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EUFORE
European Forest Research and Innovation Ecosystem

EUFORE Mid-Term Practice Abstracts Presentation (D4.2)

The following practice abstracts were drafted to share the mid-term knowledge and results generated by the WP1 and WP2 of the Horizon-funded project EUFORE. The drafted practice abstracts follow the EIP-AGRI common format, and include an overview of the work accomplished, highlight its main finding, and draw practical recommendation to the identified targeted end users. Additionally, the practice abstracts highlight the research scale and countries involved, identify its target users, and provide links to additional project documentation for the end users interested in exploring the broader research conducted or delving into further details. The practice abstracts were drafted in an accessible language and a suitable format to facilitate their wide dissemination among different end users.

The four practice abstracts were developed (table below, left column) in close collaboration with relevant EUFORE WP and/or task leaders, to summarise and highlight the results generated from four EUFORE tasks (right column). A multitude of project deliverables, milestones and project documentation were consulted during this process.

Practice Abstracts	Summarised EUFORE Tasks
1 Research & Innovation Trends in the EU Forests and the Forest-Based Sector	WP1 - T1.1. Systematic mapping of research in forestry and the forest-based sector
	WP1 - T1.2. Forestry and the forest-based sector innovation review
2 Societal Expectations and Perceptions of Europe's Forests, and the Forest-Based Sector	WP2 - T2.1 Societal expectations towards and perceptions of Europe's forests, forestry and the forest-based sector
3 Implications of EU Forest-Related Legislation on Forest Management	WP2 - T2.2 Multi-level analysis of the sector's policy framework and its R&I implications
4 Implications of EU Forest-Related Legislation on the Supply of Wood and other Forest Ecosystem Services	

We acknowledge the limitations of the practical recommendations, as some research tasks and results are still under development. These will be addressed in the final practice abstracts (D4.7) at the end of the project.

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Research & Innovation Trends in the EU Forests and the Forest-Based Sector

Scale	Global and Regional
Countries	Global with a focus on the 27 EU countries
Anticipated end users of Practice Abstract	National and EU Policy makers and practitioners
More info	EUFORE Project Resources

Setting a strong Strategic Research and Innovation Agenda and a solid foundation for evidence-based policymaking and agenda-setting for future research and innovation (R&I) directions in the EU Forests and Forest-Based Sectors (F&FS) requires comprehensive insight into its current knowledge, advancements, and key developments. This practice abstract presents a state of the art of the EU R&I in the Forests and Forest-Based Sectors. It presents the results of two separate research activities: (1) a systematic mapping of research activities, patterns, gaps, networks, capacities, and the evolution of research in the sector, as well as (2) a review of F&FS innovation activities within the sector, particularly innovation trends, type, geographical distribution and its state of development.

(1) The methodology of the first research involved identifying keywords and implementing a search query across all research databases within the Web of Science, ensuring broad coverage of over 200 million records. Two main datasets were generated through a systematic scoping process. The first dataset includes approximately 35,000 reviews from 1927–2024, covering global publications. The second dataset, a subset of the first, focuses on 642 systematic reviews geographically centered on European case studies. The data was analyzed by examining how often certain keywords appeared together. This helped create visual maps showing groups of related research topics and identifying key themes, emerging and motor themes in the field. (2) The methodology of the second involved analyzing literature of a subset of the second dataset systemic review studies on innovation studies in the F&FS which resulted in 812 entries. The entries were then filtered using various criteria. The final analysis included 13 systematic reviews focusing on innovation research. This number was recognized as non-sufficient and additional reviews in a larger dataset are being conducted.

Main Findings

EU Research in the Forests and Forest-Based Sectors

The annual scientific production of systematic literature reviews in the F&FS sector in the EU has increased dramatically since 2016, peaking in 2022, followed by a drop in 2023. The top five EU countries with the highest productivity of systematic reviews are the UK (211 publications), Germany (198), Spain (196), Italy (162), and Sweden (152). This reflects a high level of research activity and output in these countries. Globally, scientific production between 1927 and 2024 has grown almost exponentially since the 1990s. The top five countries, based on the affiliations of corresponding authors, are the USA (20,415 publications), China (6,592), Germany (4,260), the UK (6,328), and France (3,369). A higher ratio of multi-country publications was observed indicating strong international collaboration and a globally integrated research community.

Based on an overview of keyword centrality in scientific literature within F&FS from 2000 to 2022, research trends globally show an increase in the use of keywords related to complex global

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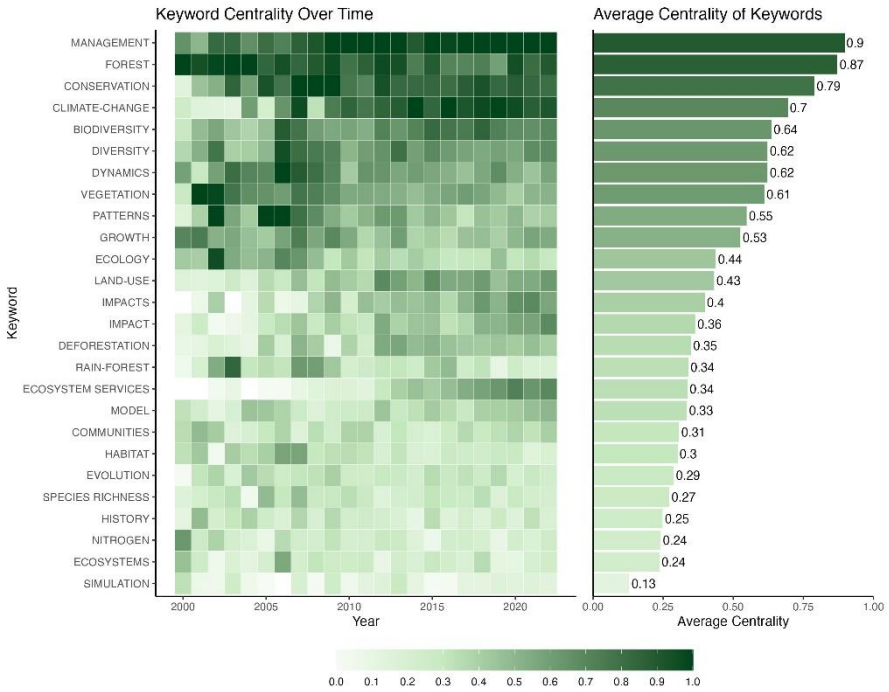
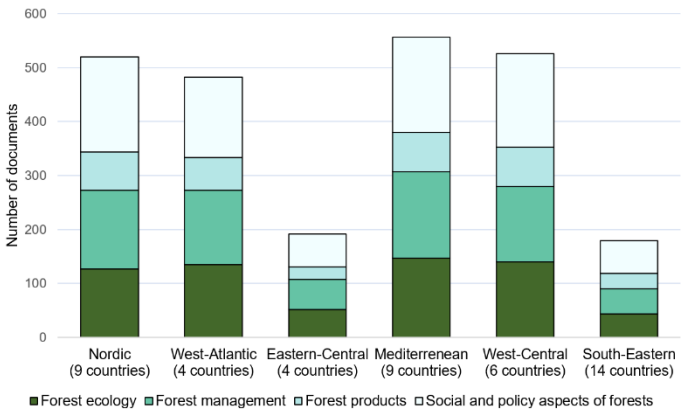
challenges in the international policy agenda and a decrease in narrower disciplinary themes, specifically:



Emerging Research Trends in the Forests & Forest-Based Sectors at a Global Scale (2000–2022)
(Figure yet to be published)

- Keywords such as "management," "forest," "conservation," and "climate change" have had consistently high centrality over time (darker cells).
- Keywords such as "conservation," "climate change," and "biodiversity" also stand out, indicating a trend in research focusing on ecological resilience, sustainable practices, and climate change adaptation within forest ecosystems.
- In recent years, attention towards topics such as "impacts," "land-use," and "ecosystem services" emerged suggesting a growing interest in understanding the complex interactions and impacts within forest ecosystems and the implications of land-use changes on forests (top figure).

The number of systematic reviews across the six EU regions (applied in the EUFORE project) is similar in the Northern, Western, West-Central & Mediterranean regions but significantly lower in the Eastern-Central and South-Eastern regions.
Systematic reviews on forest ecology, forest management and the social aspects of forests and forest policy appear to be much more abundant than those on forest products. This may suggest a lower interest in comprehensive reviews of forest products compared to other areas.



Documents per Region and Topic
(Figure yet to be published)

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EUFORE
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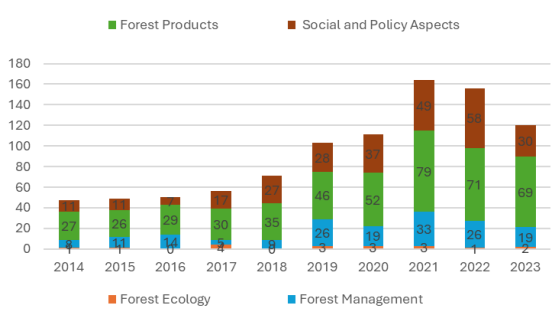
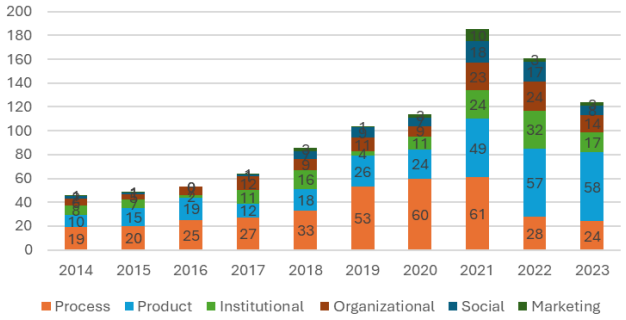
EU Innovation in the Forests and Forest-Based Sectors

Innovation-related research has increased in recent decades. The top five countries with the highest number of innovation papers, based on the first author, are Italy (138 papers), Germany (68), Finland (61), Spain (55), and Austria (53).

The distribution of innovation topics, categorized according to the EUFORE project's four topical categories, shows that the literature predominantly covers innovations in forest products and social and policy aspects of forests, with less focus on forest management and ecology. Articles on forest products particularly discuss forest-based sector technologies and planning-related topics such as digitalization and wood construction. Meanwhile, studies on the social aspects of forests and forest policy specifically address innovation development and the circular economy (left graph).



Innovation Topic Distribution per Year



Innovation Type per Year

While the selected articles covered all types of innovation, the majority focused on process and product innovations. However, since 2021, there has been a noticeable increase in studies addressing social and institutional innovations (right graph).

Practical Recommendations

This practice abstract, along with the knowledge generated from the overall analysis, aims to offer National and EU Policy makers and practitioners with an overview of trends and gaps in research and innovation in the EU Forests and the Forest-based Sector (F&FS), potentially informing future research priorities and EU policy agendas for F&FS.

F&FS Research: Patterns in research productivity, the most studied topics, and shifting research trends were observed. This information can guide practitioners on where and which topics knowledge is being generated, offering valuable insights for their practice. For policymakers, it provides an overview of knowledge generation and research that can be integrated into policymaking.

F&FS Innovation: The study provides an overview of emerging innovation types and topics, highlighting those needing further attention. While there is clear interest in forest product innovation due to its exponential growth, the number of systematic review papers remains limited. More systematic reviews on F&FS products are needed to better inform the EU green transition.

Contact Information

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Societal Expectations and Perceptions of Europe's Forests, and The Forest-Based Sector

Scale	Regional
Countries	27 EU countries, with focus groups conducted in Denmark, Finland, Croatia, Italy, Germany, and Slovakia
Targeted End Users	National and EU Policy Makers, Practitioners and Industries
More info	EUFORE Project Resources

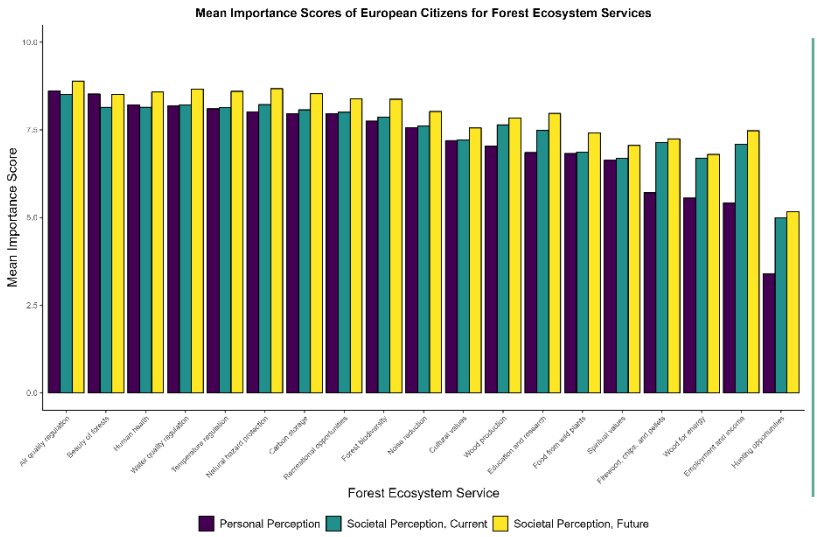
EU Forests provide various goods and ecosystems services to humans ranging from marketed to non-marketed goods, and consumptive to non-consumptive services. Forest Ecosystem Services (FES) include:

- Provisioning ecosystem services, e.g., wood and wild forest products
- Regulating ecosystem services, e.g., water and climate regulation, biodiversity, protection against natural hazards
- Cultural ecosystem services, e.g., health, recreational opportunities, cultural and spiritual values

These diverse FES highlight the ecological, economic, social and cultural importance of forests to human well-being and planetary health. European citizens are both the direct and indirect beneficiaries of these goods and services. Although they do not have direct decision power over how forests are managed, their perception and expectations towards forests and the forest-based sector influence political decision-making, thus shaping the preservation and future use of these essential FES.

Main Findings

To capture these perspectives, the general European public was surveyed about their societal expectations on and perceptions of forests, and the forest-based sector. This survey distinguished between importance of FES at the personal and societal level, and at the spatial and temporal level. Furthermore, opinions regarding key EU debates in the forest-based sector and wood use were elicited. Some of the results are as follows:



People across Europe care about the provision of multiple FES, having more emphasis on cultural and regulating services than provisioning services.

Taken from a societal perspective, provisioning services received higher values than from personal perspective.

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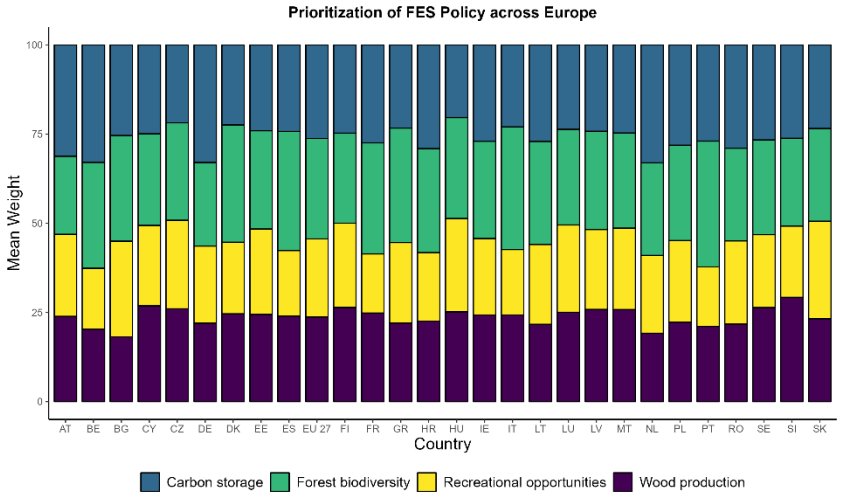
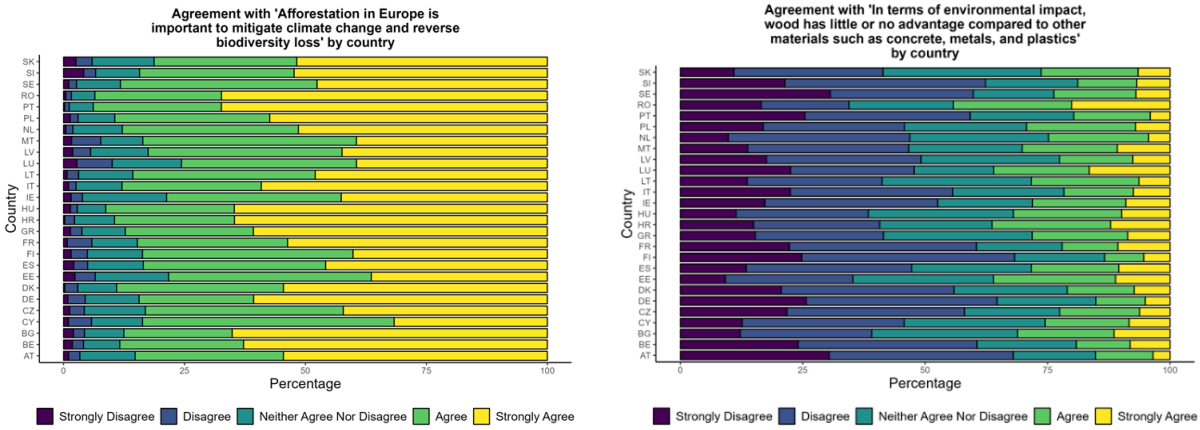
Asking respondents to prioritize opportunities in EU policies between four FES - carbon storage, biodiversity, wood provision and recreational - revealed that they consider all four are very important.





And while, across Europe, most people are positive towards afforestation as an important action to mitigate climate change and reverse biodiversity loss (left), they also tend to agree, on average, that wood utilization in buildings should increase and that it has an advantage over other materials (right).

It is worth noting that there is heterogeneity within countries, between countries, and between regions regarding some topics, such as whether forest management is believed to be done in a way that protects the environment while simultaneously providing wood material.

Practical Recommendations

The practice abstract, along with the knowledge generated from the analysis, provides an overview of the general public's perception of forests' goods and services, shedding light on what is most valued both at the individual and societal level. **National and EU policymakers** may use this knowledge in their political decision-making processes to ensure public opinion is taken into consideration. As there is considerable heterogeneity in opinions both across and within countries, **national policymakers** may benefit from these results to ensure the adaptability of policies to local contexts. **Practitioners** may use this knowledge on societal perceptions as an element that could shape the way they manage forests, as well as the way they communicate about what their forests supply to the broader public. For **forest-based industries**, the results may be useful to better adapt their operations to reflect societal expectations and values.

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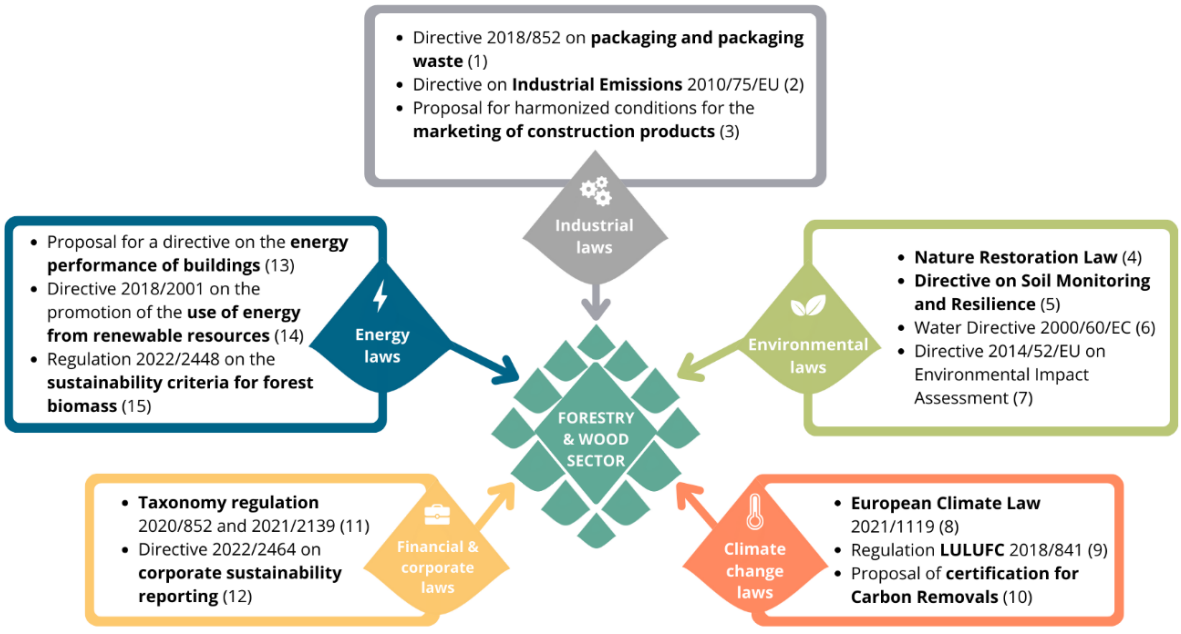
Implications of EU Forest-Related Legislation on Forest Management

Scale	Regional
Countries	27 EU countries
Anticipated end users of Practice Abstract	National and EU Policy makers and practitioners
More info	EUFORE Project Resources

Understanding the future impact of EU forest-related policies on forest management and the forest-based sector is essential for their sustainable development and use in Europe. This practice abstract presents the results of a study that examined EU policies expected to have implications on the sector, starting from the EU Forest Strategy 2030. In particular, it analysed 16 key legal policies extracted from 79 identified policy instruments within 20 sectorial policies, strategies or laws. Each policy was assessed for its main objectives, legal provisions, and potential implications on forest management. Nineteen stakeholders from diverse sectors, including forestry industry, public organizations, academia, and environmental NGOs, were consulted to consolidate the findings. This analysis provides insights to support scenario-building exercises for the development of the Strategic Research and Innovation Agenda (SRIA). By considering these findings, national and EU policymakers and practitioners can enhance strategic planning and develop and implement sustainable forest management strategies.



The analysed legal instruments

Main Findings

Legal factors are important to understand how different legislative changes might impact forest ecosystems, management practices, and related industries. We explored how these provisions

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might enable or constrain different forest management practices and therefore might influence the supply of wood and other forest ecosystem services (FES) indirectly. The considered forest management practices are afforestation for land restoration and carbon sinks, possibility for all intensities, closer-to-nature management and biodiversity conservation, high intensity, limitation to clear-cuts, multi-functional management, or strict protection. Based on the policy analysis and stakeholders' workshops, the bellow statements were developed focusing on the implication of the EU forest-related legislation on forest management:

Most of the new Climate-related European legislative framework (8, 9, 10) could support multi-functional forest management.

Directive on Soil Monitoring and Resilience (5) could increase strict protection and limit clear-cuts, especially in high slope areas.

Directive on Environmental Impact Assessment (7) relates both to (a) an increase of close-to-nature silviculture and (b) limiting high-intensity forestry.

European Climate Law (8) could support carbon sinks through strict protection and close-to-nature forestry.

Taxonomy Regulation (11), Directive on Corporate Sustainability Reporting (12) and the Proposal of Carbon Removal Certification (10) could increase investment in afforestation, land restoration and carbon sinks rather than investment in multifunctional forest management.

Directive on Soil Monitoring and Resilience (5), Directive on Environmental Impact Assessment (7), European Climate Law (8) and Directive on Corporate Sustainability Reporting (12) could constitute the legal framework with the most significant effects on biodiversity conservation.

European Climate Law (8) could support carbon storage in products through high intensity management and close-to-nature forestry.

Construction Products Regulation (3) and the Directive on the Promotion of the Use of Energy from Renewable Sources (14) could enhance multifunctional forestry through different degrees of intensity (including plantations).

Nature Restoration Law (4) promotes close-to-nature forestry and carbon sinks, whilst limiting clearcuts and monocultural coniferous plantations.

When confronted with these findings, consulted stakeholders generally agreed more than disagreed with the expected implications, but a consensus was not reached. This points to a diverse forest management implications interpretation of the EU's new regulatory developments, likely resulting from the different social, economic and cultural context of the affected stakeholders.

Practical Recommendations

This practice abstract, along with the knowledge generated from the overall analysis, offers National and EU Policy makers and practitioners with an overview of what is expected to impact forest management practices from a legal standpoint. This could support **Practitioners** in better defining their future pathways to ensure compliance with EU legislation and legal instruments, and **National and EU Policy makers** in identifying the potential synergies and conflicts that may exist among existing legal instruments to promote better coherence. Nevertheless, is worth highlighting that legal instruments alone might not be sufficient without economic and capacity-building accompanying measures.

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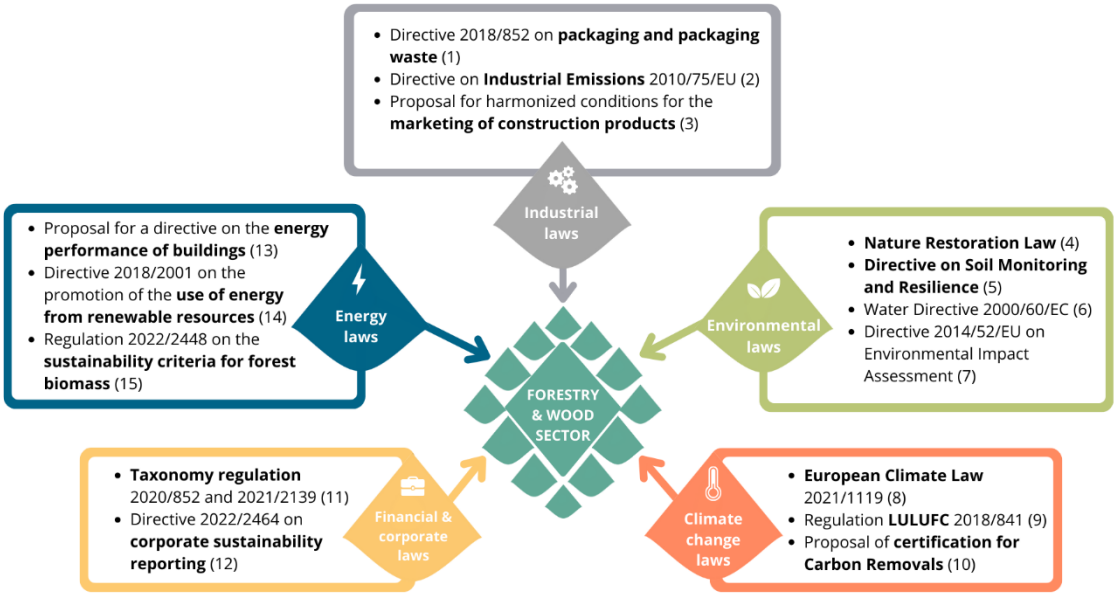
Implications of EU Forest-Related Legislation on the Supply of Wood and other Forest Ecosystem Services

Scale	Regional
Countries	27 EU countries
Anticipated end users of Practice Abstract	National and EU Policy makers and practitioners
More info	EUFORE Project Resources

Understanding the future impact of EU forest-related policies on forest management and the forest-based sector is essential for their sustainable development and use in Europe. This practice abstract presents the results of a study that examined EU policies expected to have implications on the sector, starting from the EU Forest Strategy 2030. In particular, it analysed 16 key legal policies extracted from 79 identified policy instruments within 20 sectorial policies, strategies or laws. Each policy was assessed for its main objectives, legal provisions, and potential implications on the supply of wood and other forest ecosystem services (soil and water). Nineteen stakeholders from diverse sectors, including forestry industry, public organizations, academia, and environmental NGOs, were consulted to consolidate the findings. This analysis provides insights to support scenario-building exercises for the development of the Strategic Research and Innovation Agenda (SRIA). By considering these findings, national and EU policymakers and practitioners can enhance strategic planning and develop and implement sustainable forest management strategies.



The analysed legal instruments

Main Findings

Legal factors are important to understand how different legislative changes might impact forest ecosystems, management practices, and related industries. We explored how these provisions might enable or constrain different forest management practices and therefore might influence the supply of wood and other forest ecosystem services (FES) indirectly. The considered wood and

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other FES practices are soil and water quality, transportation cost and infrastructure, logging cost, cost of monitoring and administrative aspects, restriction on use, standing wood, and technical developments and mechanization. Based on the policy analysis and stakeholders' workshops, the bellow statements were developed focusing on the implication of the EU forest-related legislation on the supply of wood and other FES:

Most of the new EU legislative framework (2, 4, 5, 6, 7, 8, 9, 11, 12, 14) in all sectors could increase soil and water quality.

Most of the new EU legislative framework (2, 4, 5, 7, 8, 9, 11, 12, 14) in all sectors could increase monitoring costs and administrative burden, leading to a potential decrease in supply of wood.

Some climate and environmental new regulations (4, 5, 7, 8, 9) could increase restrictions in harvesting, leading to a potential decrease of supply of wood. Harvesting costs will increase and more wood will be left in the forest.

European Climate Law (8) could increase carbon sinks and therefore wood production could decrease.

Some climate and environmental new regulations (4, 5, 7, 8, 9) could increase restrictions in harvesting, leading to a potential innovation in harvesting and mechanisation methods, maintaining the supply of wood.

Construction Products Regulation (3) and Energy Performance of Buildings Directive (13) could highly increase the supply/demand of sawn wood products (mainly from softwoods) for timber construction and wood-based panels for the renovation of buildings.

European Climate Law (8) and the Directive on Industrial Emissions (2) will increase the limitations on industrial operations and enhance processes to prevent pollution.

The combination of climate (8, 9, 10) and industry (1, 2, 3) regulations could increase the competition for wood between sawn-wood products and wood-based panels. Supply for low added-value products (e.g. pallets) could decrease.

Directive on the Promotion of the Use of Energy from Renewable Sources (14) reinforces principle of cascade use of wood, which could reduce the primary supply of wood for fuel in the long term, but other ecosystem services may be enhanced.

When confronted with these findings, consulted stakeholders generally agreed more than disagreed with the expected implications, but a consensus was not reached. This points to a diverse supply of wood and other FES implications interpretation of the EU's new regulatory developments, likely resulting from the different social, economic and cultural context of the affected stakeholders.

Practical Recommendations

This practice abstract, along with the knowledge generated from the overall analysis, offers National and EU Policy makers and practitioners with an overview of what is expected to impact forest management practices from a legal standpoint. This could support **Practitioners** in better defining their future pathways to ensure compliance with EU legislation and legal instruments, and **National and EU Policy makers** in identifying the potential synergies and conflicts that may exist among existing legal instruments to promote better coherence. Nevertheless, is worth highlighting that legal instruments alone might not be sufficient without economic and capacity-building accompanying measures.

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