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## : Forest genetic resources and forest reproductive material at the cross-section of multiple policy domains in Europe

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## ■ ABSTRACT

Conservation, management, and use of Forest Genetic Resources (FGR) and their related forest reproductive materials (FRM) are of key importance for fostering the resilience of forest ecosystems. FGR and FRM issues in Europe are facing several gaps related to their integration in policies, improper policy instruments, insufficient financing, siloed knowledge, uneven policy implementation, and limited monitoring. While FGR are increasingly acknowledged as an integral part of biodiversity, embedding them under this wider concept may lead to poor recognition of the relevance and specificities of FGR, and the exclusion of FRM specificities. Within the 5-years Horizon Europe project OptFORESTS, we aim to identify policy gaps pertaining to FGR and FRM and what leverage points to use to overcome them. As a first goal, we intend to explore how FGR and FRM are addressed by current European policies, by analysing domains that directly and indirectly influence FGR. Our preliminary results indicate that there are at least five relevant policy domains to consider, thus broadening the traditional, “siloed” approach that typically focuses on forest policy. To identify leverages for unlocking the potential of FGR and FRM for a more resilient environment and society, we propose a four-partite division of the policies based on their relation to FGR, thus providing a better understanding of what policies will be key for future actions.

## ■ KEYWORDS

**Forest genetic diversity, forest biodiversity, sustainable forest management, policy gap analysis, FGR, FRM**

## ■ 1 FOREST GENETIC RESOURCES AND FOREST REPRODUCTIVE MATERIAL IN EUROPE

Forest genetic resources (FGR) are the heritable materials maintained within and among tree and other woody plant species that are of actual or potential economic, environmental, scientific, or societal value (FAO, 2014). They include the genetic diversity inherent in seeds, standing trees, and entire forests, within and between species and populations (EUFORGEN, 2021). FGR allow forest tree species to adapt and evolve over time and in space, making the basis of forest biodiversity at the genetic, species, and ecosystem levels. As such, FGR play a key role in the long-term survival of a species and the stability of forest ecosystems, providing the basis for tree growth, adaptation, and evolution and underpinning a wide range of ecosystem services, such as wood production, carbon sequestration, and water regulation (FAO, 2014; EUFORGEN, 2021).

There are between 120 and 200 major forest tree species in Europe of which about 100 are partially conserved in about 3500 genetic conservation units with 4000 populations (<http://portal.eufgis.org>). Selection of suitable genetic resources through selection and breeding programs is vital for producing Forest Reproductive Material (FRM) - seeds, plants, and parts of plants of tree species - which is used in forestry to establish and regenerate forests (EUFORGEN, 2021; European Commission, 2023a). In turn, ensuring proper FRM is vital for safeguarding sufficient genetic diversity and sustainable management of future forests. Thus, both FGR and FRM are essential components of forest ecosystems and are

“valuable for present or future human use, and thus an invaluable asset and a cornerstone of sustainable forest management” (de Vries et al., 2015, p.v).

To ensure sustainable conservation, management and use of FGR, and their FRM, various initiatives and actions have been taken over the course of time, at the international, national and regional levels. These include the development of frameworks and policies that specifically address FGR conservation and management, such as the Pan-European strategy for genetic conservation of forest trees, and the establishment of a core network of dynamic conservation units (de Vries et al., 2015), as well as Forest Genetic Resources Strategy for Europe (EUFORGEN, 2021). Certain efforts are also made to improve the integration of FGR considerations into existing policies and frameworks related to forest management, biodiversity conservation, and climate change mitigation, such as the EU Biodiversity Strategy (European Commission, 2020).

Recent studies show that considerable time and effort are made in developing and testing forest genetic indicators as part of Sustainable Forest Management (SFM) criteria and indicators processes and forest certification schemes (Graudal et al., 2020). Recently, Lefèvre et al. (2020) proposed an indicator to monitor the status and the changes in FGR in Europe, which was adopted by the Forest Europe Process in 2021 in its Bratislava Ministerial Declaration (Forest Europe, 2021). In addition, Hoban et al. (2021) point out that genetic diversity (including forest genetic diversity) is considered important but interpreted narrowly in country reports to the Convention on Biological Diversity while stressing the importance of including state, pressure, response, and effect indicators for FGR. Furthermore, additional policies developed by other sectors (e.g., agriculture, energy, and trade) have also addressed many forest-related issues, thus being relevant for FGR or FRM. All these policy instruments have direct and indirect implications for the forest sector. “Within the forest sector, the conservation and use of forest genetic resources is one of the topics that have remained at the crossroads of many global, European, and national policies. This means that various policies often influence the conservation and use of forest genetic resources in one way or another, even if the policies themselves do not specifically target forests or genetic resources” (Bouillon et al., 2015).

Indeed, as the efforts to conserve, protect, sustainably manage and use FGR were facing challenges such as limited financing, uneven implementation of strategies on national levels, as well as the need for research, persist. While the FGR and FRM policy research and practice tended to focus mostly on the policies from forestry, biodiversity, rural development, and agriculture which directly address FGR or FRM, it might tend to oversee other policy domains and policies not directly addressing, but still influencing the state of FGR or FRM (i.e. employment and social policies, innovation policies) and thus identify structural policy gaps as potential deep leverage points (e.g., Kim, 1994; Meadows, 2008; Abson et al. 2017; Sterman, 2000) which could be used for strategic interventions. Starting from the premise that FGR are a basic constitutive part of forest tree species and ecosystems underpinning biodiversity, adaptation, and resilience of forests and other social-environmental systems, our contribution illustrates the complexity of polycentric forest governance based on the case of FGR in Europe. More specifically, our research aims to identify policy gaps that could be used as deep leverage points for ensuring sustainable management and use of FGR and FRM in Europe.

## ■ 2 SYSTEM COMPLEXITY, LEVERAGE POINTS, AND POLICY GAPS

In complex systems (Plummer and Armitage, 2007), leverage points are points for strategic intervention that have the potential to change or influence the system's behaviour significantly (Abson et al., 2017; Meadows, 1999, 2008). They can be seen as the doors of opportunity for targeted actions that can result in substantial and lasting impacts (Sterman, 2000). Meadows (1999) identified policies as one of the higher-level leverage points within systems, as policies shape the behaviour of systems by establishing guidelines and regulations that influence the actions of individuals, organisations, and institutions. Abson et al. (2017) highlight that policies act as strategic interventions that can modify the rules, regulations, and incentives within a system to steer it toward more sustainable trajectories. Policies can target specific leverage points within a system to influence the underlying structures or parameters that drive system behaviour. By identifying and understanding the leverage points within a system, policy makers can develop policies that influence the system's behaviour (Kim, 1994) and drive transformative changes toward sustainable management and the use of FGR and FRM. European forests, as well as FGR, are characterized by high diversity, not only in the sense of genetic diversity but also the diversity of site conditions, forest management practices, as well as cultural, economic, and policy conditions. In our research on the European level, we were interested in policy integration notably across broad EU environmental, agricultural, social and economic policy domains.

## ■ 3 METHODS

Within the OptFORESTS project, we are conducting a multiple, mixed method case study (Yin, 2009) on a European level focusing on the European policies, as well as the policies of eight partner countries (IT, FR, SI, RO, FI, SW, ES, NW), being interested in any policy domain and with it associated policies that might address FGR and FRM directly (e.g. Legislative proposal on the production and marketing of forest reproductive material in the Union (EC, 2023b), indirectly (e.g. referring to biodiversity, forests, or landscape restoration like in proposal of new European Nature Restoration Law), or potentially (e.g., by being relevant for engagement of broader "forest community"), and that were not analyzed within the previous studies (e.g., Lovrić et al., 2023; Guerde et al., 2008). In our research, we use policy gap analysis (PGA) as a method (Hoberg et al., 2016; Maniak-Hesser et al., 2021) focusing on regulatory gaps (Gjerde et al., 2008). The first step of PGA is establishing the current policy state by identification of potentially relevant policy domains and the latest current and forthcoming policies of European programming. With that purpose, we conducted desktop research<sup>1</sup> and a literature review to identify potentially relevant policies and policy domains. For identifying policies and domains, we took a broader system perspective guided by the EU's overall political goals, as well as existing Directorates-General and topics under them ([https://european-union.europa.eu/priorities-and-actions/actions-topic\\_en](https://european-union.europa.eu/priorities-and-actions/actions-topic_en)). The full list of potential domains was narrowed to eight policy domains and their respective policies (see Table 1 in the Result section) following three criteria: i) addressing FGR and/or FRM explicitly (e.g. forest genetic resources, gene pool, etc.); ii) addressing FGR and/or FRM implicitly (e.g.

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<sup>1</sup> In progress: planned period April – September 2023

as forests and/or biodiversity and/or nature); iii) relating to FGR and/or FRM implicitly. For each criteria, a list of keywords was defined. The preliminary list of policy domains and identified policies was presented to internal OptFORESTS experts with a two-fold purpose: 1) to complement the list with potentially overlooked policies and regulations; 2) to identify those they perceive most relevant for sustainable management and use of FGR and FRM on the European as well as national levels. The initial list of 56 documents was revised based on feedback from internal experts, and a final list was created to be further used in the research and selected policies will be analysed using qualitative content analysis (Mayring, 2014).

## ■ 4 RESULTS

As the research is in an early stage, our preliminary results focus on system mapping of potentially relevant policy domains and with them related policies on the European level. Based on the desktop research and a literature review, there are eight policy domains that are relevant for sustainable management and use of FGR and FRM. Within them, we identified total 56 policies potentially relevant for FGR or FRM, examples of which are provided in Table 1.

**Table 1. Identified policy domains, subdomains, and example policies potentially relevant for sustainable conservation, management and use of FGR or FRM**

Domain	Subdomain	Example policies (non-exhaustive list)
Agriculture and rural development	Forestry Agriculture Rural Development	The new EU Forest Strategy 2030 The guidelines on Biodiversity-Friendly Afforestation Reforestation, and Tree Planting The 3 billion trees initiative The new Common Agriculture Policy (CAP); Farm to Fork Strategy
Environment	Nature and biodiversity Soil and land Urban environment Water Air Marine and coastal environments Chemicals	The European Green Deal The forthcoming new Nature Restoration Law Bio-economy Strategy EU Flood Directive Directive 2000/60/EC - framework for Community action in the field of water policy Directive 2007/60/EC Urban Agenda for the EU

Health and Food safety	(e.g. protect the health of crops and forests)	Regulation (EU) No 1143/2014 Regulation (EC) 1830/2003EN Legislative proposal on the production and marketing of FRM (COM(2023) 415 final)
Energy and climate	Industry and energy Climate	The new EU Strategy on Adaptation to Climate Change EU Climate Law 2050 Long-term energy strategy (EU/2018/1999 Renewable energy Directive Industrial strategy and raw materials alliance
Economic and financial affairs	Business and industry	Circular economy action plan A sustainable bioeconomy for Europe: an updated bioeconomy strategy European industrial strategy Entrepreneurship and small business
Trade	Internal market International trade	Council Decision 2008/971/EC on the equivalence of forest reproductive material produced in third countries Council Directive 1999/105/EC on the marketing of forest reproductive material Regulation (EC) 1946/2003 on transboundary movements of GMO.
Employment, Social Affairs, and Inclusion	Employment and labor Social affairs	Employment and Social Innovation (EaSI) programme REGULATION (EU) No 1296/2013; The New European Bauhaus Initiative
Research and innovation	Research Innovation Informatics	Horizon Europe General Union Environment Action Programme to 2030 A renewed European Agenda for Research and Innovation New EU Artificial Intelligence Regulation.

Source: own elaboration

## ■ 5 DISCUSSION AND CONCLUSION

As our research is in an early stage, our discussion and conclusion are related to the preliminary mapping of relevant domains and policies. Our results further indicate that eight identified domains and respective policies can be categorized by their sensu relation, by which we understand the manner by which they relate to FGR:

1. policies sensu eminenti (most significant policies) - explicitly regulating conservation, management, and use of FGR;
2. policies sensu stricto (in the strict sense) - policies explicitly regulating management and use of FRM;
3. policies sensu lato (in the broad sense) - policies explicitly relating to FGR & FRM;
4. policies sensu amplo (in ample sense) - policies implicitly relating to FGR & FRM.

Based on the previous research (i.e., Graudal et al., 2020; Kramer et al., 2016; Kelleher et al., 2015; FAO, 2014; Lefèvre et al., 2013), the most common policy gaps identified so far are: fragmented policies and regulations, uneven national implementation, unsuitable instruments, lack of coordination mechanisms, over-regulation. Those policy gaps are related to policies from mostly forestry and biodiversity sub-domain, as well the sub-domain of rural development and health. As they are belonging to policies sensu eminenti and sensu stricto, it indicates that mostly internal policy coherence from the three to four policy sub-domains was addressed (forestry, biodiversity, rural development, health), while external and broader policy coherence remains under-researched.

Regardless of the early stage, our contribution already illustrates the complexity of forest governance on the European level, based on the mapped policy domains and potentially relevant policies on the country level for sustainable management and use of FGR and FRM. While policies belonging to agricultural and rural development domains were predominantly analysed until now, we strive to provide a broader, systemic picture of eight European policy domains and their sensu relation to FGR and FRM. In this way, our contribution highlights some of the relevant but under-investigated policies for sustainable management and the use of FGR and FRM. For better integration of FGR and FRM aspects in the European Union policy framework, increased efforts in policy coherence, including both context-dependent and deliberated integration and coordination within and across policy domains, as well as better deployment of existing policy instruments (especially from sensu lato and sensu amplo policies) are needed.

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