

EUROPEAN RESEARCH PRIORITIES IN THE FOREST DOMAIN

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SCAR Group: FOREST

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Table of contents

Climate change and other risks	2
Biodiversity and ecosystem services	4
Bioeconomy	6
Transversal topics	7
Other topics.....	8

In the framework of the preparation of the new EU Forest Strategy, the SCAR SWG FOREST has collected feedback from its members on what they perceive as the main research priorities in the forest domain nowadays. A survey has been prepared and shared with the SCAR SWG FOREST members. The report is based on the answers from eleven members from nine countries (Finland, France, Ireland, Italy, Latvia, Norway, Slovakia, Spain and Sweden).

Climate change and other risks

The adaptation of forests to climate change and climate change mitigation from forest resources are unanimously important or very important research topics for all members (Fig. 1). Fire risk and pest outbreaks are not unanimously important but still important for > 80% of the members.

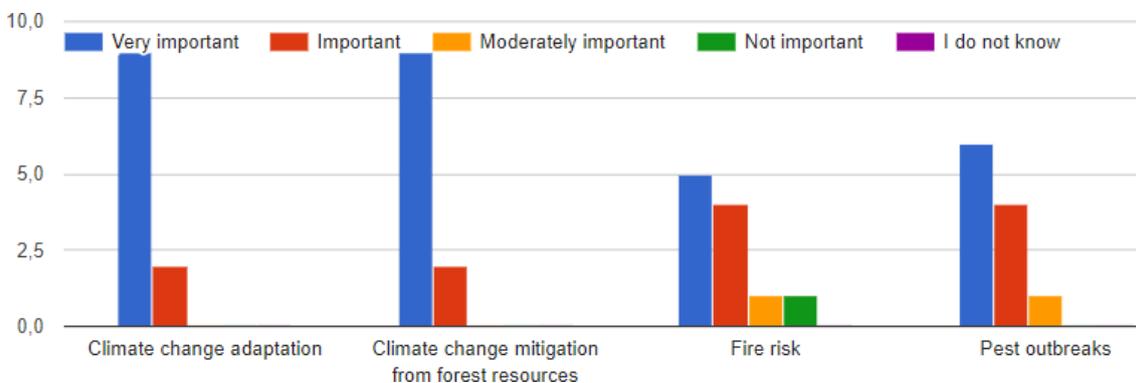


Figure 1. Distribution of the members' answers across importance scores for four research topics related to climate change and other risks.

Forest research on climate change is important given the extent of forest areas in Europe (e.g. 47% of Latvia is forest) and the extent of other natural terrestrial ecosystems (e.g. one third of Finland is peatland), and given that climate change and climate-induced changes (increased fire and wind risk, increased sensitivity to pests and diseases) are the main threats to these systems. Research on climate change and other risks is fundamental to ensure sustainable forest management and a critical enabler in forest health, public goods, ecosystem services, and economy. This research is needed to ensure and improve the resilience of forest stands, the quality of wood and non-wood products, the environmental services and the products and combine the needs of today's society and economy by defining objectives and lines of action in relation to the profound climatic, social and socioeconomic global and local climate, social and socio-economic changes looming over the next 20 years.

Climate change has a negative impact on forest condition (damage by wind, drought, growing populations of insects), thus the priority should be given to the adaptation of forests to climate change, so that adapted forests can contribute to the mitigation of climate change. In other words, adaptation of forest to climate change is a preliminary condition for successful forest-based mitigation of climate change. In southern Europe, the risk of desertification consequent to climate change cumulates can prevail. Then forests must be considered not only in the fight against climate change but also against erosion processes coming from desertification.

Adaptation to climate change requires selection of measures in forest management towards more structured forests. For instance, the observed decline of spruce has implications in both forest management techniques that must be changed, species composition (other shade-tolerant species promoted), and in the wood industry that must adapt its structure to new wood products. It is also critical to understand, **monitor** and provide early alert on climate-induced changes and associated risks. The monitoring of changes and possibly transitions (i.e. discontinuous changes) must be continuous in time.

Several members highlight that research on **genetic resources** and the interrelation between climate change and biodiversity is key for the adaptation to climate change. Research is needed to improve the management of forest genetic resources of tree species in the context of climate change. It includes research to evaluate the principles and application methods of assisted migration (at between and within species level) to boost the adaptation to rapidly changing conditions as well as balancing the intensive **application of best genetic material** (forming vital and resilient stands) with other types of management **in diverse forest landscape** in order to ensure both biodiversity and increased production of renewable material. The management of forest genetic resources would also include setting up an observatory of tree genetic resources. Another priority topic to address is how to grow new species in nurseries and all genetic aspects because the trade-off between genetic pollution and adaptation through mixing remains controversial.

Several members mention that research on the **substitution effect of wood** is needed to better assess how forest can contribute to climate change mitigation, including the substitution effect of timber in construction and the substitution effect of non-renewable materials by wood. More generally, all dimensions of the mitigation potential of forests would require research: not only the substitution effect, but also carbon sequestration, whether in forest biomass (including soils, deadwood and standing biomass) or in harvested wood products.

Several members highlight that **expectations from society** with regards to forests are part of the adaptation question. Research in sociology are needed to understand the changing expectations of society with regard to forest and forestry in a changing climate. Landscape ecological planning and green infrastructure, social enjoyment of landscape, social use, and production of tangible and intangible forest products, in harmony with international and European commitments on mitigation and adaptation to climate change are research priorities.

Societal demand for nature protection poses further risks in a changing climate. Wild forests that are deliberately left unmanaged under the principle that natural forest development optimally responds to changes may raise additional risks of spreading pests, changing species composition and destabilising production capacities. The request for broad implementation of close to nature forestry represents new challenges for forest management and related economic aspects.

While fire risk is considered important by a majority of countries and is increasing with climate change, some countries point out that it is mainly from anthropogenic sources, so that reducing fire risk will mostly stem from behavioural economics rather than from forest research. In European countries with humid climate, well organised fire prevention is considered enough to reduce the risk of forest fires. In addition to fire and pest outbreaks, another important climate-induced risk that requires research is non-pest diseases. Research on risks related to climate change are key but should not be

disconnected from research on conservation and protection (see Section “Biodiversity and ecosystem services” below) because strict protection in a changing climate may increase risks. Risks should be addressed transversally, both jointly across risks (multi-risk approach) and in connection with protected areas (especially when protection follows a wilderness approach). **Wind-storm risk** is harder to control and prevent, still the research in formation of more **resistant and resilient stands and forest landscapes** can bring a significant improvement, simultaneously increasing the value of other ecosystem services and reducing related pest outbreaks.

Several members highlight that the issue of climate change for forests entails enlarging the scope of forest research to deal with related sectors or ecosystems, mostly **agriculture**. Research on the potential of agroforestry techniques in the context of climate change is needed. Research on peatland forestry is also needed.

The transfer of research results to more mature technology should also be facilitated. In particular, for the adaptation of forest to climate change, the development of decision-making tools for forest managers is also very important.

Biodiversity and ecosystem services

Conservation and protection of forests are unanimously important or very important research topics for all members (Fig. 2). Monitoring systems for biodiversity is an important research topic for 90% of the members. Restoration has a lower importance score but is still important for a majority of members, while nature-based tourism has the lowest important score (but is still important for 55% of the members).

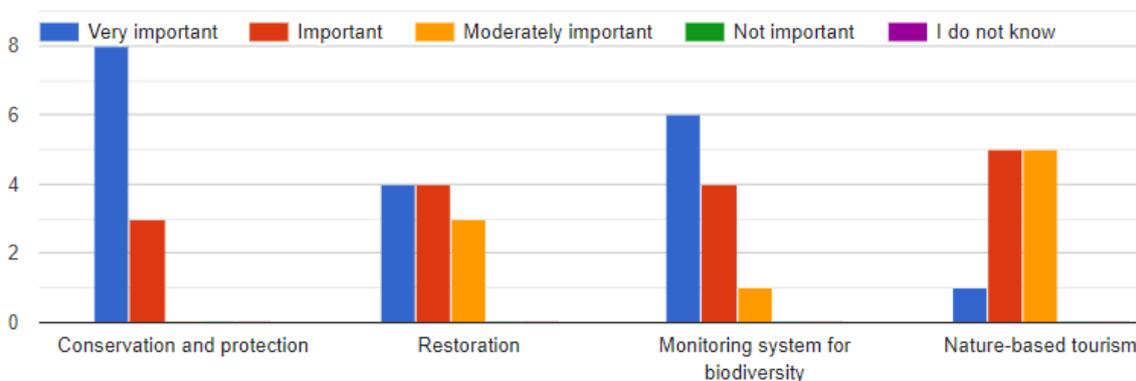


Figure 2. Distribution of the members’ answers across importance scores for four research topics related to biodiversity and ecosystem services.

Due to their longevity and relatively low intensity of management, forest play crucial role in the protection of biodiversity. Differences in European forest ecosystems call for different approaches vis-à-vis biodiversity. Some biomes are more vulnerable, such as Mediterranean forests that are highly fragile to global change and forest fires. For European countries that have a relatively low forest cover (e.g. Ireland with 11% of forest cover), interactions between forests and other land sectors (e.g. agriculture) are more relevant for biodiversity than the bulk of forests. In countries that have a relatively high forest cover (like Finland, Latvia) improved understanding of habitat requirements of protected forest species and management approaches to maintain favourable conditions for these species over space and time, while combining it with forest

production aspect are essential. **Novel approaches combining, not contradicting production and protection aspects** of forests have to be developed, and promoted, and social sciences needs to be involved in this research. Conservation, protection and monitoring of biodiversity are considered relevant issues at a time when forest timber production has taken a back seat. The provision of biodiversity protection and other ecosystem services requires further research on appropriate management techniques and active implementation of appropriate measures to satisfy expectations of society.

Research on the conservation of biodiversity must address it at all levels, including the species, community and landscape levels. Biodiversity should also be addressed from a functional perspective. The different functions of the forest (e.g. water protection) are not sufficiently explored and would deserve research works. The enhancement of habitats and biodiversity is a priority. Several ways to reach it may be investigated such as ecological corridors, forest oases in a bulk of intensive agriculture, or coastal and littoral forests. The protection of old forests is also a priority.

Biodiversity management should not entirely focus on conservation and protection in protected areas. It must take into account that forests have multiple uses and ensure inclusive and sustainable economic growth, while increasing the valuable benefits and services of natural areas. Taking care of biodiversity in practical forest management and in commercial forests is a key issue that requires research. Research on conservation and protection should not be disconnected from research on climate related risks (see previous Section); both should be jointly addressed.

The sound monitoring of biodiversity and provision of reliable data is a pre-requisite of effective decision making processes on biodiversity management. Research on biodiversity requires innovation and improvement of technological processes. It also requires strong **research infrastructures** that includes not only monitoring systems but also experimental systems. These research infrastructures are key not only in relation to biodiversity but also in relation to climate induced changes (see previous Section).

Several members point out that **ecosystem services** and nature-based solutions are research priorities. In particular, research on payments (compensation) models for provision of ecosystem services is needed. Ecosystem services associated to forests must be guaranteed. In some countries, nature-based tourism is a prospective source of income for forest owners, and research on options in this regard should also be a subject of research. In other countries, rural and landscape tourism and recreational activities in forests are growing activities or already play an important role in forest management, but are not a research topic as such. Nevertheless, the social and economic dimensions of ecosystem services (including recreational services) are research topics.

In some countries, the quantification of ecosystem services is still the Achilles' heel that prevents from designing compensation mechanisms and proposing incentives to promote ecosystem services in forestry contexts. In those cases, more advanced research on the quantification of ecosystem services is needed.

Research on the **restoration** of stable and vital forests is a priority highlighted by several members. The restoration of degraded forests is a priority of research, contributing to the effective use of natural resources as well as to the enhancement/protection of biodiversity and the environment. However, in some countries, reforestation still plays an important role in forest management but not so much in research.

Several members point out that the issue of biodiversity in forests must be addressed through synergies and interactions between different elements of the land sector, i.e. **agriculture** and forestry, or **cities** and forests. Trees outside forests (including farm trees, agroforestry systems and urban trees) are an important field of research to develop. The protection of rural and urban biodiversity is also a topic to address.

Bioeconomy

Forest management is unanimously an important or very important research topic in relation to bioeconomy for all members (Fig. 3). Wood and non-wood forest products are important research topic for 90% of the members, with a prevalence of the importance score of wood products over non-wood products. Wooden buildings have a lower importance score but is still important for a majority of members, while biomass for energy has the lowest important score (but is still important for 58% of the members).



Figure 3. Distribution of the members' answers across importance scores for four research topics related to bioeconomy.

The forest and wood sector is an important economic sector in Europe. However, there are contrasted situations across countries. In Finland, 20 % of the export is based on forest-based products. In Spain and Italy, forests have a limited timber production capacity (30% of the annual forest growth is cut in Italy), but are very important in the production of other non-wood forest products such as cork, resin, mushrooms and the production of edible pine nuts, among others. Still in Spain, the production of biomass for energy was also very important years ago, but its role has been reduced due to the existence of other renewable energy sources nowadays. Research on the forest-based bioeconomy is essential to support the countries' economies and initiate a green transition process for the entire economy, focusing on increasingly sustainable and responsible forest management and planning.

Research on forest bioeconomy is needed to improve knowledge of the forest heritage, increase awareness of good management of green infrastructure, and integrate the effects of forests on the quality of life and sustainability of the economy. For countries whose forest systems are vulnerable to global changes, research in forest management is considered essential to tackle this vulnerability, e.g. to reduce the forest fire risk.

In some countries, particularly in southern Europe, the economic analysis of the forest sector is made difficult by the lack of data regarding costs and revenues of forest firms. This lack of economic data is a problem when a level of subsidies or incentives for the

promotion of forestry activities in specific context must be evaluated. Research would then be needed to develop information systems for this kind of data.

Global changes will impact the forest sector by changing the available forest resources (both in terms of species and in terms of the size of wood stems harvested). Research is needed to **adapt the forest sector** to these major changes that are expected to occur as a consequence of global changes.

Further research on **cascade use of wood** and non-wood products is needed, as well as on further development of wood value-chains, concentrating on research and innovation in production and processes related to increasing added value and supporting development of circular economy. Products with high added value should replace products based on non-renewable materials. Wooden buildings represent an example of high added value as well as a pool for storage of carbon in wood products and research towards technology and social perception of such products should be supported. Territorial approaches to implement local timber value chains also requires research, with the aim to promote the development of local supply chain economies.

Precision forestry is a recent line of forest research that is emerging in some countries. The concept is inherited from the agricultural sector and includes several practises like the monitoring, planning, management and utilization of forest resources. The aim is to improve wood product quality and utilization, reduce waste and increase profits, while maintaining the quality of the environment. It is an innovative tool that could be included in a future forest research agenda.

Together with the wood certifications (FSC or PEFC), precision forestry could give a contribution to the development of responsible management forests and increase the

Regarding specifically wood and **biomass for energy**, some countries do not consider the production of biomass and wood for large-scale energy production as a priority option. The production of energy from forest products should rather remain subordinate to the primary objective of timber production. Residues and co-products from wood processing should be used for production of wood energy instead of massive use of primary wood material. Research is needed to (1) make better use of wood by-products and end-of-life wood products, (2) get better estimates of substitution coefficients of wood with respect to fossil energy, and (3) investigate the impact of biomass-oriented forest management on the different dimensions of sustainable management is needed.

Research is needed to develop high-value forest-based products to replace paper production that is going down. It requires research on **wood properties and chemistry**. Increasingly, novel uses for lignin and cellulose from timber have potential to replace fossil-based products with sustainable biobased energy solutions. The biochemistry of wood, which may include the production of chemical energy (e.g. production of dihydrogen and heat by pyrolysis-gasification) is an important area of research. These topics are fundamental to providing sustainable forest management and a critical enabler in forest health, public goods, ecosystem services and economy.

Transversal topics

The research agenda needs to address transversal topics. Among such topics, building partnerships is important for 81% of the members while the gender issue is considered important by 72% of the members (Fig. 4).

Most members point out that the **society-forest nexus** is a key transversal topic to be addressed by European forest research. The society has changing expectations

towards forest and forestry and it is necessary to promote awareness in society on the importance of the protection and sustainable (environmental, social and economic) valorisation of the forest heritage; to promote the participation and awareness of civil society on the role of forest activities as a tool for conservation and protection; to empower politics, institutions, society and forest owners (both public and private); and to develop aspects related to wellbeing and health.

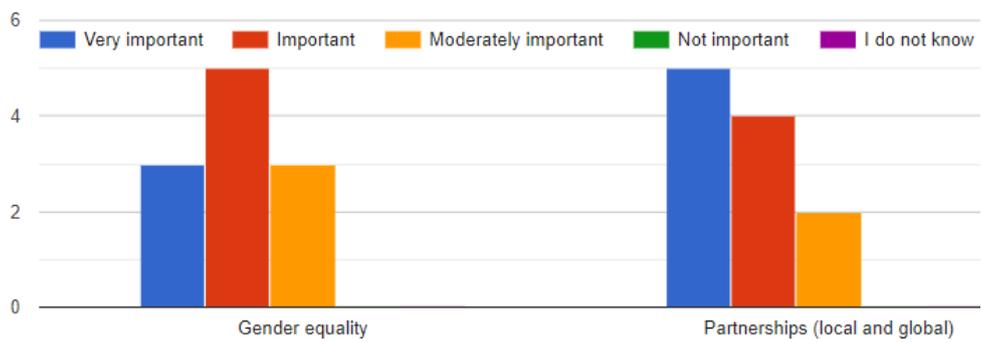


Figure 4. Distribution of the members' answers across importance scores for two transversal topics: gender equality and partnerships.

Education, training and information from research results is very important to foster the dissemination of knowledge. Childhood education, communication to society, and advanced training of students and adults are all needed. Given the global dimension of forest issues (cf. Section "Other topics" below), innovative in situ training on forests in southern countries should also be very closely connected to a European research agenda on forests.

Coordination and integration of research (including promoting partnerships and joint activities with the **European Forest Institute**) is needed to promote institutional and operational synergies and integration for the forest sector, and to coordinate existing institutional and financial resources in the best possible way. Cross-sectoral cooperation is even needed for the further development of the bioeconomy.

The further development of forest services that contribute to the development of green jobs and to the ecological transition is also seen as a cross-cutting issue.

Digitalization and new technology is also a topic that regards all aspects of forest research.

Other topics

Because changes are global and factors driving these changes are interconnected at the global level, any research agenda on forests should be developed in a **global perspective**. European countries are managing tropical forests (e.g. French Guianan forests). Tackling imported deforestation (= the process of deforestation in non-European countries to provide commodities to European countries) requires research. It includes assessment of larger scale impact of decisions to reduce sustainable wood production in Europe. More generally, because of long-range interdependencies in economies, research is needed to assess which and how decisions in European economies have an impact on global forests (e.g. protein autonomy, internalisation of externalities in agriculture).



Human and social sciences are cross-cutting to address current challenges related to forests. It implies multidisciplinary approaches to forest research. In particular, societal perception of forests and relationships between society and forest stakeholders are key research topic to address. Stakeholder involvement is key to develop forest value chains. Research should address awareness building for stakeholders and general public on higher added value products from wood and non-wood forest resources.

Territorial approaches to forest management (= how forests get integrated into its neighbouring environment at landscape level in connection with other sectors than forestry) is also an important research topic. Research on how stakeholders from regional to local level set priorities is needed. Negotiation forums, forest issues in the public sphere are processes that need to be better investigated.

