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RESEARCH ARTICLE

Barriers to ecological restoration in Europe: expert perspectives

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Ecological restoration is key to counteracting anthropogenic degradation of biodiversity and to reducing disaster risk. However, there is limited knowledge of barriers hindering the wider implementation of restoration practices, despite high-level political priority to halt the loss of biodiversity. In Europe, progress on ecological restoration has been slow and insufficient to meet international agreements and comply with European Union Nature Directives. We assessed European restoration experts' perceptions on barriers to restoration in Europe, and their relative importance, through a multiple expert consultation using a Delphi process. We found that experts share a common multi-dimensional concept of ecological restoration. Experts identified a large number of barriers (33) to the advancement of ecological restoration in Europe. Major barriers pertained to the socio-economic, not the environmental, domain. The three most important being *insufficient funding*, *conflicting interests among different stakeholders*, and *low political priority given to restoration*. Our results emphasize the need to increase political commitment at all levels, comply with existing nature laws, and optimize the use of financial resources by increasing funds for ecological restoration and eradicate environmentally harmful subsidies. The experts also call for the integration of ecological restoration into land-use planning and facilitating stakeholders' collaboration. Our study identifies key barriers, discusses ways to overcome the main barriers to ER in Europe, and contributes knowledge to support the implementation of the European Biodiversity Strategy for 2030, and the EU 2030 Restoration Plan in particular.

Key words: Biodiversity Strategy for 2030, Biodiversity Strategy to 2020, Delphi process, EU restoration plan, European Union Nature Directives, political priorities

Implications for Practice

- European experts agree on a multifaceted interpretation of ecological restoration, which should facilitate consensus on the development and implementation of policies addressing ecological restoration.
- A wide number of barriers must be overcome to hasten progress on ecological restoration in Europe.
- Political commitment to allocate more funds to ecological restoration and reconcile the interests of different stakeholder groups is key for the advancement of ecological restoration in Europe.
- Solutions to overcome the barriers to ecological restoration, identified in this study, should contribute to the realization of Biodiversity Strategy for 2030.
- Our approach can be used to identify barriers to ecological restoration in other regions and specific land cover types.

Introduction

Increasing concerns about biodiversity loss and the decline in the provision of ecosystem services have prompted international

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efforts to combat environmental degradation and restore ecosystems (CBD Secretariat 2010; IPBES 2018; UN General Assembly 2019). In 2010, the European Commission (EC) adopted CBD's Aichi Biodiversity Targets, as part of the EU Biodiversity Strategy to 2020. Target 2 of this Strategy, which translates Aichi Target 15, states that "by 2020, ecosystems and their services are maintained and enhanced by establishing green infrastructure and restoring at least 15% of degraded ecosystems." Target 2 embodies the EC commitment to assist Member States to develop the strategic framework to set priorities for ecosystem restoration (ER, hereafter) at sub-national, national, and European Union (EU) levels. However, Member States later agreed that these priorities should be decided nationally, without EU-level coordination and burden sharing. To promote engagement and facilitate implementation, in 2012, the EC appointed an ad hoc experts' working group, whose outputs included recommended guidelines to support implementation prioritization (Lammerant et al. 2013), estimates of the financing needs to implement Target 2 (Tucker et al. 2013), and studies using green infrastructure mapping to identify priority areas for restoration (EEA 2014; Estreguil et al. 2019). EC officers were also involved in multiple actions to disseminate EU strategy and promote engagement.

In parallel, Member States initiated various approaches to meet Target 2, which differed widely in their scope and ambition. While some formally presented prioritization frameworks (BMUB 2015; Kotiaho et al. 2016), others referred to ER in their national biodiversity strategies but lacked prioritization frameworks or specific restoration strategies (MEDDE 2010; EC 2015; ANB 2016; Hagen et al. 2016; Valladares et al. 2017; Dekker 2019).

Despite these efforts, concerns about Europe's capacity to achieve Target 2 have grown (Langhout 2014; Cortina et al. 2016; EHF 2019). In the mid-term Review of the Biodiversity Strategy to 2020, the EC recognized that progress towards Target 2 was insufficient and required increased efforts (EC 2015). According to the fitness, check of the key Birds and Habitats Directives, the extent of restoration carried out is largely unknown (Milieu et al. 2016). This refers to restoration carried out to achieve Favorable Conservation Status of EU protected habitats and species, good status of the Water Framework Directive, and good environmental status of the Marine Strategy Framework Directive. Yet, at the EU level, 77% of the Annex I habitat type assessments of the Habitats Directive show an unfavorable status, thus requiring restoration (EEA 2015). A comprehensive study undertaken to assess ecosystem restoration activity in Europe and its potential to contribute to economic growth estimated that current financial commitments were much lower than those required to achieve Target 2 (EFTEC et al. 2017). This study also stressed that 800,000 km^2 of the Natura 2000 habitats are classed as unfavorable conservation status, while current annual restoration efforts concern a surface area that is two orders of magnitude smaller. Efforts to promote sustainable or best practices, such as Forest Certification, or progress towards the implementation of the Water Framework Directive and the Floods Directive, have been revealed to be insufficient (Gómez-Zamalloa et al. 2011; EC 2019).

There are likely multiple and interacting reasons for the limited success of restoration, which have so far challenged the diagnosis and hampered the adoption of correcting measures. The lack of financial resources is frequently noted, as are knowledge gaps of various types (e.g. Ockendon et al. 2018). Other probable factors include limited political support for the Directives, uncertainty over the Directives' requirements, inadequate stakeholder consultation and involvement, the unintended impacts of certain, so-called perverse incentives and subsidies in other policy sectors (such as the Common Agricultural Policy), inadequate enforcement, and the limited expertise and capacity of environmental authorities and other institutions involved in the implementation of the Directives (Milieu et al. 2016). Other constraints may include difficulties in defining restoration, restoration targets, and measures, absence of widespread baseline information, lack of systematic long-term monitoring, and disparity in monitoring practices across the EU, knowledge gaps related to marine restoration, and limited understanding of the socio-economic benefits of restoration (EFTEC et al. 2017). We must also bear in mind the large diversity of actors involved in ER in Europe, as well as the different ecological, governance, and socio-economic contexts coexisting in the EU, which combine to complicate the identification of major barriers to ER, and the design and implementation of proper solutions (EFTEC et al. 2017). This situation contrasts with ER programs in other geographical areas outside of Europe (Yin & Yin 2009; DEE 2014; Hagger et al. 2017; Bennett 2018; Towns et al. 2018; Matzek et al. 2019).

In this context, BiodivERsA, a network of funding organizations promoting pan-European research on biodiversity and ecosystem services, requested that EKLIPSE, the Knowledge and Learning Mechanism on Biodiversity and Ecosystem Services, identify and rank what is hampering the effectiveness of existing approaches to restore biodiversity and ecosystem function and services in Europe. EKLIPSE appointed 12 experts to form an Expert Working Group (EWG) from eight European countries (Czech Republic, Finland, Greece, Ireland, the Netherlands, Portugal, Spain, and the United Kingdom) and one non-European country (Australia). The EWG used two approaches to respond to the

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BiodivERsA request: a scoping review and a participatory process. This article analyzes the main components of effective ecological restoration and the main barriers for its implementation in Europe identified by means of the participatory process involving stakeholders representing different levels of governance and geographic regions. Here, we use the term ecological restoration as "any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state." This is consistent with the definition of ecological restoration of the Society for Ecological Restoration (SER 2004). This study represents a significant step towards overcoming the main barriers to ER in Europe and will inform the design of suitable measures for the implementation of the EU 2030 Biodiversity Strategy (EC 2020). The Commission has argued that implementing this Strategy will require identifying the conditions in which the targets must be met, as well as the most effective measures to reach them. It also notes the need to account for the diversity of challenges across domains, regions, and Member States. The present article addresses these tasks.

To identify barriers for effective ER in Europe we used a Delphi process, a well-recognized approach for eliciting expert knowledge and achieving formal consensus (Dalkey & Helmer 1963; Habibi et al. 2014; Fig. 1). The Delphi process has been defined as "a method for achieving consensual agreement among expert panelists, through repeated iterations (usually by email) of anonymized opinions and of proposed compromise statements from the group moderator" (Bloor & Wood 2006). The Delphi process combines the knowledge of multiple, carefully selected experts into quantitative and/or qualitative assessments, and has been widely used in the fields of conservation and restoration (Orsi et al. 2011; Egan & Estrada 2013; Mukherjee et al. 2015).

Methods

We used an online version of the Delphi process for our investigation, as it facilitated both the consultation of a relatively large number of experts dealing with different land cover types and geographic origins, while maintaining anonymity, accessibility, and transparency. It also had lower costs in terms of financial resources and time, and allowed time for participants to reflect and respond, as well as the potential to re-analyze the data obtained. It is worth noting that it was used retrospectively, that is, to analyze past events (e.g. Manley 2013), but not as a forecasting tool to identify future trends and drivers, as originally designed. During the process, we made efforts to avoid, and later discuss, the limitations of our approach. Panel recruitment bias, poor specification of questions/tasks by the moderator, high rates of panel attrition, problematic consensus where it is unclear what actually constitutes consensus, and "specious consensus," where panelists conform out of attrition, are known weaknesses

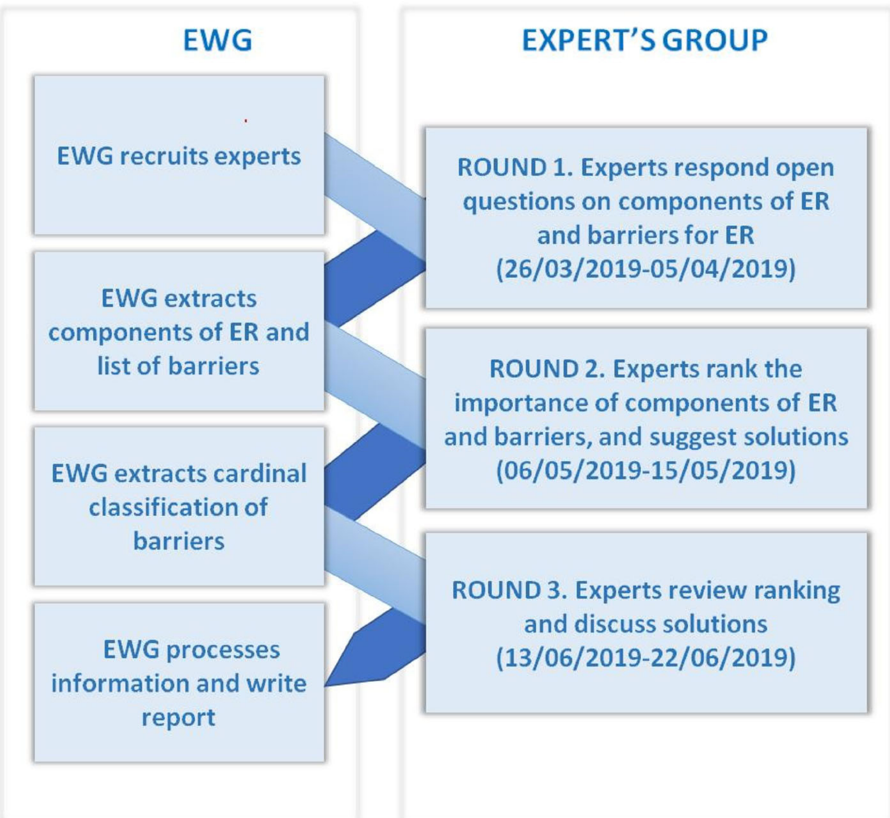


Figure 1. Workflow describing the successive steps of the Delphi process and the involvement of the EKLIPSE Working Group (EWG) and the experts' group. ER, Effective ecological restoration.

(Rowe & Wright 1999; Garrod & Fyall 2005; Bloor & Wood 2006).

In this study, the Delphi process was used to understand what is effective ER, what hampers effectiveness, and to create a ranked list of components of effective ER. This followed the usual Delphi procedure of surveying anonymous participants on a series of questions and providing opportunities for experts to revise their answers in light of fellow participants' responses.

Participant Recruitment

The EWG categorized expert participants according to their engagement in ER, and their specialist ER land cover type. Engagement was in one or more of the following areas: (1) policy and governance, (2) science, education, and research, (3) technical biophysical aspects of restoration practice, (4) participatory processes and social interaction, and (5) users that were not involved in any of the previous activities. Land cover types were modified from Corine Land Cover Classes to include the type of degradation, and the array of methodologies used to perform ER. Land cover types were characterized by their use of specific scientific and local knowledge, their values, and their rules (sensu Ravetz 1999; Colloff et al. 2017; EFTEC et al. 2017). The EWG identified eight land cover types: (1) forest-scrubland-grassland, (2) rivers and wetlands, (3) agricultural systems, (4) pastures, (5) mining-industrial areas, (6) urban environments and civil works, (7) coastal-marine environments, and (8) Arctic and alpine areas (Table S1). EWG members then identified experts across as many approaches and land cover types as possible, distributed across as many European countries as possible. The assistance of various organizations was requested in this phase (Table S2). We considered experts as people with considerable knowledge or skills in ER, and we drew upon both practitioner and academic expertise (Grundmann 2017).

The final list of targeted experts numbered 145 individuals, 141 from 18 European countries, and four from countries outside Europe with experience in restoration in the European context. Despite our efforts, certain regions and countries were under-represented (e.g. Eastern European countries, including the Baltic countries). Most experts focused on several approaches and land cover types (Tables S3 and S4). The majority worked on the restoration of continental aquatic environments (rivers and wetlands, 50%) and forests (36%). Only 1% focused on Arctic and Alpine restoration. Experts worked for a wide range of organizations, including foundations, universities, public, private. and public-private companies, European, national, and sub-national governmental agencies, non-governmental organizations, research centers, and others. The number of males and females in the group was 91 and 54, respectively.

Consultation Process

The consultation process was designed to elicit European restoration experts' knowledge to, first, agree on a common definition of effective ER (Supplement S1), and, second, create and rank a list of barriers for the implementation of effective restoration in the European context. The consultation was carried out through a Delphi process, based on a structured, anonymous, and iterative survey sent to experts in restoration (Mukherjee et al. 2015; Fig. 1). The Delphi process was managed electronically through the SurveyMonkey platform. In each of the three consultation rounds, experts were invited by email with 5–7 days to answer, and one reminder was sent with a few days' extension to encourage participation. The whole consultation process lasted 3 months, from 26 March 2019 to 22 June 2019. Although responses to the surveys were anonymous, participants were asked to describe their involvement in ecological restoration by identifying the type of organization they worked for, the type of restoration with which they were most familiar, the country of origin and work, and the duration of their involvement in ER.

Round 1 began with a set of open-ended questions, prepared by the EWG members, to extract participants' opinions on the components of, and barriers to, effective ER, and knowledge gaps for the application of effective ER (Supplement S1). The definition of ER provided to experts in the Delphi process was "any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state," while a barrier was defined as "something which significantly hampers the process of restoration." We analyzed the participants' responses in this round of the Delphi process by qualitative inductive content analysis, by grouping and categorizing the responses to clusters (Hsieh & Shannon 2005; Elo & Kyngäs 2008), which were then used in the second round. Clusters were given explanatory titles and represented barriers to ecological restoration that were synthesized from responses to open questions. We used Atlas.ti software in this phase of the study to explore the large amount of information obtained (Muhr 2004). Atlas.ti is an assisted qualitative data analysis software, with a complex inter-connected, hypertext structure, that operates in a visual and spatial medium with data and software functions intuitively organized in pictorial form. It has been widely used in qualitative data analysis of environmental issues, including ecological restoration (Hodge & Adams 2016; Park et al. 2018). The resulting lists of components and barriers were then refined and classified, after iterative discussions among EWG members to reach consensus on the final list of barriers to be ranked. This step was considered necessary to reach a compromise between the needs to avoid EWG bias in the interpretation of experts' responses, and the need to reduce the initial long list of barriers to the minimum possible number that preserved distinct information, and minimized expected participant fatigue.

In Round 2, experts were asked to rate the importance of the different components of, and barriers to, effective ER identified in the previous step, using a 7-point Likert scale and a 5-point Likert scale, respectively (Supplement S2). By reducing the number of options in the Likert scale for ER barriers to 5, we aimed to reduce the probability of participant attrition, given the relatively large number of barriers to be ranked. Boxes allowed experts to comment on their rating. Finally, we asked experts to suggest solutions to address the major barriers that they had previously identified.

Round 3 followed a similar procedure to Round 2. Experts who participated in Round 2 were informed of the results of this round (assessment of the importance of each barrier, showing the results on Likert scales and experts' comments). They were asked to again rate the barriers using the same Likert scale as in Round 2, and to explain the reasons for their rating. They were then asked to provide specific solutions for the three top barriers identified in Round 2, or to any other barrier that they perceived as important (Supplement S3). Experts who did not participate in Round 2 were asked to describe their involvement in ER, and then directed towards the last section of the survey, where they were asked about possible solutions.

It must be noted that the facilitators of the consulting process (the EWG) worked together throughout the whole process. Different options for the design of the experimental procedure, as well as the analysis of experts' responses, were discussed by the EWG through regular online meetings, until consensus was reached. Questions included in the first questionnaire of the Delphi process were open, and in each round of the process, participants had access to the results of previous rounds.

Normalizing the Scores

We normalized the data obtained in Rounds 2 and 3 by considering the Likert scale as an interval scale. This step was taken to represent the weight of each component and barrier as a single value and facilitate the comparison between different components and barriers. The limitations of the Delphi process were considered and thus the need to analyze the results taking into account potential errors generated by this method (Jamieson 2003, Wu & Leung 2017; see below). Thus, the frequency of responses in Round 2 was used to estimate the weight that the experts allocated to each component of effective ER following the procedure:

(1) Likert score of each response option. Responses were provided on a Likert scale ranging from 1 to 7, where 1 = Strongly disagree, 2 = Somewhat disagree, 3 = Slightly disagree, 4 = Neither agree nor disagree, 5 = Slightly agree, 6 = Somewhat agree, and 7 = Strongly agree.
(2) Total weight of each question. For a given question, the frequency of each response option was multiplied by its Likert score, and then we summed these values to obtain the total weight of each question. For example, for a question where two experts strongly disagreed and one expert strongly agreed, total weight would be (2*1) + (3*7) = 23.
(3) Maximum possible total score. The maximum possible total score was calculated as the total number of respondents multiplied by the maximum value of the Likert scale response. In the example above, the maximum possible total score equals (5*7) = 35.
(4) Normalized values. The total weight of each question (as calculated in #2) was divided by the maximum possible total score to normalize the values (i.e. 23/35 = 0.66).

The same procedure was applied to weight and normalize the responses to questions on the relative importance of the barriers to effective ecological restoration, but in this case, the Likert scale was 1–5, where 1 = No importance, 2 = Low importance, 3 = Medium importance, 4 = High importance, and 5 = Extreme importance. This was carried out separately for Rounds 2 and 3. A 1–5 scale was used in this case to simplify the procedure and facilitate participants' contributions, as the number of barriers was larger.

A New Conceptual Model of Major Barriers and Their Interactions

By means of iterative design, the EWG generated a new exploratory model of the causal relationships between major barriers to ecological restoration in Europe based on its own expertise and participant' comments.

Results

Profile of the Experts' Group

Seventy-one experts agreed to participate in Round 1 of the Delphi process (49% of the group). Of those, 48 completed the questionnaire related to the components of, and barriers to, effective ER (33% of the group). Experts participating in Round 1 based their activity in 14 European countries (plus 3 experts working in countries outside Europe). The countries with the highest representation were Spain, France, and Ireland (Table 1).

Thirty-three experts (23% of the group) participated in Round 2, of whom 32 completed the survey. Eleven countries were represented, with the most frequent Spain and Ireland, followed by France, Greece, and Norway. Forty-two experts responded to our invitation to Round 3. Of these, 15 had also participated in Round 2 and thus reviewed and re-rated the importance of barriers for effective ER. They were based in eight different countries.

One-third of the participants in Round 1 were employed by academic institutions (Table 2). Sectors with the lowest representation were private and public companies, and NGOs. In Round 2, most experts were employed by academic institutions, other research institutions, and government-associated agencies and public bodies. In Round 3, the number of experts from government agencies and public bodies was similar to that of previous rounds, but they represented almost 50% of the participants. No direct representatives of governments participated in Rounds 2 and 3.

Almost all experts who completed Round 1 focused on more than one land cover type (Table 3). *Restoration of rivers and wetlands* were the most common, and *Coastal and marine systems* the least common. Many of the experts who completed Rounds 2 and 3 focused on *Forests and shrublands* and *Rivers and wetlands*, with *Coastal and marine systems* the least represented.

Technical practice and implementation of ecological restoration by managing biotic and abiotic elements was the main approach used by the experts participating in Round 1 (Table 4). Other common approaches were *Science and education* and *Policy and governance*. Participants in Round 2 showed similar profiles, most of them focusing their work on *Technical practice* and *Science and education*. The pattern was similar in Round 3.

Table 1. Countries represented in the experts' group in Rounds 1, 2, and 3 of the Delphi process. Figures are absolute and relative number of experts per country.

	Round 1		*Round 2*		*Round 3*	
Country	*Number of participants*	*(%)*	*Number of participants*	*(%)*	*Number of participants*	*(%)*
Spain	12	25	8	25	4	27
France	6	13	3	9	1	7
Ireland	6	13	5	16	3	20
Greece	4	8	3	9	3	20
Norway	4	8	3	9	1	7
Finland	3	6	2	6	0	0
Germany	3	6	1	3	1	7
Portugal	2	4	2	6	1	7
UK	2	4	1	3	0	0
Belgium	1	2	0	0	0	0
Hungary	1	2	1	3	1	7
Sweden	1	2	0	0	0	0
Switzerland	1	2	0	0	0	0
Italy	0	0	2	6	0	0
EU	0	0	1	3	0	0
Non-EU	2	4	0	0	0	0
Total	48	100	32	100	15	100

Table 2. Absolute and relative number of experts participating in Rounds 1, 2, and 3 of the Delphi process per type of employer.

Employment	*Round 1* *Number of participants (%)*	*Round 2* *Number of participants (%)*	*Round 3* *Number of participants (%)*
Academic institution, e.g. university	16 (33)	8 (25)	4 (27)
Government-associated agency or public body	7 (15)	7 (22)	7 (47)
Other research institution	6 (13)	7 (22)	1 (7)
Government	6 (13)	0 (0)	0 (0)
Non-governmental organization or charity	5 (11)	4 (13)	1 (7)
Private company	4 (8)	6 (19)	2 (13)
Government-associated company	4 (8)	0 (0)	0 (0)

Table 3. Absolute and relative number of experts participating in Rounds 1, 2, and 3 of the Delphi process, specializing in the restoration of different land cover types.

Land cover type	*Round 1* *Number of participants (%)*	*Round 2* *Number of participants (%)*	*Round 3* *Number of participants (%)*
Rivers or wetlands, including inland water bodies and banks, coastal wetlands, estuaries, tidal plains	25 (28)	21 (29)	8 (25)
Forest and scrub, including natural ungrazed grassland, sand dunes, areas with scarce woody vegetation	14 (16)	19 (26)	6 (19)
Urban and peri-urban areas, including brownfields, land strips along transport and energy infrastructure	12 (13)	6 (8)	2 (6)
Pasture and rangelands, with frequent livestock grazing	12 (13)	7 (10)	6 (19)
Mining or industrial areas, including surrounding affected areas	11 (12)	6 (8)	2 (6)
Agricultural, including arable land, permanent crops, and heterogeneous agricultural areas	8 (9)	8 (11)	4 (13)
Coastal and marine	2 (2)	1 (1)	1 (3)
Arctic and alpine	3 (3)	4 (5)	1 (3)
No specific system	3 (3)	1 (1)	2 (6)

All experts participating in the different rounds of the Delphi process had considerable expertise in ecological restoration. In Round 1, 75% had been involved in restoration activities between 11 and 30 years, and 2% for 31 years or more (Table 5), while only 23% of the experts had less than 10 years' experience. Experts in Rounds 2 and 3 had similar profiles.

Table 4. Approaches to ecological restoration used by experts participating in Rounds 1, 2, and 3 of the Delphi process.

Approaches	*Round 1 Number of participants (%)*	*Round 2 Number of participants (%)*	*Round 3 Number of participants (%)*
Technical practice, implementation of restoration through dealing with biotic and/or abiotic elements but not focused on people	34 (35)	23 (33)	12 (41)
Science and education	27 (28)	20 (29)	8 (28)
Policy or governance	18 (18)	12 (17)	5 (17)
Participatory practice, including environmental education, volunteer coordination and training, facilitating participatory processes, etc.	14 (14)	9 (13)	4(14)
Other concerned user, such as a member of a nature leisure organization, hunters' association, etc.	3 (3)	3 (4)	0 (0)
Other	2 (2)	2 (3)	0 (0)

Table 5. Years of experience in ecological restoration of experts completing Rounds 1, 2 and 3 of the Delphi process.

Years	*Round 1 Number of participants (%)*	*Round 2 Number of participants (%)*	*Round 3 Number of participants (%)*
0–5	4 (8)	1 (3)	1 (7)
6–10	7 (15)	5 (16)	3 (20)
11–20	18 (38)	10 (31)	4 (27)
21–30	18 (38)	16 (50)	7 (47)
+31	1 (2)	0 (0)	0 (0)

Components of Effective Ecological Restoration

Experts identified 10 components of effective ER broadly concerning project goals, knowledge, and techniques needed, degradation drivers, and transfer of results (Table 6). There was general agreement on the importance of the different components of ER. The scores of the different components were all high, ranging from 0.78 to 0.98. Almost all respondents agreed that *Effective restoration aims to enhance ecosystem services, functions, and biodiversity*. In contrast, the components of effective ER considered to be of somewhat lower importance were *Magnitude of the intervention* and *Optimization of cost–benefit and cost-effectiveness*.

Barriers to Effective Ecological Restoration

Identification and classification of barriers described by experts was multifaceted, with 204 barriers submitted initially, representing diverse perspectives. The EWG agreed on a final list of 33 barriers to effective restoration, which summarized the full list, classified into six groups (Table 7). These groups were economics, policy and governance, legal and ownership issues, management, environmental conditions, and socio-cultural aspects.

Ranking the Barriers to Effective Ecological Restoration

Most experts participating in Round 2 considered that nearly all barriers were important to some degree (Fig. 2, Table 7). Participants identified the main barriers for effective ER in the EU to be: *insufficient funding*, *conflicting interests of different stakeholders*, and *low political priority given to restoration*. Most experts considered the latter as extremely important. The 12 most important barriers were of a socio-economic nature. The first ecological barrier, namely a *high level and rate of degradation*, scored 13th. Most barriers related to the availability of knowledge, human resources, and materials, and project goals were considered of relatively lower importance.

Table 6. Standardized weight of the different components of effective ecological restoration conferred by the experts' platform.

Component of effective ecological restoration	*Weight*
Enhance ecosystem services, functions, and biodiversity	0.982
Assists and hastens natural recovery towards self-sustaining systems	0.933
Includes prior assessment, monitoring, and adaptive management	0.929
Tackles degradation factors and assists in deterring further ecosystem degradation	0.906
Is based on sound knowledge of the ecosystem including the soil	0.902
Transfers results to society	0.888
Relies on a solid participatory process and involves landowners	0.875
Considers large temporal and spatial scales (landscape-scale restoration)	0.866
Sets and achieves ambitious goals aligned with legal and socio-economic contexts	0.857
Uses minimum intervention and optimizes cost–benefit and cost-effectiveness	0.781

The weights assigned to the 33 barriers in Round 3 were similar to those of Round 2 (Table 7). Most barriers (24) showed an increase in their ratings between Rounds 2 and 3, while the importance of seven barriers decreased, and the importance of two remained unchanged. *Lack of skilled professionals to perform restoration* (+0.12) and *lack of societal awareness and engagement* (+0.09) were the barriers showing the highest increases, whereas *timing of restoration projects not corresponding to ecological and social timescales* and *lack of motivation in decision-makers to incorporate innovation* showed the largest decreases (−0.08).

Table 7. Importance of the different barriers for effective ecological restoration, obtained as weighted scores in the Delphi process. Barriers with a score higher than 0.75 are shown in bold.

Barrier	Type	Round 2	Round 3
Insufficient funding	Financial	**0.86**	**0.92**
Conflicting interests of different stakeholders	Social-cultural	**0.85**	**0.88**
Low political priority for restoration	Policy and governance	**0.85**	**0.93**
Lack of integrated land use planning	Legal and ownership	**0.83**	**0.87**
Difficulty in obtaining legal or property rights over the area to implement restoration	Legal and ownership	**0.82**	**0.85**
Harmful subsidies favoring degradation	Financial	**0.80**	**0.77**
Lack of collaboration between different stakeholders	Social-cultural	**0.79**	**0.80**
Lack of evaluation, monitoring, and documentation	Management planning, implementation	**0.79**	**0.84**
Lack of appropriate compensation and financial returns on restoration	Financial	**0.79**	**0.77**
Lack of coordination between decision-makers in different domains and administrative departments	Management planning, implementation	**0.77**	**0.79**
Complexity of the legal framework	Legal and ownership	**0.76**	**0.83**
Unsuitable policies and lack of enabling policy instruments	Policy and governance	**0.76**	**0.79**
High level and rate of degradation	Environmental	**0.76**	0.72
Inadequate implementation of current policies	Policy and governance	**0.76**	0.71
The timing of restoration projects does not correspond to ecological and social timescales	Management planning, implementation	**0.76**	0.68
Lack of understanding and collaboration across different aspects of restoration, e.g., ecology, engineering, social sciences, etc.	Social-cultural	0.73	**0.75**
Constraints due to biotic challenges, e.g. concerning species dispersal rates, inter-specific interactions, etc.	Environmental	0.72	0.72
Lack of effective knowledge exchange	Social-cultural	0.72	**0.79**
Lack of motivation in decision-makers to incorporate innovation	Management planning, implementation	0.72	0.64
Lack of prior evaluation, assessment and design	Management planning, implementation	0.71	0.73
Lack of societal awareness and engagement	Social-cultural	0.71	**0.80**
Lack of involvement of the private sector	Management planning, implementation	0.70	0.69
Lack of relevant ecological knowledge and experience	Management planning, implementation	0.68	**0.76**
Perceived complexity of implementing restoration	Legal and ownership	0.68	0.69
Constraints due to abiotic characteristics of the area, e.g. climate, topography, water availability	Environmental	0.68	0.72
Unrealistic or unclear project goals	Management planning, implementation	0.68	0.69
Lack of standards against which progress can be measured	Management planning, implementation	0.67	0.68
Lack of quality plant material (including lack of suitable species and genotypes)	Environmental	0.66	0.67
Lack of skilled professionals to perform restoration	Management planning, implementation	0.65	**0.77**
Lack of knowledge about soils	Management planning, implementation	0.64	0.65
Conflicts between restoration goals, e.g. biodiversity, climate change mitigation, nutrient retention	Environmental	0.63	0.63
Lack of sense of identity, attachment to the landscape	Social-cultural	0.61	0.65
Lack of suitable technology	Management planning, implementation	0.55	0.59

Discussion

Methodological Approach

We targeted a large group of participants for the Delphi process to encompass the views of the diverse ER community in Europe. The composition of the ER community in Europe, in terms of diversity of actors and views, has been previously and thoroughly described (Orsi et al. 2011; EFTEC et al. 2017). The number of participants in Rounds 1 and 2, and their distribution across various land cover types, approaches, and countries ensure representation of a diverse set of perspectives. Yet, we must consider that participants did not constitute a democratic representation of society. Thus, there was a substantial male gender bias in the number of experts, which may have affected

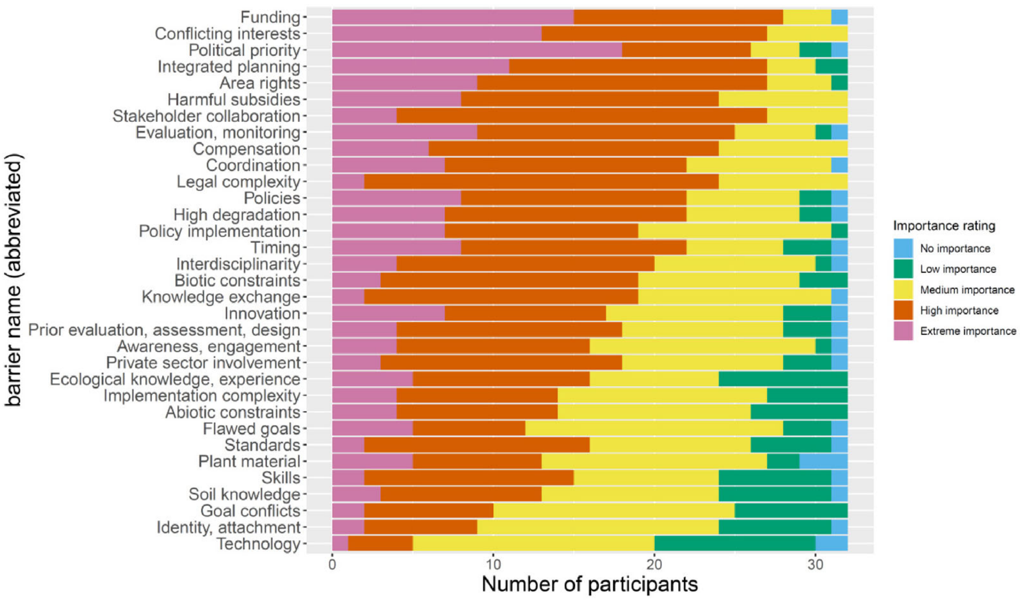


Figure 2. Participant importance ratings of different barriers for effective ecological restoration, based on Round 2 of the Delphi process. The number of respondents to all questions was 32. Barriers are arranged in decreasing order of weighted score (see Table 7).

our results (Sijapati Basnett et al. 2017). Most participants had been involved in ER for a long time, which reflects the methodological approach used, and ensures broad experience in this field. Low representation from some land cover types (coastal and marine habitats), approaches (government), and areas (e.g. Eastern Europe) may be an artifact of the sampling procedure, but may also reflect late adoption of the concept of ER. This may represent an additional barrier for the progress of ER, although this was not mentioned in the Delphi process.

The number of participants in Round 3 that also participated in Round 2 was relatively low, thus reducing the number of experts that re-considered barrier ranking. It was not possible to carry out the analysis of individual changes in barrier scores as complete anonymity was kept in all rounds. Thus, no statistical analysis of the consensus between subsequent rounds was possible. Yet, similarity in the results obtained in Rounds 2 and 3 and experts' comments in Round 3 suggest a high level of agreement between participating experts. The fact that the Delphi process was used to analyze past events, and not as a forecasting tool, may have reduced uncertainty and contributed to agreement.

The composition of the Delphi expert group and resource constraints prohibited in-person meetings and limited the ability to analyze the results segregated by land cover type, approach, or geographic scope. It also restricted the number of interaction rounds, although 2–3 rounds are common in experimental studies using this technique (Rowe & Wright 1999; Habibi et al. 2014). We recommend that detailed analyses are carried out separately for different land cover types, countries, and regions, for example, combining Delphi with regional workshops. This could increase accuracy in identifying barriers and corresponding solutions at national and sub-national levels, by overcoming other factors, such as language barriers.

The possibility that experts failed to identify barriers that are not easily perceived in their daily practice must also be considered. For example, failure to consider the *lack of quality plant material* (including lack of suitable species and genotypes) as a major barrier may reflect the lack of knowledge on wild species seed zones and/or lack of regulations for the use of local species and genotypes in many European countries, rather than confidence in the availability of local materials (Thomas et al. 2014; Abbandonato et al. 2018; Cross et al. 2020). Similarly, the *lack of sense of identity and attachment to the landscape* was considered of lesser importance, while it may underlie other barriers and stakeholder perception of ecological restoration (Couix & Gonzalo-Turpin 2015; Verbrugge & Van den Born 2018), and may be hidden by them. Finally, the *lack of societal awareness and engagement*, which was considered of relatively low importance, may be at the basis of *low political priority of restoration*, the third most important barrier, as societal awareness can be a major driver of environmental policies (Anderson et al. 2017), although other factors, such as opportunity structure and political commitment, are also important in shaping uptake (Meyer & Minkoff 2004).

Components of Effective ER

The EU ecological restoration community is highly diverse, representing involvement in restoration across a wide range of land cover types, approaches, and geographic scopes. This in turn leads to a diversity of views among ER practitioners. Yet, agreement on the components of effective ER was unanimous, reflecting consensus on a comprehensive approach to ER, where the 10 components were all highly valued, and thus far from the narrow interpretation of ER as the recovery of historical reference ecosystems (Dufour & Piégay 2009). It is worth emphasizing that the three most valued components describe effective ER as a process that aims at enhancing biodiversity and ecosystem functions and services by assisting and hastening natural recovery towards self-sustaining systems; a process that is based on prior assessment, monitoring, and adaptive management. The 10 components of effective ER identified here call for a comprehensive approach based on sound and integrative knowledge of all socio-ecological components and dynamics and framed by the iterative loops that characterize adaptive management. These components are similar to the so-called "attributes of restored ecosystems" identified by the Society for Ecological Restoration (SER) and other standards of ecological restoration, particularly those integrating social systems (Hernández 2013; Standards Reference Group SERA 2017; Gann et al. 2019).

Major Barriers to the Progress of ER in Europe

A large and diverse set of barriers were identified by the European experts through the Delphi process, which is in agreement with previous assessments of the constraints on ecosystem restoration in Europe, and the constraints on the maintenance and restoration of the Favorable Conservation Status of many European habitats and species (Milieu et al. 2016; EFTEC et al. 2017). Barriers can be grouped into six categories: financial constraints, environmental constraints, legal, and ownership issues, management planning and implementation, policy and governance constraints, and the socio-cultural context. Despite the high level of consensus, experts showed some differences in their valuation of the importance of the barriers. A group of interrelated barriers namely *insufficient funding*, *conflicting interests of different stakeholders,* and *low political priority for restoration* were all rated close to 0.9. Conversely, others like *lack of knowledge about soils*, *conflicts between restoration goals*, *lack of a sense of identity attachment to the landscape* and, particularly, *lack of suitable technology* were below 0.65. The large number of barriers, and the relatively high weight given to many, may have contributed to the slow progress towards identifying and overcoming these barriers. A deeper analysis of the hierarchy of barriers or the causal relationships between them could help identify fundamental barriers and concentrate efforts on their solution.

Of the ecological constraints, *high level and rate of degradation* (with a Round 2 weight of 0.76) and *biotic constraints* (0.72) were the most important. Ecological constraints to restoration are well documented in the literature, including climatic limitations, altered geo- and hydromorphology, soil degradation, biological invasions, and lack of adequate seeds and seedlings (Richardson et al. 2007; Cortina et al. 2011; Pedersen et al. 2014; Costantini et al. 2016; Abbandonato et al. 2018). Interestingly, explicit mentions of climate change were scarce, and they mostly referred to ER potential to aid adaptation. Only one participant considered climate change as a barrier to ER, considering the barrier together with other abiotic constraints. It is worth noting that the 12 barriers with the highest weights were not related to ecological constraints. Other studies have emphasized the importance of socio-economic, management and governance barriers. Thus, EFTEC et al. (2017) found that 5 types of constraints were most frequently mentioned by experts, and concerned: limited awareness of regulatory authorities and sector bodies about ER, sector adaptability, funding shortages and underutilization of allocated funds, and poor land-use planning and development. These largely coincide with the main barriers identified in our study. The lesser significance of environmental barriers may not reflect a failure to recognize the importance of such challenges for ER, including abiotic constraints, the assemblage of complex communities, and their interactions, as well as the integration of landscape-scale processes into ER projects (Harris et al. 2006; Pocock et al. 2012; Ockendon et al. 2018). Instead, this finding should be interpreted in terms of priorities: no further progress can be achieved in ER in Europe unless the top barriers are addressed.

Inefficient use of financial resources (as insufficient funding, environmentally harmful subsidies, and lack of appropriate compensation and financial returns for ecological restoration actions) is widely recognized as a major constraint for ER in Europe (Tucker et al. 2013; Gantioler et al. 2014; Sewell et al. 2016). Costs are associated directly with restoration actions, but also indirectly with actions that relieve pressure on ecosystems, as they may reduce incomes in the form of opportunity costs and unused subsidies. As most restoration benefits take the form of public goods and services, public funding, together with private funding in regulated sectors, have been the major sources of funds to finance restoration (BenDor et al. 2014; EFTEC et al. 2017). The European Commission and the Member States currently promote restoration projects linked to the implementation of existing legislation, such as the Birds and Habitats Directives, the Water Framework Directive, the Marine Strategy Framework Directive, the Nitrates Directive, the Environmental Impact Assessment Directive, the Strategic Environmental Assessment Directive and the Environmental Liability Directive. At the EU level, the main sources of public investment in restoration are the LIFE program, the European Maritime and Fisheries Fund, and to a lesser extent, the Natural Capital Financing Facility (NCFF), for loans and equity investments for revenue-generating or cost-saving pilot projects promoting the preservation of natural capital. The LIFE program (https://ec.europa.eu/easme/en/life), with a 3.4 billion EUR budget for 2014–2020 has funded 3,453 projects dealing with reforestation, renaturation, restoration measures, or site rehabilitation between 1998 and 2018 (https://ec.europa.eu/easme/en/life). Additional public funding for restoration projects come from EU Structural and Cohesion Funds, particularly the European Regional Development Fund and Pillar 2 of the Common Agricultural Policy, which may be considered a payment for ecosystem services schemes (Pe'Er et al. 2019). The experts in our study also suggested the implementation of tax-deduction measures for private investments in ER as a way to provide financial support to such projects (see Box 1 for a complete list of solutions suggested by the experts group to overcome barriers for effective ER).

Conversely, experts participating in the Delphi process also identified environmentally harmful subsidies from the EU and the Member States as a major barrier to ER. Environmentally harmful subsidies cover a wide range of policy areas, including

Box 1 Suggested measures to foster the advance of ecological restoration in Europe. Key recommendations forwarded by experts, and sketched and grouped by the EWG.

1. Resourcing and incentives

1.1. Ensure restoration is adequately resourced with funding and skills adequate to address socio-ecological complexity and to provide for ecosystem-oriented implementation, science-based knowledge, evaluation, monitoring, restoration techniques and technology. This may be achieved by integrating ecological restoration into major European Union funding programs (e.g. 2021–2027 Multiannual Financial Framework, CAP, Structural Funds), engaging major private stakeholders in sectors such as energy, food, and environment, implementing tax deductions and payment for ecosystem services, engaging developers to set aside funds for ecological restoration as a compensation for the use of land and resources, and promoting high-level public-private partnerships.

1.2. Seek to design incentives that recognize the value of natural capital and the benefits of nature-based solutions.

2. Policy

2.1. Formulate clear policy goals incorporating ecological, social, and economic needs in order to raise the political priority of restoration while integrating regulatory and compliance mechanisms.

2.2. Enhance policies and political commitment by: (i) analyzing current policies concerning ecological restoration, (ii) identifying lacking and unsustainable policies, (iii) identifying harmful subsidies that favor degradation, (iv) defining the legal framework with specific legalities linked to restoration, and (v) simplifying and clarifying the chain of responsibility, authority, and accountability.

2.3. Develop and implement national and regional frameworks to promote restoration and green infrastructure.

2.4. Bring disconnected policies together, with restoration of natural capital and ecosystem services as a linking mechanism. Seek synergies and design "policy mixes" that combine incentives, regulation and participatory practices to enhance motivation for restoration, interlinking ecological, social, and economic needs.

2.5. Integrate restoration into land use planning to ensure that restoration actions are linked to supporting ecosystems. This includes recognition of the value of Natural Capital in strategic environmental assessment and land use and spatial planning, implemented through planning permissions and other measures.

2.6. Implement holistic governance structures including the design of governance instruments and policies that maintain the sustainability of socio-ecological systems.

2.7. Enhance coordination to boost implementation of high-level restoration goals at transnational, national, and local level.

3. Society

3.1. Incorporate stakeholder engagement, participatory processes, and collaboration throughout the planning, design, and implementation of the restoration process. This will ensure that restoration is not compromised by competing objectives. The consideration of property rights is a key example.

3.2. Consider the socio-economic and cultural context of the landscape and ecosystems to be restored, incorporating interdisciplinary and transdisciplinary approaches to understand restoration constraints linked to wider societal factors.

3.3. Create conditions for knowledge exchange platforms and mechanisms for communicating, implementing, and demonstrating best practices, while recognizing and respecting legitimately diverse stakeholders, including landowners. This must incorporate appropriate mechanisms for building effective working relationships based on rapport.

3.4. Promote ecological restoration in all areas, including urban areas, and link ecological restoration with rural development programs and across a variety of sectors.

3.5. Highlight the contributions of restoration to ecosystem services and illustrate how they benefit society.

3.6. Develop and implement transdisciplinary socio-ecological restoration projects incorporating political decision-makers and all relevant stakeholders.

4. Knowledge

4.1. Apply principles of adaptive co-management including comprehensive site pre-restoration baseline measures and ongoing monitoring of ecological, social and economic effectiveness of actions.

4.2. Recognize the ecological and social complexities of the restoration site and processes involved across different spatial and temporal scales.

3.4. Facilitate knowledge production and use in areas identified as the most limiting for the success of ecological restoration such as: (a) biotic factors (provenance of restoration materials including species and intraspecific genetic diversity, community assembly processes, species interactions, ecosystem structure and functioning, invasive species, and landscape-scale processes), (b) soil processes, (c) historical land-use, (d) temporal and spatial scales of restoration, (e) social integration.

3.5. Consider experience-based, practice-based, local knowledge and stakeholders' knowledge as legitimate in addition to scientific knowledge, to gain more holistic views on restoration and the factors underlying its successes and failures.

3.6. Develop flexible standards for the practice of ecological restoration that can be adapted to different situations, to be revised periodically, including evaluation and monitoring protocols, while documenting restoration projects and supporting adaptive management.

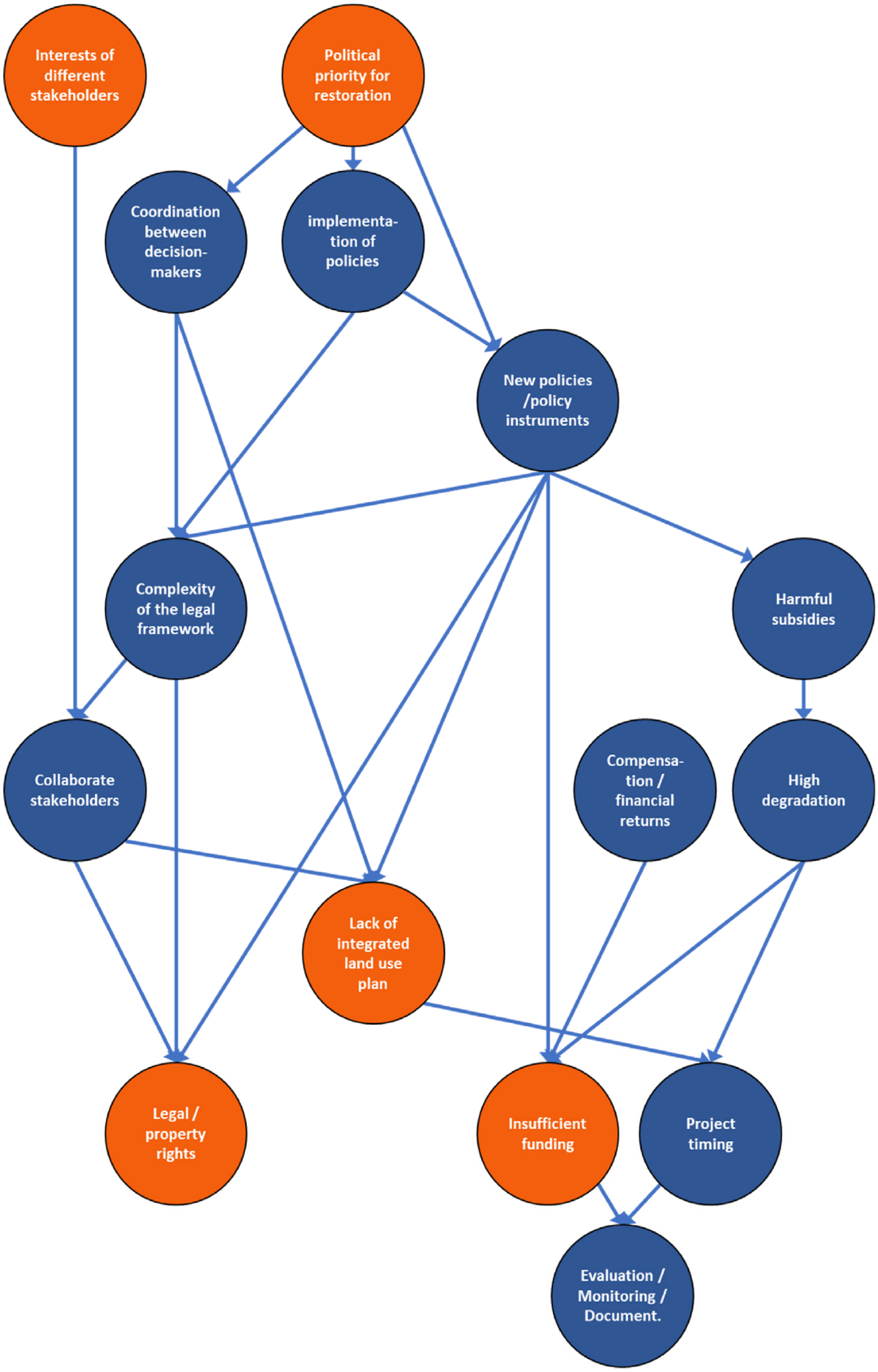
climate change and energy, fisheries, agriculture, forestry, the production of materials, transport, waste, and water (Withana et al. 2012), affecting nature in many ways (Wichmann et al. 2016; Le Manach et al. 2019; Pe'Er et al. 2019; Quiroga et al. 2019; Rey et al. 2019). In Germany, the costs of subsidies to energy, transport, construction, housing, agriculture, forestry, and fisheries with harmful effects on the environment have been estimated at 57 billion EUR in 2012 (Berg et al. 2010), thus, much larger than the contribution of the LIFE program mentioned above. Harmful effects of EC subsidies on the environment have been extensively discussed, and they will be a major priority in the proposed European New Green Deal (Withana et al. 2012; Von der Leyen 2019).

Private sources of funding for restoration, either direct or through regulatory policies, are diverse, and will likely increase in diversity and magnitude in the future (Viszlai et al. 2016; Illes et al. 2017). Private engagement could be encouraged through public–private partnerships and engaging developers to set aside funds for ER as a compensation for the use of land and resources, and activities developed under corporate social responsibility programs (Blignaut & Van der Elst 2014; EFTEC et al. 2017; Weber & Saunders-Hogberg 2018; Box 1). Of those, product labeling and forest certification have shown great potential to protect nature and promote ER (Gómez-Zamalloa et al. 2011; Dias et al. 2015; Clément & Malaval 2019). Private funds could also be generated for public investment in restoration through enhanced use of compensation mechanisms (as for transport infrastructures and mining activities), and payments for ecosystem services (Viszlai et al. 2016; Salzman et al. 2018). Private investment will be critically dependent upon whether ER can be turned into a profitable investment, which in turn would require further research into regulatory, including land use planning, and other barriers to realizing investment opportunities. Private companies could also gain "advertising value" by displaying their green credentials through investment, which, in turn, would be dependent upon, but could also contribute to, enhancing the societal recognition of the value of restoration. This opens opportunity for product labeling and certification, and the development of bio-carbon markets. Finally, increased emphasis on the economic returns from investments in ER could stimulate public and private funding. The Nature Fitness Check, for instance, showed that the benefits of Nature 2000 are valued at between €200 and 300 billion per year (Milieu et al. 2016). Similarly, in a regional assessment of the potential for wetland restoration in Flanders, it was calculated that the benefits outperformed the costs (Decleer et al. 2016).

Participants believed that conflicting interests and lack of collaboration between different stakeholders may be also responsible for the slow progress of ER in Europe. Experts mentioned that these barriers may indeed derive from the lack of communication between stakeholders, and differences in appreciation of nature across stakeholder groups. However, the literature points to a complex array of factors shaping conflict. Conflicts often involve the reduction in the supply of provisioning services resulting from restoration actions, and thus they mostly concern impacts of restoration on commercial use of natural resources in agriculture, forestry, and fisheries (Flávio et al. 2017; Kärvemo et al. 2017; Buitenhuis & Dieperink 2019). Conflicts also reflect disagreements between stakeholders' groups prioritizing a set of ecosystem services that are different from provisioning services (Trabucco et al. 2008; Drenthen 2009), and social distress resulting from disservices brought by restoration actions (Lyytimäki et al. 2008; Handel 2016; Arsénio et al. 2020). Place attachment also plays a key role and thus attitudes to restoration can be shaped by whether or not restoration activities disrupt a community's sense of place, identity, and use (Baker et al. 2014). Recently, increased emphasis on the use of ecological restoration to mitigate climate change has been challenged by warnings over the negative impact of large-scale tree plantation on the supply of other ecosystem services and the sustainability of non-forested habitats and landscapes (Bastin et al. 2019; Temperton et al. 2019; Veldman et al. 2019). Conflicts may sometimes arise from disagreements in the definition of ER and its priorities and the identification of target ecosystems (Hodge & Adams 2016; Nogués-Bravo et al. 2016).

Despite efforts of EU Member States to implement Action 6a of the EU Biodiversity Strategy to 2020, overall, expert perception is that ER has not been a political priority so far, decision-makers have failed to coordinate efforts towards achieving Aichi Target 15, current policies are unsuitable or lack enabling policy instruments, and the legal framework is too complex. As previously mentioned, Member States decided that priorities for ER should be defined at a national level (EC 2015). This decision, although not explicitly mentioned by the experts, was probably derived from (i) the prevalence of subsidiarity over integration, (ii) the absence of extra funds for ER, and (iiI) the lack of sanctions for non-compliance. This raises the need for further research into why Member States wish to retain this competence at the national level—research that might reveal other barriers to effective restoration actions operating at lower scales. Experts' concerns on the excessive complexity of the legal framework is somewhat surprising, as the fitness check of Nature Directives showed that they are fitted for purpose (Milieu et al. 2016). Furthermore, estimates of the rate of restoration show that restoration efforts are poorly reported and are well below what is needed to achieve Action 6a target (EFTEC et al. 2017). It may be argued that the restoration of 15% of degraded ecosystems is a complex and very ambitious goal (Egoh et al. 2014; Egoh et al. 2015; Kotiaho & Moilanen 2015). However, it must be noted that recent restoration rates in Europe are indeed an order of magnitude below what is needed to comply with the nature firectives (EFTEC et al. 2017). Failure to achieve the Action 6a target occurred despite the existence of a comprehensive legal framework, which endorses the management of protected and unprotected areas (e.g. Habitats and Birds Directives, Water Framework Directive, Marine Strategy Framework Directive, National Emissions Ceiling Directive; see national reports to the Convention on Biological Diversity at the CBD clearing house, https://chm.cbd.int/search/reporting-map?filter=AICHI-TARGET-01; Milieu et al. 2016). The slow progress in prioritization of ER in Europe must be framed in the context of a wider failure to comply with biodiversity policies, which is not limited to Europe (Tittensor et al. 2014). Despite being a relatively highly regulated,

Box 2 Proposed model to explain causal relationships between the 15 major barriers for the implementation of effective ER in Europe. The five top barriers are colored in orange.



institutionalized, and developed policy field, EU environmental legislation, including the Nature Directives, suffers from a persistent implementation deficit. The causes of this implementation deficit have been put down to a number of factors, including the lack of effective governance of legislation, lack of appropriate institutional framework, failure in policy coherence and coordination, weaknesses in the application of legal and non-legal instruments, limited engaging with non-governmental stakeholders, lack of adequate levels of knowledge and skills, and failures in the development of strategic plans (EC 2017). Further investigation of these factors, as they apply to restoration, is urgently required.

In the present study, experts emphasized the lack of inclusion of ER projects into integrated land-use planning. On the one hand, the theory and practice of ER has traditionally focused on species and ecosystems, failing to integrate higher spatial scales, commensurate with environmental problems (Ockendon et al. 2018), and eventually failing to address the root causes of degradation (Beechie et al. 2010), or understand the impacts of degradation (Willemen et al. 2020). On the other hand, land-use planning has paid scarce attention to the potential of ER to enhance landscape-scale biodiversity and the provision of ecosystem services. Recently developed tools to integrate ER into land-use planning (Budiharta et al. 2016; Cortina et al. 2017; Metzger et al. 2017; Strassburg et al. 2019), and claims to integrate multiple spatial and temporal scales in restoration governance (Sapkota et al. 2018; Mansourian & Sgard 2019), may help to fill this gap.

A New Model of the Interactions Between Major Barriers

Major barriers concerned the domains of economy, policy, and governance. We may infer the causal relationships between the 15 major barriers with weight above 0.75 as illustrated in Box 2. According to this network of interactions, an increased political commitment in the EU and the Member States should (i) adopt and enforce legal obligations concerning nature protection and restoration, (ii) identify lacking and unsuitable policies, (iii) support and coordinate the efforts of decision-makers at European, national, and sub-national levels, (iv) stop environmentally harmful subsidies, (v) facilitate collaboration between different stakeholders, avoiding conflicts derived from property rights, (vi) foster the integration of restoration projects into land and water management plans and land-use planning, and (vii) ensure that restoration projects match ecological timing, are adequately documented to facilitate knowledge production and use, and include comprehensive evaluation and monitoring programs facilitating adaptive management practices. To achieve these goals, financial resources allocated to ER must be substantially scaled-up across organizational domains. Furthermore, the EWG considered that there was an overarching constraint, namely the lack of societal awareness of restoration and the lack of support for investments in restoration, especially in economically difficult times. Targeted campaigns for mainstreaming the importance of restoration, ecosystem services, and biodiversity into relevant sectoral and cross-sectoral policies at all levels, and ambitious education and training programs are needed to inform the public and generate social support for policy measures. A detailed analysis of hierarchical or causal relations between barriers is urgently needed to confirm our exploratory model, identify the root causes of the slow progress of ER in this region, and design specific solutions.

Implications for the European Biodiversity Strategy for 2030

The EU Biodiversity Strategy for 2030 aims at effectively addressing the biodiversity and climate crisis by providing ambitious targets and mechanisms to protect and restore nature, and enable transformative change in crucial policy sectors such as agriculture, fisheries, and forestry. It addresses some of the major barriers identified in the present study. Thus, under the Biodiversity Strategy for 2030, at least 30% of the EU land and sea will be protected and managed for nature by 2030, with strong emphasis on building ecological corridors between Natura 2000 sites (the largest network of protected areas worldwide) and nationally designated areas. By the end of 2021, binding EU nature restoration targets will be defined in the EU Restoration Plan, including targets for ecosystems, species (including pollinators and invasive alien species), soils, agriculture, fisheries, forestry, river management, and the urban environment, with particular attention paid to their potential to capture and store carbon, to prevent and reduce the impact of natural disasters, and to adapt to climate change effects. Prior to the adoption, the Plan will be subjected to an impact assessment and public consultation, which will offer the opportunity to verify whether sufficient tools and mechanisms are provided that address the major barriers for restoration. The impact assessment will also look at the possibility of an EU-wide methodology to map, assess, and achieve the targets for nature and nature-based solutions. To enable transformative change at both EU and Member State levels, and responding to related claims made by participants in the Delphi process, a new governance framework will be installed, providing a clear roadmap with milestones to implement obligations and commitments for the EU and Member States. In addition, the new governance framework aims to foster co-responsibility and accountability by all relevant actors, to provide a monitoring framework with a clear set of indicators and a mechanism for progress review and corrective action if needed, to integrate the targets with other policy areas and governance levels, to promote transparent and participatory stakeholder dialogue, and to strengthen administrative capacity for implementation. Furthermore, the governance framework is designed to help unlock financing as part of the Member State multi-annual budget planning in prioritized action frameworks, with business engagement, knowledge gathering (e.g. Horizon Europe and a European Biodiversity Partnership), education, and promotion. Finally, an assessment to measure the progress of the Biodiversity Strategy, planned in 2024, will provide an additional opportunity to evaluate the persistence of major implementation barriers as identified in this study.

The progress of ER in Europe has been too slow to achieve international goals implemented via the Nature Directives. Identifying and overcoming barriers to ER has a key role to play in supporting the effectiveness of the EU Biodiversity Strategy for 2030 and enhance Member States' strategies for effective ER. The European restoration community shares a common view on what is ecological restoration. There is also a high level of consensus among European experts on the main barriers to implementing ER. Ensuring that the Nature Directives are implemented, developing specific policies for ecological restoration, ear-marking funds for ecological restoration programs, aligning subsidies to the implementation of sustainable management measures in different sectors, and facilitating participatory restoration are among the measures that could help achieve the aims of ER efforts in Europe. Our study represents a significant step to identify the underlying causes of the slow progress towards achieving Target 2 of the EU Biodiversity Strategy to 2020 and contributes to an effective implementation of the Nature Restoration Plan under EU Biodiversity Strategy for 2030.

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Supporting Information

The following information may be found in the online version of this article:

Table S1. Labels used to define the profiles of the experts participating in the consulting process.
Table S2. List of organizations collaborating in the recruitment of experts.
Table S3. Absolute and relative number of experts using the different approaches to ecological restoration.
Table S4. Absolute and relative number of experts working on different land cover types.
Supplement S1. Questionnaire used in Round 1 of the Delphi process.
Supplement S2. Questionnaire used in Round 2 of the Delphi process.
Supplement S3. Questionnaire used in Round 3 of the Delphi process.

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