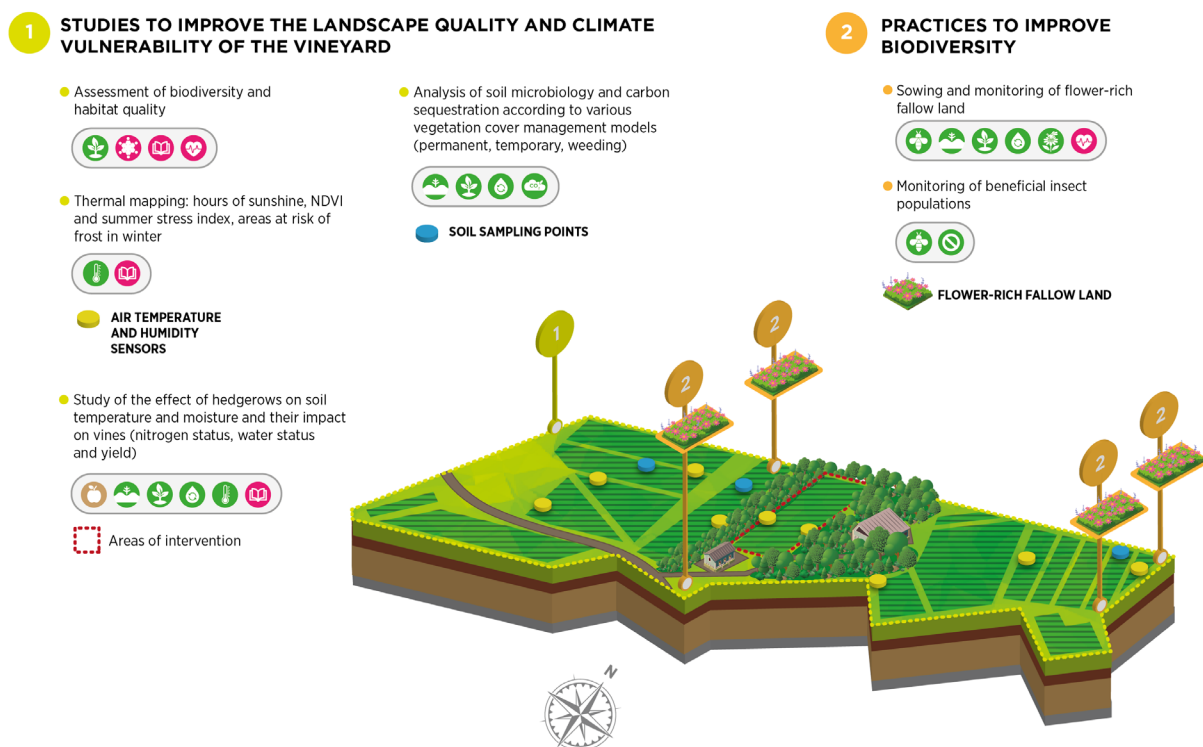


Figure 7. Summary of the actions carried out in the Gaillac-Tarn pilot area (Gaillac AOP).

In the **Alto Douro Vinhateiro pilot area (Douro DOC | PDO Porto)**, a total of 12 ecosystem services have been enhanced, by establishing soil cover with vegetation and grain cultivation, preserving and planting trees and shrubs, recovering and reconstructing of heritage elements, and applying biocontrol strategies for protection against pests (Figure 8).

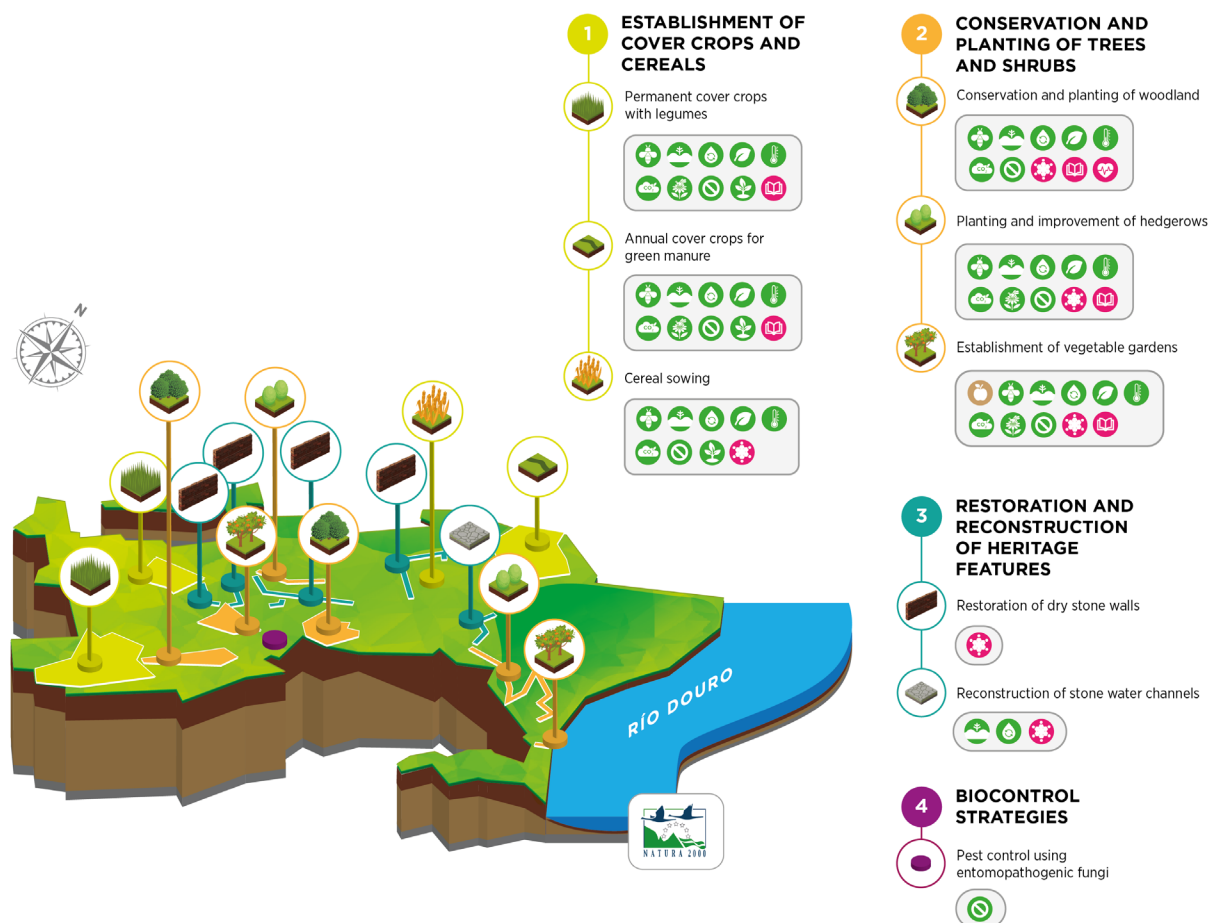


Figure 8. Summary of the actions carried out in the Alto Douro Vinhateiro pilot area (Douro DOC | PDO Porto).

In the **Arribes del Duero (PDO Arribes)** pilot area, 10 ecosystem services have been enhanced, through actions designed to improve the biodiversity of cultivated fields, preserve rare grape varieties, and recover the use of traditional terracing systems (Figure 9).

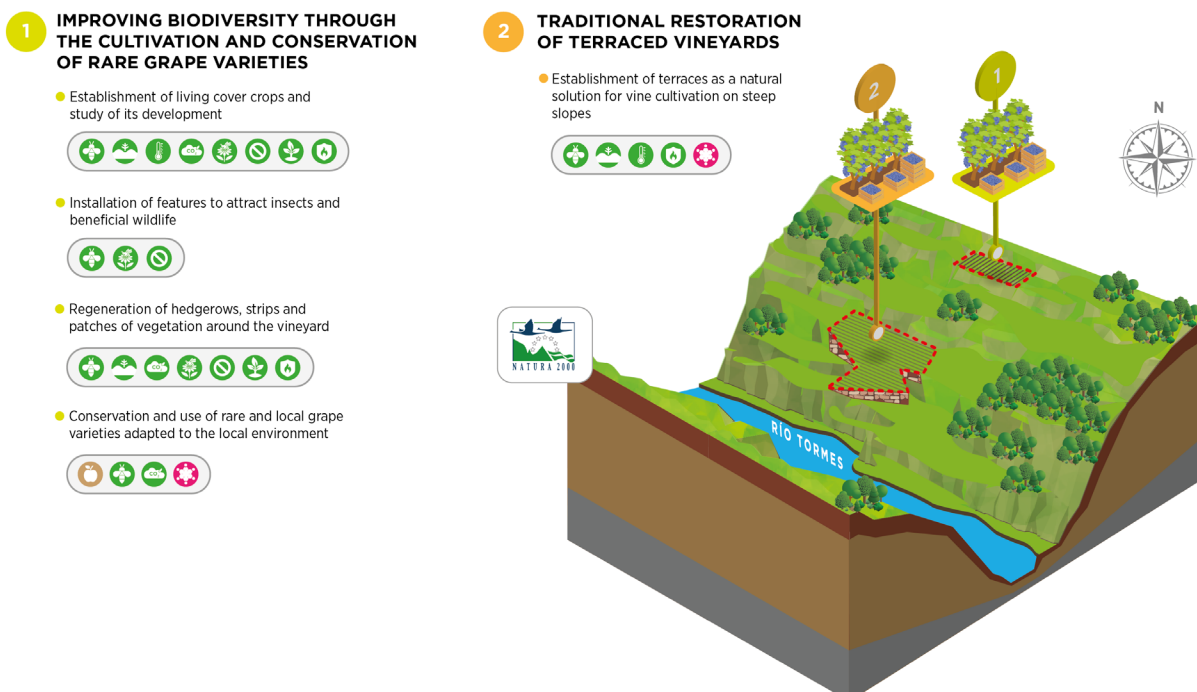


Figure 9. Summary of the actions carried out at the Arribes del Duero pilot area (Arribes PDO).

In the case of the Paderne pilot area (IGP Betanzos), 9 ecosystem services have been enhanced, through actions focused on experimental monitoring of the health of the wine-growing soil, revitalisation of traditional viticultural practices, and ecological restoration and heritage recovery of the elements found in the pilot area (Figure 10).

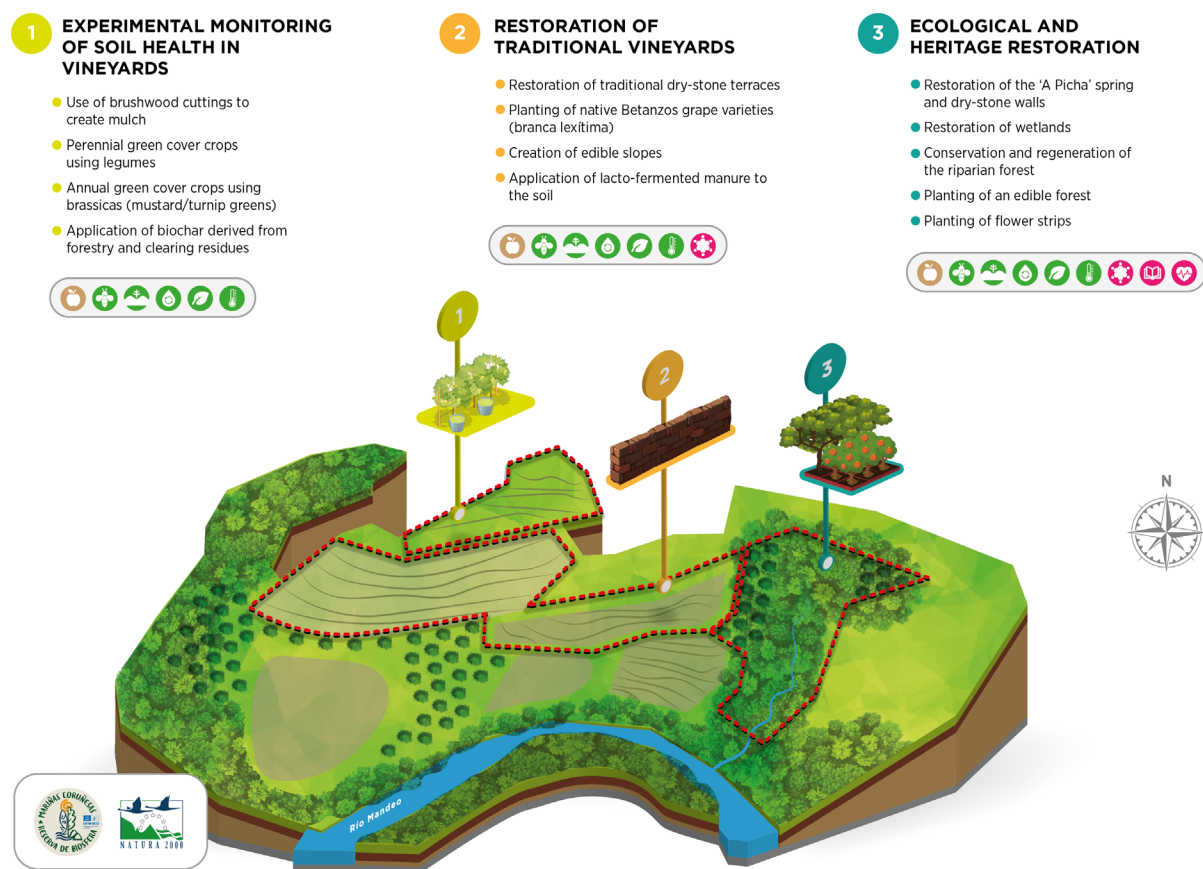


Figure 10. Summary of the actions carried out in the Paderne pilot area (IGP Betanzos).

Based on the experience gained in these pilot study areas, this Green Infrastructure Strategy for wine-growing landscapes with high ecological value in the Sudoe space has been designed as a transferable, scalable model. In this way, the strategy is intended to transcend the local scope of the pilot projects, to offer a full set of shared criteria, technical guidelines and lines of action that can be applied in a wide variety of wine-growing landscapes in those areas, while at the same time respecting their individual characteristics and promoting a consistent, coordinated implementation of GI at the regional scale.



5. VISION

By 2050, the Sudoe space **will represent a consolidated Green Infrastructure (GI) network comprised of wine-growing landscapes**, where wine production has been combined with biodiversity conservation, ecological connectivity and the provision of essential ecosystem services (provisioning, regulatory, and cultural). In addition, this green network **will have fostered climate change mitigation and adaptation**, strengthened the resilience of rural areas and improved well-being and sustainable management for communities that depend upon vineyards **as the foundation of their economy, heritage and landscape**.

Consolidation of this GI network for vineyards in the Sudoe space **has been based on ecological restora-**

tion of wine-growing landscapes, implementation of **Nature-Based Solutions (NBS)**, **coordination of land-use planning** among regions, and integration of the local agricultural, environmental and tourism policies. It has also been supported by **participatory and cooperative governance models**, with the committed involvement of winegrowers, wineries, governmental agencies, and local residents, all under a shared vision that brings together **wine production and the protection of natural and cultural capital**. In this way, the Sudoe space **has become a European benchmark for ecological transition**, where vineyards function as **resilient, multifunctional landscapes** with a suitable balance of nature, culture and sustainable development.



6. MISSION

The mission statement presented here establishes the framework for action that is needed in order to achieve the vision described above, and to allow ongoing progress towards the consolidation of a GI network in the wine-growing landscapes of the Sudoe space:

Aims to define, promote and consolidate a **Green Infrastructure (GI) Strategy for the wine-growing landscapes of the Sudoe space**, with the aim of integrating agricultural production with biodiversity conservation and enhancement of ecosystem services. The Strategy is intended to promote **identification, planning and coordinated**

management of the natural, semi-natural and cultural elements of vineyards, which all make a contribution to ecological connectivity, climate resilience and the well-being of rural communities. To this end, the Strategy establishes **common criteria and shared methodologies** for the identification, restoration, and management of green infrastructure in the different regions of the Sudoe space, to foster cross-border cooperation, application of **Nature-Based Systems (NBS)**, and active involvement by winegrowers, wineries, and governmental agencies in the transition towards a sustainable and multi-functional land-use model.





7. OBJECTIVES AND STRATEGIC LINES

In order to establish a unified framework for action in relation to planning and management of green infrastructure (GI) in the wine-growing landscapes of the Sudoe space, and to achieve a balance between production, biodiversity and adaptation to climate change, this Strategy establishes 4 main objectives, which are implemented via 12 strategic lines:

GENERAL OBJECTIVE 1 (01):

To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

Strategic lines:

- » **SL1.1.** Specifically adapt, to wine-growing landscape, the methodologies that have been used to identify and design the green infrastructure network.
 - » **SL1.2.** Analyse the biodiversity of the wine-growing landscapes of the Sudoe space, paying special attention to the functional species linked to the vineyard and their contribution to ecosystem services.
 - » **SL1.3.** Identify the most relevant ecosystem services for the vineyard, adapting the evaluation and calculation methodologies to its scale and particular land-use characteristics.
-

GENERAL OBJECTIVE 2 (02):

Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

Strategic lines:

- » **SL2.1.** Promote the conservation of GI elements in vineyard landscapes of high ecological value.
 - » **SL2.2.** Perform a diagnosis of the current state of the vineyards and identify their GI elements at a detailed scale.
 - » **SL2.3.** Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis.
 - » **SL2.4.** Implement other good practices that allow for comprehensive, sustainable management of the vineyards and enhancement of ecosystem services, maintaining the productivity and functional diversity of the ecosystem so that it will provide multiple ecosystem services.
 - » **SL2.5.** Implement tracking and monitoring systems for the results of the NBS applied in the vineyards.
-

GENERAL OBJECTIVE 3 (03)

Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

Strategic lines:

- » **SL3.1.** Establish mechanisms for protection and management of wine-growing landscapes, while promoting local, sectoral and multi-level governance and cooperation among all participants.
 - » **SL3.2.** Organise and align strategic communications for each land area.
-

GENERAL OBJECTIVE 4 (04)

Promote awareness, training and building of technical skills in relation to green infrastructure in the vineyards, encouraging the use of sustainable practices, and strengthening the commitment of the representatives of each land area to the programme's ecological, cultural and landscape values.

Strategic lines:

- » **SL4.1.** Increase knowledge and awareness of the value of green infrastructure in vineyard landscapes.
 - » **SL4.2.** Give local stakeholders the technical and practical knowledge they need in order to design, implement and manage green infrastructure.
-

Within the framework of this Strategy, actions are understood to be operational proposals for specific measures, focused on their implementation in the local areas, with the objective of improving the integration and functionality of vineyards in wine-growing landscapes with high ecological value. These actions are designed to be applied by different types of stakeholders, from wine-growers and wineries to land managers and public-sector bodies, at a variety of scales of intervention, ranging from individual plots to entire wine-growing regions. The actions are defined in a manner that combines the results and lessons learned from the pilot study areas studied as part of the ECOSPHEREWINES

project, and technical recommendations from the specialised literature and proven best practices, thus configuring a set of realistic, transferable measures that can be adapted to the different contexts present within the Sudoe space. To specify the strategic lines described and achieve the proposed objectives, **a total of 28 actions** have been defined as the operational core of the Strategy, to implement the strategic lines proposed. These actions represent structured and prioritised proposals for specific interventions, with the eventual aim of their implementation in all wine-growing areas located within the Sudoe space.

The following is a list of the identified actions (A):

8. ACTIONS TO ENHANCE GREEN INFRASTRUCTURE IN VINEYARD LANDSCAPES WITH HIGH ECOLOGICAL VALUE

A01. Identification of the existing GI network in areas within the recognised wine-quality designations of the Sudoe space.

A02. Design and dissemination of specific methodologies for the identifying GI elements at a detailed scale, and for identifying strategic areas of intervention.

A03. Design of a biodiversity metrics system for the functional flora and fauna of the vineyards, based on quantifiable, comparable and replicable indicators that can be tracked over time in wine-growing landscapes.

A04. Analysis of the composition and functioning of the flora present in wine-growing landscapes, to assess their role in producing vegetation cover, ecological connectivity and soil improvement, and formulation of measures for floral and vegetation conservation and/or recovery.

A05. Identification and study of the fauna associated with the GI and the relationships between the fauna and vineyards, paying special attention to functional species that promote pollination, biological control and other key ecosystem services.

A06. Monitoring the biodiversity of the vineyard to evaluate the solutions implemented.

A07. Identification and prioritisation of the ecosystem services linked to wine-growing landscapes, by bringing together technical expertise and the participation of relevant representatives.

A08. Calculation and mapping of the ecosystem services in areas within the recognised wine-quality designations of the Sudoe space.

A09. Application of specific measures for the shelter and feeding of existing fauna in the identified green infrastructure network, to ensure that its functional connectivity continues to exist at the landscape scale.

A10. Identification of weaknesses, threats and pressures to connectivity, with priority areas established for restoration.

A11. Mapping and diagnosis of the health status of the soil in the vineyards (water resources, climate, biodiversity, plant health problems).

A12. Implementation of nature-based solutions (NBS) to improve vineyard resilience.

A13. Diversification of the production system, by incorporating associated crops and conserving or restoring biological refuge areas.

A14. Designing the water cycle for sustainable use of water resources through nature-based solutions.

A15. Apply integrated and sustainable management of vineyard pests and diseases, with reduction of chemical inputs and the use of biocontrols to enhance the ecosystem services.

A16. Digitalisation and adaptive management of the vineyards through the use of precision agriculture, and optimisation of pruning practices to improve climate resilience and enhance the ecosystem services.

A17. Incorporation of sustainable and circular management measures for the managing and enhancing the value of resources derived from winegrowing.

A18. Installation of sensors and specific sampling approaches for evaluation of the ecosystem services relevant to the vineyards.

A19. Drafting of multi-level participatory governance plans, for each delimited area within the recognised wine-quality designations of the Sudoe space.

A20. Establishment of agreements between winegrowers, winemakers and local governmental agencies, to produce integrated landscape management and ensure the preservation of local environmental and cultural values.

A21. Promotion of charters, pacts (or equivalent forms of landscape legislation or agreements in each specific area) for the protection and conservation of vineyard landscapes.

A22. Design and implement models of participation and co-creation with representatives from the local area.

A23. Promotion, recognition and consolidation of a network of entities and organisations associated with the Strategy.

A24. Development of a coordinated communication plan within the framework of the Strategy, to ensure

access to information and participation in the activities being promoted.

A25. Design and implementation of an awareness-raising campaign for the general public, on the benefits of green infrastructure in vineyards.

A26. Design and promotion of specific theoretical-practical training programmes for the implementation of IV in vineyards, with technical training for key participants (winegrowers, winemakers, oenologists, wine tourism professionals, etc.).

A27. Publication and distribution of the ECOSPHEREWINES Practical Guide, as a way to help develop and enhance green infrastructure elements in vineyards.

A28. Organisation of technical visits to exemplary vineyards, to demonstrate in the field the technical, environmental and economic viability of implementing NBS, and to encourage exchanges of learning, implementation of good practices and replicability of the model.

Each of these actions are further detailed in fact sheets, which include the following data:

- » Code (**» AXX**) and **category** identifier.
- » The **General Objective** associated with the action.
- » The strategic line (**SL**) associated with the action, as well as **other SLs** to which it makes a contribution.
- » **A general description** of the proposed action.
- » **Pilot area where the action** has been implemented: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, Sudoe space.
- » **Time horizon** for execution of the action.
- » **Indicators** for monitoring, to measure the degree of effectiveness of the action implemented: literature review, study carried out, etc.

» A01

SUMMARY: Identification of the existing GI network in areas within the recognised wine-quality designations of the Sudoe space.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.1. Specifically adapt, to wine-growing landscape, the methodologies that have been used to identify and design the green infrastructure network.

OTHER SLs: SL1.3.

DESCRIPTION: The aim of this action is to establish a methodology that allows each recognised wine region (e.g. PDO or PGI) to identify and map its GI network, following the approaches developed at European and national levels regarding GI planning and ecological connectivity.

The process will begin with the collection and analysis of available territorial and environmental information through official sources and open data* (land use mapping, habitats, protected areas, hydrography, forest areas, infrastructure, etc.) in order to build a homogeneous cartographic base of the wine-growing territory.

Based on this information, a specific analysis of biodiversity and ecological connectivity will be developed for the area, identifying relevant natural and semi-natural habitats, areas of high ecological value, and elements of the agricultural landscape that contribute to maintaining biodiversity (river-banks, forest patches, agroforestry mosaics, vegetated field margins, hedgerows, or spontaneous vegetation). When the existing information is insufficient, specific studies may be carried out to complete the ecological knowledge of the area at a regional scale.

In addition, an assessment of the ecosystem services present in the area will be carried out, paying special attention to those most relevant to vineyard landscapes, such as pollination, biological pest control, water regulation, soil protection against erosion, microclimate regulation and landscape and cultural values.

Integrating this information through spatial analysis with GIS (Geographic Information Systems) tools and the advice of specialised technical personnel will allow the identification of the structural elements of the area's GI, delimiting core areas, ecological corridors, buffer zones and other multi-functional elements, as well as strategic areas for conservation and ecological restoration.

** Examples of cartographic databases in France (RPG, CarHab, OCGSE); Portugal (DGT, BDNC) and Spain (IGN, BCN, SIG PAC).*

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2035.

INDICATORS: Literature review.

» A02

SUMMARY: Design and dissemination of specific methodologies for the identifying GI elements at a detailed scale, and for identifying strategic areas of intervention.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.1. Specifically adapt, to wine-growing landscape, the methodologies that have been used to identify and design the green infrastructure network.

OTHER SLs: SL1.2, SL2.2.

DESCRIPTION: The aim of this action is to develop and disseminate a practical methodology that allows wine-growers, winemakers and vineyard managers to identify the GI present in their plots and understand its role within the ecological network of the area.

The methodology will be based, firstly, on the review of the GI identified at territorial scale (A1), so that managers can understand the ecological context of the vineyard and its relationship with the main biodiversity hubs, ecological corridors and strategic landscape areas.

Based on this reference, a plot-scale analysis procedure will be proposed to create a detailed map of the current state of the vineyard and its associated natural or semi-natural elements. This map may be supported by high-resolution remote sensing tools, such as drone flights with LiDAR sensors and multispectral cameras, to identify the different vegetation layers, generate three-dimensional terrain models, and calculate vegetation vigour indices such as NDVI.

The methodology will be complemented by fieldwork aimed at characterising functional biodiversity in the vineyard itself, including the observation and inventory of spontaneous flora, the identification of elements of the agricultural landscape (boundaries, walls, slopes, hedges, riverbanks, shrub or forest patches) and the performance of biodiversity transects to detect the presence of auxiliary fauna, such as pollinators, predatory insects or insectivorous birds.

Integrating this information will allow for the identification of the ecosystem services present in each plot, the assessment of their ecological status, and the detection of opportunities to improve or strengthen ecological connectivity on a small scale. This action will include the development of methodological guides and outreach materials to facilitate the application of these guidelines by vineyard managers, promoting management practices that are more favourable to biodiversity and ecosystem services.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2035.

INDICATORS: Literature review, cartographic review, experimental studies.

» A03

SUMMARY: Design of a biodiversity metrics system for the functional flora and fauna of the vineyards, based on quantifiable, comparable and replicable indicators that can be tracked over time in wine-growing landscapes.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.1. Specifically adapt, to wine-growing landscape, the methodologies that have been used to identify and design the green infrastructure network.

OTHER SLs: SL1.2, SL2.5.

DESCRIPTION: The aim of this action is to design a comprehensive system of biodiversity metrics that allows for an objective and homogeneous evaluation of the ecological status of wine-growing landscapes and the effectiveness of GI in providing ecosystem services.

The system will be based on the definition of quantifiable indicators, comparable between territories and replicable over time, aimed at measuring the functional biodiversity associated with the vineyard, with special attention to key species that promote essential ecological processes such as pollination, biological pest control and trophic balance.

The indicators will include aerial biodiversity metrics linked to the diversity and abundance of pollinating insects, predatory arthropods, and insectivorous birds, allowing for the assessment of the impact of GI elements on the vineyard's ecological functionality. Soil and microclimatic indicators will also be integrated to measure the benefits associated with the presence of native hedgerows, ground cover, and other semi-natural elements, such as carbon storage in the soil, improved soil structure, thermal regulation, and moisture stability.

Monitoring environmental variables using temperature and humidity sensors, along with the use of biophysical models and spatial analysis, will allow for the evaluation of ecological connectivity, microclimatic regulation, and the improvement of the environmental quality of the wine-growing area.

The system will integrate standardised measurement and monitoring protocols that combine field-work, mapping tools, and biophysical technologies, as well as the use of artificial intelligence tools, ensuring data comparability across regions within the Sudoe space. These protocols will include periodic measurements of biodiversity indices, monitoring of functional species associated with the GI (International Viticulture), and assessment of medium- and long-term ecological trends.

The action will include the design of a continuous monitoring plan that allows monitoring the effectiveness of the measures adopted, evaluating their contribution to the resilience of the vineyards and ensuring the continuous improvement of wine ecosystems and their environment.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2040.

INDICATORS: Experimental studies, monitoring protocols, periodic records of biodiversity indicators.

» A04

SUMMARY: Analysis of the composition and functioning of the flora present in wine-growing landscapes, to assess their role in producing vegetation cover, ecological connectivity and soil improvement, and formulation of measures for floral and vegetation conservation and/or recovery.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.2. Analyse the biodiversity of the wine-growing landscapes of the Sudoe space, paying special attention to the functional species linked to the vineyard and their contribution to ecosystem services. Analyse the biodiversity of the wine-growing landscapes of the Sudoe space, paying special attention to the functional species linked to the vineyard and their contribution to ecosystem services.

OTHER SLs: SL1.1, SL2.2.

DESCRIPTION: The aim of this action is to analyse the floristic composition present in wine-growing landscapes and evaluate the ecological function of plant species in relation to soil cover, ecological connectivity and the improvement of soil conditions in the vineyard.

The analysis will make it possible to identify how plant communities —both spontaneous and managed— contribute to the provision of key ecosystem services, such as protection against erosion, water regulation, improvement of soil fertility, stabilisation of slopes and terraces, and the creation of ecological corridors that promote landscape connectivity.

The action will conclude with the formulation of a catalogue of species and recommended practices for plant management aimed at strengthening the GI of the vineyard, such as the use of functional plant covers, the planting of hedges with native species and the restoration of those natural habitats of interest identified for each wine-growing landscape, including riparian forests, wooded borders, vegetated slopes and other semi-natural formations of high ecological value.

This catalogue will facilitate the implementation of actions aimed at improving the functional biodiversity of vineyards, increasing soil quality, and strengthening the provision of essential nutrients for the productive and environmental sustainability of the wine system. It will also promote the diversification of plant species and the application of agroecological practices that promote the conservation of natural capital, contribute to adaptation to climate change, and strengthen the resilience of agricultural ecosystems.

The study will combine botanical inventories, fieldwork, and spatial analysis with cartographic tools, allowing for the evaluation of the conservation status of existing plant formations and the detection of opportunities for ecological restoration and functional improvement of green infrastructure.

The recommendations derived from the analysis will be aimed at facilitating the replicability of the actions in other wine-growing areas of the Sudoe space, promoting transferable plant management models that integrate production, biodiversity and territorial resilience.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, entire Sudoe space.

TIMELINE: 2026-2040.

INDICATORS: Botanical inventories, areas with functional plant cover, length of planted native hedges, restored areas of semi-natural habitats.

» A05

SUMMARY: Identification and study of the fauna associated with the GI and the relationships between the fauna and vineyards, paying special attention to functional species that promote pollination, biological control and other key ecosystem services.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.2. Analyse the biodiversity of the wine-growing landscapes of the Sudoe space, paying special attention to the functional species linked to the vineyard and their contribution to ecosystem services.

OTHER SLs: SL1.2, SL2.4.

DESCRIPTION: The aim of this action is to identify and analyse the fauna associated with the GI present in wine-growing landscapes, evaluating its role in the ecological functionality of the vineyard and its contribution to the provision of key ecosystem services.

The study will focus on identifying functional species that promote ecological processes essential for vineyard sustainability, especially pollination, biological pest control, and the balance of food webs. To this end, those responsible for managing recognised wine-growing areas will conduct a systematic inventory of pollinating insects, predatory arthropods, insectivorous birds, and other relevant species associated with integrated vineyard elements such as hedgerows, ground cover, flower strips, vegetated margins, and semi-natural patches integrated into the vineyard landscape.

The faunal characterisation will allow us to evaluate the relationship between the presence of these species and the conservation status of the GI elements, as well as their influence on the ecological resilience of the vineyard to pests, diseases and environmental disturbances.

Based on the results obtained, a catalogue of key functional species and best management practices aimed at their conservation will be developed, focusing on the availability of habitats, refuges, and trophic resources. These measures will contribute to strengthening sustainable agricultural models that integrate biodiversity and wine production.

The action will incorporate standardised sampling methodologies, fieldwork and spatial analysis supported by cartographic tools, allowing the evaluation of the distribution of functional species and their connectivity at the landscape scale.

The management of the GI will be geared towards maximising its benefits in terms of biodiversity and provision of ecosystem services, facilitating the replicability of intervention models in other wine-growing areas of the Sudoe space.

LOCATION: AOP Gaillac, Douro DOC | DPDO Porto, PDO Arribes, IGP Betanzos, entire Sudoe space.

TIMELINE: 2026-2040.

INDICATORS: Fauna inventories, abundance of functional species, biodiversity indices, GI areas managed for helpful fauna.

» A06

SUMMARY: Monitoring the biodiversity of the vineyard to evaluate the solutions implemented.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.2. Analyse the biodiversity of the wine-growing landscapes of the Sudoe space, paying special attention to the functional species linked to the vineyard and their contribution to ecosystem services.

OTHER SLs: SL2.5.

DESCRIPTION: The aim of this action is, based on the biodiversity metrics system established in A03, to establish a biodiversity monitoring plan in wine-growing landscapes that allows the evaluation of the effectiveness of the NBS and the GI elements implemented in the vineyard.

Monitoring will focus primarily on areas where conservation and/or restoration actions have been implemented for elements of the GI, such as hedges, vegetation cover, flower strips, secondary crops associated with the vineyard and other semi-natural elements that reinforce the ecological connectivity of the landscape.

The monitoring will include tracking functional fauna linked to the provision of key ecosystem services. Specifically, pollinating insects and predatory arthropods will be monitored through direct censuses, standardised sampling, and selective trapping. Birdlife will also be monitored using linear transects and listening points, allowing for the assessment of insectivorous birds and other species that are indicators of ecological quality.

In restored or created wetlands, such as ponds and riparian forests, regular visits will be conducted to assess associated biodiversity, including the recording of amphibians, dragonflies, and other species linked to aquatic ecosystems. Additionally, specific observation protocols will be implemented for monitoring reptiles and other species of ecological interest in structural landscape features such as dry-stone walls.

The monitoring system will be based on the standardised sampling and data recording protocols developed in A03, ensuring the temporal and territorial comparability of the collected information. This approach will allow for the evaluation of biodiversity trends, the measurement of the effectiveness of implemented solutions, and the adjustment of management practices to maximise the vineyard's ecological functionality.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2035-2050.

INDICATORS: Monitoring campaigns carried out, records of functional biodiversity, indicator species monitored, standardised protocols applied.

» A07

SUMMARY: Identification and prioritisation of the ecosystem services linked to wine-growing landscapes, by bringing together technical expertise and the participation of relevant representatives.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.3. Identify the most relevant ecosystem services for the vineyard, adapting the evaluation and calculation methodologies to its scale and particular land-use characteristics.

OTHER SLs: SL3.1.

DESCRIPTION: The aim of this action is to identify and prioritise the ecosystem services linked to the wine-growing landscapes of the Sudoe space through a technical approach that integrates the active participation of relevant actors in the area.

The process will begin with the identification of the ecosystem services present in each wine-growing landscape, using assessment methodologies adapted to the scale of the vineyard and the specific territorial characteristics. These methodologies will be designed to be flexible, adapting to the environmental, climatic, and socioeconomic conditions of each context, ensuring that the results obtained are representative and transferable to different situations.

The action will pay particular attention to the most relevant ecosystem services for vineyard sustainability, such as biological pest control, erosion control, water regulation and retention, improved soil fertility, and carbon storage, among other key processes for the resilience of agricultural systems. Special attention will also be given to cultural ecosystem services related to landscape enhancement and wine culture.

The prioritisation process will combine scientific and technical knowledge with local participation, incorporating the collaboration of winegrowers, wineries, environmental authorities, local entities, and community organisations. This cooperation will allow the evaluation criteria to be tailored to the specific needs of each area, promoting adapted management of the GI.

Integrating participatory approaches will ensure that the prioritisation of ecosystem services not only responds to ecological and functional criteria, but also promotes the active involvement of key stakeholders in the planning and management of the wine-growing area.

The results will guide strategic decision-making, facilitating the planning of actions that maximise the provision of ecosystem services and strengthen the environmental and productive sustainability of the vineyard.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, entire Sudoe space.

TIMELINE: 2026-2035.

INDICATORS: Ecosystem services identified, prioritisation matrices developed, participatory workshops conducted, evaluation methodologies adapted.

» A08

SUMMARY: Calculation and mapping of the ecosystem services in areas within the recognised wine-quality designations of the Sudoe space.

OBJECTIVE: O1. To understand and identify the GI network associated with wine-growing landscapes in the Sudoe space.

SL: SL1.3. Identify the most relevant ecosystem services for the vineyard, adapting the evaluation and calculation methodologies to its scale and particular land-use characteristics.

OTHER SLs: SL1.1, SL2.3.

DESCRIPTION: The aim of this action is to calculate and map the ecosystem services within the limits of the wine quality designations recognised in the Sudoe space, such as PDO and PGI.

The process will include the cartographic delimitation of the reference geographical areas (environmental units) and the inventory of the ecosystem services identified in the A07 for their relevance to wine-growing systems.

Based on this information, the evaluation methodologies that best suit the scale of the study area and its territorial particularities will be selected, ensuring that the calculation of the ecosystem services is as representative as possible of the biophysical, climatic and socioeconomic conditions of each area.

Whenever possible, area-specific baseline data will be generated using metrics from experimental vineyards in the area and capitalising on the results of A06. When this is not possible, scientific literature will be used, extrapolating data from territories with similar characteristics to the area under study.

The results of the analysis will be represented through thematic maps and distribution maps of ecological ecosystem services (EES) that allow visualisation of their intensity and spatial variability across the wine-growing region. This information will facilitate strategic decision-making, territorial planning, and the design of actions aimed at strengthening green infrastructure.

The mapping work will allow the identification of areas with greater potential for the conservation, restoration and improvement of the ecosystem services, promoting their integration into vineyard management and sustainable territorial development policies.

Furthermore, the information derived from the calculation and mapping of the ecosystem services will feed the process of identifying the GI network described in A01, reinforcing the methodological coherence with the European strategy on GI34 in the integration of ecological connectivity criteria and ecosystem services for the planning of the GI network in the wine-growing area.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2035.

INDICATORS: Ecosystem services mapped, thematic maps prepared, calculation methodologies applied, wine-growing territories analysed.

» A09

SUMMARY: Application of specific measures for the shelter and feeding of existing fauna in the identified green infrastructure network, to ensure that its functional connectivity continues to exist at the landscape scale.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.1. Promote the conservation of GI elements in vineyard landscapes of high ecological value.

OTHER SLs: SL1.2, SL2.3.

DESCRIPTION: The aim of this action is to implement specific measures for the creation, improvement and management of habitats that promote the refuge, feeding and movement of the fauna associated with the GI network previously identified in the wine-growing landscapes of the Sudoe space.

The actions will be aimed at strengthening the ecological functionality of the existing GI elements, increasing their capacity to support biodiversity and ensuring landscape-scale connectivity between core areas, ecological corridors and agroforestry mosaics.

The interventions will include the implementation and management of plant cover, the installation of multifunctional hedges with native species, the creation of floral fallows and areas of semi-natural vegetation and the creation of unmowed areas around the plots that serve as a refuge for fauna (selective skewed mowing) that provide trophic resources for pollinators and natural enemies, as well as the structural diversification of the agricultural landscape.

Likewise, the creation of complementary habitats that act as a refuge for fauna will be promoted, such as the establishment of groves and riparian forests, the restoration of dry-stone walls as micro-habitats for reptiles and invertebrates, the provision of water points and wetlands for amphibians, dragonflies and birds,

These actions will be designed to promote key functional species in the provision of ecosystem services, such as pollinators, predatory arthropods of pests, insectivorous birds and fauna associated with rocky and riparian habitats.

The planning of the interventions will guarantee functional connectivity between GI elements, promoting the mobility of the species and reducing the fragmentation of the wine-growing landscape.

The action will contribute to strengthening the ecological multifunctionality of the wine-growing area, integrating biodiversity conservation, climate resilience and productive sustainability.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2040.

INDICATORS: GI elements managed for wildlife refuge, created and restored habitat areas, multifunctional hedgerows, covered areas and established biodiverse floral fallows.

» A10

SUMMARY: Identification of weaknesses, threats and pressures to connectivity, with priority areas established for restoration.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.1. Promote the conservation of GI elements in vineyard landscapes of high ecological value.

OTHER SLs: SL2.2, SL2.3.

DESCRIPTION: The aim of this action is to identify, at the plot scale, the weaknesses, threats, and pressures affecting the ecological connectivity of wine-growing landscapes, establishing priority restoration areas within the green infrastructure network. This identification will be carried out both at a macro scale, building on the results of A01 and A08, and at a micro scale, at the plot level, based on the planning established in A02.

The analysis will focus on detecting discontinuities and degraded elements that limit the ecological functionality of vineyards and their immediate surroundings, paying special attention to habitat fragmentation, structural simplification of the agricultural landscape, and the loss of key semi-natural elements.

Within the vineyard plots, pressures associated with erosion on slopes and terraces, the degradation of traditional stone walls, the alteration of wetlands and water sources, the loss of natural vegetation on plot boundaries and margins, and the homogenisation of soil cover will be assessed. These factors directly affect the connectivity of the agroforestry mosaic and the availability of habitats for beneficial fauna.

The diagnosis will allow the location of critical areas where the GI presents less ecological functionality or risk of deterioration, identifying priority areas for habitat restoration and the improvement of micro-scale connectivity.

The action will combine fieldwork, direct observation and detailed cartographic analysis, facilitating the precise delimitation of intervention points within each wine-growing plot.

The results will guide the planning of ecological restoration measures and reinforcement of green infrastructure, contributing to restoring the functional continuity of the landscape and improving the environmental resilience of the winegrowing system.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2035.

INDICATORS: Diagnosed plots, identified critical connectivity points, and delimited priority restoration areas.

» A11

SUMMARY: Mapping and diagnosis of the health status of the soil in the vineyards (water resources, climate, biodiversity, plant health problems).

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.2. Perform a diagnosis of the current state of the vineyards and identify their GI elements at a detailed scale. Perform a diagnosis of the current state of the vineyards and identify their GI elements at a detailed scale.

OTHER SLs: SL1.2, SL2.5.

DESCRIPTION: The aim of this action is to carry out a detailed mapping and a comprehensive diagnosis of the health status of the soil in wine farms, evaluating the main biophysical factors that condition the productive and ecological sustainability of the vineyard.

The analysis will address in an integrated manner the characterisation of available water resources, local climatic conditions and their influence on the vineyard's microclimate, soil biodiversity and the main phytosanitary problems affecting the crop.

The soil diagnosis will include the study of physical-chemical and biological parameters, such as structure, texture, organic matter content, water retention capacity, structural stability, and the presence of microbial communities associated with soil fertility. The influence of management practices on soil quality and the provision of soil-related nutrients will also be evaluated.

Regarding water resources, runoff, infiltration, and water availability for the crop will be analysed, identifying areas at risk of erosion, compaction, or water stress. The study will also incorporate the analysis of microclimatic variables using sensors and agroclimatic records to assess their impact on vineyard resilience to climate change.

The action will integrate the assessment of biodiversity associated with the soil and plant cover, as well as the identification of relevant phytosanitary problems and their relationship with the state of the vineyard.

The information obtained will be represented by detailed thematic mapping that allows visualisation of the state of the soil and its environmental conditions within each wine farm, facilitating the identification of priority areas for intervention.

The results will serve as a basis for guiding measures of sustainable viticultural practices, ecological restoration and improvement of GI at the plot scale, strengthening the environmental and productive resilience of the wine system.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, entire Sudoe space.

TIMELINE: 2026-2035.

INDICATORS: Plots mapped, thematic soil health maps prepared, soil parameters analysed, priority intervention areas identified.

» A12

SUMMARY: Implementation of nature-based solutions (NBS) to improve vineyard resilience.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.3. Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis.

OTHER SLs: SL2.1, SL2.4.

DESCRIPTION: The aim of this action is to promote the implementation of nature-based solutions (NBS) to improve ecological functionality in vineyard cultivation areas (including both rows and inter-row lines) by adapting management practices to improve resilience in the productive context of the vineyard.

The solutions to be implemented include permanent and temporary plant cover crops, both spontaneous and sown, aimed at protecting the soil from erosion, improving its structure and fertility, increasing organic matter, and optimising the nutrient cycle. Properly managed cover crops will increase soil stability, promote water infiltration, and improve the vineyard's resilience to extreme weather events. The selection of species should be based on functional criteria, combining grasses, legumes, and other plant families to balance nutrient supply, soil decompaction, promote faunal diversity, and control runoff, always adapting them to the specific conditions of each wine-growing region.

Furthermore, the technical and economic feasibility of applying organic mulching techniques using plant residues from other areas of the plot will be studied. These practices promote moisture retention, reduce evaporation, and protect the soil from radiation and the direct impact of rain, contributing to a gradual improvement in soil organic matter content and biological activity. Additionally, the use of mulch can help control vegetation between vineyard rows, reducing the need for herbicides.

Additionally, it will be recommended to incorporate strips of flowering meadow in some crop rows or floral fallows in certain points to increase the heterogeneity of the system and reinforce the presence of functional biodiversity associated with the vineyard.

The management of these solutions will be approached adaptively, adjusting the type of cover, its duration, and its management to the soil and climate conditions, water availability, and the cropping system. Whenever feasible, priority will be given to the development of spontaneous cover crops due to their better adaptation to the environment and lower input requirements. These practices will be integrated into a resource optimisation strategy at the farm level, including the use of plant byproducts for their reincorporation into the soil.

The results of this action will contribute to the improvement of ecosystem services associated with vineyard soil, strengthening its resilience to climate disturbances and promoting a more sustainable, efficient management model adapted to the territorial context.

For further information on the implementation of nature-based solutions, it is recommended to consult the practical summaries and technical guide produced within the framework of the ECOSPHEREWINES project.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2030-2045.

INDICATORS: Pilot plots with NBS implemented, surface with vegetation cover, establishment of hedges and vegetated strips, GI created or restored, traditional elements recovered, plots with soil quality improvement, plots with biological control practices.

» A13

SUMMARY: Diversification of the production system, by incorporating associated crops and conserving or restoring biological refuge areas.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.3. Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis. Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis.

OTHER SLs: SL2.1, SL1.2.

DESCRIPTION: The aim of this action is to diversify the wine production system at the plot scale by incorporating associated crops and the conservation, restoration and active management of non-productive areas that act as biological refuge zones within the wine landscape.

The intervention promotes the integration of plant and structural elements traditionally considered non-productive—riparian vegetation, groves, hedgerows, scrubland, large isolated trees, traditional dry-stone walls and terraces, and historical irrigation systems—as functional components of the wine-growing agroecosystem. These spaces act as core areas of biodiversity and ecological corridors, providing refuge, feeding grounds, and movement for beneficial fauna, and reinforcing the ecological connectivity of the vineyard.

The action includes the restoration of degraded areas and the connection of strategic areas of the vineyard by planting multifunctional hedges with native species (of fruit or aromatic interest) and floral strips on plot boundaries, as well as the recovery of traditional walls and structures adapted to current management needs.

The A14 regenerative hydrology practices are also incorporated, promoting the conservation of riparian vegetation, the restoration of small bodies of water (ponds and springs) and the recovery of traditional sustainable drainage systems such as vegetated ditches and dry-stone channels, which have essential value for biodiversity.

Productive diversification is reinforced by the incorporation of complementary crops and associated orchards that generate new economic opportunities, while increasing the structural heterogeneity of the landscape and the provision of essential services.

These actions contribute simultaneously to productive sustainability, the conservation of landscape and cultural heritage, the improvement of functional biodiversity and the climate resilience of the wine system, promoting management models that can be replicated in other territories of the Sudoe space.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, Sudoe space.

TIMELINE: 2026-2040.

INDICATORS: Plots with non-productive areas managed as GI, riparian vegetation areas and conserved or restored groves, linear meters of rehabilitated traditional hedges and walls, recovered traditional drainage systems; plots with established associated crops.

» A14

SUMMARY: Designing the water cycle for sustainable use of water resources through nature-based solutions.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.3. Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis. Create a strategic design for the implementation of nature-based solutions (NBS) over the short, medium and long terms, based upon the established diagnosis.

OTHER SLs: SL1.3, SL2.4.

DESCRIPTION: The aim of this action is to design and optimise the water cycle at the plot scale by applying NBSs that promote sustainable use of water resources and strengthen the resilience of the vineyard to climate change.

The intervention starts with the analysis of the hydrological behaviour of the vineyard, evaluating, based on the results of A2 and A11, the dynamics of runoff, infiltration, water retention and the state of the soil and vegetation, in order to identify eroded areas, impermeable areas or areas with low infiltration capacity, as well as degraded or disappeared watercourses.

The hydrological design will incorporate regenerative hydrology practices that adapt the vineyard layout to the contours of the land, promoting natural water infiltration and reducing the loss of fertile soil. The conservation and restoration of riparian vegetation and small bodies of water in water accumulation areas will be promoted, creating spaces of high biodiversity that act as thermal regulators and climate refuges.

Traditional sustainable surface drainage systems will also be restored, such as vegetated ditches and dry-stone channels, which allow for redirecting and regulating the flow of water, preventing erosion, and improving the ecological connectivity of the landscape.

The project will also incorporate efficient irrigation management measures through the implementation of precision systems adapted to the characteristics of the plot and the water needs of the vines. Aboveground or subsurface drip irrigation solutions will be prioritised, optimising water use and promoting system efficiency.

Soil moisture control will rely on moisture sensors and agronomic monitoring tools to adjust irrigation based on objective measurements. Additionally, water restriction models based on meteorological data and the crop's soil and physiological characteristics will be used to optimise irrigation planning throughout the growing season.

These solutions improve soil fertility and quality, regulate the water cycle, reduce erosion, promote biodiversity associated with humid habitats, and create microclimates favourable to vineyards, reinforcing the productive and environmental sustainability of the wine system.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos

TIMELINE: 2026-2040.

INDICATORS: Plots with adapted hydrological design, implemented or restored sustainable drainage systems, areas with riparian vegetation and preserved wetlands, plots with implemented precision irrigation, plots monitored with soil moisture sensors.

» A15

SUMMARY: Application of integrated, sustainable management of vineyard pests and diseases, with reduction of chemical inputs and the use of biocontrols to enhance the ecosystem services.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.4. Implement other good practices that allow for comprehensive, sustainable management of the vineyards and enhancement of ecosystem services, maintaining the productivity and functional diversity of the ecosystem so that it will provide multiple ecosystem services.

OTHER SLs: SL1.2, SL2.5.

DESCRIPTION: The aim of this action is to implement integrated pest and disease management strategies for vineyards at the plot scale, reducing dependence on chemical inputs and promoting biocontrol solutions that strengthen functional biodiversity and the provision of essential nutrients.

The intervention is aimed at promoting natural biological control by encouraging beneficial fauna associated with vineyard management, integrating phytosanitary management within an agro-ecological approach.

The measures implemented include actions aimed at strengthening favourable habitats for predatory arthropods, pollinators and insectivorous birds, through the implementation and management of plant cover, flower strips and multifunctional hedges that act as reservoirs of biodiversity useful for the natural control of pests.

In addition, biological crop protection solutions are incorporated based on the use of natural agents and sustainable management techniques that allow for a reduction in the use of synthetic plant protection products, minimising impacts on the soil, water and biodiversity associated with the vineyard.

The action integrates the observation and monitoring of functional biodiversity as a tool to support decision-making in phytosanitary matters, with the idea that preventive practices should be given priority over reactive approaches.

These measures contribute to maintaining vineyard productivity while strengthening the functional diversity of the agricultural ecosystem, improving resilience to climate disturbances, and promoting sustainable and replicable management models in other wine-growing territories of the Sudoe space.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2040.

INDICATORS: Plots with implemented biocontrol strategies, areas with favourable habitats for beneficial fauna, plots with reduced chemical treatments, and integrated management practices implemented.

» A16

SUMMARY: Digitalisation and adaptive management of the vineyards through the use of precision agriculture, and optimisation of pruning practices to improve climate resilience and enhance the ecosystem services.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.4. Implement other good practices that allow for comprehensive, sustainable management of the vineyards and enhancement of ecosystem services, maintaining the productivity and functional diversity of the ecosystem so that it will provide multiple ecosystem services.

OTHER SLs: SL1.1, SL2.5.

DESCRIPTION: The aim of this action is to strengthen the sustainable management of the vineyard at the plot scale by incorporating precision agriculture tools and adapting pruning practices to the new climatic conditions, improving crop resilience and the provision of essential nutrients.

The digitalisation of vineyards relies on decision-support technologies that optimise vine yield, grape composition, and efficient resource management. Implemented solutions include pest and disease prediction models linked to weather stations, as well as remote sensing tools using drones equipped with multispectral and hyperspectral cameras that allow for the early identification of phytosanitary problems and crop heterogeneity.

These technologies contribute to A02 by facilitating the development of vegetative indices, such as NDVI, and the generation of prescription maps using GIS tools. This enables variable-rate application of inputs and reduces the use of pesticides and fertilisers. Furthermore, the use of field sensors and predictive models based on meteorological and agronomic data will be promoted to optimise irrigation, fertilisation, and harvest planning, thereby reducing the environmental footprint of the production system.

In addition, adaptive pruning practices are being promoted to mitigate the effects of climate change on vineyards. These practices include systematic monitoring of the phenological and health status of the vines, adjusting the timing of pruning to avoid damage from late frosts or premature heat stress, and adapting the intensity of pruning according to vine vigour and water availability.

The most suitable pruning method is selected based on the variety, training system, and soil conditions, combining short pruning, long pruning, and summer pruning to promote foliage ventilation, uniform bunch ripening, and a reduced risk of fungal infections. Managing the crop load by adjusting the number of buds allows for a balance of vegetative vigour, yield, and fruit quality under climate stress.

These practices contribute to the regulation of pests and diseases, the improvement of efficient water use, the protection of the functional biodiversity of the vineyard and the reduction of emissions associated with agricultural inputs, reinforcing the productive and environmental sustainability of the wine-growing landscape.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2040.

INDICATORS: Plots with precision agriculture technologies implemented, plots monitored by sensors and remote sensing, prescription maps generated, plots with adaptive pruning practices applied, estimated reduction of inputs through precision management.

» A17

SUMMARY: Incorporation of sustainable and circular management measures for the managing and enhancing the value of resources derived from winegrowing.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.4. Implement other good practices that allow for comprehensive, sustainable management of the vineyards and enhancement of ecosystem services, maintaining the productivity and functional diversity of the ecosystem so that it will provide multiple ecosystem services.

OTHER SLs: SL1.3, SL2.3.

DESCRIPTION: The aim of this action is to promote the sustainable and circular management of resources derived from wine-growing activity in the Sudoe space, boosting their environmental, productive and territorial valorisation through nature-based solutions.

The use of plant by-products generated in vineyard management—such as pruning waste, green residues, and biomass—will be encouraged for their reincorporation into the production system through the ecological mulching practices described in A12. The application of layers of plant matter on the soil contributes to protection against erosion, improves water infiltration and retention, increases organic matter, and promotes functional soil biodiversity, reducing dependence on herbicides and intensive mechanical work.

Furthermore, the integration of controlled grazing practices in the vineyard will be promoted as a circular management strategy for weeds and the valorisation of organic resources. The use of livestock allows for maintaining plant cover, improving soil fertility through the natural recycling of nutrients, and reducing the use of machinery and chemical inputs. This practice promotes soil regeneration, biodiversity, and the mitigation of environmental risks such as erosion and fires.

These solutions reinforce the multifunctionality of the wine-growing landscape, transforming waste into resources, reducing the environmental footprint of the operation and promoting circular bioeconomy models adapted to the territories of the Sudoe space.

The action simultaneously contributes to productive sustainability, the conservation of natural capital and climate resilience, promoting replicable practices that integrate agricultural management, biodiversity and the valorisation of local resources.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2040.

INDICATORS: Territories that apply circular valorisation practices, areas with planted ecological mulches, farms with integrated grazing, estimated volume of valorised biomass, reduction of chemical inputs associated with circular management.

» A18

SUMMARY: Installation of sensors and specific sampling approaches for evaluation of the ecosystem services relevant to the vineyards.

OBJECTIVE: O2. Promote the conservation and restoration of the ecological connectivity of wine-growing landscapes, promoting good practices that integrate biodiversity and ecosystem services in the management of the vineyard and its environment to increase resilience to climate change.

SL: SL2.5. Implement tracking and monitoring systems for the results of the NBS applied in the vineyards.

OTHER SLs: SL1.2, SL2.4.

DESCRIPTION: Building on the results of A03, this action aims to implement a plot-scale monitoring system by installing sensors and taking specific samples that contribute to A06 and A08, allowing for a more accurate assessment of the relevant ecosystem services for the vineyard, as well as measuring the effectiveness of the implemented NBSs.

The monitoring system will integrate environmental monitoring technologies aimed at recording key variables related to water regulation, soil quality, microclimate and the functional biodiversity of the vineyard.

The actions include the installation of soil moisture and temperature sensors to analyse water availability, water retention dynamics, and the thermal regulation of the soil system. Microclimatic recording devices will also be incorporated to allow for the evaluation of temperature variations and environmental conditions in different areas of the plot.

Soil sampling will allow the characterisation of relevant physicochemical and biological parameters, including organic matter content, soil carbon, nutrients, structural stability and biological activity associated with the soil microbiome, facilitating the evaluation of ecosystem services linked to fertility, nutrient cycling and carbon sequestration.

The system will also incorporate functional biodiversity monitoring protocols, through specific sampling of auxiliary fauna, pollinators and biodiversity associated with plant cover and elements of green infrastructure in the vineyard.

The information obtained will be integrated into recording and analysis systems that allow the evaluation of the temporal evolution of ecological indicators and the measurement of the impact of the practices aPDOted on climate resilience, ecosystem functionality and the productive sustainability of the vineyard.

This action strengthens the scientific basis for decision-making in wine management, allowing management practices to be adjusted based on quantifiable evidence and promoting replicable monitoring models in other territories of the Sudoeste space.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos.

TIMELINE: 2026-2050.

INDICATORS: Plots monitored with installed sensors, soil sampling campaigns carried out, environmental variables recorded, ecosystem service indicators evaluated, time series generated.

» A19

SUMMARY: Drafting of multi-level participatory governance plans, for each delimited area within the recognised wine-quality designations of the Sudoe space.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.1. Establish mechanisms for protection and management of wine-growing landscapes, while promoting local, sectoral and multi-level governance and cooperation among all participants.

OTHER SLs: SL1.3.

DESCRIPTION: The aim of this action is to develop participatory and multi-level governance plans for the wine-growing territories of the Sudoe space delimited by recognised quality designations, in order to strengthen institutional coordination and the active involvement of the area's stakeholders in the management of the IV.

The plans will establish a structured cooperation framework that integrates the main actors linked to the wine landscape, including local administrations, regulatory boards of designations of origin (AOP, PDO or PGI) and other equivalent entities, winegrowers, wineries, tourism companies, environmental entities, sustainability managers, local associations and civil society.

The action will promote the creation of stable spaces for multi-level coordination that facilitate articulation between local, regional, national and transnational scales, promoting coherence in territorial planning and the implementation of GI strategies in the Sudoe space.

These governance spaces will allow the consolidation of mechanisms for public participation, multi-stakeholder dialogue and shared decision-making, ensuring that vineyard management policies integrate environmental, productive, cultural and socio-economic criteria.

The plans will define organisational structures, roles and responsibilities, channels of institutional coordination and collaboration tools that strengthen cooperation between wine-growing sectors and territories in the Sudoe space.

The action will contribute to consolidating replicable territorial governance models that integrate the conservation of natural capital, climate resilience and sustainable development of the wine sector.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2035.

INDICATORS: Governance plans developed, territorial actors involved, stable multi-level coordination spaces established, participatory mechanisms implemented.

» A20

SUMMARY: Establishment of agreements between winegrowers, winemakers and local governmental agencies, to produce integrated landscape management and ensure the preservation of local environmental and cultural values.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.1. Establish mechanisms for protection and management of wine-growing landscapes, while promoting local, sectoral and multi-level governance and cooperation among all participants.

OTHER SLs: SL2.1, SL2.3.

DESCRIPTION: The aim of this action is to promote and formalise cooperation agreements between winegrowers, wineries and local administrations in the wine-growing territories of the Sudoe space delimited by recognised quality designations, in order to move towards integrated and coordinated landscape management.

The agreements will establish operational commitments for agricultural stewardship to integrate the productive management of the vineyard with the conservation of the GI, the protection of environmental values and the preservation of the wine-growing cultural heritage, promoting joint and coherent action at the territorial scale.

The initiative will promote various collaborative instruments tailored to the characteristics of each area, including voluntary agreements, territorial pacts, and formal agreements between public and private stakeholders. These mechanisms will enable the definition of shared commitments, joint lines of action, and specific responsibilities regarding sustainability, ecological connectivity, habitat management, conservation of traditional landscape features, and the implementation of nature-based solutions.

The operational-territorial approach of the action will facilitate practical coordination between the wine sector and local entities in the implementation of concrete measures on the ground, promoting coherence between planning, agricultural management and landscape conservation.

The formalisation of these agreements will contribute to consolidating collaborative governance models in the wine-growing territories of the Sudoe space, reinforcing the co-responsibility of the actors involved and the integration of environmental and cultural criteria in the ordinary management of the vineyard.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Voluntary agreements signed, territorial pacts formalised, collaboration agreements signed, participating entities, joint actions implemented.

» A21

SUMMARY: Promotion of charters, pacts (or equivalent forms of landscape legislation or agreements in each specific area) for the protection and conservation of vineyard landscapes.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.1. Establish mechanisms for protection and management of wine-growing landscapes, while promoting local, sectoral and multi-level governance and cooperation among all participants.

OTHER SLs: SL2.1.

DESCRIPTION: The aim of this action is to promote the development and promotion of formal instruments for the recognition, protection and management of the wine-growing landscape in the territories of the Sudoe space delimited by recognised quality designations.

The initiative will encourage the aPDOf of landscape charters, or equivalent instruments as included in the specific legislation of each area, as strategic planning tools and collective commitment aimed at preserving the environmental, cultural and productive values of the vineyard landscape.

These instruments will allow the definition of shared reference frameworks for the protection of the wine-growing landscape, establishing principles of action, common objectives and management criteria that integrate conservation of natural capital, productive sustainability, climate resilience and enhancement of territorial heritage.

The action will incorporate the participatory processes necessary for the development and validation of these instruments, involving public administrations, sector entities, regulatory councils, wine-growers, wineries, local associations and civil society, promoting inclusive and multi-level governance.

Promoting these designations will help strengthen the institutional recognition of the wine-growing landscape as a strategic asset of the area, facilitating its integration into sectoral policies, territorial planning instruments and sustainable development strategies.

Likewise, these mechanisms will strengthen cooperation between wine-growing territories in the Sudoe space, promoting common frameworks for landscape protection and replicable management models.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Landscape charters promoted, territorial pacts promoted, equivalent instruments aPDOfed, participatory processes developed, territories adhering to landscape protection frameworks.

» A22

SUMMARY: Design and implementation of models for participation and co-creation with representatives from the local area.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.1. Establish mechanisms for protection and management of wine-growing landscapes, while promoting local, sectoral and multi-level governance and cooperation among all participants.

OTHER SLs: SL3.2.

DESCRIPTION: The aim of this action is to design and implement structured models of participation and co-creation that facilitate the direct involvement of local stakeholders in the planning, management and evaluation of GI in the wine-growing landscapes of the Sudoe space.

The initiative will promote multi-stakeholder collaboration spaces that integrate public administrations, regulatory boards, winegrowers, wineries, environmental entities, the tourism sector, local associations, the scientific community and local residents, fostering open processes of dialogue and shared decision-making that contribute to the A01 and A07.

This model will allow the incorporation of technical knowledge, professional experience and local knowledge into the design of territorial strategies, promoting the formalisation of agreements and pacts included in the A19 and the A20, and ensuring that actions respond to the real needs of the area and reinforce the co-responsibility of the actors involved.

This action will design and promote participatory methodologies adapted to each territorial context, including collaborative workshops, sectoral roundtables, deliberative processes, territorial laboratories and social innovation dynamics that encourage the collective generation of solutions.

These spaces will facilitate the joint identification of priorities, the social validation of proposed measures and the building of consensus around the sustainable management of the vineyard and the conservation of the wine-growing landscape, promoting the implementation of nature-based solutions and good practices included in A12, A13, A14, A15, A16, A17 and A18.

The participatory approach will reinforce the legitimacy of the decisions adopted, strengthen territorial cooperation networks and contribute to consolidating multi-level governance models that can be replicated in other territories of the Sudoe space.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Co-creation processes developed, territorial agents participating, workshops and collaborative spaces carried out, proposals co-designed, cooperation networks consolidated.

» A23

SUMMARY: Promotion, recognition and consolidation of a network of entities and organisations associated with the Strategy.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.2. Organise and align strategic communications for each land area.

OTHER SLs: SL3.1.

DESCRIPTION: The aim of this action is to promote, recognise and consolidate a Network of Entities associated with the Strategy that strengthens transnational cooperation and strategic communication between actors linked to the sustainability of the wine sector in the Sudoe space.

The Network is configured as a stable platform for exchange, dissemination and training aimed at maximising the territorial impact of the Strategy, facilitating the transfer of knowledge and promoting the adoption of sustainable practices in wine-growing landscapes.

Its creation responds to the need to actively involve actors in the wine sector, generate spaces for cooperation between regions and strengthen the connection between technical results and practical application in the area.

The Network will integrate entities interested in sustainability, the implementation of GI and the valorisation of vineyard's ecosystem services, including winegrowers, wineries, sector associations, universities and research centres, public administrations, technical staff and agricultural consultants, as well as other organisations committed to the sustainable transition of the sector.

Its main functions include promoting the actions contained in this strategy, disseminating the results of the ECOSPHEREWINES project and other related projects, promoting sustainable solutions for vineyards, strengthening the technical training of the sector, exchanging experiences between wine-growing territories, and fostering cooperation between entities in the Sudoe space.

The Network will be used for the development and dissemination of the activities described in the different actions of the strategy, especially those of communication, awareness and training, such as technical workshops, training sessions, visits to experimental areas, seminars and events for the transfer of results, or the creation of the necessary exchange spaces to facilitate the circulation of knowledge and the construction of a practical community around the GI wine industry.

The consolidation of this Network will strengthen the participatory dimension of the Strategy, amplify its territorial reach and promote collaborative models of sustainable vineyard management that can be replicated throughout the Sudoe space.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Entities adhering to the Network, Network activities carried out, participants in technical events, training actions developed, materials and results disseminated.

» A24

SUMMARY: Development of a coordinated communication plan within the framework of the Strategy, to ensure access to information and participation in the activities being promoted.

OBJECTIVE: O3. Promote a participatory and multi-level form of governance that brings together representatives of the local area and fosters transnational cooperation for managing the green infrastructure of the Sudoe space.

SL: SL3.2. Organise and align strategic communications for each land area.

OTHER SLs: SL4.1.

DESCRIPTION: The aim of this action is to design and implement a coordinated communication plan that guarantees open access to information and promotes the participation of local stakeholders in the initiatives developed within the framework of the Strategy.

The plan will establish a structured approach to strategic communication aimed at facilitating the dissemination of results, transparency in management, and the involvement of public and private actors in the transition towards more sustainable winemaking models.

The action will define key messages, target audiences, communication channels and tools adapted to the different territorial scales of the Sudoe space, ensuring coherent, accessible communication aligned with the objectives of the Strategy.

The combined use of digital media, face-to-face meetings, and dissemination formats will be promoted to facilitate access to technical information, knowledge transfer, and participation in collaborative processes.

The plan will include internal communication actions to strengthen coordination between involved entities, as well as external communication strategies aimed at highlighting the progress of the Strategy, raising awareness in the wine sector and strengthening the social recognition of green infrastructure and ecosystem services.

In addition, two-way communication mechanisms will be promoted to gather input from stakeholders in the area, encourage multi-stakeholder interaction and strengthen the participatory dimension of governance.

The implementation of this plan will contribute to consolidating a culture of collaboration, transparency and participation, reinforcing the territorial impact of the Strategy and facilitating its replicability throughout the Sudoe space.

LOCATION: Espacio SUDOE.

TIMELINE: 2026-2050.

INDICATORS: Communication plan developed, communication actions implemented, informational materials produced, events and activities disseminated, territorial agents reached.

» A25

SUMMARY: Design and implementation of an awareness-raising campaign for the general public, on the benefits of green infrastructure in vineyards.

OBJECTIVE: O4. Promote awareness, training and building of technical skills in relation to green infrastructure in the vineyards, encouraging the use of sustainable practices, and strengthening the commitment of the representatives of each land area to the programme's ecological, cultural and landscape values.

SL: SL4.1. Increase knowledge and awareness of the value of green infrastructure in vineyard landscapes.

OTHER SLs: SL3.2.

DESCRIPTION: The aim of this action is to design and implement an awareness campaign aimed at the general public to increase knowledge about the environmental, social and cultural benefits of GI in wine-growing landscapes.

The campaign will seek to strengthen the role of consumers as agents of change, promoting a greater appreciation of wine products obtained through sustainable practices and encouraging responsible consumption decisions that drive the ecological transition of the sector.

The communication approach will combine accessible scientific dissemination and territorial narratives that connect vineyard sustainability with product quality, landscape conservation, and resilience to climate change.

The planned actions include the production of informative audiovisual capsules, interactive digital content and multimedia materials that clearly explain the ecosystem services associated with the GI wine industry.

Likewise, the development of experience packages and face-to-face activities will be promoted to bring the public closer to wine-growing territories, facilitating the practical understanding of the NBSs applied in the vineyard and their contribution to sustainability.

The campaign will foster the connection between local area, product and consumer, reinforcing the social recognition of the wine-growing landscape as ecological and cultural heritage, and contributing to generating a market demand aligned with responsible production practices.

This action will broaden the social impact of the Strategy, strengthening public awareness of green infrastructure and promoting behavioural changes that support sustainable winemaking models in the Sudoe space.

LOCATION: Espacio SUDOE.

TIMELINE: 2026-2050.

INDICATORS: Campaign designed and implemented, audiovisual materials produced, digital content disseminated, territorial experiences developed, audience reached by awareness actions.

» A26

SUMMARY: Design and promotion of specific theoretical-practical training programmes for the implementation of IV in vineyards, with technical training for key participants (winegrowers, winemakers, oenologists, wine tourism professionals, etc.).

OBJECTIVE: O4. Promote awareness, training and building of technical skills in relation to green infrastructure in the vineyards, encouraging the use of sustainable practices, and strengthening the commitment of the representatives of each land area to the programme's ecological, cultural and landscape values.

SL: SL4.2. Give local stakeholders the technical and practical knowledge they need in order to design, implement and manage green infrastructure.

OTHER SLs: SL2.4, SL3.2.

DESCRIPTION: The aim of this action is to design and implement specific theoretical-practical training programmes aimed at strengthening the technical capacities of key agents in the wine sector in NBS and GI management, ensuring the implementation of A12, A13, A14, A15, A16, A17 and A18 in the wine territories of the Sudoe space.

The training will be aimed at strategic profiles in the area, including winegrowers, winemakers, oenologists, agricultural technical staff, wine tourism professionals and other actors linked to the wine value chain.

The programmes will combine conceptual content on GI, ecosystem services, climate resilience and productive sustainability with practical training applied in the field, facilitating the direct transfer of knowledge to the real management of the vineyard.

The training activities will cover ecological diagnostic methodologies, design of GI at plot and landscape scale, implementation of NBS, monitoring of results and adaptive vineyard management, capitalising on the results of the other actions of the strategy and relying on the ECOSPHEREWINES Practical Guide (A27).

In addition, demonstration activities will be promoted in experimental areas, practical workshops, exchanges of experiences between wine-growing territories and specialised training focused on innovation in sustainable practices.

The action will promote the professionalisation of the sector, the adoption of production models compatible with landscape conservation and the strengthening of communities of practice around wine sustainability.

These programmes will contribute to accelerating the ecological transition of the sector, strengthening the human capital of the area and promoting the replicability of solutions throughout the Sudoe space.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Training programmes designed, training actions delivered, agents trained, practical activities developed, training materials prepared.

» A27

SUMMARY: Publication and distribution of the ECOSPHEREWINES Practical Guide, as a way to help develop and enhance green infrastructure elements in vineyards.

OBJECTIVE: O4. Promote awareness, training and building of technical skills in relation to green infrastructure in the vineyards, encouraging the use of sustainable practices, and strengthening the commitment of the representatives of each land area to the programme's ecological, cultural and landscape values.

SL: SL4.2. Give local stakeholders the technical and practical knowledge they need in order to design, implement and manage green infrastructure.

OTHER SLs: SL2.3, SL3.2.

DESCRIPTION: The aim of this action is to disseminate the practical guide developed within the framework of ECOSPHEREWINES as a knowledge transfer tool aimed at winegrowers and agents interested in the implementation of green infrastructure (GI) and nature-based solutions (NBS) in vineyards.

The guide is conceived as an operational instrument to support decision-making, structured to facilitate the practical application of sustainable measures based on the experience accumulated in the project's pilot study areas.

The document will describe in a sequential and didactic manner the vineyard diagnosis process, the planning of interventions and the implementation of sustainable agricultural practices, incorporating technical guidelines adapted to different wine-growing contexts.

Detailed practical guides will be included that address the NBS applied in the pilot projects, such as plant covers, green manures, organic mulches, restoration of walls and terraces, recovery of wetlands and watercourses, drainage management, flowering fallows, flower strips, multifunctional hedges, edible forests, slope management and innovative biological control.

Each practice will incorporate objectives, design criteria, selection of species and materials, action schedules, maintenance recommendations, indicative costs and lessons learned, along with real examples documented photographically.

The guide will integrate the identification of the ecosystem services associated with each intervention, facilitating the understanding of the environmental, productive, and cultural benefits derived from green infrastructure in the vineyard. It will also include practical tools such as technical data sheet templates, annual management schedules, guidelines for landscape enhancement and wine tourism, and supporting technical and scientific references.

Its dissemination will accelerate the aPDotion of good practices, improve the sector's technical training, provide key support to the A26, and promote the replicability of sustainable solutions in the wine-growing territories of the Sudoe space.

LOCATION: Entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Practical guide published, copies distributed, digital downloads registered, dissemination actions carried out, agents of the sector reached.

» A28

SUMMARY: Organisation of technical visits to exemplary vineyards, to demonstrate in the field the technical, environmental and economic viability of implementing NBS, and to encourage exchanges of learning, implementation of good practices and replicability of the model.

OBJECTIVE: O4. Promote awareness, training and building of technical skills in relation to green infrastructure in the vineyards, encouraging the use of sustainable practices, and strengthening the commitment of the representatives of each land area to the programme's ecological, cultural and landscape values.

SL: SL4.2. Give local stakeholders the technical and practical knowledge they need in order to design, implement and manage green infrastructure.

OTHER SLs: SL2.3, SL3.2.

DESCRIPTION: The aim of this action is, by building on the network created in the A23, to organise technical visits to demonstration vineyards in the Sudoe space to facilitate practical learning about the implementation of NBS and GI management in real wine-growing contexts.

The visits will allow us to showcase on-site experiences applied in pilot plots, demonstrating the technical feasibility of the interventions, their environmental benefits and their contribution to the economic sustainability of the wine-growing operations.

These activities will facilitate the direct transfer of knowledge between professionals, promoting the exchange of experiences, the observation of tangible results, and learning based on real implementation cases.

During the sessions, practices related to improving soil quality, efficient water management, GI restoration, functional biodiversity, the circular economy applied to vineyards, and the integration of precision agriculture technologies will be presented.

The visits will foster dialogue between winegrowers, winemakers, technical staff, public officials and other stakeholders in the area, strengthening cooperation networks and communities of practice around wine sustainability.

This demonstrative approach will help reduce adoption barriers, build trust in the solutions applied, and promote the replicability of sustainable management models in other wine-growing territories in the Sudoe space.

The action will strengthen the practical dimension of the training, accelerating knowledge transfer and expanding the territorial impact of the Strategy.

LOCATION: AOP Gaillac, Douro DOC | PDO Porto, PDO Arribes, IGP Betanzos, entire Sudoe space.

TIMELINE: 2026-2050.

INDICATORS: Organised technical visits, participating demonstration vineyards, attending agents, demonstrated practices, technical exchanges carried out.

TIMELINE

ACTION	MAIN CONTENT	HORIZON				
		2030	2035	2040	2045	2050
A01	Identify GI Network					
A02	Design GI methodologies at a detailed scale					
A03	Implement biodiversity metrics systems					
A04	Analyse functional flora					
A05	Study functional fauna					
A06	Monitor biodiversity					
A07	Identify and prioritise ecosystem services (EESS)					
A08	Calculation and mapping of ecosystem services					
A09	Wildlife refuge and habitats					
A10	Connectivity assessment and priority areas					
A11	Soil mapping and diagnosis					
A12	Implementation of nature-based solutions (NBS) in vineyards					
A13	Diversification of production and biological refuges					
A14	Design of sustainable water cycle					
A15	Integrated pest management and biocontrols					
A16	Precision agriculture and adaptive pruning					
A17	Circular management and resource recycling and reuse					
A18	Sensors and evaluation of ecosystem services					
A19	Plans for multi-level governance					
A20	Agreements on integrated landscape management					
A21	Landscape charters, pacts and agreements					
A22	Co-creation models for each area					
A23	Establishment of network of entities for the area					
A24	Production of a coordinated communication plan					
A25	Public awareness campaign					
A26	Specialised training programmes					
A27	Dissemination of the ECOSPHEREWINES practical guide					
A28	Technical visits to demonstration vineyards					



9. GLOSSARY OF RECURRING TERMS

» BIOCONTROL (BIOLOGICAL CONTROL)

Means the use of living organisms to control pests and diseases, reducing dependence on chemical plant protection products.

» FUNCTIONAL BIODIVERSITY

Means a group of species that perform key ecological functions in an agroecosystem, such as pollination or biological pest control.

» MAPPING OF ECOSYSTEM SERVICES (EESS)

Means a spatial representation of ecosystem services, used to support planning and decision-making in a particular area.

» ECOLOGICAL CONNECTIVITY

Means the degree to which landscape elements allow the movement of species and the flow of ecological processes among habitats.

» CUSTODY OF THE LAND

Means a set of strategies and voluntary agreements between owners and entities, for the conservation of natural and cultural values.

» PDO / AOP / DOC

These are European designations that are used to identify products with quality characteristics derived from a specific geographical environment, as influenced by both natural and human factors. These are relied upon as key territorial units for the planning and management of wine-growing landscapes.

» CIRCULAR ECONOMY IN VINEYARDS

Means the use of by-products produced from viticultural activities (pruning waste, biomass), with the aim of reducing waste and improving the sustainability of the system.

» STRUCTURAL ELEMENTS OF THE LANDSCAPE

Means the physical components of an area (hedges, boundaries, riverbanks, terraces, walls) that contribute to ecological functionality.

» SUDOE SPACE

Means the scope of application of the project, which is a defined area of regional cooperation that covers parts of Spain, Portugal, southwest France and Andorra.

» HELPFUL FAUNA

Means a group of animals and organisms that provide benefits to vineyards, especially through biological pest control and pollination. These include, among others, predatory arthropods, parasitoids, pollinators and insectivorous birds.

» GIS (GEOGRAPHIC INFORMATION SYSTEMS)

Means technological software systems that are used for the analysis, management and representation of spatial information for a particular area.

» MULTI-LEVEL GOVERNANCE

Means coordination among various governmental levels (local, regional, national and European) in relation to managing an area.

» PARTICIPATORY GOVERNANCE

Means a management model that integrates local stakeholders into the decision-making process for matters involving land planning and use.

» GREEN INFRASTRUCTURE (GI)

Means a planned network of interconnected natural, semi-natural and cultural elements, designed to support the maintenance of biodiversity, ecological connectivity and provision of ecosystem services.

» MULTIFUNCTIONALITY OF THE LANDSCAPE

Means an area's ability to simultaneously perform functions that are related to production, ecology, culture and society.

» LANDSCAPE (EUROPEAN LANDSCAPE CONVENTION)

According to the Council of Europe, a landscape is "an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors." In the context of vineyards, this concept brings together ecological, cultural and productive dimensions.

» WINE-GROWING LANDSCAPE WITH HIGH ECOLOGICAL VALUE

Means an agricultural system where the vineyard is closely integrated with natural and cultural elements, which generates high environmental, landscape and productive value.

» PLOT (VINEYARD)

Means a wine-growing landscape unit that is under a single source of agricultural management. This is the operational scale at which sustainable practices and nature-based solutions are implemented.

» RESILIENCE (CLIMATIC/ECOLOGICAL)

Means a system's ability to resist, adapt to, and recover from disturbances such as those caused by climate change.

» ECOLOGICAL RESTORATION

Means the process of recovering degraded ecosystems to restore their functionality and biodiversity.

» ECOSYSTEM SERVICES (EESS)

Means the benefits that ecosystems provide to society, including regulatory services, provisioning services, and cultural services.

» NATURE-BASED SOLUTIONS (NBS)

Means actions that utilise natural processes to address environmental challenges, while simultaneously improving biodiversity and production sustainability.

» KNOWLEDGE TRANSFER

Means the process of disseminating results, methodologies and good practices to others in the sector and in the local area.

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