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RESEARCH

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Factors influencing public support for forest restoration in Europe: evidence from Sweden and Spain

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ABSTRACT

Forest restoration is essential for reversing biodiversity loss and enhancing ecosystem services. While its ecological dimensions are well recorded, the societal aspects, particularly public support, remain underexplored. This study examines the factors influencing public support for forest restoration in Sweden and Spain, two regions with distinct ecological and socio-cultural contexts. Drawing on a standardised survey ($n = 241$) and a generalised linear model (GLM), we analyse the influence of socio-demographic, behavioural, and perception-based factors. The findings reveal contrasting age-related patterns: older individuals in Sweden show greater support for restoration, while younger individuals are more supportive in Spain. Longer travel times to forests are associated with reduced support, especially in Sweden. Positive perceptions of forest benefits, including biodiversity, risk mitigation and recreation, enhance support, whereas perceptions of forest exploitation are linked to reduced support, particularly in Spain. These results underscore the need for context-sensitive communication and engagement strategies. Tailoring policy measures to local perceptions and values is vital for fostering public participation and ensuring the success of forest restoration initiatives.

KEY POLICY HIGHLIGHTS

- Higher support in Spain suggests EU restoration must prioritise wildfire risk reduction and drought resilience in Mediterranean landscapes.
- Age shapes support in both regions, while occupation matters only in Spain; engagement strategies should reflect socio-demographic patterns and local structures.
- Reduced support with longer travel times indicates the need to improve equitable access to forests, especially in sparsely populated northern regions.
- Biodiversity gains drive support, so policies must stress ecological benefits while balancing competing land uses, including Indigenous rights and timber production.

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1. Introduction

As the global loss of forest ecosystem functionality, intactness and biodiversity intensifies, the intersection of forest restoration and societal engagement has become a critical concern in environmental science. Forest restoration is increasingly recognised as an essential strategy (Ciccarese et al. 2012; Gann et al. 2019). Over the past decades, it has attracted substantial attention in both policy and academic arenas, exemplified by high-level initiatives such as the Bonn Challenge (2011), the UN Decade on Ecosystem Restoration (2019), and the EU Nature Restoration Regulation (EC 2023). These frameworks underscore the importance of inclusive decision-making and public participation as foundational components of effective restoration efforts.

Integrating ecological and societal dimensions in forest restoration is essential for the success of restoration initiatives (Mansourian et al. 2024). Major global and regional policy declarations – such as the New York Declaration on Forests (UN Climate Summit 2014), the African Forest Landscape Restoration Initiative (AFR100), and the EU Biodiversity Strategy (EC 2020) – have promoted research on effective restoration strategies. However, much of this research has focused primarily on ecological outcomes, relying on experimental methodologies to assess restoration success (Crouzeilles et al. 2016, 2017). While these studies have contributed to understanding restoration's ecological impacts, a critical gap remains in research addressing public attitudes, perceptions, and participation in restoration initiatives (Chazdon and Uriarte 2016; Mansourian

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et al. 2017). Addressing these societal factors is key to ensuring broad public support and the long-term success of restoration programmes (van Oosten et al. 2014).

The recently adopted EU Nature Restoration Regulation (EC 2023) establishes pathways for member states to implement, evaluate, and report their progress toward restoration objectives set in the EU Habitats Directive and Biodiversity Strategy for 2030 (EC 2020). Given EU member states' diverse biophysical and socio-economic conditions, understanding variations in public perceptions of forest restoration is crucial for designing effective, regionally tailored policies.

Sweden and Spain provide particularly insightful cases due to their contrasting forest landscapes and societal interactions with these ecosystems. Sweden, situated in Northern Europe, is characterised mainly by boreal forests, where forest use is deeply embedded in everyday life (Forest Europe 2020). The country has a long-standing tradition of sustainable yield forestry, supported by national forest legislation, certification schemes, and forest monitoring systems that facilitate spatial planning and decision-making (Kangas et al. 2018). However, this model has also been criticised for insufficiently addressing biodiversity loss and failing to meet national and international environmental targets. For instance, studies highlight growing concerns around monoculture practices, uneven stakeholder participation, and landscape fragmentation in Swedish forestry (Lindahl et al. 2017; Angelstam et al. 2020). These challenges have prompted calls for adaptive landscape planning and increased public engagement in restoration, making Sweden a critical case for understanding restoration perceptions in northern and temperate Europe.

Spain presents a complementary case, shaped by its diverse forest types (Mediterranean, temperate, and mesotonal) and more acute environmental pressures. These include land-use changes, wildfires, and rural depopulation – many of which are anthropogenic in nature (Forest Europe 2020; Vadell et al. 2022). As a result, Spain has implemented large-scale restoration efforts aimed at combating land degradation and enhancing climate resilience. This southern European context highlights the role of restoration in addressing both ecological and socio-economic challenges, such as job creation, tourism, and fire prevention (Varela et al. 2017).

While previous research highlights the importance of integrating ecological and societal considerations in forest restoration, existing studies remain fragmented – often prioritising economic considerations while overlooking broader societal values crucial for fostering public support (Ssekuubwa et al. 2018; Schimetzka et al. 2024). Thus, an integrated approach is needed to acknowledge the diverse values of different societal groups. While economic incentives can

catalyse restoration efforts, they often fail to capture the intrinsic, place-based values that local communities associate with forest ecosystems. When these cultural and emotional connections are overlooked in favour of narrowly defined economic objectives, restoration initiatives may encounter local resistance, disengagement, or a lack of long-term commitment (Mansourian et al. 2017; Jones et al. 2021). Wilson et al. (2012) note, effective restoration must be assessed not only by ecological outcomes but also by its contributions to social and economic wellbeing. This underscores the importance of adopting a holistic and inclusive approach that integrates the diverse values and priorities of all stakeholders to build lasting support.

Despite the growing recognition of the societal role in forest restoration, key gaps remain in understanding how socio-demographic, behavioural, and perception-based factors influence public support for restoration efforts. Several studies (Karppinen 2005; Eriksson et al. 2013; Riechers et al. 2018; Tiebel et al. 2021; Wang et al. 2022) have highlighted age, accessibility, and economic dependency as key determinants of environmental attitudes. However, little research has systematically compared these factors across contrasting socio-ecological contexts in Europe.

To examine how socio-demographic, behavioural, and perception-based factors influence support for restoration, this study compares two socio-ecologically contrasting regions: Västerbotten County in northern Sweden and Castilla y León autonomous community in north-western Spain. These regions were not selected to represent national trends, but to reflect distinct forest restoration contexts under the shared umbrella of EU policy. Västerbotten exemplifies boreal landscapes shaped by commercial forestry and Indigenous Sámi land use, with restoration needs specifically concerning biodiversity, ecological connectivity, and the recognition of Indigenous and other claims to forests and forest landscapes. In contrast, Castilla y León faces challenges from Mediterranean land degradation, wildfires, and rural depopulation, where restoration initiatives often intertwine ecological goals with socio-economic revitalisation. This pairing offers a meaningful and policy-relevant contrast to explore how public support for restoration varies across diverse European settings.

This study examines public perceptions, behavioural influences, and socio-demographic attributes influencing support for forest restoration in Västerbotten County, Sweden, and Castilla y León autonomous community, Spain. Specifically, we ask:

- (1) How do public perceptions of environmental quality, forest utilisation, and recreational opportunities of forests differ between Sweden and Spain?
- (2) What socio-demographic attributes (such as age and education level) and behavioural

aspects (such as direct engagement with forests) influence support for forest restoration in these regions?

- (3) How does access to educational resources and outreach on forest restoration influence public attitudes toward supporting forest restoration?

By answering these questions, this study provides insights into the interplay between environmental awareness, personal engagement with forests, and public support for restoration in two contrasting socio-ecological contexts. While the findings are not intended to represent national trends in Sweden or Spain, they offer valuable region-specific perspectives that can inform the design of locally adapted restoration strategies. These insights are particularly relevant for implementing the EU Nature Restoration Regulation (EC 2023), which mandates large-scale restoration initiatives across Europe and encourages public involvement tailored to diverse regional contexts.

2. Conceptual and theoretical framework

2.1. Understanding forest restoration

Forest restoration has been defined in multiple ways, reflecting disciplinary differences in emphasis. While some definitions centre on ecological recovery, others adopt broader frameworks that incorporate social, economic, and institutional dimensions (Lamb 2014). According to Ciccarese et al. (2012), and Fischer and Fischer (2012), forest restoration involves intentional efforts to return degraded forest ecosystems to a reference or near-original state. In contrast, Halme et al. (2013) view restoration through the lens of enhancing ecological functionality and resilience rather than returning to a past state.

The concept of Forest Landscape Restoration (FLR), as presented by Mansourian et al. (2005), expands this further by promoting integration of environmental goals with land-use planning, economic development, and inclusive governance. Later contributions highlight that governance quality, institutional capacity, and public participation are pivotal in determining restoration success (Mansourian et al. 2017, 2024; Mansourian 2018).

In applied contexts, restoration encompasses a diversity of objectives. These include enhancing timber and non-timber forest production (Thomas and Gale 2015; Adams et al. 2016; Cerullo and Edwards 2019), improving habitats for biodiversity (Hynes et al. 2021; Eckerter et al. 2021; Williams et al. 2022), and restoring floodplains and degraded lands to deliver broader ecosystem services (Blaen et al. 2016).

In this study, we define forest restoration as a set of planned ecological interventions aimed at renewing and improving the health, structure, and functioning of the forests that have been

substantially transformed from their natural conditions. These actions may include replanting native trees, managing vegetation dynamics, removing invasive species, or re-establishing natural processes such as large- or small-scale disturbances or hydrological integrity to enhance forest resilience and ecosystem services. This definition guides the interpretation of restoration across the two case study regions and forms the conceptual foundation for examining public support in varied socio-ecological contexts.

2.2. Support for forest restoration

Support for forest restoration is a multidimensional concept encompassing both individual and collective forms of engagement. Drawing from existing literature on public participation in environmental initiatives (Alexander et al. 2011; Chazdon and Uriarte 2016; Wakiyama et al. 2021), we identified a set of actionable indicators commonly used to assess public support. These include volunteering in restoration activities, participating in awareness campaigns, advocating for policy change, contributing financially, and endorsing public funding mechanisms.

Community engagement is widely recognised as a critical factor in restoration success. Volunteering contributes not only to ecological outcomes but also to fostering environmental stewardship and long-term commitment (Schultz et al. 2012). Engaging stakeholders and facilitating inclusive participation are central to building societal and political momentum for restoration efforts (Chazdon and Uriarte 2016).

Public perceptions of tangible local benefits – such as improved water quality, recreation, or landscape aesthetics – can significantly enhance motivation to support restoration. For example, elsewhere, Brancalion et al. (2014) found that the majority of residents perceived both cultural and ecological benefits from a forest restoration project and were willing to pay higher water tariffs to support similar initiatives. This illustrates the importance of aligning restoration goals with ecosystem services that communities value and experience directly.

At the institutional level, public support may manifest through policy advocacy and financial mechanisms, including publicly funded programmes and payments for ecosystem services (PES), which help sustain restoration efforts over time (Wu et al. 2011; Patrick et al. 2023). Furthermore, community-led initiatives that integrate local knowledge and participatory planning enhance the legitimacy, contextual relevance, and long-term viability of restoration programmes (Alexander et al. 2011; Schultz et al. 2012).

These indicators reflect the behavioural, institutional, and economic dimensions of public support necessary for achieving effective and durable forest restoration outcomes.

2.3. Factors influencing support for forest restoration

The Value-Belief-Norm (VBN) Theory provides a foundational framework for understanding public support for forest restoration by explaining how personal values, environmental beliefs, and moral norms influence pro-environmental behaviours (Stern 2000). According to this theory, individuals are more likely to endorse environmental initiatives when they perceive ecological threats, recognise conservation benefits, and feel a moral obligation to act.

Building on this framework, several individual, behavioural, and perceptual factors have been found to influence public support for forest restoration. First, socio-demographic characteristics – notably age – play an important role. Older individuals generally show greater support for forest-related policies, including conservation and restoration (Eriksson et al. 2013; Riechers et al. 2018). In contrast, evidence on the role of education in shaping environmental awareness and support remains mixed and less conclusive.

Second, behavioural engagement with forests – such as regular visits or outdoor recreation – has been linked to greater ecological awareness and stronger conservation attitudes. Direct experience with forest ecosystems tends to reinforce the perceived benefits of healthy forests and may motivate support for restoration (Fuller et al. 2007; Riechers et al. 2018).

Third, recognition of forest benefits – including improved environmental quality, recreational value, and sustainable resource use – can significantly influence attitudes toward restoration (Plieninger et al. 2019; Tiebel et al. 2021; Wang et al. 2022). Awareness of restoration initiatives and access to relevant information also play a role in shaping public engagement (Sallmannshofer et al. 2023).

Based on these theoretical and empirical foundations, we formed the following hypotheses:

H1: Older individuals are more likely to support forest restoration than younger individuals.

H2: Individuals who frequently visit forests are more likely to support forest restoration due to their experiences with forest ecosystems.

H3: Increased awareness of and access to forest-related information positively influences public support for forest restoration efforts.

H4: Perceptions of specific forest benefits (e.g. environmental quality, recreation, and resource utilisation) positively influence support for forest restoration, with stronger perceived benefits leading to higher support.

3. Methods

3.1. Study areas

This study is undertaken in two distinct regions: Västerbotten County, Sweden, and Castilla y León autonomous community, Spain (Figure 1). These areas were selected for their contrasting forest governance and management systems, and restoration approaches, offering valuable insights into large-scale forest restoration initiatives tailored to unique ecological and socio-economic contexts (Forest Europe 2020; SUPERB 2022).

3.1.1. Västerbotten County, Sweden

The focus of the study in Västerbotten County, Sweden, encompasses the municipalities of Umeå, Vindeln, and Åsele (Figure 1, Supplementary Material, Table S2). This selection captures a broad spectrum of ecological and socio-economic contexts essential for comprehensively understanding ongoing restoration efforts (SUPERB 2022). Specifically, active restoration initiatives in Umeå and Vindeln aim to enhance biodiversity and improve the health of forest ecosystems historically affected by anthropogenic activities.

The dominant tree species in this region include Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*), intermixed with a small share of deciduous species. Restoration efforts prioritise ecological connectivity, habitat diversity, natural ecosystem functionality, and the provision of essential ecosystem services (SUPERB 2022). However, due to Sweden's strong focus on sustainable yield forestry, the balance between timber production and environmental consideration including biodiversity conservation remains challenging, mainly due to artificial rotation forestry systems, forest fragmentation, low share and connectivity protected forest networks, limiting progress toward international biodiversity targets (Angelstam et al. 2020; Forest Europe 2020).

Swedish forestry operates under a regulatory framework that promotes sustainable forestry practices, established by the Swedish Forestry Act (SFS 1979:429, revised in 1993). This legislation mandates that forest owners maintain biodiversity and ecosystem services while managing their forests for timber production (Lindahl et al. 2017). But this mandate is not

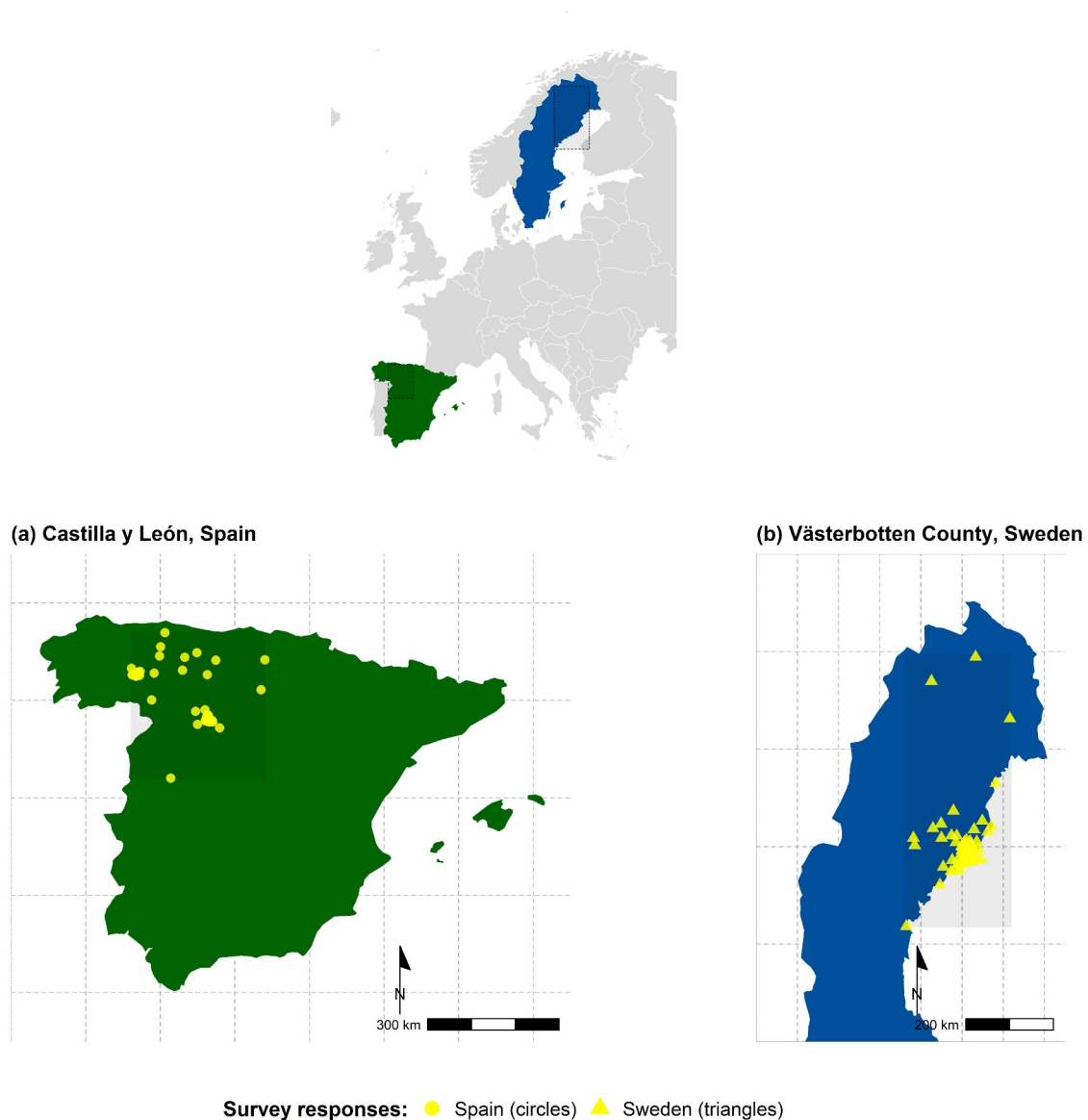


Figure 1. Study locations in Europe and country context. Top panel: Europe with Spain and Sweden highlighted; the study regions are indicated by black dashed rectangles with subtle shading. Bottom panels: (a) Castilla y León autonomous community, Spain ($n=70$) and (b) Västerbotten County, Sweden ($n=171$) shown at the whole-country scale, with the respective study region lightly shaded. Yellow symbols mark survey responses – circles for Spain and triangles for Sweden – and some points fall just outside the shaded regions reflecting respondent mobility (e.g. travel or work).

sufficient to in practice realise sustainability and meet the many and diverse values, interests and claims associated with the Swedish forests and forest landscapes (Angelstam et al. 2020). While Sweden's forests contribute significantly to carbon sequestration, removing approximately 10% of the country's total greenhouse gas emissions, reinforcing their role in climate change mitigation (Forest Europe 2020), carbon storage and substitution is reduced due to the extensive logging (Skytt et al. 2021). Furthermore, climate change poses emerging risks, including increased insect outbreaks, extreme weather events, and shifting precipitation patterns, affecting forest resilience (Forest Europe 2020), which calls for an immediate adaptation and transformation of Swedish forest governance and management (Angelstam et al. 2020).

The historical land use in Västerbotten – including Sámi reindeer husbandry and commercial forestry – necessitates restoration strategies that effectively balance ecological integrity with traditional and economic land uses. While participatory processes are incorporated into forestry management, challenges remain to integrate Indigenous land rights into forestry planning, reflecting broader tensions between timber production objectives and Indigenous land use (Lindahl et al. 2017; Brännström 2023). Together, these sample municipalities represent a mosaic of forest ownership and use – including production forestry, ecological restoration initiatives, and protected areas – which provides a valuable lens through which to examine the interplay between ecological objectives, economic activities, and local governance.

3.1.2. Castilla y León, Spain

The study in Castilla y León, Spain, focuses on the municipalities of Ponferrada, Carracedelo, and Valladolid (Figure 1, Supplementary Material, Table S2). Active forest restoration efforts are particularly emphasised in Ponferrada and Carracedelo, with initiatives addressing the critical challenges of recurrent forest fires, rural land abandonment, and habitat fragmentation (SUPERB 2022). The overarching goals of these restoration activities are to bolster forest resilience, enhance biodiversity and establish wildlife corridors that specifically support endangered species, such as the Cantabrian brown bear (*Ursus arctos*) (Forest Europe 2020; SUPERB 2022).

Key restoration interventions in the region include reforestation with native species, implementing silvicultural treatments, and developing agroforestry projects, including establishing chestnut (*Castanea sativa*) plantations (SUPERB 2022). These initiatives create multifunctional landscapes where biodiversity conservation is synergistically integrated with sustainable rural development.

The Mediterranean climate of Castilla y León presents specific challenges to effective forest management, particularly regarding prolonged droughts and increased wildfire risks. Spain has one of Europe's highest rates of forest fire occurrences, primarily due to climate conditions and land-use changes that have led to increased fuel loads (Forest Europe 2020). These municipalities collectively reflect the multifunctional character of Mediterranean forest landscapes, encompassing silvicultural plots, actively managed reforestation areas, and conservation zones. This diversity allows for the exploration of public perspectives across varied land use contexts.

3.2. Survey designs

The development of the survey instrument followed a systematic and collaborative process involving researchers and forest restoration practitioners from multiple European countries, including Sweden and Spain. As a foundational step, 20 structured key informant interviews were conducted with individuals from selected regions in Sweden, Scotland, Germany, Serbia, Croatia, and Spain. Participants were selected based on their local knowledge and direct involvement in forest-related sectors such as research, outdoor recreation, and advocacy. These interviews provided critical insights into forest use, societal perceptions and restoration dynamics, as detailed in Kazungu and Hunziker (2025), and were instrumental in shaping the content and framing of the questionnaire (Supplementary Material, S1).

The questionnaire was designed to capture perceptions across several domains, including the perceived

benefits of forests, expected impacts of forest restoration on those benefits, willingness to support forest restoration, and the socio-demographic characteristics of the respondents (Supplementary Material, S1). To ensure accessibility and inclusivity, it was translated into the predominant languages of the study countries – Swedish and Spanish – using advanced artificial intelligence (AI) tools, specifically DeepL (DeepLPro n.d.). The AI-generated translations were subsequently reviewed and refined by researchers from each respective country to ensure both linguistic accuracy and cultural relevance.

3.3. Data collection

Three municipalities were selected per study region to ensure representation across both densely and sparsely populated areas (Supplementary Material, Table S2). This approach aimed to capture a diverse demographic landscape and enhance the generalisability of the findings. In Sweden, household registers were obtained directly by our collaborators through established partnerships with local authorities, ensuring access to accurate and up-to-date demographic information. In Spain, a specialised agency was engaged to acquire household registers, leveraging local expertise to navigate national regulatory frameworks and ensure compliance with data privacy legislation. These complementary strategies facilitated efficient and legally compliant data acquisition in both countries.

Respondents were selected using a random sampling method across all chosen municipalities. Within each household, the individual aged 18 years or older whose birthday occurred first within the calendar year was invited to complete the survey. This method ensured that only one response per household was collected, minimising potential biases arising from multiple responses while maintaining an equitable selection process.

Although the sampling strategy ensured random selection across households, we did not stratify invitations by age group. Because the invitation was addressed to the household member aged 18 or above whose birthday came first in the calendar year, we could not verify whether the distribution of invitations was evenly spread across all age groups. Consequently, the age variation observed in the final sample likely reflects differential response rates rather than sampling bias.

The number of households invited was proportional to the population size of each municipality, ensuring appropriate representation from larger municipalities. The number of households invited per municipality was proportional to its population size, ensuring appropriate representation from larger municipalities. Survey invitations were distributed via

postal services and included a QR code and direct link to the online questionnaire. A reminder letter was sent ten days after the initial invitation in each region to encourage participation.

Data collection was conducted between March and September 2024. In total, 3,000 invitation letters were sent to randomly selected households – 1,500 per study region. A total of 247 surveys were completed (173 in Sweden and 74 in Spain), yielding an overall response rate of 8.2% (11.5% in Sweden and 4.9% in Spain). After data cleaning, 241 valid responses were retained for analysis (171 from Västerbotten County and 70 from Castilla y León). Invalid responses included surveys where participants declined consent at the start page or submitted empty forms without completing any survey sections. This systematic approach to data collection and processing enhanced the reliability and replicability of the data.

While responses were largely concentrated within the selected municipalities, a few originated from outside the immediate study regions, particularly in Sweden (Figure 1). This reflects common mobility patterns, where individuals may live, work, or temporarily stay in different locations (Poltimäe et al. 2022). As the survey was household-based and not tied to respondents' physical presence at the time of completion, such cases are consistent with everyday residential and working arrangements and do not reflect a methodological issue.

All data processing activities were carried out in accordance with the Swiss Federal Act on Data Protection (nFADP) and relevant European Union regulations, particularly the General Data Protection Regulation (GDPR; Regulation (EU) 2016/679), ensuring the protection of personal data and individual privacy throughout the research process.

3.4. Data processing and analysis

3.4.1. Principal components analysis of support for forest restoration

In this study, we employed Principal Components Analysis (PCA) using R statistical programming to explore patterns of association among various observed indicators of support for forest restoration. Our primary objective was to identify whether distinct forms of support shared common variance, suggesting a cohesive dimension of engagement (Supplementary Material, Table S3). PCA creates new uncorrelated components from original variables, each explaining a proportion of the total variance. In our case, a single component explained approximately 48% of the total variance, allowing for an effective summarisation of interrelated support indicators without modelling latent constructs explicitly.

Support for forest restoration was measured using six key indicators reflecting both individual and

community participation: (1) volunteering for restoration initiatives, (2) participating in awareness campaigns, (3) advocating for supportive policies, (4) engaging in community activities, (5) donating financial resources and (6) supporting public funding for restoration endeavours (see Supplementary Material, Table S3). To examine the underlying patterns among these indicators, we applied PCA with varimax rotation, which enhances interpretability by maximising the variance of component loadings.

Component loadings equal to or exceeding 0.6 were treated as significant (Reise et al. 2000). The results revealed that all six indicators loaded strongly onto a single component, suggesting they collectively represent a coherent dimension of support for forest restoration (Supplementary Material, Table S3). This confirmation of shared variance justified the aggregation of responses into a continuous composite variable, designated as the dependent variable for subsequent analyses.

Following the same procedure, we applied PCA with varimax rotation to examine independent variables related to forest restoration's perceived benefits and impacts (Tables S4 and S5). The perceived benefits were grouped into three principal components based on the thematic similarity of variables with high loadings (≥ 0.6) following varimax rotation: Environmental Quality (e.g. habitat for species and quality of life), Recreation (e.g. opportunities for outdoor activities), and Resource Utilisation (e.g. access to non-edible materials, food, and medicinal resources) (Supplementary Material, Table S4). Similarly, the perceived impacts were classified into two components: Recreation & Ecological Services (e.g. habitat provision, aesthetics, outdoor recreation opportunities) and Timber & Fuelwood Production (e.g. firewood and timber availability) (Supplementary Material, Table S5).

This structured approach provides a robust framework for understanding how different dimensions of perceived benefits and impacts relate to support for restoration initiatives. Across all three PCA models, the cumulative variance explained was as follows: 48% for support for restoration (Supplementary Material, Table S3), 59% for perceived forest benefits (Supplementary Material, Table S4), and 73% for perceived impacts of restoration (Supplementary Material, Table S5). These results indicate that the selected components capture a substantial proportion of the variability in the original variables, supporting their use in subsequent modelling.

3.4.2. Modelling approach: generalised linear model

A Generalised Linear Model (GLM) was implemented in IBM Corp (2021) to analyse the relationships between support for forest restoration and the

independent variables. GLMs are an extension of linear regression that allow the response variable to follow non-normal distributions, making them suitable for modelling a broader range of data types (Dobson and Barnett 2018; McCullagh 2019). They consist of three components: a probability distribution (from the exponential family), a linear predictor, and a link function that relates the mean of the response to the linear predictor.

In our case, support for forest restoration was a continuous and positively skewed variable. We therefore used a GLM with a Gamma distribution and a log link function. While the canonical link for the Gamma distribution is the inverse $1/\mu$, the log link was preferred for its interpretability, as it models multiplicative rather than additive effects. This means that a one-unit change in a predictor corresponds to a proportional (percentage) change in the expected outcome (Myers and Montgomery 1997).

Model selection was based on best-fit criteria such as the log-likelihood and Akaike Information Criterion (AIC), which offer advantages over R-squared used in traditional Ordinary Least Squares (OLS) regression (Akaike 1974; Burnham and Anderson 2004).

The theoretical model follows the generalised linear model (GLM) framework described by Myers and Montgomery (1997), and is expressed as:

$$g(E[Y]) = \beta_0 + \sum \beta_i X_i \quad (1)$$

Where:

$g(E[Y])$ is the link function applied to the expected value of the dependent variable.

β_0 is the intercept.

$\beta_i X_i$ represents the linear predictor.

The GLM for a Gamma-distributed dependent variable with a log link function is given by:

$$\ln(E[Y]) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \quad (2)$$

Where:

Y is the dependent variable representing support for forest restoration.

$\ln(E[Y])$ applies the log link to ensure positive values and to model relationships on a multiplicative scale.

Interpretation of coefficients:

A one-unit increase in X_i results in a multiplicative change in the expected value of Y .

The effect size is given by e^{β_i} .

For example, if $\beta_1 = 0.3$, then $e^{0.3} \approx 1.35$ indicating a 35% increase in support for restoration.

3.4.3. Empirical model for analysing public support for forest restoration

This study examines the factors influencing public support for forest restoration initiatives by analysing socio-demographic, behavioural, and perception-based variables. The dependent variable (DV),

support for restoration, was derived through principal component analysis (Section 3.1.1) and is operationalised as a continuous, positive measure reflecting the extent to which individuals endorse forest restoration efforts (see Section 2.2).

The independent variables (IVs) were grouped into three categories, guided by the Value-Belief-Norm (VBN) framework and empirical evidence from previous studies (Stern 2000; Riechers et al. 2018; Wang et al. 2022). Socio-demographic variables include age, education level, and profession, which are typically associated with differences in environmental concern and policy support (Eriksson et al. 2013). Behavioural variables reflect engagement with forested environments and include mode of transport to the forest, travel time and frequency of forest visits. These were selected based on evidence that direct nature contact enhances pro-environmental behaviour (Fuller et al. 2007). Perception-based variables included awareness of forest programmes, access to forest information (Sallmannshofer et al. 2023) and perceived benefits related to environmental quality, recreation and resource use (Pleninger et al. 2019; Tiebel et al. 2021) (see also Section 3.1.1).

Perceived impacts of restoration (e.g. on recreation, ecological functions and timber availability) were initially included but were excluded from the final model due to multicollinearity. To ensure model validity, we conducted diagnostic tests using the Variance Inflation Factor (VIF) and Pearson correlation coefficients (Allison 1999; Hair et al. 2009). All retained variables had VIF values below the threshold of 10. A backward elimination strategy was used to remove non-significant predictors ($p > 0.5$), which led to the exclusion of gender and membership in forest-related associations.

Model selection followed an incremental approach, in which variables were introduced in stages and evaluated using log-likelihood and Akaike Information Criterion (AIC) values (Akaike 1974; Burnham and Anderson 2004). In both Västerbotten and Castilla y León, Model 4 had the highest Log-likelihood, indicating the best model fit. Although Model 1 in Castilla y León had a slightly lower AIC, Model 4 was retained to ensure consistency in the modelling across the study areas (Tables S8 and S9).

4. Results

4.1. Greater support for forest restoration in Castilla y León than Västerbotten

Support for forest restoration differed significantly ($p < 0.01$) between the two study regions, with respondents in Spain expressing higher levels of support compared to those in Sweden (Table 1).

Table 1. Socio-demographic characteristics of respondents in Västerbotten County (Sweden) and Castilla y León autonomous community (Spain).

Variable	Västerbotten, Sweden (n = 171)	Castilla y León, Spain (n = 70)
Support for restoration (DV)	3.13 (0.9)*** ^a	3.74 (0.74)**** ^a
Socio-demographic variables (IV)		
Age (years)	51.6 (18.6)* ^a	47.1 (14.0)* ^a
Residence duration (years)	28.5 (19.0) ^a	33.1 (17.8) ^a
Gender – Female	78 (45.6%) ^b	31 (44.3%) ^b
Gender – Male	93 (54.4%) ^b	39 (55.7%) ^b
Age group 16–26	17 (9.9%) ^b	3 (4.3%) ^b
Age group 27–37	31 (18.1%)* ^b	18 (25.7%)* ^b
Age group 38–48	24 (14%) ^b	16 (22.9%) ^b
Age group 49–59	28 (16.4%) ^b	17 (24.3%) ^b
Age group 60+	71 (41.5%) ^b	16 (22.9%) ^b
Education – Primary school	5 (2.9%) ^c	N/A ^c
Education – Professional/vocational training	25 (14.6%) ^c	17 (24.3%) ^c
Education – Secondary school	30 (17.5%) ^c	8 (11.4%) ^c
Education – University	111 (64.9%) ^c	44 (62.9%) ^c
Profession – Environment/nature protection	13 (7.6%) ^b	7 (10%) ^b
Profession – Others	158 (92.4%) ^b	60 (85.7%) ^b
Membership – Environment/nature protection	42 (24.6%) ^b	10 (14.3%) ^b
Membership – Farming	2 (1.2%) ^b	5 (7.1%) ^b
Membership – Others	127 (74.3%) ^b	55 (78.6%) ^b

DV = Dependent Variable (continuous); Mean value indicates willingness to support restoration, ranging from 1 (completely unwilling) to 5 (completely willing). IV = Independent Variables. Significance levels: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

Mean values are presented as Mean (SD), while categorical variables are presented as Count (%).

Perception variables were measured on a 1–5 scale, where 5 indicates the highest perceived benefit.

Independent t-tests (^a) were used for continuous variables (Mean values).

Chi-square tests (^b) were used for categorical variables (Proportions).

Fisher's Exact Test (^c) was used for variables where counts in some categories are less than 5 (small, expected counts).

Despite this difference in support, most socio-demographic characteristics were similar across regions. No significant differences ($p > 0.05$) were observed in gender distribution, residence duration, education level, profession, or membership in organisations (Table 1). However, age distribution varied significantly ($p < 0.05$): Sweden had a higher proportion of older respondents (aged 60+), while Spain had more respondents in the 27–37 age group. This may reflect variation in response behaviour across age groups, as invitations were not stratified by age.

4.2. Forest access is more frequent and localised in Sweden

Forest visitation frequency differed significantly ($p < 0.01$), with Swedish respondents visiting forests more regularly; a greater proportion reported visiting at least once a week. In Spain, forest visits were less frequent, with more respondents reporting visits less than once a month (Table 2).

Mode of transport also differed significantly ($p < 0.01$). Private vehicle use was more common in Spain, while walking and cycling were more prevalent in Sweden. Likewise, travel time to forests varied ($p < 0.01$): Swedish respondents typically had quicker access, with more reporting forest visits within 10 minutes, compared to longer travel times among Spanish respondents (Table 2).

4.3. Swedish respondents report greater environmental and economic forest benefits

Awareness of forest-related programmes did not differ significantly ($p > 0.05$), with most respondents in both regions reporting limited awareness (Table 2). However, a marginally significant difference ($p < 0.1$) was found in reported access to forest-related information, with Swedish respondents more likely to have received such information.

Perceptions of forest benefits varied by region. Swedish respondents reported significantly higher perceived benefits in relation to environmental quality ($p < 0.01$) and resource utilisation ($p < 0.01$). Perceived recreational benefits, however, were similar across both study regions ($p > 0.05$) (Table 2).

4.4. Västerbotten respondents prioritise material benefits, Castilla y León emphasises habitat value

Perceptions of forest benefits differed between respondents in Västerbotten County, Sweden, and Castilla y León, Spain, with several statistically significant contrasts across specific benefit types (Figure 2; Supplementary Material, Table S6). While both groups recognised the diverse value forests offer, the emphasis placed on different benefit types varied by region.

Swedish respondents placed greater importance on material forest benefits, reporting significantly higher agreement that forests provide non-edible

Table 2. Continued from Table 1: forest-related behaviours and perceptions of composite scores of forest benefits in the study regions.

Variable	Västerbotten, Sweden	Castilla y León, Spain
Behavioural variables (IV)		
Frequency of visits to forests		
not at all	5 (2.9%) ^{**c}	5 (7.1%) ^{**c}
less than once a month	23 (13.5%) ^{**c}	21 (30%) ^{**c}
1–3 times a month	67 (39.2%) ^{**c}	21 (30%) ^{**c}
1–2 times a week	39 (22.8%) ^{**c}	12 (17.1%) ^{**c}
3–7 times a week	37 (21.6%) ^{**c}	11 (15.7%) ^{**c}
Mode of transport from home to forests		
Private vehicle	48 (28.1%) ^{***c}	33 (47.1%) ^{***c}
Bicycle	32 (18.7%) ^{***c}	4 (5.7%) ^{***c}
On foot	81 (47.4%) ^{***c}	28 (40%) ^{***c}
not applicable	5 (2.9%) ^{***c}	5 (7.1%) ^{***c}
Public transportation(others)	5 (2.9%) ^{***c}	0 (0%) ^{***c}
Average time to reach the forests		
Under 10 minutes	71 (41.5%) ^{***c}	16 (22.9%) ^{***c}
10–30 minutes	79 (46.2%) ^{***c}	28 (40%) ^{***c}
30 minutes –1 hour	14 (8.2%) ^{***c}	15 (21.4%) ^{***c}
Longer than 1 hour	1 (0.6%) ^{***c}	5 (7.1%) ^{***c}
other	1 (0.6%) ^{***c}	1 (1.4%) ^{***c}
not applicable	5 (2.9%) ^{***c}	5 (7.1%) ^{***c}
Perception (IV)		
Access to forest information		
Aware of forest programs – NO	146 (85.4%) ^b	61 (87.1%) ^b
Yes	25 (14.6%) ^b	9 (12.9%) ^b
Received information about the importance of forests – No	69 (40.4%) ^{*b}	38 (54.3%) ^{*b}
Yes	102 (59.6%) ^{*b}	32 (45.7%) ^{*b}
Perceived forest benefits		
Perception – Environmental Quality	4.86 (0.42) ^{**a}	4.63 (0.8) ^{**a}
Perception – Recreation	3.83 (0.75) ^a	3.93 (0.85) ^a
Perception – Resource utilisation	3.14 (1.07) ^{***a}	2.13 (1.12) ^{***a}

DV = Dependent Variable (continuous); Mean value indicates willingness to support restoration, ranging from 1 (completely unwilling) to 5 (completely willing). IV = Independent Variables. Significance levels: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***).

Mean values are presented as Mean (SD), while categorical variables are presented as Count (%).

Perception variables were measured on a 1–5 scale, where 5 indicates the highest perceived benefit.

Independent t-tests (^a) were used for continuous variables (Mean values).

Chi-square tests (^b) were used for categorical variables (Proportions).

Fisher's Exact Test (^c) was used for variables where counts in some categories are less than 5 (small, expected counts).

resources (Mean = 4.13) compared to their Spanish counterparts (Mean = 2.27, $p < 0.001$). They also perceived forests as more significant sources of medicinal herbs and food ($p = 0.008$) than respondents in Spain.

Conversely, Spanish respondents expressed stronger agreement that forests serve as vital habitats for species ($p = 0.009$), and rated forests higher in terms of learning opportunities ($p = 0.029$), both statistically significant differences. These results indicate that forest ecosystems are viewed in Spain more through the lens of ecological and experiential value.

GGNo statistically significant differences were found in perceptions of emotional health ($p = 0.367$), contributions to quality of life ($p = 0.247$) or outdoor recreation ($p = 0.200$), suggesting similar views across the two regions for these benefit types (Supplementary Material, Table S6).

4.5. Respondents in Castilla y León perceive more positive impacts of forest restoration on benefits

Perceived impacts of forest restoration differed between respondents in Västerbotten County, Sweden, and Castilla y León, Spain, with clear regional variation in how restoration is viewed across multiple benefit types

(Figure 3; Supplementary Material, Table S7). While both groups acknowledged that restoration influences forest benefits, their evaluations diverged notably.

Spanish respondents generally viewed restoration more positively, with most benefit types receiving mean scores above zero on the transformed Likert scale. This indicates a perceived enhancement of forest aesthetics, space for outdoor activities, and space for social interaction. In contrast, Swedish respondents rated these aspects lower, with mean scores falling below zero – suggesting a perceived reduction in such ecosystem services.

Significant differences were also observed in perceptions of mushroom picking, habitat provision for wildlife, and non-edible materials, all of which Spanish respondents rated more positively ($p < 0.001$). For other forest uses – including firewood, timber, animal food, and edible resources – Spanish respondents again reported stronger perceived benefits from restoration, while Swedish respondents tended to report no significant change.

Independent samples t-tests confirmed these regional differences were statistically significant for most benefit types (see Supplementary Material, Table S7), with the strongest effects observed in perceived changes to aesthetics ($p < 0.001$), recreation space ($p < 0.001$) and mushroom picking ($p < 0.001$).

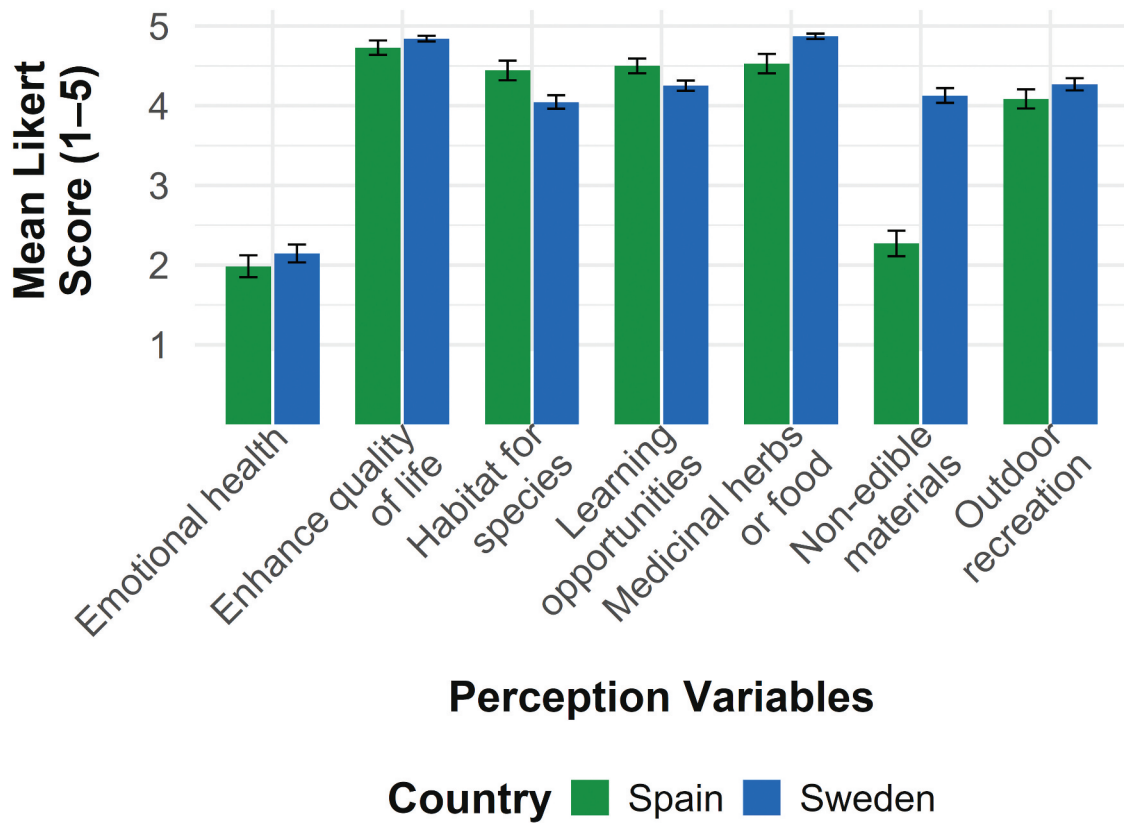


Figure 2. Mean perceived forest benefits in the study regions of Västerbotten County, Sweden, and Castilla y León autonomous community, Spain. Responses are based on a five-point Likert scale, where 1 = completely disagree and 5 = completely agree. Error bars indicate standard errors of the mean.

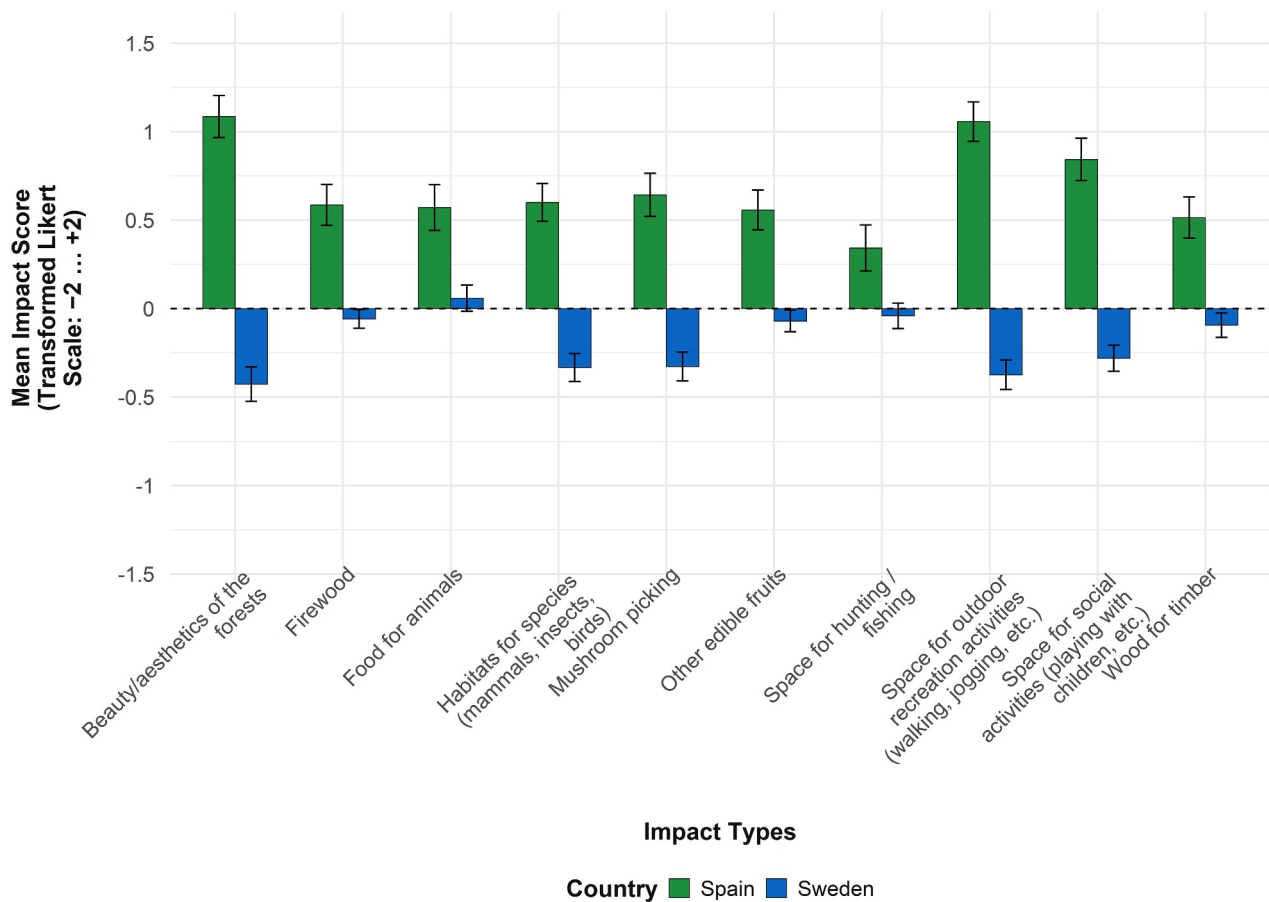


Figure 3. Mean perceived impacts of forest restoration on forest benefits in Västerbotten County (Sweden) and Castilla y León autonomous community (Spain). Scores use a transformed Likert scale (−2 = significantly reduces, −1 = moderately reduces, 0 = No significant impact, +1 = moderately enhances, +2 = significantly enhances). The y-axis is displayed from −1.5 to +1.5 to improve readability, as all group means and their standard errors fall within this range; no bars are truncated. Error bars represent standard errors of the mean.

4.6. Factors influencing support for forest restoration in the study regions

4.6.1 Socio-demographic characteristics and support for forest restoration

Age significantly influenced support for forest restoration, though the patterns varied between Sweden and Spain (Table 3). In Sweden, the reference group for age was respondents aged 38–48 years. Compared to this group, individuals aged 16–26 years exhibited 41% lower support ($\exp(\beta) = 0.59$), while those aged 27–37 years showed a 37% decrease ($\exp(\beta) = 0.63$).

In Spain, the reference group was the youngest age category, 16–26 years. Compared to this group, support was 72% lower among respondents aged 27–37 years ($\exp(\beta) = 0.28$), 61% lower for those aged 38–48 years ($\exp(\beta) = 0.39$) and 60% lower for those aged 49–59 years ($\exp(\beta) = 0.40$). These findings align with Table 1, which shows that Sweden had a higher proportion of older respondents, while Spain had more individuals in younger age brackets.

Professional background also influenced support. In Spain, respondents working in environmental or nature-related professions were 70% more likely to support restoration ($\exp(\beta) = 1.70$), highlighting the role of occupational expertise in shaping pro-environmental

attitudes. In Sweden, this association was positive but not statistically significant.

In Sweden, years of residence had a small but statistically significant negative effect: each additional year of residence was associated with a 1% decrease in support ($\exp(\beta) = 0.99$). No such association was found in Spain.

4.6.2 Behavioural characteristics and support for forest restoration

Behavioural attributes, particularly travel time to forests, were strong predictors of support, with contrasting patterns between the two countries (Table 3). In Sweden, the reference group was respondents who lived less than 10 minutes from a forest. Compared to this group, those who travelled more than one hour were 80% less likely to support restoration ($\exp(\beta) = 0.20$), suggesting that forest accessibility is a key factor influencing support.

In Spain, the reference group was also those living less than 10 minutes from a forest. Respondents who travelled 10–30 minutes had 90% higher support ($\exp(\beta) = 1.90$), while those who travelled 30–60 minutes showed a 49% increase ($\exp(\beta) = 1.49$). These patterns are consistent with Table 2, which shows shorter travel times among Swedish respondents compared to those in Spain.

Table 3. The generalised linear model (GLM) results of factors influencing support for forest restoration in Västerbotten county, Sweden and Castilla y León autonomous community, Spain.

Variable	Sweden (n = 171) Coefficient	Spain (n = 70) Coefficient	Sweden (Exponentiated – $\exp(\beta)$)	Spain (Exponentiated – $\exp(\beta)$)
Intercept	1.88** (0.812)	2.08*** (0.732)	6.55** (0.812)	8.00*** (0.732)
Socio-demographic variables				
Age group [>60 years]	–0.28 (0.200)	–0.45 (0.426)	0.76 (0.200)	0.64 (0.426)
Age group [49–59 years]	–0.08 (0.231)	–0.92** (0.430)	0.92 (0.231)	0.40** (0.430)
Age group [38–48 years]	0a*** (0.000)	–0.95** (0.394)	1.00a*** (0.000)	0.39** (0.394)
Age group [27–37 years]	–0.47** (0.225)	–1.26*** (0.400)	0.63** (0.225)	0.28*** (0.400)
Age group [16–26 years]	–0.53* (0.270)	0a*** (0.000)	0.59* (0.270)	1.00a*** (0.000)
Educational level [University]	–0.24 (0.311)	0.14 (0.179)	0.79 (0.311)	1.15 (0.179)
Educational level [Secondary school]	–0.38 (0.345)	0.04 (0.281)	0.68 (0.345)	1.04 (0.281)
Profession [Environment/Nature]	0.42 (0.275)	0.53** (0.260)	1.52 (0.275)	1.70** (0.260)
Years of residence	–0.01*** (0.004)	0.00 (0.006)	0.99*** (0.004)	1.00 (0.006)
Behavioural variables				
Transport mode [Bicycle]	0.44 (0.378)	–0.43 (0.496)	1.55 (0.378)	0.65 (0.496)
Transport mode [On foot]	–0.17 (0.346)	–0.40 (0.335)	0.84 (0.346)	0.67 (0.335)
Transport mode [Private vehicle]	0.19 (0.348)	–0.43 (0.329)	1.21 (0.348)	0.65 (0.329)
Average time to forests [10–30 min]	0.23* (0.133)	0.64*** (0.205)	1.26* (0.133)	1.90*** (0.205)
Average time to forests [30 min –1 hour]	0.09 (0.260)	0.40** (0.200)	1.09 (0.260)	1.49** (0.200)
Average time to forests [<10 minutes]	0a*** (0.000)	0a*** (0.000)	1.00a*** (0.000)	1.00a*** (0.000)
Time to forests [>1 hour]	–1.63*** (0.433)	0.42 (0.298)	0.20*** (0.433)	1.52 (0.298)
Frequency of visits [1–3 times a month]	–0.04 (0.183)	0.20 (0.198)	0.96 (0.183)	1.22 (0.198)
Frequency of visits [3–7 times a week]	0.27 (0.252)	0.36 (0.255)	1.31 (0.252)	1.43 (0.255)
Perception variables				
Access to forest information				
Aware of forest programs 1 = yes/0 = no	–0.02 (0.191)	–0.19 (0.223)	0.98 (0.191)	0.83 (0.223)
Received information about forests 1 = yes/0 = no	0.36*** (0.128)	–0.02 (0.175)	1.43*** (0.128)	0.98 (0.175)
Perceived forest benefits				
Perceived benefit: Environmental Quality	0.48*** (0.132)	0.30*** (0.102)	1.62*** (0.132)	1.35*** (0.102)
Perceived benefit: Recreation	0.25*** (0.092)	0.07 (0.106)	1.28*** (0.092)	1.07 (0.106)
Perceived benefit: Forest resource use	0.04 (0.070)	–0.15** (0.074)	1.04 (0.070)	0.86** (0.074)

Estimates are presented with standard errors in parentheses.

Statistical significance is indicated by: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

a. Set to Zero because this parameter is a reference category.

Likert scale: When treating Likert scales as continuous, the regression coefficients represent the change in the dependent variable (support for forest restoration) for each incremental increase of one unit on the 5-point scale (e.g. from 3 to 4).

Forest visitation frequency did not significantly predict support in either country, suggesting that the mere frequency of visits is not a sufficient driver of pro-restoration attitudes.

4.6.3 Perceptions of forests and support for forest restoration

Perceived benefits of forests played a crucial role in shaping support for restoration, with environmental quality emerging as the strongest predictor.

In Sweden, respondents who recognised forests as enhancing environmental quality were 62% more likely to support restoration ($\exp(\beta) = 1.62$). In Spain, the effect was slightly weaker but still significant, with a 35% increase in support ($\exp(\beta) = 1.35$). Perceived recreational benefits were also associated with support in Sweden (28% higher likelihood, $\exp(\beta) = 1.28$), but this relationship was not statistically significant in Spain. These findings mirror Table 2, where Swedish respondents rated environmental quality benefits more highly than Spanish respondents.

In contrast, in Spain, respondents who perceived forests primarily as a source of materials (e.g. timber, food) were 14% less likely to support restoration ($\exp(\beta) = 0.86$). This suggests concern that restoration might limit access to forest resources. No such trade-off was observed in Sweden, possibly reflecting different livelihood dependencies or conservation outlooks.

Awareness of forest programmes did not significantly influence support in either country. However, receiving forest-related information was associated with a 43% increase in support in Sweden ($\exp(\beta) = 1.43$), supporting findings in Table 2, where a greater proportion of Swedish respondents reported receiving such information compared to their Spanish counterparts.

5. Discussion

This study examines factors influencing public support for forest restoration in Västerbotten County (Sweden) and Castilla y León autonomous community (Spain). We observed patterns showing how support varies with demographic, behavioural, and perception-based attributes, complementing existing literature and informing local policy interventions. These findings, however, reflect regional rather than national perspectives and should be interpreted in light of the sample characteristics and response dynamics discussed in Section 5.6 (Study Limitations). The following subsections detail these factors and patterns, with particular attention to their policy implications.

5.1. Socio-demographic influences on support for forest restoration

Our analysis revealed that age plays an important role in shaping support for forest restoration in the two study regions. In Västerbotten, younger respondents showed lower levels of support compared to middle-aged participants. In contrast, in Castilla y León, older individuals were less supportive, with particularly low support among those aged 27–37 years. This suggests that age-related attitudes towards restoration differ between the two regions rather than indicating a uniform generational pattern across countries.

In the Swedish case, this pattern is consistent with research suggesting that older people in Northern Europe are more inclined to support conservation due to stronger environmental values and a sense of moral obligation (Eriksson et al. 2013; Riechers et al. 2018). The Value-Belief-Norm (VBN) framework (Stern 2000) provides a theoretical lens through which to understand these findings, highlighting how deeply held personal values among older individuals can translate into stronger environmental commitment. This pattern may also be explained by a lower demand of economic revenue among older owners compared with younger owners that have made a more recent investment in forest land. In Sweden as well as in these municipalities (Supplementary Material, Table S2), non-industrial private forest ownership is substantial; on national level covering half of the forest area (Angelstam et al. 2020).

In the Spanish context, younger populations appear more receptive to restoration efforts, potentially influenced by long-standing public reforestation campaigns and EU-supported programmes (Vadell et al. 2016). While our data do not allow direct comparison between Spanish and Swedish youth, previous studies focused on Spain suggest that younger demographics are especially responsive to restoration benefits such as wildfire prevention, biodiversity protection and recreational access (Varela et al. 2017).

Importantly, perceptions of what ‘restoration’ entails may differ between regions. In Sweden, where forests are extensive and managed to optimise wood biomass yield, restoration may be perceived as a potential yield reduction or as interference with the land use norm. This could account for lower support among younger individuals who may not associate restoration with positive environmental or economic outcomes. In contrast, in Spain, where past land degradation and afforestation campaigns have shaped the landscape, restoration may be perceived as a beneficial increase in forest cover, with clear links to environmental protection and rural development. These differing mental models and policy legacies likely influence how people interpret the goals and

implications of restoration and should be more explicitly addressed in both public outreach and policy design.

Lastly, while some age-related differences emerged, they also point to opportunities for intergenerational collaboration in restoration planning. Older individuals can serve as mentors in environmental education, while younger populations may contribute energy and innovation to contemporary policy implementation. Bridging these perspectives could strengthen local restoration efforts and foster shared responsibility across generations.

5.2. Behavioural characteristics and accessibility to forests

The outcome of this study underscores the crucial role of accessibility to forests as a determinant of support for restoration initiatives, revealing distinct regional patterns in Sweden and Spain. In the Swedish study region, individuals facing longer travel times to forests exhibited a notable decline in restoration support, consistent with Wang et al. (2022), who found that accessibility influences perceptions of cultural ecosystem services (CES) and engagement with natural spaces. Conversely, respondents with moderate travel times (10–30 minutes) in Spain were more likely to support restoration, suggesting that a certain level of accessibility fosters a connection to forests, encouraging stewardship.

However, our findings challenge the assumption in hypothesis H2 that frequent forest visits necessarily translate to more substantial restoration support, as no significant relationship was observed. While previous research (Larson et al. 2011; Ibáñez-Rueda et al. 2022) highlights nature exposure as a key driver of conservation attitudes, Eriksson et al. (2015) suggest that broader socio-economic contexts, policy frameworks, and personal values may exert a stronger influence on environmental attitudes than direct interactions with nature. This aligns with our results, indicating that while accessibility matters, awareness campaigns and policy interventions may play a more decisive role in fostering public support for restoration.

Beyond accessibility, our findings highlight the need for spatially sensitive policy interventions catering to regional needs. In Sweden, improving transportation infrastructure or enhancing connections between urban areas and nearby forests through green corridors or park-like spaces could help reduce barriers posed by distance, thereby encouraging greater engagement with forest ecosystems (Sandström 2002). Meanwhile, in Spain, where accessibility is relatively moderate, community-driven restoration efforts may further strengthen support for biodiversity conservation, recreation, and wildfire prevention initiatives (Vadell et al. 2016; Varela et al. 2017).

5.3. Perceptions of forest benefits and support for forest restoration

Perceptions of forest benefits influenced support for restoration, with regional contrasts observed in how environmental quality, recreation and resource use were perceived. In Sweden, respondents who viewed forests as contributing positively to environmental quality were significantly more likely to support restoration, reinforcing hypothesis (H4) and aligning with prior studies linking biodiversity appreciation with conservation attitudes (Fuller et al. 2007; Wang et al. 2022). Recreational benefits also influenced Swedish respondents positively, whereas the same pattern was not evident in Spain.

However, not all perceived impacts of restoration were viewed favourably. In Sweden, respondents expressed concerns that restoration could negatively affect aesthetic value, recreational space and habitat quality, as well as activities like mushroom picking and social gatherings. These sceptical views may reflect uncertainty about how restoration is implemented in the Swedish context. Unlike in regions where restoration equates to afforestation, in Sweden it often involves increasing biodiversity through structural complexity – such as more deadwood, thinning, or creating semi-open or open areas (Lindkvist et al. 2012). It is possible that respondents, particularly those accustomed to managed production forests, associate restoration with unfamiliar or less accessible landscapes. This interpretation helps explain why restoration is not universally seen as enhancing forest services and suggests that public understanding of restoration goals remains uneven.

Previous studies (Eriksson et al. 2013) have recorded tensions in Sweden around changing forest management practices, particularly where public access or traditional uses are perceived to be at risk. However, as Langner et al. (2017) note, well-designed restoration can maintain or even improve recreational opportunities, depending on how interventions are communicated and executed. This points to the importance of public engagement in defining what restoration should look like and ensuring that it aligns with both ecological goals and societal expectations.

Conversely, in Spain, respondents generally viewed forest restoration more favourably, particularly in terms of aesthetics, habitat for species, and outdoor recreation. However, individuals who associated forests with resource use (such as timber, food and non-timber products) were less likely to support restoration, possibly due to concerns that such efforts might restrict access to these resources. These patterns align with broader findings in land-use and restoration literature, which emphasise trade-offs between forest use and conservation goals (Peña et al. 2018).

5.4. Forest information and awareness as enablers of restoration engagement

This study highlights the pivotal role of public awareness of forest programmes and access to forest information as enablers of restoration engagement, particularly in Sweden. Our results indicate that individuals who received forest-related information exhibited significantly higher support for restoration initiatives. This underscores the importance of effective communication strategies in fostering public engagement with forest restoration efforts. However, formal education did not significantly influence support for restoration in either Sweden or Spain. This contrasts with studies that report a positive association between higher education and pro-environmental behaviours (Vicente-Molina et al. 2013). The discrepancy may stem from methodological differences, as our study focuses on the public. In contrast, Vicente-Molina et al. examined university students who may have greater exposure to environmental discussions within academic settings.

Nonetheless, our findings suggest that environmental awareness and access to information may play a more critical role in influencing pro-environmental behaviour than formal education alone. This aligns with previous research highlighting that information dissemination can more profoundly impact conservation attitudes than traditional educational pathways (Stern 2000; Kortmann et al. 2021).

Similarly, Tedesco et al. (2022) emphasise that access to information, public engagement, and institutional support are essential for restoration success. Their findings further reinforce that restoration programmes incorporating strong communication and awareness strategies generate higher public commitment and support. The regional differences observed in our study further emphasise the need for customised information dissemination strategies that address specific knowledge gaps and foster broader societal support for restoration efforts. This aligns with hypothesis (H3) of this study, which posits that greater awareness and access to forest-related information positively influence public support for restoration initiatives.

5.5. Contextualising forest restoration and societal expectations

Building on the role of socio-demographic attributes in influencing support for forest restoration, the broader context of the impacts of forest restoration and societal expectations reveals a complex and sometimes divergent landscape of public perceptions. While age and access to information influence restoration engagement, how individuals perceive restoration outcomes is also influenced by regional

values, cultural associations, and expectations of ecosystem benefits. In Spain, respondents generally viewed restoration as a means to enhance ecosystem benefits, whereas in Sweden, perceptions were more neutral to slightly negative, particularly regarding recreational and social aspects. This divergence aligns with Kortmann et al. (2021) and Tedesco et al. (2022), who noted that management interventions can lead to mixed public perceptions, even when ecological benefits are evident. Additionally, Riechers et al. (2018) and Kelly et al. (2015) highlight that cultural ecosystem services are perceived and valued differently across social groups, influencing expectations for restoration outcomes. These variations in perception suggest that forest restoration is both an ecological process and a socially constructed phenomenon, where cultural, historical and economic factors influence how restoration efforts are received. Such insights reinforce our hypothesis (H4), demonstrating that societal perceptions of forest benefits influence public attitudes toward forest restoration.

5.6. Study limitations

While this study provides valuable insights, several limitations must be acknowledged. Västerbotten County (Sweden) and Castilla y León (Spain) were intentionally selected for their contrasting socio-ecological conditions, aligning with our aim to examine variation in public support for forest restoration across diverse contexts. This regional focus enabled us to address perceptions, socio-demographic attributes, and behavioural influences, but the findings should not be generalised to national-level patterns. In Sweden, the results may broadly reflect the boreal region, given shared socio-cultural and ecological characteristics (Angelstam et al. 2020), though factors such as forest accessibility and age-related attitudes may differ in more urbanised or southern areas. Future research should therefore expand the geographical scope within each country to better capture regional variation and enhance generalisability.

The study employed a Generalised Linear Model (GLM) with a Gamma distribution and log link function to examine relationships between public support for forest restoration and key independent variables. While GLMs are appropriate for non-normal data, their validity depends on correct link specification and independence of observations. In social-ecological contexts, where spatial and temporal dependencies are common, violations of these assumptions may bias estimates (Dobson and Barnett 2018). Model selection was based on the Akaike Information Criterion (AIC), which, although effective for identifying parsimonious models, does not fully address model uncertainty (Burnham and

Anderson 2004). Future studies may benefit from Bayesian hierarchical approaches to improve robustness and capture complex interactions.

Unequal response rates and sample sizes – 11.5% in Sweden ($n = 171$) and 4.9% in Spain ($n = 70$) – also limit comparability across regions. The lower response rate in Spain increases the risk of non-response bias, potentially reducing representativeness. Although our analysis emphasised patterns and associations over causal inference, future research could adopt more balanced sampling strategies or apply post-survey weighting to strengthen comparability.

Finally, the principal components analysis explained 48% of the variance in support indicators, suggesting that future studies could incorporate additional behavioural and attitudinal variables to improve explanatory power.

6. Conclusion and implications for restoration policy and practice

This study advances understanding of public support for forest restoration by examining two socio-ecologically distinct regions in Sweden and Spain. It highlights the importance of tailoring restoration strategies to regional contexts, as public attitudes are influenced by socio-demographic factors, accessibility, and information access. In particular, differences in perceptions – such as concerns about recreational impacts in Sweden and resource use conflicts in Spain – reveal the need for inclusive engagement strategies that reflect local values and forest traditions.

These insights are timely in light of the EU Nature Restoration Regulation (EC 2023), and the Kunming-Montreal Global Biodiversity Framework (CBD 2022), both of which emphasise the need for regionally tailored and inclusive approaches to ecosystem restoration. Policymakers should incorporate diverse public perspectives to ensure effective implementation and societal legitimacy of restoration efforts. Ultimately, fostering regional ownership and addressing socio-cultural differences can enhance the success and sustainability of forest restoration initiatives across Europe.

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