A COMPREHENSIVE ANALYSIS OF FOREST RESTORATION PRACTICES ACROSS EUROPE: ECOLOGICAL, ECONOMIC, SOCIAL AND POLICY DIMENSIONS

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Upscaling Forest Restoration

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EXECUTIVE SUMMARY

Scaling up ecosystem restoration is essential to halt and reverse land degradation and biodiversity loss and ensure future functionality and resilience. However, the implementation of concrete restoration initiatives will present many challenges, such as setting appropriate and realistic goals, selecting or developing the most effective and efficient restoration practices, as well as carrying out effective short- and long-term monitoring of success. Furthermore, there is a lack of information to facilitate the implementation of effective restoration interventions. To address this knowledge gap, this study gathered information on the ecological, economic, social and policy challenges faced by restoration practitioners across Europe using a widely distributed online survey.

Based on the 398 responses received from practitioners working in 31 countries the study assessed how practical and scientific knowledge form an integral part of restoration initiatives. The focus of more than 40% of respondents from restoration projects was on increasing the population of species (plant species) and promoting their regeneration. Two common elements emerged across the wide diversity of responses: 1) a prevalent belief that restoration enhances multiple ecological aspects simultaneously, and subsequently, 2) the importance of developing monitoring frameworks that holistically evaluate restoration effectiveness, given the difficulty in defining a single, exclusive indicator of restoration success, as this could oversimplify the outcomes in complex ecosystems. Furthermore, respondents emphasized the importance of taking a holistic approach to restoration design, encompassing not only ecological aspects but also social, economic, and policy dimensions. The findings from the analysis of this survey provide, for the first time, a comprehensive view of the ecosystems and restoration activities that European countries are prioritizing, along with evaluation by the stakeholders involved.

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INTRODUCTION

Despite widespread agreement on the benefits of ecological restoration, significant knowledge gaps persist regarding the long-term effectiveness of such initiatives, particularly in terms of ecosystem service provision. Addressing this challenge requires enhanced monitoring strategies spanning decades, as emphasized by the EU's Nature Restoration Law (NRL), to evaluate both biodiversity and ecosystem outcomes. In the EU, forest restoration has been shaped by a combination of non-forest sector policies, including the Common Agricultural Policy, the Nature Directives, and the Water Framework Directive. However, the conservation status of forest habitats and species in the EU continues to decline with 85 % being assessed as having an unfavorable conservation status. Recent policy developments, such as the European Green Deal's pledge to plant 3 billion trees and the 2030 Biodiversity Strategy's restoration targets, aim to reverse this trend. The newly adopted NRL (2024) introduces legally binding goals. It aims to restore at least 20% of degraded land and sea by 2030 while promoting close-to-nature forest management.

Beyond EU-level policies, national and regional restoration strategies have emerged, yet economic, political, and governance barriers, such as insufficient funding, conflicting stakeholder interests, and weak policy integration, continue to hinder progress. Recent research has sought to address these challenges by surveying restoration practitioners, assessing freely available information on assisted forest restoration, and analyzing global restoration targets. Moreover, emerging data platforms such as Restor, the IUCN Restoration Barometer, and the Framework for Ecosystem Restoration Monitoring have made significant strides towards providing data on the restoration initiatives undertaken. Nevertheless, restoration remains a complex socio-ecological process influenced by direct factors (e.g., land use, climate change) and indirect drivers (e.g., policy, economics). Given the limited understanding of these dynamics in Europe, a more comprehensive approach—integrating ecological, social, economic, and policy dimensions—is essential to advance effective and sustainable restoration efforts.

The main aim of this study is to analyze and learn from the European forest restoration initiatives from a holistic perspective, by providing a comprehensive overview of the restoration activities being undertaken by European countries, and synthesizing practitioner perspectives on what drives the outcomes of their projects. The specific objectives of this study are: (1) to describe the goals of implemented, ongoing, or planned restoration initiatives; (2) to evaluate the compatibility of these goals; (3) to compile the indicators used to assess project outcomes; and (4) to analyze the benefits across ecological, economic, policy and social aspects of the initiatives. To achieve this, data was collected from practical experiences across Europe via cross-sectional stakeholder surveys, exploring the ecological, social, economic, and political drivers of restoration initiatives and how their outcomes are being assessed.

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METHODOLOGY

The research employed a large-scale online survey (Fig. 1) distributed to over 1,500 stakeholders, including researchers, policymakers, and practitioners involved in forest restoration. The questionnaire, available in six languages, collected 398 responses (26.5% response rate) and was structured to gather detailed information across four key dimensions: ecological, economic, social, and policy aspects. Questions covered restoration objectives, pre-restoration land use, stakeholder engagement, funding mechanisms, and monitoring practices. Statistical analyses, including Pearson Chi-squared tests and Cramer's V, were used to identify regional patterns and dependencies. The survey design incorporated a dynamic branching system, allowing respondents to answer questions tailored to their specific expertise and project characteristics. Data were grouped by five European regions (Northern, Central-Western, Central-Eastern, Southwestern, and Southeastern Europe) to enable geographic comparisons.
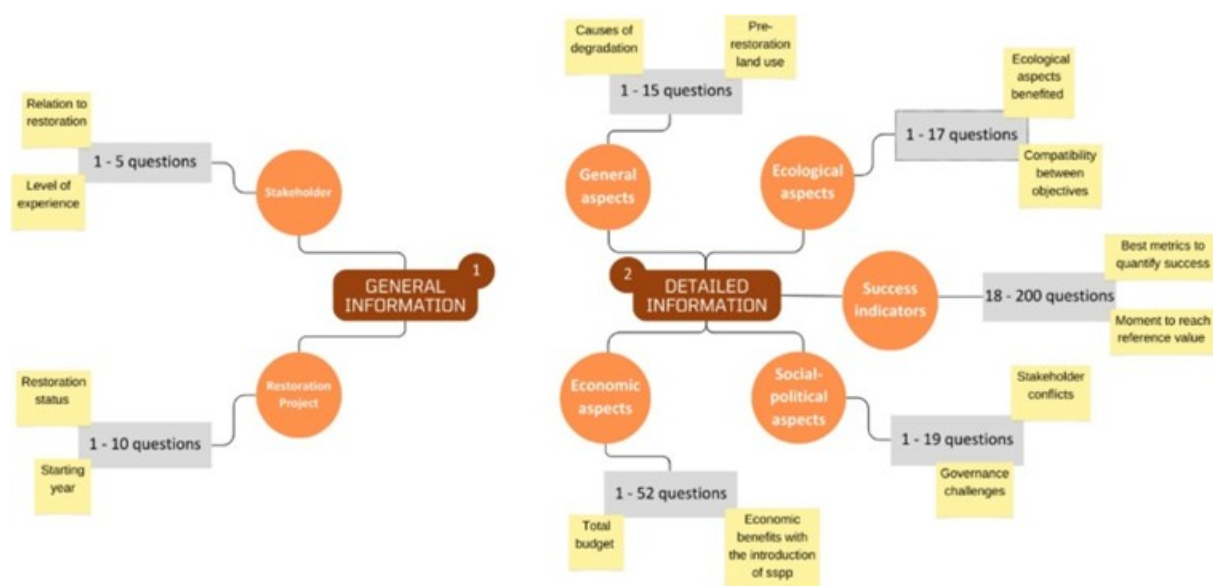

Figure 1. Scheme of the online questionnaire structured into general or more detailed information (brown color), with the various aspects considered (orange color) to classify the topics of the questions, the range of possible questions, per aspect, in grey, and examples of addressed topics in light yellow.

RESULTS

Responses were received from restoration projects spanning 31 different European and non-European countries, encompassing initiatives at national, transnational, regional, and local levels. The analysis revealed that increasing species populations (19.7%), promoting tree regeneration (12.8%), and enhancing ecosystem resilience (12.3%) were the most common objectives (Fig. 2). Distinct regional patterns emerged: Southern European initiatives focused on increasing the population of species, while Central Europe prioritized the promotion of habitats of interest. Notably, 36.6% of projects targeted already forested areas, suggesting restoration often addresses degraded forests rather than land-use conversion. The compatibility assessment showed 68.7% of objectives had medium compatibility, indicating most projects pursue multiple ecological benefits simultaneously. Water provisioning showed particularly high compatibility with other goals.

Most respondents (70%) expected moderate ecological benefits across multiple indicators, with local climate regulation showing the highest level of benefit. However, deadwood management revealed a significant tension. While scientifically recognized as crucial for biodiversity and carbon storage, many practitioners viewed it as conflicting with fire risk reduction and biomass production goals. This highlights the need for better knowledge transfer between research and practice. Similarly, ecosystem resilience proved challenging to assess, with varying interpretations among practitioners reflecting the concept's complexity.

Only 14% of respondents provided budget details, revealing a critical data gap. Among these, the implementation phases received in most of the restorations 50% or more of the funding, while monitoring in many cases only accounted for less than 5% of the budgets. This disproportionate allocation threatens long-term evaluation of success, as inadequate monitoring prevents proper assessment of restoration outcomes.

While 66% of projects reported no stakeholder conflicts, engagement was often limited to specific phases (design: 33.8%; implementation: 23.9%, monitoring: 18.3%). Central-Western Europe reported the most stakeholder challenges, potentially reflecting complex land-use conflicts.

Responses revealed challenges in establishing standardized indicators to evaluate restoration success, showing particular difficulty in selecting single metrics. While practitioners generally agreed with the proposed indicators for 12 of 21 objectives, four indicators (quality of water for human consumption, quality of water for the ecosystem, biomass yield, and number of recreation visits) showed no consensus. Notable patterns emerged: erosion protection initiatives saw agreement on "soil loss" and "ground vegetation cover" metrics but not "area affected by soil erosion". For wood production objectives, opinions split evenly regarding "wood yield," with 50% agreeing that it is an appropriate

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indicator and 50% disagreeing or doubting its appropriateness. These findings highlight both the subjectivity in metric selection and need for context-specific evaluation frameworks.
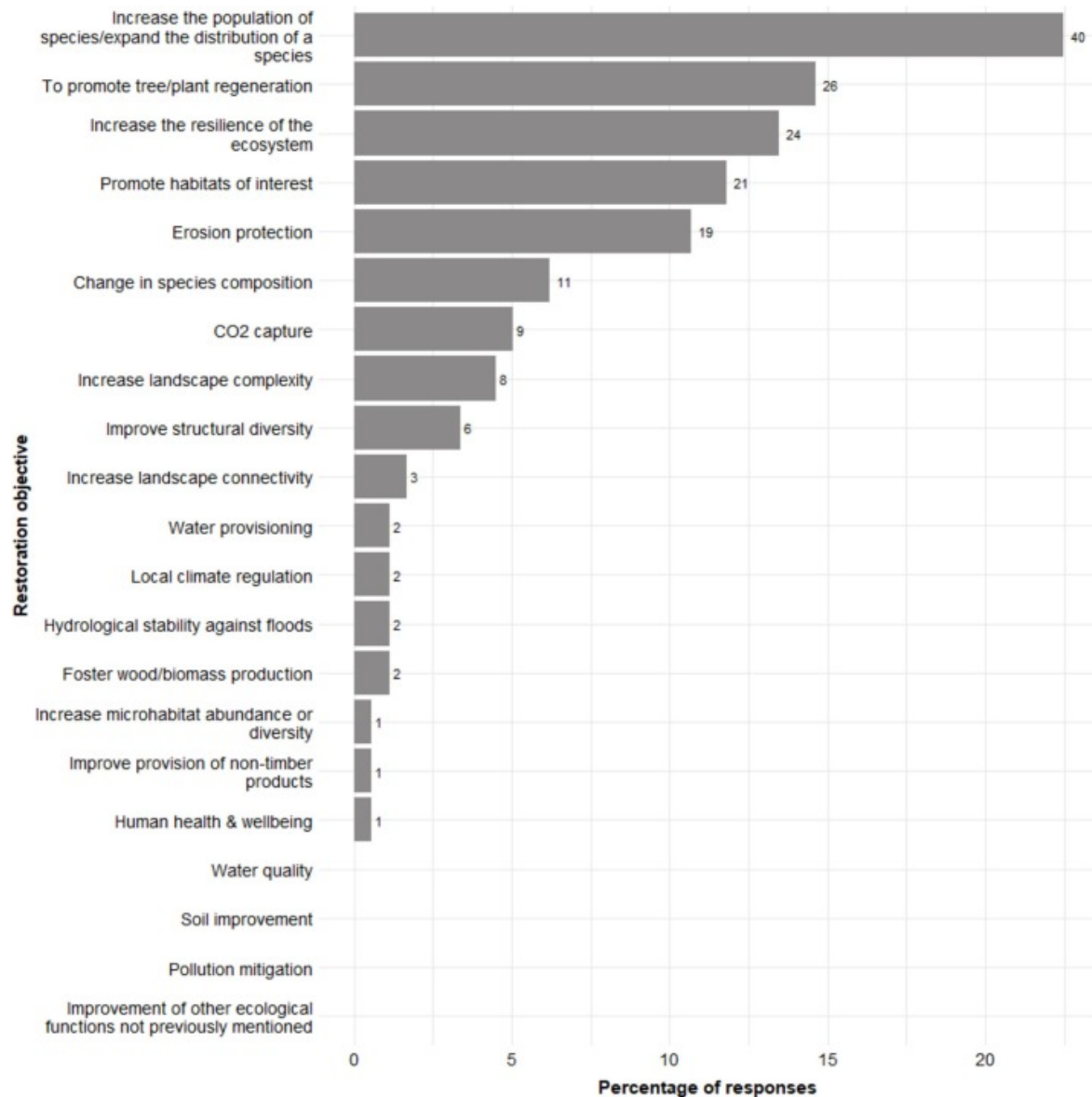

Figure 2. Distribution of responses according to the restoration objective of the initiative. Numbers appearing on each bar correspond to the exact number of responses received for each option.

KEY FINDINGS

Key finding #1

This study provide a first-ever comprehensive view of EU ecosystems and restoration efforts.

Key finding #2

This study shows a strong link between restoration goals and geographical zones.

Key finding #3

Over 40% of respondents focused restoration on increasing species and promoting regeneration.

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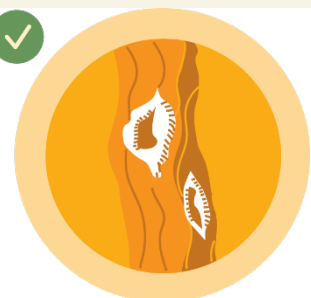Upscaling Forest Restoration

RECOMMENDATIONS

Takeaway #1

Allocating sufficient budget to monitoring phase. Restoration monitoring should consider ecological, socio-economic, and policy factors.

Takeaway #2

Considering ecosystems' complexity, a set of harmonized indicators needs to be considered.

Takeaway #3

Inclusive stakeholder engagement processes need to be promoted to reduce conflict and align objectives, and education and communication need to be prioritized to overcome misconceptions (e.g., about deadwood).

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