



**TEAMING
UP4 FORESTS**

Forest, science and business platform.

**PRODUCTIVE AND BIODIVERSE:
MANAGING EUROPE'S FORESTS FOR
ECONOMIC AND ECOLOGICAL OUTCOMES**
Business Brief of the Synthesis Report

This publication is based on the peer-reviewed scientific report “Productive and Biodiverse: Managing Europe’s Forests for Economic and Ecological Outcomes” published as IUFRO World Series Volume 46

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Forests play a vital role in conserving biodiversity, regulating the climate, and supporting human well-being © Quentin Schulz (Unsplash)

FOREWORD

TeamingUp4Forests(TU4F) was established as a science-business platform that brings together forest scientists, business communities, and other stakeholders in the forest-based sector, to address current and future challenges and identify specific response options.

The latest scientific study developed under the platform, “Productive and Biodiverse: Managing Europe’s Forests for Economic and Ecological Outcomes”, responds to the increasingly complex demands placed on Europe’s forests. Forests are expected to contribute to biodiversity conservation, climate change mitigation and adaptation, renewable raw material supply, and a broad range of ecosystem services. Meeting these objectives requires approaches that recognise the diversity of forest conditions and societal priorities, rather than treating productivity and biodiversity as opposing goals.

Drawing on scientific evidence from a broad range of disciplines, the study provides an integrated perspective on how forest management can contribute to both economic and ecological outcomes. The key transition is not from ‘management’ to ‘no management’, or

from ‘production’ to ‘protection’, but towards diversified forest management that can respond to different ecological, economic, and societal objectives. We hope that this Business Brief will provide a useful entry point to the full study, stimulate discussion, and support informed decision-making across the sector.

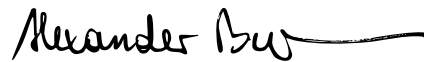
Achieving forests that are both productive and biodiverse will require continued dialogue and the willingness to consider different perspectives and pathways. We invite you to join the TU4F journey, where industry meets science in a dynamic exchange of knowledge and ideas.

We take pride in addressing the pressing issues that matter most to our forests and to the forest-based sector. Our aim is to connect industry and science, as our unique platform brings together key players from the wood-based industry, sciences, society, and decision-makers to foster meaningful dialogue and exchange. TU4F is committed to driving change by its selection of topics that are not only relevant, but also of high importance to the sustainable future of forests and the forest-based economy.



Dirk Längin

Mondi Group, Group Head of Fibre Sourcing



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PRODUCTIVE AND BIODIVERSE FORESTS TO STRENGTHEN THE FUTURE OF THE FOREST-BASED SECTOR

Forests are expected to deliver more than ever before. They provide renewable raw materials that underpin a growing bioeconomy while simultaneously storing carbon, conserving biodiversity, protecting water and soils, supporting recreation, and enhancing resilience to climate change. As these expectations continue to grow, so does the need for forest management approaches that can balance multiple objectives without compromising the long-term health and productivity of forest ecosystems.

Productivity and biodiversity should not be viewed as competing goals. Instead, they are increasingly recognised as complementary foundations of sustainable forest management. Biodiversity contributes directly to forest resilience by enhancing the ability of forests to withstand and recover from disturbances such as droughts, storms, pests, and wildfires. Structurally diverse and species-rich forests are generally better equipped to adapt to changing environmental conditions while continuing to provide wood, carbon storage, and the many ecosystem services upon which society depends. Protecting and enhancing biodiversity is therefore not only an environmental responsibility, but also a strategic investment in the forests' future productivity and stability.

Nevertheless, important trade-offs exist. No single forest can maximise wood production, biodiversity conservation, carbon storage, recreation, and all other ecosystem services simultaneously. The challenge is therefore not to eliminate trade-offs, but to manage them intelligently through science-based decision-making that identifies synergies and balances competing objectives across different spatial and temporal scales. This perspective moves beyond the traditional debate of “production versus protection” and instead focuses on how productive and biodiverse forests can coexist within multifunctional landscapes. For Europe, where forests are embedded

within highly fragmented landscapes, diverse ownership structures, and centuries of human management, integrative and multifunctional forest management offers a particularly relevant pathway forward. Rather than relying exclusively on either intensive production forests or strictly protected areas, approaches that combine active management with targeted conservation measures are the key, adapting management to local ecological, economic, and societal conditions. Such flexibility will become increasingly important as climate change, evolving policy frameworks, and changing public expectations continue to reshape the operating environment of the forest sector.

Additionally, sustainably managed forests play a central role in achieving Europe's climate and bioeconomy ambitions. Forests contribute to climate mitigation both by storing carbon and by providing renewable wood products that substitute for fossil-intensive materials. Maximising these climate benefits, however, depends on maintaining resilient forest ecosystems, using wood resources efficiently, and integrating biodiversity considerations into management decisions. Healthy forests are therefore fundamental not only to environmental objectives but also to the long-term competitiveness of the forest-based sector.

Successfully navigating these challenges will require robust scientific knowledge, harmonised monitoring systems, clear indicators, and effective communication. Equally important is collaboration across the forest value chain, including forest owners, managers, industry, researchers, policymakers, and civil society to ensure that management decisions are informed by evidence and supported by appropriate governance and incentives. By strengthening dialogue between science and practice, the sector can better demonstrate how sustainable forest management contributes simultaneously to biodiversity conservation, climate resilience, and a competitive circular bioeconomy.



Sustainable forest management can create synergies between climate action, biodiversity and broader ecological, economic and societal objectives © Merlin Kraus (Unsplash)

PATHWAYS TO PRODUCTIVE AND BIODIVERSE FORESTS: INTEGRATIVE FOREST MANAGEMENT AND COMPLEMENTARY APPROACHES

Integrative Forest Management (IFM) is a practical, science-based framework for combining active forest management with biodiversity conservation. Rather than treating wood production and biodiversity conservation as competing objectives, IFM integrates them within multifunctional landscapes through adaptive management. Recognising that no single management approach can optimise all ecosystem services, IFM combines complementary management elements across multiple spatial scales. These include multiple-use forests, strictly protected reserves, old-growth and special habitat patches, intensively managed production forests, early successional habitats, and the retention of habitat trees and deadwood. Together, these elements create resilient forest landscapes that support biodiversity while ensuring a reliable and sustainable supply of wood resources.

At the operational level, IFM relies on silvicultural practices that work with natural forest dynamics. Partial harvesting, including selective tree removal, helps maintain continuous forest cover while reducing disturbance. Natural and site-adapted regeneration enhances the capacity of forests to adapt to environmental change, while increasing structural diversity improves habitat quality and ecosystem resilience. Retaining

habitat trees and deadwood provides essential resources for forest-dependent species without compromising long-term forest productivity. These practices demonstrate that biodiversity conservation can be embedded within everyday forest management rather than become an additional constraint.

A defining strength of IFM is its flexibility. Europe's forests vary widely in ecological conditions, ownership structures, and socio-economic contexts, requiring management approaches tailored to local circumstances rather than a single universal model. Diversified silvicultural practices, varied successional stages within and between stands, and planning across multiple spatial scales enable forest managers to address local challenges while maintaining landscape functionality.

As climate change intensifies disturbances and societal expectations continue to evolve, IFM offers an adaptive framework for safeguarding long-term forest resilience, productivity, and biodiversity. By integrating production and conservation within a single management approach, IFM provides the forest sector with a credible pathway to deliver renewable raw materials while supporting climate mitigation, adaptation, and sustainability.

Core principles of Integrative Forest Management. Drawing by F. Måling based on Vitali et al. (2026), concept of A. Spinu (p. 24 in the report).



Retention of habitat trees, special habitats, and deadwood



Promotion of site-adapted native tree species and non-native species



Promotion of natural tree generation



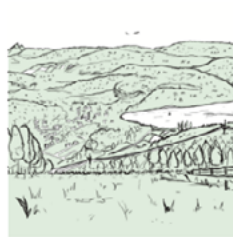
Partial harvest and promotion of structural heterogeneity



Promotion of tree species variation and genetic diversity



Avoidance of intensive management operations



Support of landscape heterogeneity and functioning



Management of factors that hinder ecosystem functions



MEASURING BIODIVERSITY FOR A SMARTER MANAGEMENT OF FOREST

Effective biodiversity conservation depends on the ability to measure, monitor, and evaluate management outcomes. As biodiversity becomes an increasingly important component of sustainable forest management and European policy frameworks, the forest sector needs practical tools that translate ecological complexity into information that supports day-to-day management decisions. Robust, science-based indicators provide this foundation, enabling forest managers to assess forest conditions, evaluate management effectiveness, and communicate measurable progress towards sustainability objectives.

Because forest biodiversity encompasses species, habitats, forest structure, genetic diversity, and ecological processes, no single indicator can capture its full complexity. Instead, a complementary set of practical indicators can provide actionable information to support planning, management, and continuous improvement. Such indicators also enable the sector to demonstrate progress towards European biodiversity and climate objectives in a transparent and credible manner.

Reliable biodiversity monitoring is also essential for informed decision-making. Advances in field-based monitoring, National Forest

Inventories, and remote sensing technologies now offer unprecedented opportunities to assess forest conditions across multiple spatial scales. Combined, these complementary data sources provide a robust evidence base for adaptive forest management, allowing managers to detect changes over time, evaluate management interventions, and respond proactively to emerging risks. They also strengthen sustainability reporting and support compliance with evolving biodiversity and climate policies.

As expectations for sustainable forest management continue to grow, the ability to measure and communicate biodiversity outcomes will become an increasingly valuable asset for the forest sector. Harmonised indicators, robust monitoring systems, and science-based reporting can strengthen confidence among policymakers, customers, investors, and society while supporting better management decisions. By measuring what matters, the forest sector can demonstrate that productive forest management and biodiversity conservation are mutually reinforcing objectives, providing clear evidence of its contribution to resilient forests and a competitive, sustainable bioeconomy.

MAXIMISING CARBON BENEFITS ACROSS THE FOREST VALUE CHAIN

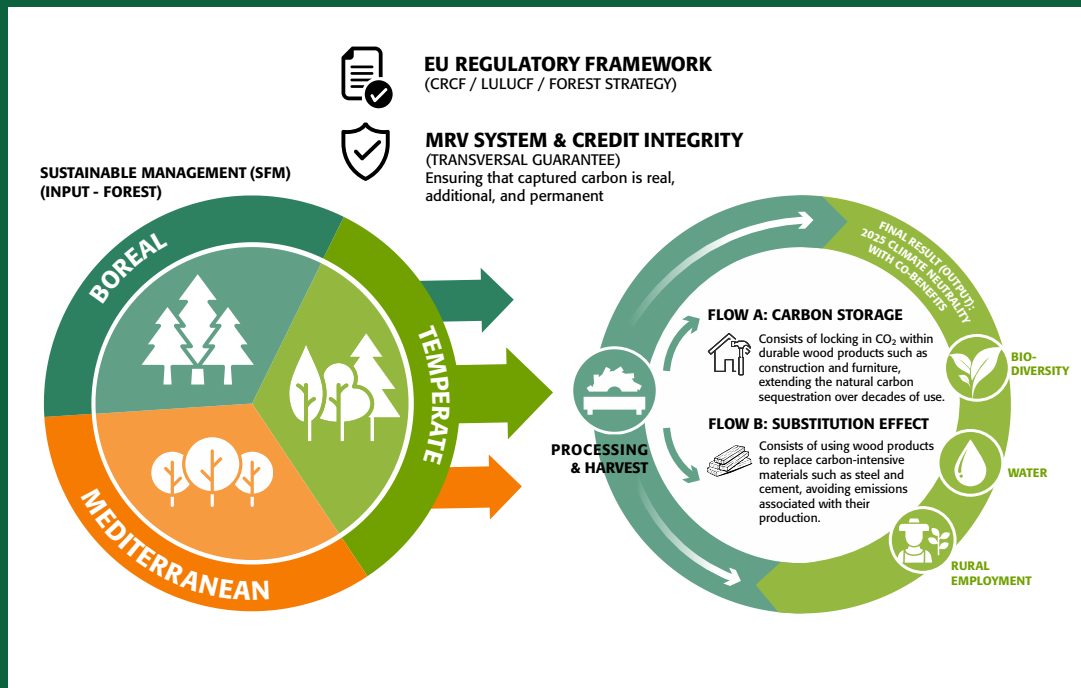
Maximising the contribution of forests to climate mitigation requires looking beyond carbon stored in standing trees. The climate value of forests is shaped by decisions made throughout the forest and wood value chain, from management practices that influence forest growth and resilience to the production and use of wood products that store carbon and substitute for fossil-intensive materials. Consequently, climate mitigation should be assessed across the entire forest and wood value chain, rather than focusing exclusively on carbon stocks within forest ecosystems. Understanding these interconnected benefits is essential for designing policies and management strategies that deliver meaningful and lasting climate outcomes.

As interest in nature-based climate solutions continues to grow, carbon markets are emerging as an important source of finance for sustainable forest management. Their long-term credibility, however, depends on the environmental integrity of the carbon credits they generate. Carbon accounting methods must accurately reflect additional climate benefits, avoid double

counting, and ensure that carbon storage is durable and verifiable over time. Without robust monitoring, transparent reporting, and credible verification systems, carbon markets risk undermining confidence among investors, policymakers, and society, thereby limiting their ability to mobilise meaningful finance for climate action.

For the forest sector, this presents both an opportunity and a responsibility. Sustainable forest management already delivers substantial climate benefits through carbon sequestration, renewable wood production, and material substitution. Strengthening these contributions requires management approaches that are adapted to regional conditions, supported by sound science, and recognised through credible carbon accounting frameworks. By combining resilient forest management with transparent monitoring and efficient wood value chains, the forest-based sector can reinforce its position as a key partner in contributing to climate neutrality objectives while supporting a competitive and sustainable bioeconomy.

Centre: EU Regulatory Framework as a driving force. Left Block (Input-Forest): SFM in the three climate zones. Right Block: Flow A: Storage in Long-Lived Products; Flow B: Substitution Effect. Linking both Blocks: MRV System and Credit Integrity. "Envelops" the process to ensure carbon capture is real, additional, and permanent. Final Output: Climate Neutrality by 2050 with co-benefits (biodiversity, water, rural employment). AI-generated figure using author's data (p. 71 in the report).



CREATING THE CONDITIONS FOR COMPETITIVE, CLIMATE-RESILIENT FORESTRY

Aligning public policies, private investment, and stakeholder interests is essential to support forest management approaches that deliver climate resilience, biodiversity conservation, and economic value over the long term. Integrated forest management provides a practical framework for balancing these multiple objectives across diverse forest landscapes. This approach can be combined with complementary pathways; for example, through:

- Forest certification: robust certification schemes provide market recognition for sustainable management practices, increasing transparency and building confidence among customers, investors, and society.
- Value-added wood products: promoting higher value-added wood products extends carbon storage, strengthens resource efficiency, and increases the economic return generated from sustainably managed forests.
- Improved governance: coherent policies, effective institutions, and stronger collaboration among public and private actors improves governance and creates the conditions needed for long-term investment and adaptive forest management.

Realising these opportunities requires addressing several persistent barriers such as fragmented policy frameworks, which often create conflicting objectives across climate, biodiversity, forestry, and rural development agendas, making it difficult to implement coherent management strategies. At the same time, short-term economic incentives frequently favour immediate returns over long-term ecosystem resilience, while limited coordination among stakeholders can reduce the effectiveness of both public policies and private initiatives. Overcoming these challenges requires stronger cross-sectoral governance, better alignment of policy objectives, and market-based instruments that reward the multiple environmental and societal benefits generated by sustainably managed forests.



TURNING KNOWLEDGE INTO ACTION

Multifunctional forestry depends not only on sound management practices but also on an enabling environment that supports their implementation. Experience shows that supportive institutions, well-designed incentives, and science-driven knowledge sharing are mutually reinforcing pillars that help translate policy ambitions into practical forest management. Together, they provide forest owners and managers with the confidence, capacity, and flexibility needed to balance wood production with biodiversity conservation, climate adaptation, and other ecosystem services.

Effective governance must reflect the diversity of forests, including ownership structures. Rather than relying on a single policy instrument, successful implementation requires coherent combinations of regulatory, financial, and capacity-building measures adapted to local ecological and socio-economic conditions. In addition to traditional public support, market-based instruments such as payments for ecosystem services (PES), carbon and biodiversity markets, and blended public-

private finance are creating new opportunities to reward sustainable forest management. Their effectiveness, however, depends on transparent governance, clear responsibilities, stakeholder trust, and manageable transaction costs.

Science-driven knowledge sharing connects policy with practice. Decision-support systems, advisory services, digital knowledge platforms, and participatory approaches enable forest managers to integrate scientific evidence with practical experience and local knowledge. This strengthens evidence-based decision-making, supports adaptive management, and builds trust among stakeholders while improving the uptake of innovative management solutions.

Multifunctional forestry is most successful when governance, incentives, and knowledge systems are developed together rather than in isolation. Strengthening policy coherence, expanding results-based financing, improving advisory services, and promoting collaboration across the forest value chain will create the enabling conditions needed for resilient forests, competitive businesses, and the long-term delivery of ecosystem services.



Management choices made today shape the resilience and productivity of future forests © Benjamin Balazs (Unsplash)

SYNTHESIS AND KEY RECOMMENDATIONS

Forests are expected to contribute simultaneously to climate mitigation, biodiversity conservation, renewable material supply, and a wide range of ecosystem services. Meeting these expectations requires a shift from managing individual objectives towards managing resilient, multifunctional forest landscapes. The scientific evidence shows that productive forestry and biodiversity conservation are not competing goals, but complementary objectives that reinforce the long-term resilience, productivity, and societal value of forests.

For the forest-based sector, the priority should be to embed biodiversity and climate resilience as core components of sustainable forest management. Integrative Forest Management is a practical framework for achieving this by combining active forest management with targeted conservation measures, and adapting management to local ecological, economic, and social conditions. A diversified portfolio of region-specific silvicultural practices, rather than a one-size-fits-all approach, will be essential to strengthen forest resilience while maintaining a reliable supply of renewable wood resources.

Demonstrable sustainable forest management will become increasingly important. Investing in harmonised biodiversity indicators, robust monitoring systems, and transparent reporting will enable the sector to measure management outcomes, communicate progress credibly, and respond to evolving regulatory and market requirements. Advances in remote sensing, National Forest Inventories, and digital technologies provide new opportunities to support adaptive management and strengthen confidence among policymakers, investors, customers, and society.

Additionally, it is becoming increasingly important to consider climate benefits across the entire forest and wood value chain. Sustainable forest management, combined with efficient resource use, cascading use, and circular economy principles, can maximise carbon benefits beyond the forest itself. At the same time, maintaining the credibility of carbon markets through transparent governance, robust monitoring, and high-integrity accounting frameworks will be essential for attracting long-term investment in climate-smart forestry.

Success, however, depends not only on management practices, but also on the enabling environment in which they operate. Supportive institutions, coherent policies, well-designed financial incentives, and science-driven knowledge sharing are critical for translating sustainability objectives into practical action. Public and private financing mechanisms, including payments for ecosystem services, carbon and biodiversity markets, and blended finance, should be designed to reward the delivery of multiple ecosystem services while remaining transparent, efficient, and adapted to local contexts.

Finally, the forest-based sector has an opportunity to strengthen its leadership by fostering collaboration across the value chain. Closer cooperation among forest owners, industry, researchers, policymakers, financial institutions, and civil society will improve knowledge exchange, accelerate innovation, and support evidence-based decision-making. By integrating sustainable management, credible monitoring, climate-smart value chains, and effective governance, the forest-based sector can reinforce its competitiveness while demonstrating its essential contribution to the climate, biodiversity, and bioeconomy ambitions.

ACKNOWLEDGEMENTS

This publication is based on the Teaming Up 4 Forests' study "Productive and Biodiverse: Managing Europe's Forests for Economic and Ecological Outcomes", published as IUFRO World Series Volume 46. We extend our heartfelt appreciation to all authors and contributors for their valuable work. In particular, we would like to thank Frank Krumm for serving as the Scientific Chair of the study, and the Lead Authors Tommaso Chiti, Zuzana Dobšínská, Nataša Lovric, Maria Nijnik, and Andreea Spinu for their contributions.

We express our gratitude to Mondi for the financial support provided to conduct the study and produce this publication. In line with the principles of Teaming Up 4 Forests, the highest standards of scientific quality, integrity, and independence have been applied when carrying out this study. This Business Brief provides a concise overview of the key messages and findings of the full, peer-reviewed study, highlighting considerations of particular relevance to the forest-based sector, business executives, and other decision-makers. We recommend the full report to the reader for deeper insights into the scientific evidence and the range of perspectives underpinning its findings. We hope that this publication will contribute to an informed dialogue and to support decision-making towards forests that are both productive and biodiverse.

A handwritten signature in black ink, appearing to read 'Nelson Grima', with a long horizontal stroke extending to the left.

Nelson Grima

A handwritten signature in black ink, appearing to read 'L. Walther', with a stylized, cursive script.

Laura Walther

This publication has been prepared in the framework of the science-business
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