SUPERB
Upscaling Forest Restoration

Deliverable 8.1
Annex 6

Upscaling plan, route-map for upscaling Spanish demo

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DISCLAIMER

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Executive Summary

Background

The Spanish demonstration area is located in **El Bierzo**, a region in northwest Spain within the province of León, covering **307,778 hectares**, of which **over 80% is forested**. The area is characterized by two distinct landscapes: mountainous zones dominated by forestry, livestock, and abandoned mining, and valleys with intensive agriculture. Since the 1950s, rural depopulation has led to land abandonment, increasing shrubland and fire-prone forests.

Key challenges include:

- **Increased wildfire risk**: Over **33,000 hectares burned (2007–2021)** due to unmanaged vegetation.
- **Habitat fragmentation**: Threatening the endangered **Cantabrian brown bear**, whose recovery depends on improved habitat connectivity.
- **Economic decline**: Loss of traditional livelihoods (mining, agriculture) exacerbates rural exodus.

The **upscaling plan** aims to restore degraded landscapes, enhance biodiversity, and promote sustainable rural economies through silviculture, reforestation, and community engagement.

Objectives

The restoration strategy targets:

1. **Ecological Resilience**:
   - Restore degraded forests and shrublands to **reduce wildfire risk**.
   - Expand **brown bear corridors** by planting native species (e.g., *Quercus pyrenaica*) and improving habitat connectivity.
2. **Economic Revitalization**:
   - Promote **chestnut plantations, ecotourism, and non-timber forest products** (mushrooms, honey) to support rural livelihoods.
3. **Climate Mitigation**:
   - Enhance **carbon sequestration** through reforestation.
4. **Stakeholder Collaboration**:
   - Engage local communities, policymakers, and private investors in long-term land management.

Methods

The plan employs a **multi-stakeholder approach**, combining:

- **Silvicultural treatments**: Thinning, controlled burns, and mixed-species planting to reduce fire risk and improve forest health.
- **Habitat restoration**: Planting bear-friendly species (e.g., fruit-bearing trees) to enhance food availability.
- **Community involvement**: Workshops, participatory planning, and awareness campaigns to foster coexistence with wildlife.
- **Policy alignment**: Leveraging EU and regional funding (e.g., **EAFRD, LIFE Programme**) and aligning with the **EU Nature Restoration Law**.

Two upscaling scenarios were defined:

1. **Regional (SC1)**: Focused on **northern Castilla y León** (Zamora, León, Palencia, Burgos) to connect brown bear subpopulations.
2. **Iberian Peninsula (SC2)**: Broader restoration across Spain and Portugal (long-term vision).

Summary of Key Results

Ecological Benefits:

- **137 hectares** restored in the pilot phase, with plans to expand.
- Improved **brown bear habitat connectivity** and reduced fire-prone landscapes.

Economic Opportunities:

- **Chestnut plantations** and **eco-tourism** identified as key income sources.
- **Hunting and mushroom picking** revitalized as cultural-economic activities.

Stakeholder Engagement:

- **81 stakeholders** mapped, including landowners, NGOs, and regional authorities.
- **Three participatory workshops** held to align restoration goals with local needs.

Barriers Addressed:

- **Funding gaps**: Explored **carbon credits, corporate partnerships, and EU grants**.
- **Policy coordination**: Advocated for updated **brown bear recovery plans** and streamlined regulations.

Key Messages

Integrated Landscape Management is critical to address **wildfires, biodiversity loss, and rural abandonment** simultaneously.

Community-led solutions—such as chestnut farming and eco-tourism—can **counter depopulation** while supporting conservation.

Policy Action Needed:

- Strengthen **cross-regional governance** for bear habitat management.
- Implement the **EU Restoration Law** to standardize ecological recovery efforts.

Scalability: The **Regional Scenario (SC1)** is the most feasible for immediate action, but long-term success requires **Iberian-wide collaboration (SC2)**.

Sustainable Financing: Public-private partnerships and **payment for ecosystem services** must be prioritized to ensure long-term viability.

Conclusion

The Spanish demo demonstrates that **ecological restoration, economic incentives, and stakeholder engagement** can coexist. By upscaling these efforts, El Bierzo can serve as a model for **fire-resilient landscapes, wildlife conservation, and rural revitalization** across Europe.

Keywords

Up-scaling, forest restoration, forest ecosystem services

1. Introduction and Background

1.1 Background

The Spanish demo area is located in a region called El Bierzo, in the northwest of Spain, at the western end of the Cantabrian Mountains within the province of León. It borders the province of Lugo to the west and the Principality of Asturias to the north. The area includes 37 municipalities within the province of León, covering a total of 307,778.47 hectares. Of these, more than 250,000 hectares are covered by forest and woodlands, representing more than 80% of its total surface area, of which about 130,000 hectares are wooded[1] (see Figure 1). The responsibility for forest management and planning in the area[2] falls on the public administration, specifically on the Regional Ministry of Development and the Environment (Consejería de Fomento y Medio Ambiente), through the General Directorate of Natural Heritage and Forestry Policy (Dirección General de Patrimonio Natural y Política Forestal).

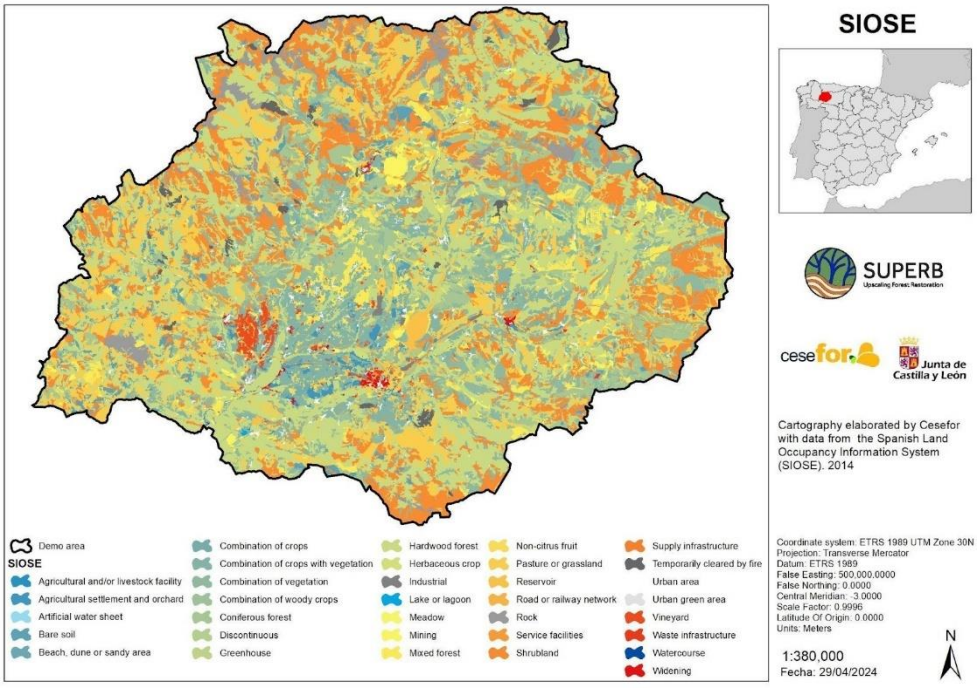


Figure 1. Map of the Demo land uses elaborated with data from the Spanish Land Occupancy Information System (SIOSE) 2014.

In El Bierzo, it is possible to distinguish two distinct physiographic environments which have influenced human occupation, land use and the formation of the landscape: the mountain and the valley. In the mountain areas, forestry, extensive livestock farming and mining predominate (mainly slate mining and coal mining, the latter of which has recently disappeared). In contrast, in the valley areas, intensive farming is the most important. Meanwhile, the agriculture carried out in the mountainous areas has been primarily oriented towards self-consumption.

[1]A wooded forest area is a forest area with a canopy cover of tree species equal to or greater than 10% (Ministerio para la Transición Ecológica y el Reto Demográfico (MITECO), 2023).

[2]Decreto 23/2019, de 1 de agosto, por el que se establece la estructura orgánica de la Consejería de Fomento y Medio Ambiente.

2. Strategic approach

2.1 Building the case for upscaling

Since the 1950s, in the region of El Bierzo, as in the rest of Spain and developed countries in general, a phenomenon of rural-urban migration has led to profound changes in land use. Due to the abandonment of agrosilvopastoral practices, the area of shrubland and young forests has increased on previously arable and pasture land. In addition, the end of mining activities has contributed, not only to an increase in migration to urban areas, but also to intensified environmental degradation of the landscape.

Rural abandonment and the lack of any management have caused changes in the ecosystems, affecting the distribution of animals and creating more suitable areas for some species (i.e. mammalian ungulates, Martínez-Abrain et al., 2020). One consequence of decreased land management, combined with the typical Mediterranean climate, is a dangerous increase in large forest fires. Analysis of the fire series since 2007 shows a high number of fires in the demo area, burning around 2,000 ha of forest land annually. From 2007 to 2021, more than 33,000 ha have been burned (personal communication with the Junta de Castilla y León personnel in 2024). Therefore, maintaining population and decreasing the rural exodus becomes a keystone in areas such as the Spanish Demo.

The Cantabrian brown bear (*Ursus arctos*) is amongst the most severely threatened populations of brown bear in Europe (Zarzo-Arias et al., 2019). It currently lives in two small and quite isolated subpopulations in the northwest of Spain (López-Bao et al., 2021; Pérez et al. 2010). This isolation is attributed to anthropogenic pressure (Mateo-Sánchez et al. 2016) and loss of continuous suitable habitat (Martínez Cano et al., 2016; Zarzo-Arias et al., 2018). The Cantabrian brown bear has been under strict protection since 1973 and most of the known habitat of the species is within areas with different types of protection (e.g. Natura 2000 Network, Natural Parks and Recovery Plans for the species in the different Autonomous Communities involved in its management). Protection measures have promoted a genetic and demographic recovery and increased the gene flow among subpopulations (Gonzalez et al., 2016). However, migration, gene flow, population increase and mortality are not balanced among the two subpopulations (Ferreira et al., 2021). Moreover, spatial habitat constraints, and primary infectious diseases hinder the species' recovery and threaten its long term viability (Balseiro, et al., 2024, Penteriani et al., 2020). Therefore, the recovery of the Cantabrian brown bear is tightly linked to the improvement of its habitat and its connectivity (Scharf & Fernández, 2018). Thus, we must address three interconnected problems: rural abandonment, the reduction of forest fire risk and the improvement of brown bear habitat and its connectivity.

With this in mind, upscaled restoration targets include several goals:

- Create a more resilient landscape that protects and extends brown bear corridors.
- Restore degraded areas, such as shrublands and low quality forests of *Quercus pyrenaica*, through silviculture activities.
- Plant species suitable for bear feeding and create mixed forests.
- The planting increases carbon sequestration as well, and contributes to climate change mitigation and enhances forest biodiversity.
- Both restoration activities, silviculture and planting, improve other ecosystem services, such as water regulation or soil conservation.

- Engage the rural population in the demo area through chestnut productive plantations.

With a focus on brown bear habitat connectivity and wildfire prevention, upscaling the activities in the demo has significant potential to address rural abandonment through the promotion of silvicultural activities either from wood as non-wood products. In particular the chestnut plantations together with hunting, mushroom picking and honey production are economic pillars that could gain more importance. In addition, ecotourism, especially the wildlife watching, that should be promoted. All in one, the mission is that whilst we enhance biodiversity through wildlife corridors, building up a broad range of profitable forest activities to hinder the rural depopulation.

Defining upscaling extent

The current brown bear distribution area will serve as a starting point to define the upscaling extent of the restoration actions implemented in El Bierzo. The brown bear's distribution area is fragmented in two populations in the Iberian Peninsula (Fig. 2), poorly connected to each other: The Cantabrian population (northwest of Spain) and the Pyrenean population (northeast of Spain). Within the Cantabrian population we also distinguish two subpopulations: the Western subpopulation and the Eastern subpopulation.

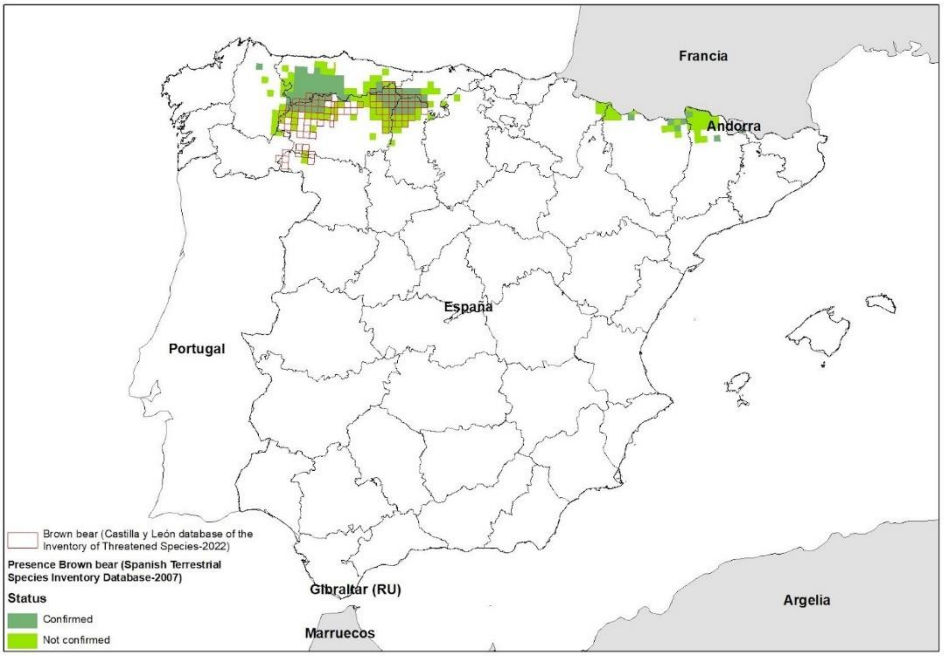


Fig. 2. Current brown bear distribution in the Iberian peninsula. The Cantabrian population in the Northwest and the Pyrenean population in the Northeast. Dark green color stands for the confirmed presence of the species on a 10km x 10km species distribution grid (Spanish Terrestrial Species inventory database, 2007). Light green colour stands for not confirmed presence of the species on a 10km x 10km species distribution grid (Spanish Terrestrial Species inventory database, 2007). 10 km x 10 km grid stands for brown bear confirmed presence in the Castilla y León database of threatened species (2022).

Due to climate change, bears are expected to become more active in winter, with a decreasing number of hibernation days by year and an increased tendency to forage in areas with higher human presence during this season (Navarro Gómez et al., 2021). Additionally, simulations of plant species distributions that represent the main food sources and shelter for Cantabrian bears, suggest that the geographic range of these plants may be altered by climate change, with most bear resources experiencing a reduction in their range (Penteriani et al., 2019).

Therefore, measures to mitigate the impacts of climate change on Spanish bear populations should take into account shifts in bear resources distribution and ensure the provision of food for bears during winter.

The combination of the climate change impacts and land use changes needs to be addressed to prevent an increase in the incidence of fires. In fact, the current circumstances of land abandonment, and subsequent loss of traditional agro-pastoral activities are shaping the landscape, leading to the expansion of extensive shrubland and monospecific forests. This phenomenon is explained by Silva and collaborators (2023). Fire has increased in intensity and extent in the recent decades in response to variations in climate, but mostly due to changes in land use and land cover and also by factors such as management intensity, livestock composition, land ownership structure, and demography. Agricultural activities, which contributed to the management of fuel in the overall landscape, were allocated to the most productive areas, while the steepest areas were occupied by extensive areas of shrubland and monospecific forests, creating landscapes of high fire-proneness. These challenging circumstances call for landscape transformation actions focusing on reducing the burned area, conditioned by land morphology, which limits the actions (e.g., farming operations) that can be taken. In the more fire-prone areas, a 40% proportion of agricultural uses in the landscape results in an effective reduction in the burned area (Adapted from Silva et al. 2023). Following the same line is Moreno et al. (2023). They stated in the aforementioned research that the maintenance and recovery of traditional agro-pastoral activities is an effective option to reduce flammability and increase the resilience of cultural landscapes in hazardous climatic conditions. Being itself, the traditional agro-pastoral activities, a critical target, a barrier to overcome and an enabler for a successful restoration.

Bearing in mind the aforementioned factors, we define two potential upscaling scenarios: a Regional Scenario (SC1) and an Iberian Peninsula Scenario (SC2).

A. Regional Scenario (SC1).

The regional upscaling scenario (Fig. 3) covers the northern provinces of Castilla y León, Spain, (Zamora, León, Palencia and Burgos) where brown bear is currently present in Castilla y León. In addition, this scenario would help to improve the connection of the two Cantabrian brown bear subpopulations.

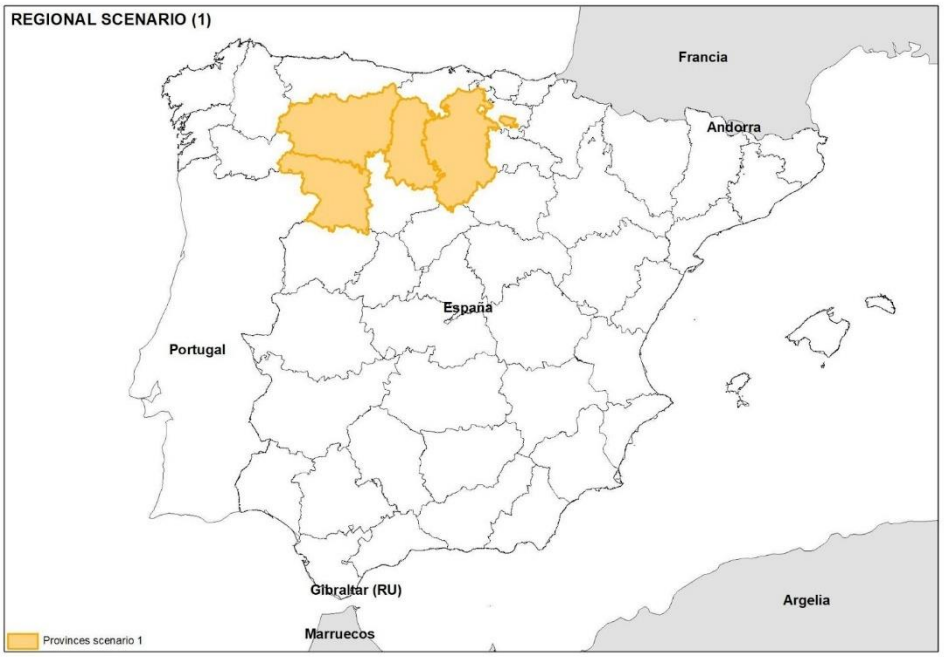


Figure 3. Regional upscaling scenario in Zamora, León, Palencia and Burgos provinces in Castilla y León.

B. Iberian Peninsula Scenario (SC2).

The Iberian Peninsula upscaling scenario (Fig. 4) covers the whole potential distribution area of the brown bear in the Iberian Peninsula, according to Araújo et al. (2011). This scenario covers the regions of Galicia, Asturias, Cantabria, País Vasco, Navarra, Aragón (province of Huesca), Catalonia (provinces of Lleida, Barcelona and Girona) and Castilla y León (provinces of León, Zamora, Palencia, Burgos, Soria, Segovia and Ávila) in Spain and the districts of Viana do Castelo, Braga, Vila Real, Bragança, Porto, Aveiro, Viseu, Guarda and Coimbra in Portugal.

Figure 4. Iberian Peninsula upscaling scenario.

Of the two scenarios presented, SC1 exhibits more ecological and governance similarities than SC2. Also, being in the same region as the demo area, it seems the most realistic

upscaling scenario as it is subjected to the same legislation. For these reasons, we will focus on this scenario over the plan, while recognizing the long-term restoration needs across northern Spain and Portugal (SC2).

Beyond the current restoration targets:

Landscape restoration enhances environmental quality and provides numerous benefits to the restored area. In addition to the economic profits from chestnut plantations, hunting will be the primary economic activity to benefit from this ecosystem restoration. Since the 20th century, the hunting activity has expanded in Spain because of the social and ecological conditions that have been promoted. Three of these fundamental characteristics are the suitability of the territory for roe/red deer, wild boar, hare and fowl hunting, the agrarian crisis and the property structure of the hunting preserves (Rengifo Gallego, J.I., 2009). Another key factor driving the recent rise in hunting in Castilla y León has been the exemption from fees for hunting licenses since December 2022 (Junta de Castilla y León, 2025).

Another economic and cultural activity that can be derived from the restoration is the collection of mushrooms. Castilla y León is one of the most important producers of mushrooms in Spain, specifically in *melojares* (*Quercus pyrenaica* forests) according to the European Mycological Institute (EMI). We can find boletus, chanterelle and *Amanita caesarea,* all of them edible. Mushroom picking has such an important cultural heritage as hunting, being both of them the main leisure activities of the rural population.

In a smaller share, it is also important to mention that the undergrowth of this type of forest can house shrubs like *Vaccinium myrtillus,* from which the blueberry fruit can be obtained. In addition, and still related with the undergrowth, it is important to clarify the ecology of *Quercus pyrenaica*. The roots of the Spanish oak frequently produce suckers and the species has high resprouting capabilities. These features are the ones that increase the risk of wildfires, and the same ones can be used to produce firewood (unseasoned). The firewood can be collected by the surrounding population, reducing by this way, the fuel in the forest promoting the reduction of forest fires and, with an economic purpose, as a source of heat and energy at a local level.

2.2 Situational analysis

A fundamental step for upscaling of restoration is to explore barriers to success. Critical issues may arise in several dimensions and a valid approach is to conduct a so-called PESTEL analysis. It aims at exploring issues across political, economic, social, technical, environmental and legal dimensions.

The Castilla y León Demo has performed a PESTEL analysis that identified the following challenges and enablers for future restoration efforts in the area (Table 1).

Table 1. Barriers and enablers, as well as target groups and feasibility, for upscaling in Spain.

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
Political	P1- Lack of coordination between autonomous communities and the state government, as well as between the scientific-technical sector and the bodies of the competent administrations.	Strengthening coordination mechanisms of related public and private institutions through stakeholder engagement workshops	Policy makers, local authorities, and regulating actors	Medium
	P2- The time scale used by ecosystems is generally long and usually longer than the mandatory two-year guarantee periods normally established in public procurement. The timeframes that the new Public Sector Contracts Law indicates for the different types of contracts would therefore make the implementation of the SR more difficult and lead to more complex procedures.	Encourage the development of frameworks and instruments to suit the programmes and needs of the forestry and environmental sector	Policy makers, local authorities, and regulating actors	Low
	P3- At the political level, in Spain, the forestry and environmental sector continues to have very little weight at national level	Promoting sustainable natural resource management models that contribute to the conservation and	Policy makers, local authorities, and regulating actors	Low

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
		enhancement of tree stands		
Economic	Ec1- Lack of a standardised and accepted procedure for valuation of ecosystem services and natural capital, which in many cases prevents economic valuation of the cost/benefit balance of an ecological restoration project, especially as some environmental and social benefits are difficult to quantify in monetary terms.	Approach some large companies interested in financing restoration projects showing examples from the National Carbon Market to support the economic value of restoration activities and justify the investment costs		Low
	Ec2- Lack of continuity in funding	Seek new funding opportunities for projects that promote forest restoration and biodiversity enhancement in Europe (including research grants and equity funds from private corporations)	Local authorities, researchers, forest associations, NGOs and other non profit forest foundations	Medium
	Ec3- Low flow of investment into reforestation and protection of forests and woodlands	Promote the implementation of compensation mechanisms for the environmental services provided by forests and woodlands	Policy makers, local authorities, and regulating actors	Low

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
	Ec4- Low level of income in rural segments of the population, especially forestry sector and in particular mountain areas with small ownerships and difficult access	Promote partnerships and other tools to increase profitability in the forestry and agroforestry sector. In particular, the Consejo Comarcal del Bierzo or the Asociación Berciana de Agricultores could lead these joint efforts	Private landowners, beekeepers and farming associations	Medium
Social	S1- Demographic loss and rural abandonment: young people are leaving the area leading to a lack of land use and management	Promote productive activities with favourable conditions at the local population level, and livelihoods compatible with the conservation of natural resources	Private landowners, beekeepers and farming associations	Low
	S2- Social distrust among some sectors of society of the presence of the bear	Promoting awareness and education programmes to encourage coexistence with the brown bear and the importance of sustainable forest management	Private landowners, beekeepers, farming associations and civil society	Medium
	S3- Distorted view of some sectors of society about the measures to be taken to deal with the bear. A large part of the urban	Promote the training of local stakeholders (mayors, forest rangers, etc.) in bear protocols	Local and regional forestry administration, forest rangers, private landowners,	High

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
	population has a conservationist view of the bear, without taking into account rural activities and their interaction.		beekeepers, farming associations and civil society	
	S4- Lack of understanding of the need for and objectives of the treatments carried out, and the benefits of a sustainable forest management	Disseminate the restoration activities and the needs of forest management. This will contribute to the success of the restoration (during planning, implementation and after completion)	Local and regional forestry administration, forest rangers, private landowners, beekeepers, farming associations and civil society	High
Legal	L1- Poor enforcement of forestry regulations	Revisions or updates to management plans should balance land use with the conservation of protected species	Policy makers, local authorities, and regulating actors	Low
	L2- In certain protected areas, it is difficult to manage and reconcile use and conservation with current legislation	Review the legal framework of the management plans of protected areas for updating	Policy makers, local authorities, and regulating actors	Medium
Technical	T1- Restoration works are often inadequate or insufficient due to lack of funding	Monitoring and mitigating measures		Medium
	T2- Lack of planning in some restoration actions (including unexpected	Extension of technical documentation and training of contractors		High

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
	disturbances) , or poor execution			
	T3- Lack of technical knowledge of local stakeholders on how to deal with a bear incursion in rural or urban areas	An intervention protocol has been developed with guidelines for dealing with bear incursions in urban and peri-urban environments. There is a well-qualified institution (Fundación Patrimonio Natural) that carries out preventive work to avoid damage in the increasingly frequent bear-human interaction	Local and regional administration, forest associations, beekeepers, farmers, other local associations and civil society	High
	T4- Lack of sufficient skilled workers to carry out forestry works	Boost the training of quality forest workers and promote the specialist forestry courses	Schools and universities, forest associations	Low
Environmental	En1- The effect of drought reduces the survival of seedlings in reforested areas	Carry out a careful selection of the species and provenances to plant in the restoration plan and promote watering in the restored areas during the first summer after the execution, if needed	Local and regional administration, contractor in charge of the execution, supervisor of the contractor	High

Issue	Barriers/challenges to address	Enablers to promote	Stakeholder Group	Feasibility (ease of achievement)
	En2- Possible forest pests and diseases and their relationship with local environmental conditions	Promote an integrated management of forest pests and diseases in the restoration plan	Local and regional administration, contractor in charge of the execution, supervisor of the contractor	Medium
	En3- Recurrent fires in the area	Promote forest fire prevention and control through restoration actions in the restoration plan and after the implementation	Local and regional administration	Medium

3. Addressing the barriers to upscaling

3.1 Stakeholder engagement

Stakeholder mapping:

The stakeholder mapping was conducted by the Cesefor demo team during the spring of 2022. This process identified 81 stakeholders across the categories defined by the Prospex Institute (PI). Many stakeholders fall into multiple categories simultaneously due to their professional roles or personal connections to the forest in the area. While all stakeholder categories are relevant, the following have been identified as key actors for the Castilla y León Demo Area (see Table 2) and should be targeted for further upscaling in the region.

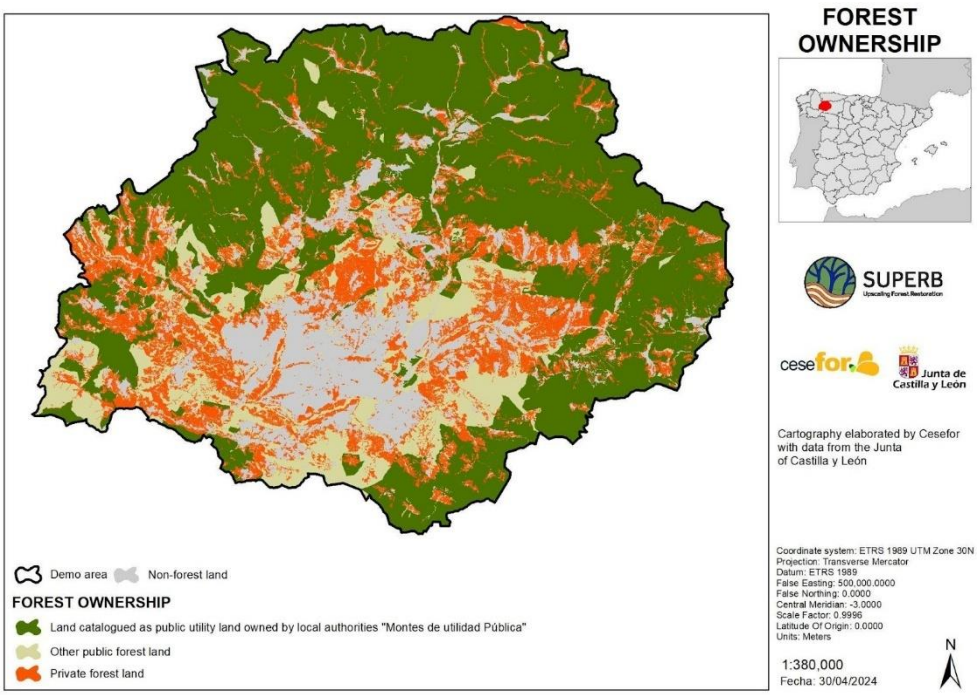
Table 2. Stakeholders from the Stakeholder mapping in the Spanish Demo.

Stakeholder category	Stakeholder	Key actor*
Landowners		Tertiary
Forest landowner associations	*ASFOLE, FAFCYLE*	Primary
Forest rangers	*Head of the environmental police of the Villafranca and Bembibre regions*	Primary
Local council/municipalities	*Municipalities of Corullón, Trabadelo, Igüeña, Noceda, etc.*	Primary
Local public administration	*Fourth Territorial Section of the Junta de Castilla y León (JCyL)*	Primary

Stakeholder category	Stakeholder	Key actor*
Regional public administration	*Regional Ministry of Development and Environment of the JCyL*	Primary
Regional public agencies	*Fundación Patrimonio Natural de Castilla y León, Fundación Oso Pardo*	Primary
Forest certification organisations	*PEFC, FSC*	Primary
Beekeepers	*Asociación Leonesa de Apicultores, Asociación Berciana de Apicultores, Apícola del Bierzo S.Coop.*	Primary
Local farming associations	*Asociación Berciana de Agricultores*	Primary
Local chestnut associations	*Mesa del Castaño del Bierzo, Asociación de Castañicultores Los Tres Valles, etc.*	Primary
Recreational, leisure and cultural associations	*Club Deportivo Rutas del Bierzo, Asociación de Turismo Activo de Castilla y León (ATACYL), Club Alpino Berciano (CAB), etc.*	Tertiary
Environmental NGOs	*A Morteira, Tyto Alba, etc.*	Primary
Researchers	*Universidad de León*	Primary
Schools and University teachers	*Centro Integrado de Formación Profesional de Almázcara, Escuela de Ingeniería Agraria y Forestal de la Universidad de León*	Primary
Students	*Escuela de Ingeniería Agraria y Forestal de la Universidad de León*	Tertiary
Media/social media	*El Bierzo Digital S.L., InfoBierzo, EFE VERDE, etc.*	Secondary
Wood-based products and services providers	*Foresa S.A., Ecosistema Bierzo S.L., etc.*	Secondary
Business investors	*LandLife Company (*intermediary company to find business investors*),* but also any private company interested in undertaking corporate social responsibility actions through restoration actions or investing in carbon credits to offset their carbon emissions (ex. *Herrero Brigantina*, *Fundación Repsol*)	Primary
State investors	*Sociedad Pública de Infraestructuras y Medioambiente de Castilla y León (SOMACYL)*	Primary

*Stakeholders categorization is based on the relevance and influence that each stakeholder has in the Spanish Demo territory.

The following map illustrates the distribution of forest ownership in the Spanish Demo of El Bierzo. Data extracted from this map, categorized according to the main forest typologies in Spain (see the table below), indicate that approximately 86% of the forest in the Spanish Demo is publicly owned, with the remaining 14% under private ownership.



FOREST OWNERSHIP	ha	% of total
Land catalogued as public utility land owned by local authorities, "Montes de Utilidad Pública"	154,996.90	85.82
Other public forest land	215,953.04	
Private forest land	60,771.07	14.08

Demos vision on engagement and community involvement: objectives

For upscaling the work done in the demo is critical to engage and empower local stakeholders in the restoration process by building collaborative partnerships based on mutual learning and shared decision-making.

In order to define the engagement objectives, the key stakeholders were classified into three groups according to their roles and interests:

- **Policymakers, local authorities, and regulating actors**. This group includes the forest rangers, local council/municipalities, local and regional public administration, regional public agencies and forest certification organisations. These stakeholders are in charge of managing the territory.
- **Private landowners, beekeepers and farmers**. In this group, we find the private landowners, beekeepers, local farming associations and local chestnut associations. This group is the action group and is supported by non-timber forest products.

- **Civil society**. Here it includes the recreational, leisure and cultural associations, environmental NGOs, schools and university teachers and researchers. This group is indirectly related to forest restoration.

The objectives are different for each stakeholder category depending on what is expected to be achieved (Table 3). In parentheses, the code of the barrier that is related to.

Table 3. Objectives, timelines and success indicators were established for the engagement of each stakeholder category. In parentheses, the code of the barrier that is related to.

Stakeholder category	Objective	Success indicator
Policy makers, local authorities, and regulating actors	Sustainable forest management and fire prevention (P1, Ec1, S1, S4, L3 En3)	The restored forest area = 137ha in the restoration plan.
	Monitoring the state of conservation (Ec1,S4, En2, En3)	Forest inventory
	Wildlife management and conservation; improvement of the connectivity of brown bear's habitat (S2, S3, S4, L2, L3, T3, En1, En2, En3)	Improvement and connected habitats and wildlife corridor enhancement
Private landowners, beekeepers and farming associations	Promoting good forestry practices (Ec3, Ec4, S4, L3, T2, T4, En2, En3)	Stakeholders' quiz survey
	Extending the creation of sustainable forest management plans to more areas (S1, S4, L3, T4, En1, En2, En3)	Number of sustainable forest management plans created
	Rural development and reversing the abandonment of rural areas (Ec4, S1, S4)	Planting of chestnut trees for fruit production together with other small business as wood carving, chestnut-base food and drink (gluten free) and indirect benefits as bigger mushroom production
	Uses of mechanisms for the prevention of brown bear attacks (S1, S2, S3, L3, T3)	Increase in number of beehives with electric fences and decrease in number of claims for payment of damages
	Achieving bear-human coexistence in rural areas (S1, S2, S3, L2, T3)	Degree of acceptance of the presence of bears through surveys
Civil society	Disseminating the importance of forest management (S1, S4, T4)	Level of awareness as measured through surveys
	Disseminating the importance of browns bear's conservation (S2, S3, L2, T3)	Level of awareness as measured through surveys
	Promoting research (Ec1, S4, T3, En1, En2, En3)	Article/book publications, conference assistance

Recommended stakeholder activities for the Spanish demo.

On the basis of the defined objectives for the engagement and the involvement of the community (Table 3), some activities are proposed (Table 4). These activities are proposed for future implementation in other projects or initiatives.

Table 4. Activities proposed by stakeholder categories for the engagement of the community. In parentheses, the code of the barrier that is related to.

Stakeholder category / Target group	**Objective**	**Activity**
Policy makers, local authorities, and regulating actors	Sustainable forest management and fire prevention	Promote that restored areas have a management plan to apply for forest certification Ec4, S1,S4,
	Monitoring the state of conservation	Political/business commitments for following up the monitoring in collaboration with researchers P1, P2, P3, Ec2, T2
	Wildlife management and conservation; improvement of the connectivity of brown bear's habitat	Networking with other projects P1, Ec1, S4, L2, T3
Private landowners, beekeepers and farming associations	Promoting good forestry practices	Talks or workshops in different rural areas of the Demo to inform about the project and the restoration actions Ec1, Ec4, S1, S2, S3, S4, T2, T3, T4
	Extending the creation of sustainable forest management plans to more areas	Talks or workshops in different rural areas of the Demo to inform about the project and the restoration actions Ec1, S1, S4, T2, T3, T4
	Rural development and reversing the abandonment of rural areas	Talks or workshops in different rural areas of the Demo to inform about the project and the restoration actions Ec4, S1, S2, S4, L3
	Uses of mechanisms for the prevention of brown bear attacks	Talks or workshops in different rural areas of the Demo to inform about the project and the restoration actions T2, T3
	Achieving bear-human coexistence in rural areas	Talks or workshops in different rural areas of the Demo to inform about the project and the restoration actions S1, S2, S3, S4, L3
Civil society	Disseminating the importance of forest management	Informative video for social media and related events - Request EFI Ec1, Ec3, S1, S4
	Disseminating the importance of brown bear's conservation	Informative video for social media and related events - Request EFI S2, S3, L2, T3

Stakeholder category / Target group	Objective	Activity
	Disseminating the restoration activities	Notice boards in some restoration sites with restoration activities information S4, T1, En3
	Promoting research	Establish agreements with the University of León and other universities to develop research projects or continue monitoring P1, Ec2, Ec3, S4, T2, T3, En1, En2, En3
All stakeholders	Stakeholder engagement	Participatory planning sessions within the workshops P1, P2, P3, Ec3, S1, S2, S3, S4, L3, T3, En2, En3

Activities targeting policymakers, local authorities, and regulatory actors include promoting the development of management plans for the restored areas, to ensure continued management and facilitate forest certification. Additionally, connections with stakeholders involved in related projects will be fostered through their participation in planned workshops and talks.

Regarding private landowners, beekeepers and farming associations the main activity is the delivery of brief workshops or talks in key rural locations of the Demo area. These sessions aim to inform participants about the project and its restoration actions. Where feasible, participants will visit some of the chestnut tree plantations, clearings, and newly established fire prevention areas. Furthermore, we aim to explore the possibility of providing them with firewood from the restored areas to demonstrate how they can directly benefit from upscaling activities.

Civil society engagement will focus on creating dynamic and engaging information material, such as infographics and short videos, for dissemination at relevant events, on social media, and through local websites. This interactive approach aims to raise awareness about the Demo area's restoration goals among a broader audience. To this end, we have requested support from EFI, to produce a short video highlighting the importance of brown bear conservation, sustainable forest management in the Spanish Demo.

During and after the project period, Cesefor, in collaboration with other partners, organizes Biocastanea, an annual event connecting forest owners, researchers, local communities, and the tourism sector. For instance, during Biocastanea fair (Yearly chestnut event), the regional government delivered a presentation on the benefits and opportunities available, including subsidies, thereby enhancing the outreach and impact of these forestry promotion efforts. Cesefor also offers annual courses related to chestnut management, showcasing best forestry practices getting the feel also of restoration needs in the area.

When further upscaling restoration activities are planned, informational boards detailing the project's objectives and activities need to be permanently installed on-site.

To promote research, agreements will be pursued with the University of León and other institutions to develop research projects and ensure continued monitoring in the restored sites.

Three participatory workshops are being conducted, involving all stakeholders identified in the stakeholder mapping process. These workshops, held across the demo area, allowed stakeholders provide input on restoration activities and helped shape the future direction of the area. Insights from the first two workshops revealed a demand among stakeholders to promote association, cooperation, land concentration and tax incentives for forest owners. They also emphasized the need for awareness-raising efforts on forestry practices and the challenges posed by the presence of bears for both rural and urban populations. Additionally, stakeholders expressed a desire to establish suitable financial systems for long-term monitoring and maintenance of restoration activities, particularly through private sector involvement and potential payments for ecosystem services. Finally, they highlighted the importance of streamlining procedures for addressing bear-related damage and directly linking management plans to specific regulations, rather than relying solely on guidelines.

To maximize the project's future impact and outreach, the following actions was proposed within the framework of the collaboration agreement between the Regional Government of Castilla y León and Cesefor, as well as through other initiatives such as the Endangered Landscapes Programme, Forwards, H2020, Fundación Biodiversidad, and Operational Groups:

a) Organize annual talks in each municipality to explain the progress of the upscaling plan.

b) Plan citizen science trips to the Demo area, tailored to university, high school, and elementary school students.

c) Create a time-lapse video of some of the most degraded stands for mass media dissemination.

d) Install camera traps to monitor and track brown bear activity in the restored areas.

3.2 Governance and Legal considerations

Each region with bear presence approved its bear recovery plans between 1989 and 1992 (Cantabria, 1989; Galicia, 1989; Junta de Castilla y León, 1990; Asturias, 1991). These recovery plans were intended to be reviewed every 5 years, but only Asturias has done it (in 2002).

Natura 2000 areas in the Cantabrian mountains coincide to a large extent with the areas designated by the recovery plans. Recovery plans cover the breeding range, but there are new territories with bear presence in which no legal instrument is available for the management and protection of the species. Nevertheless, there are bear damages in those unregulated areas out of those included in the recovery plans (Díaz-Fernández et al., 2023).

Updating recovery plans and Natura 2000 areas should follow the trend of the bear population in real time in order to achieve effective conservation. This update might help the increase of the breeding range by the improvements in the habitat as well as manage adequately the areas of recent colonization, increasing management personnel and unifying damage prevention and compensation criteria (Díaz-Fernández et al., 2023). Thus, the upscaling plan of the Spanish demo could play an important role in the adequate management of these recently colonized brown bear territories.

Nevertheless, the preliminary document of the bear recovery plan of Castilla y León is ambitious but lack a clear framework between bear protection and those negatively affected by the bear (e.g. promoting land stewardship or polishing the bear damage compensation system). In addition, in the current version, there are listed strategies in order to active management/restoration and conservation join forces in protected areas to solve issues instead of being antagonistic drivers (e.g. specific silviculture actions that include bear protection in the goals of the forest restoration).

Legal scope. Some relevant laws, plans and strategies for restoration:

- Reglamento (UE) 2024/1991 del Parlamento Europeo y del Consejo de 24 de junio de 2024 relativo a la restauración de la naturaleza y por el que se modifica el Reglamento (UE) 2022/869. This is the European restoration law which is still pending to be addressed and adapted to the Spanish context.
- Ley 43/2003, de 21 de noviembre, de Montes. This law aims to guarantee the conservation and protection of Spanish forests, promoting their restoration, improvement, sustainability and rational use, based on collective solidarity and territorial cohesion.
- Ley 3/2009, de 6 de abril, de montes de Castilla y León. Like the national forestry law, one of its objectives is the restoration of degraded forest ecosystems, especially those subject to erosion.
- Natural Heritage and Biodiversity Law (Ley 42/2007). As a planning instrument for biodiversity conservation and sustainable use policy in Spain, the Law creates the State Strategic Plan for Natural Heritage and Biodiversity 2011-2017 (PEPNB).
- With the amendment of the Law on Natural Heritage and Biodiversity in 2015, the central administration, with the collaboration of the autonomous communities, is obliged to draw up the State Strategy for Green Infrastructure and Ecological Connectivity and Restoration (IVCRE).
- The Environmental Assessment Law (Ley 21/2013) refers to ecosystem restoration actions in the framework of the measures foreseen to compensate for the negative environmental impact caused by plans, programmes and projects subject to the administrative environmental assessment procedure.
- The Environmental Liability Act (Ley 26/2007) mentions restoration - although not ecological - in Article 20, which refers to remedial measures to be taken by operators when environmental damage has occurred.
- National Plan for Recovery, Transformation and Resilience (PRTR) that brings together the different strategies, such as the Biodiversity and Science Strategy 2023-2027 (EByC) or the Spanish Strategy for Science, Technology and Innovation 2021-2027 (EECTI). These strategies are integrating tools that serve as a link between national biodiversity and natural heritage initiatives and those of science, technology and innovation (EECTI), as well as between policies for the conservation, sustainable use, improvement and restoration of natural heritage and biodiversity, and sectoral policies, science and the practical implementation of actions to improve knowledge and conservation of biodiversity (EByC).

- The Spanish Forestry Plan, approved by the Council of Ministers on 5 July 2002.
- Decree 55/2002, which approves the Forestry Plan of Castilla y León.
- HYDROLOGICAL RESTORATION: The National Strategy for River Restoration (ENRR) has made it possible to restore many stretches of river ecosystems. The National Priority Action Plan for Hydrological-Forestry Restoration, Erosion Control and Combating Desertification (PNAP) and the National Action Programme to Combat Desertification (PAND) of the Ministry for Ecological Transition, in collaboration with the Autonomous Communities, is the framework for action on soil conservation, combating desertification and hydrological-forest restoration.
- Decree 108/1990, establishing a statute for the protection of the brown bear in the Community of Castilla y León and approving the recovery plan for the brown bear.
- Decree 139/2011, developed the list of wild species under special protection regime and the Spanish catalogue of endangered species in which the brown bear is mentioned.

Business scope

- Spanish Business and Biodiversity Initiative (IEEB): aims to include biodiversity conservation and management in the business strategies of different business sectors and to identify opportunities for alternative and innovative projects that demonstrate the compatibility of an economic activity with natural capital. However, it does not look that the biodiversity credits are taken into account yet. In regards to the carbon credits, they are still in a very initial stage and in the demo area are only two enrolled projects. However, to monitor these two websites that act as a comprehensive registration list of carbon credits projects could be a good starting point. (https://www.miteco.gob.es/es/cambio-climatico/temas/registro-huella/organizaciones-proyectos.html and Fondo de Carbono FES-C02)

Scientific-academic scope

- The Pyrenean Institute of Ecology (IPE) is a research centre of the Spanish National Research Council (CSIC). It has a Research Group on Ecological Restoration.
- FORECOLab. The Ecology and Restoration Group is a multidisciplinary team of researchers from the Science and Mathematics departments of the University of Alcalá de Henares.
- Research group of the Complutense University of Madrid: Plant Evolutionary Ecology and Ecological Restoration.
- Research group of the University of Alicante: Management of Ecosystems and Biodiversity.
- SECF Working Group on Forestry Reforestation.
- Ecological Restoration Working Group of the AEET.

Management scope

- Spanish Forest Plan.
- Forestry Plan of Castilla y León.
- Basic plans for the management and conservation of Natura 2000 network values.
- Programme for the mobilisation of forest resources 2014-2022 (Castilla y León area)
- Restoration plans for large fires.
- Forest management plans or instruments for forest land (in El Bierzo more than half of the forest land lacks this type of plan).
- Instruments to minimise, correct or compensate for negative environmental impacts: Standardised Environmental Management Systems (ISO 9001:2015, ISO 14001:2015, EMAS, among others).
- Recovery and conservation plans for endangered species. Examples of projects: Brown Bear recovery plan, Basic Management plan for Natura 2000 Network Values – Mammals - 1354 - *Ursus arctos*, Cantabrian Capercaillie recovery plan, etc.

Taking into consideration the various laws, policies, and strategies described above, influencing forest restoration in Spain overall and specifically in Castilla y León, several barriers that could impact the effective implementation of these regulatory frameworks and strategic actions are identified.

In the legal realm, the complexity of the legal framework might pose obstacles to the approval and execution of restoration projects, while coordination between central and regional administrations could be a challenge. In the field of hydrological restoration, interdisciplinary collaboration and governmental coordination could be crucial for the success of actions, emphasizing the importance of addressing these issues.

Laws on environmental assessment and environmental liability present potential inconsistencies in enforcement, which could affect the effectiveness of ecosystem restoration measures. Specific examples include divergent interpretations of specific environmental assessment requirements, approval delays due to discrepancies in the interpretation of environmental laws, and the possibility of different interpretations regarding what actions constitute restoration. The lack of a legal definition by the absence of a restoration law plays an important role in defining what constitutes restoration and what not. We believe that the implementation of the UE restoration Directive could solve these issues with the legal terms. When this implementation takes place, it would be desirable to apply the legal definition in similar terms of the article 12 by the EU Nature restoration law.

Additionally, despite the existence of national and regional recovery and resilience plans, the actual allocation of resources for the implementation of restoration actions may be insufficient, posing challenges in terms of financial resources.

In the business sector, despite the efforts of the Spanish Business and Biodiversity Initiative (IEEB) to integrate biodiversity conservation into business strategies, widespread adoption of these principles and active participation in restoration projects may be limited. Corporate social responsibility actions that include payment for carbon storage and biodiversity are desirable,

however business or companies with such strategies are scarce in the region of the demo area.

The gap between scientific research and practical application in the academic field highlights the need to ensure that scientific findings are effectively translated into applicable restoration strategies. Incomplete forest management and the absence of management plans for extensive forested areas in El Bierzo raise concerns about the efficient execution of restoration efforts.

On the other hand, forest certification, whether through FSC or PEFC, stands as a crucial element for long-term sustainable management in the restoration of brown bear habitats in El Bierzo. Castilla y León region has the largest certified areas, ca. 30% of the Spanish certified forest, which means more than 800000 ha. However, this approach comes with pivotal considerations that shape its role in this specific context. In terms of long-term sustainability, certification promotes sustainable practices, aligning with the ongoing restoration of the brown bear habitat. This establishes a direct connection between certification actions and the continual improvement of the environment's health. Furthermore, forest certification brings significant economic incentives for conservation. By adding value to certified products, substantial financial stimuli are generated, which can be channelled into sustainable management and specific restoration activities, providing essential resources for long-term conservation initiatives. Cohesion with environmental objectives is strengthened by aligning certification with established environmental standards. This direct link reinforces the integration of certified practices with broader conservation and restoration goals.

Obtaining forest management certification is usually easier with group certificates. In Castilla y León, there is a PEFC Regional Certificate sponsored by the Junta de Castilla y León, which both public and private owners and managers can join, free of charge.

In the case of FSC certification, there are also several groups to which an owner or manager can join. In the case of joining a Public Forest Estate, there is a group whose certified entity is the *Consejería de Medio Ambiente, Vivienda y Ordenación del Territorio* of the *Junta de Castilla y León*. The rest of the forests of private owners and other public lands that are not recognized as Public Forest Estate, must opt for an individual or group certification, where they will have to pay the certification costs.

Nevertheless, it must be taken into account that the certification entails an exhaustive monitoring of the forest management, which can become a major barrier for the effective participation of owners with few economic resources. The obligation to comply with certification standards and regulations annually could induce short-term management approaches at the expense of long-term strategies. Overall, this underscores the need to balance certification requirements with the broader vision of brown bear habitat restoration.

3.3 Financing

Funding is critical for upscaling restoration, and the possibility of obtaining it varies depending on who owns and manages the land. Since the objectives of this work are related to increasing the connectivity of brown bear populations, improving forest stands through their conversion to high forest, and reducing combustibility, we have focused on public forests (86% of the forested area in the demo). These forests, owned by the local administration, are managed by the Junta de Castilla y León (JCYL). Therefore, the coordination of the various funding streams from the regional government inevitably plays a critical role in the success of this plan.

Several public funding streams necessary to initiate a project of this scale have been activated within the framework of SUPERB. This began with the funding of a small-scale project (137 ha) in El Bierzo (H2020 SUPERB funding) and by supporting similar actions with these objectives across the rest of the demo area. These efforts are carried out by forestry crews funded by the Junta de Castilla y León, which implement silvicultural treatments aimed at multiple objectives, including wildfire prevention and vegetation structure improvement. Simultaneously, forest reforestation actions co-financed by EAFRD funds have also been launched.

However, we believe that the SISREP tool (System for Information, Monitoring, and Evaluation of Projects), developed under the H2020 program, could help mobilize additional resources needed for upscaling. This, combined with the biodiversity conservation plan, the forest plan, and the national restoration plan, represents a significant challenge in terms of coordination among administrations.

Bearing in mind the complexity of coordinating these public funding streams, we are organizing the final workshop with stakeholders of the SUPERB project, which will take place in May 2025 in León. This event offers an opportunity to bring together the leaders of these various funding streams to align efforts and collaborate toward these shared objectives. Ultimately this should provide a starting point for well financed restoration in the future.

Based on the Spanish demo experience in restoration projects we estimate an average cost of restoration of 3000€ per hectare which we believe would not vary when implementing large scale restoration. In SC1 scenario means 12000 millions of euros.

Potential alternative funding sources may come on a small scale from European research project calls such as HE, LIFE, and ELSP, as well as from national projects co-financed with European funds, such as those promoted by the Biodiversity Foundation and Operational Groups.

Public-private collaborations could be explored through co-directed meetings involving Cesefor, the Junta de Castilla y León, and the Fundación Patrimonio Natural, alongside companies such as Grupo Sylvestris (Fundación Repsol), Land Life, and Ametlan. These companies have already acted as restoration agents in the region.

Potential financial mechanisms have been identified in WP4 such as biodiversity offsets, carbon credits, payment for ecosystem services and Corporate Social Responsibility actions. Potential connections with other carbon sequestration projects and associated entities could be explored through the Carbon Footprint Registry of the Ministry for Ecological Transition and Demographic Challenge.

Regarding large-scale funding entities, we believe they could play a relevant role due to the interest generated by the recovery of such emblematic species as the brown bear. In this regard, we have engaged with the European Investment Bank and proposed potential scenarios to carry out these actions; albeit not in place yet, this provides an example of new funding mechanisms that has the potential to support large upscaling efforts.

Through the *Mesa de la Castaña del Bierzo* (an organization that promotes chestnut and acts as a link between landowners and policy makers) we can implement and suggest new practices. Once more, the event organized by Cesefor and other partners, Biocastanea, has an important role in this. For example this year, an important change was discussed related

with an emerging chestnut disease and how important it would be to change the food chain from current locations in the supermarket to chilled/refrigerated areas to reduce the brown chestnut rot, *Gnomoniopsis smithogilvyi* impact in the chestnuts. Similarly, within this framework, it could be considered to contact chestnut suppliers to explore commercialization in other formats in supermarkets and large retail chains, aiming to promote local development.

3.4 Knowledge needs and ecological conditions

Plant reproductive material:

The quality standards for seedlings required for upscaling, as well as the most suitable species and provenances, are ensured by the forest nursery of the Regional Government of Castilla y León. However, it is necessary to adjust seedling production capacity as scaling progresses. Additionally, it would be possible to increase the production of these species on demand.

Furthermore, scenarios involving changes in the distribution of forest species in Castilla y León will be taken into account, including the potential introduction of more Mediterranean species such as holm oak (*Quercus ilex*).

Monitoring needs:

At the time this document is finalized, we do not yet have the results of the biodiversity monitoring conducted in the chronosequence stands (WP6.3) to determine whether it will be necessary to complement them with additional monitoring actions in the future.

Regarding the monitoring of the restoration plan actions, Spanish public procurement law provides for a two-year monitoring period. Additionally, the Junta of Castilla y León has forest management crews that can continue working towards the objectives set by the SUPERB project in the long term, including priority goals such as forest fire prevention and silvicultural treatments to improve forest stand structure. However, the size or capacity of these crews may need to be increased depending on the area that can be restored.

Furthermore, the Junta of Castilla y León has the possibility of carrying out reforestation actions co-financed by EAFRD funds.

The European Forest Damage Network could also assist in long-term monitoring if monitoring plots of this network were established in the upscaling areas. We believe this would be an important consideration to take into account in the implementation of the European Nature Restoration Law.

4. Recommendations

This upscaling plan builds on our experience in the SUPERB demo area in Spain. It is meant to stimulate restoration action beyond our demonstration phase (‘upscaling’). It provides guidance and good practice examples for considering and planning upscaling and offers advice on how to ensure that our experience with the SUPERB demo has a strong legacy.

Getting a feel of the demands and needs through public events, stakeholder workshops or related initiatives is important to bring up strategies for upscaling. These strategies are shown below grouped by fields:

Political strategies.

a) Collegiate working groups. The main political barriers to overcome in the SC1 upscaling scenario are related to the lack of coordination between regional and central government administrations and the scientific community. The group dynamics suggested creating collegiate working groups including scientists as advisors with voice and the administration officers implied in Forestry and Biodiversity Conservation.

b) Stable financial system. The mandatory two year guarantee period set out in the Spanish public procurement is not enough for the time scale ecosystems need to be restored. Public-private partnerships financing initiatives should be explored to have adequate financial flows for restoration monitoring and maintenance after the restoration project is finished to lower the risk of stakeholder fatigue. (directly related with economic strategies)

c) Forestry-conservation specific institution to raise awareness on sustainable resource management in Spain. Currently, sustainable forest management is mainly operated by two NGO, PEFC and FSC. However, an institution that centralises and establishes mandatory guidelines in this scope is absent in practice. Perhaps, National Forest Council, a recently established organism could lead this task but it has a clear lack of activity.

Economic strategies.

a) Increase the cooperation between rural sectors to develop non-wood products with high value. For example, cheese and chestnuts (flowers), craft beer and chestnuts, chestnut honey, etc.

b) Enhance the possibilities of payment for ecosystem services to promote biodiversity.

c) Promote the implementation of compensation mechanisms for ecosystem services provided by forests and wooded areas (i.e. carbon market).

d) Develop and/or implement standardised procedures to valuate ecosystem services and natural capital. These procedures will help to evaluate the cost-benefit trade-off of restoration projects.

e) Foster cooperation and land concentration in the forestry and agroforestry sectors through associations as a tool to increase profitability, especially in mountainous, smallholder and hard to reach areas. Also citizen cooperation.

f) Private sector needs to be involved in restoration monitoring and funding.

Social strategies.

a) Enhance telecommunications. Improved mobile and broadband may deter demographic loss and rural abandonment of young people.

b) Awareness raising campaigns to promote forest and agricultural land use and management to maintain livelihoods compatible with the conservation of natural resources. Recovering the communal forest spirit from decades ago that was created in a fire prevention campaign with huge impact.

Fidel, the rabbit, from a school book in 1968

c) Expedite compensation procedures when there is bear damage, inform of the positive impact of having bears in the territory and involve all forest users in decision making.

d) Promote training and outreach plans for rural and urban population about bear protocols implying mayors, forest rangers and local associations.

e) Promote outreach on the needs and goals of the treatments to restore the habitat of bears, and the benefits of sustainable forest management through dissemination sessions and posters.

f) Dissemination of restoration actions to society and local inhabitants to contribute to the success of the restoration during planning, execution and after completion.

g) Consider local people and businesses to improve the planning in restoration actions and control the execution.

Technical strategies.

a) Create protocols to account for disturbances (i.e. floodings, droughts, chestnut gall wasps) in the areas to be restored to train restoration contractors.

b) Disseminate action protocols and review the brown bear conservation plan to give tools to local stakeholders on how to deal with a bear incursion into rural and urban areas.

Environmental strategies.

a) Select the most adapted species, understand the ecology of seedlings and the best moment of the year to plant them to cope with droughts. This is particularly relevant to reduce seedling mortality in reforested areas. Consider the possibility of watering seedlings if needed.

b) Promote the most adapted provenances of the selected species to cope with potential forest pests and diseases and more frequent droughts.

c) Evaluate fire prevention, fire control structures, fire return periods, firefighting plans and bring back Plan 42 (wildfire prevention initiative implemented in Castilla y León since 2002, when 42 municipalities in the region accounted for 40% of all wildfires).

d) Surveillance of biodiversity indicators related with the upscaling (bear population, pollinators, bat diversity, etc)

e) Restoration monitoring to control the effects of it, showing unexpected consequences during the restoration process.

Legal strategies.

a) There is a need of a clearer legislation, less subject to interpretation, to reconcile land use with conservation of protected species. The Spanish Forestry law is not developed with specific regulations, but with decrees. Also the Natura 2000 network management plans only have management guidelines, not regulations. The Bear Plan also needs to be updated.

b) Update the management plans of protected areas implying all stakeholders.

c) Key document will be the implementation of the EU restoration law ("Reglamento (UE) 2024/1991 del Parlamento Europeo y del Consejo de 24 de junio de 2024 relativo a la restauración de la naturaleza y por el que se modifica el Reglamento (UE) 2022/869") once it is adapted to the Spanish context.

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