

Forests and climate change: new challenges

Preface

Marc Fesneau, Minister for Agriculture and Food Sovereignty

Introduction

Bérolde Costa de Beauregard, Municipal councillor and forester, and **Jean-Luc Dunoyer**, Project Director of the Comité Stratégique de Filière Bois

Much is expected of the forest, both in terms of the amenities and the products it provides. Its sustainable management between generations, including the long-term maintenance of the forest carbon sink, requires that the forest be vigorous, managed dynamically and that its product is essentially oriented towards sustainable uses. And pleasure presupposes that the forest remains beautiful.

The French forest has developed remarkably, in terms of surface area and quality in the last century.

Since then, climate change that is faster than the natural adaptation of forests has called into question the long-term vitality of many massifs, a trend aggravated by the occurrence of crises such as fires or attacks by insect pests that brutally modify the local forest landscape.

The quality of products likely to be used for wood is itself modified with an expected increasing share of "crisis wood". From a social and economic point of view, the strengthening of industrial sovereignty for the recovery and processing of wood from this French harvest is a priority, for the trade balance, for the maintenance of a diffuse industrial fabric as well as for the reduction of significant "logistical" carbon emissions.

These subjects take their rightful place in the definition of public policies for the ecological transition and the transition to a low-carbon economy.

Policies for which it will be necessary to be able to project and integrate a scenario of long-term closure between forest management, product supply and consumption demands, with a systemic vision of the balances to be maintained and a maintained complementarity between multiple uses for wood.

Forests and climate change: adaptation, management and renewal

The origins of sustainable forest management

Michel Hermeline, General Council for Food, Agriculture and Rural Areas

The concept of sustainable management was born from demographic and economic development which has drawn on forest resources to the point of threatening their existence. The principles of sustainable management, as they are defined today, appeared several centuries ago. This sustainable management was built as limits were reached, under pressure from the consequences of the disappearance, degradation and over-exploitation of forests. Gradually, the concern for the renewal of forests – and the income, goods and services they provided –, long-term planning and the preservation of the forest cover has forged forest law but also a technical corpus, implemented by a dedicated administration: « Les Eaux et Forêts ». The notion of sustainable development, recognized at the global level since 1987, is a generalization to all the planet's resources of an awareness that we have had on a national scale with our forests.

Forest carbon: striking a balance between preserving stocks and maintaining a carbon pump

Christine Deleuze, Carbon strategy project director, ONF, **Salomé Fournier**, **Antoine Billard** and **Emila Akroume**, R&D officers at the ONF, **Antoine Colin**, Head of the forest analysis department at IGN, **Claire Bastick** and **Henri Cuny**, Research engineers, forest analysis department, IGN, **Estelle Vial**, Environmental engineer, FCBA, **Mélanie Juillard**, Research engineer at CITEPA, **Meriem Fournier**, Director of the SILVA-INRAE unit, and **Jean-François Dhôte**, INRAE Research Director

In 2013, French forests absorbed almost 72 MtCO₂eq, thus represented a significant carbon sink able to offset around 15% of France's yearly greenhouse gas emissions. This situation was the result of the historic forest growth during the XXth century, both in surface area and standing volume. Our forest was therefore still young and growing.

Since then, this sink has been drastically reduced, around a 50% collapse in 10 years. The forest has since suffered from major dieback and forest fires, as well as a decreased growth following the extreme weather events of recent years.

As the French national low-carbon strategy is being revised, the forest mitigation potential is being questioned between growing a standing stock which provides a support for its own biological production as well as many environmental services, optimising carbon removal from the atmosphere, or supplying wood as a renewable, long-lasting material essential to decarbonise our society.

Projections of carbon stocks and flows in the French forestry and wood sector in the context of climate change

Claire Bastick, Antoine Colin, Henri Cuny, IGN, Marin Chaumet, Gérard Deroubaix, Mouchira Lahiani, Lucile Savagner and Estelle Vial, FCBA

To achieve carbon neutrality by 2050, France has set itself ambitious targets for reducing greenhouse gas emissions. Forests and wood are key elements in the National Low-Carbon Strategy because of their ability to sequester carbon and avoid fossil carbon emissions through the use of wood. To support these strategies, public authorities and economic players are relying on documented information and expertise.

This article summarises the main conclusions of the IGN-FCBA study of May 2024 on the climate change mitigation potential of the French forestry and timber sector.

Various scenarios for the joint development of forest resources and the sector's carbon balance were simulated for the 2050 and 2080 timeframes, taking into account a gradient of harvest levels, the effects of climate change and renewal strategies. These projections, whose assumptions have been validated with specialist experts, draw on the most up-to-date scientific and technical tools and knowledge.

Changes in forest health, with a focus on recent crises

Fabien Carouille, Forest Health Department, Ministry of Agriculture and Food Sovereignty

Since 2015, the general conditions for monitoring forest health have changed dramatically. The exception that was the summer drought and heatwave of 2003 has become the rule almost every year, involving strong and varied reactions from the forestry community, both in the short and long term.

Observing, adapting and renewing forests

Albert Maillet, Director General of the Office National des Forêts (ONF)

The French forest is facing the challenge of climate change and it is suffering. Choosing a strategy requires a relevant upstream diagnosis. The national forest inventory provides an initial data base that is regularly updated. The HD LIDAR mission completes this overview of woodland resources. The Forest Health Department provides information on forest health. Finally, the RENECOFOR network detects underlying trends. Simulation tools for future climate scenarios, such as CLIMESSENCES and ZOOM 50, can be used to check the degree of climatic compatibility of a species, and therefore to determine when and where this species could fall into climatic discomfort. In this way, we can build a gradual response strategy that is proportionate to the risk, diversified and supported by a proactive mobilisation of available forest genetic resources, all within the framework of the mosaic forest concept.

Private forests and dynamic management methods

Roland de Lary, Managing Director of the Centre National de la Propriété Forestière (CNPF)

The French forest belongs to 3.5 million owners. Its management of 12.5 million ha is supervised by various sustainable management documents. They are more or less compulsory and/or recommended. The National Center for Private Forest (CNPF) is the guarantor of these efforts which enable responsiveness to climatic hazards.

Communes forestières, committed to the defence of French forests

Philippe Canot, President of the National Federation of Forest Communities (FNCOFOR)

Elected representatives have a special role to play in the forestry and wood industry, as regional planners in their many roles. Aware of the challenges facing forests today, they are already working with other players in the sector to find solutions for adapting forests to climate change. Within the Communes forestières (forest communities), they are promoting the use of wood in short circuits, contractual agreements to enhance the value of wood from communal forests, and are seeking to involve younger people in these forward-looking issues, notably through the "In 1,000 communes, the forest is a school" programme. They are also mobilising forest owners to improve forest land ownership and thus promote good silvicultural management in France, and are keeping a closer watch on risks. These challenges facing forests, in the service of the general interest, for future generations, require anticipation, planning and regional development.

Assisted migration of forest species: one adaptation lever among others

Brigitte Musch, French National Research Institute for Agriculture, Food and the Environment (INRAE) and Éric Paillassa, National Forest Property Centre (CNPF)

Climate change, with its unprecedented speed, is disrupting forest ecosystems. Faced with this challenge, foresters are trying to find solutions to make the forest as resilient as possible. Genetic resources, and in particular assisted migration, are part of the forest adaptation strategy.

Assisted migration is based on a natural biological process that species use to adapt to the environment in which they thrive. Foresters implement assisted migration both at the provenance level (within the species' range) and at the species level (increasing the range of a species present on the European continent). The objective is to identify and plant provenances and species more adapted to prolonged water stress and high heat to enrich existing resources. Nevertheless, they pay particular attention to the risks of poorly adapting this forest material to current conditions and to the disturbance of ecosystems.

Adaptive evolution of oak trees to climate change

Antoine Kremer, UMR Biodiversity, Genes and Communities of INRA - University of Bordeaux

This paper focuses on the evolutionary mechanisms operating in forest stands, which could contribute to their adaptation to ongoing climate change. Biological evolution is considered here when forest stands are renewed by natural regeneration. Taking oaks as an example, contemporary evolution draws on knowledge acquired on the historical trajectories, at different time scales, which have shaped the responses of trees to previous severe environmental changes. The article then examines the mechanisms of natural selection and adaptive introgression, which trigger adaptation to ongoing climate change. Finally, the lessons that can be drawn from this analysis in terms of management and silviculture are discussed in the last paragraph.

Uses for wood: meeting people's needs and contributing to the transition to a low-carbon economy

Proposal for a supply-demand convergence scenario for the timber industry

Hugues-Marie Aulanier, Principal - Carbone 4, and **Gabriel Follin-Arbelet**, Project Manager – Carbone 4, and, as representatives of the “core group” coordinating the timber industry: **Maxime Chaumet**, General Delegate of France Bois Forêt, and **Jean-Luc Dunoyer**, Project Director of the Comité Stratégique de Filière Bois

Forests are complex ecosystems with multiple ecological, economic and social functions. This ecosystem is now being turned upside down in the context of climate change and the desire to move towards carbon neutrality. Carbone 4 worked with the forestry and wood industry in 2023 for a year, in conjunction with France Bois Forêt, Codifab and Copacel and with the support of the CSF Bois, to collectively build a scenario for the industry that would meet these challenges and articulate ‘wood-biomass’ supply and demand for mainland France by 2050.

This ‘major industry’ project is unprecedented in terms of the exhaustive scope of its analysis and the involvement of all the players in the forestry-wood value chain. The resulting convergence scenario provides a unifying vision for the future of the industry. It outlines a ridge to climb, demanding in terms of the multiple transformations it requires to reach its destination, but coherent in terms of the sector’s contribution to the national economy, employment and the achievement of carbon neutrality, and thus meaningful for all its players, from upstream to downstream.

Building and renovating homes with wood

Dominique Cottineau, General Delegate of the Union des Industriels et Constructeurs Bois (UICB) and **Nicolas Douzain-Didier**, General Delegate of the Fédération Nationale du Bois (FNB)

Wood has a long history in construction, and has many assets to become essential again: it’s the only natural and renewable material, it meets the targets of carbon neutrality that France has set itself as part of its National Low Carbon Strategy and its different deadlines. The housing market has undergone an unprecedented change in recent years, whether in single-family homes or apartment buildings, in new homes or in renovations. Citizens’ aspirations tend to favor a healthy environment for building occupants and respectful of the planet, and the massification of wood construction meets these new needs. The UICB (French union of industrial and wood builders) and the FNB (French national wood federation) provide an overview of constructive wood solutions and their benefits.

Timber construction: low-carbon, safe and efficient

Michel Veillon, Managing Director of Ossabois

Wood is an age-old building material with a proven track record. Today, thanks to science, its performance is perfectly characterised, and with the help of technology, we know how to use it in an optimised, industrial and safe way. Its historic qualities (ease of processing, lightness and insulation) are enhanced by its ability to absorb and store CO₂ over the long term.

Combining it with other materials such as concrete and metal only enhances it.

Its use in construction, naturally off-site, encourages optimisation of materials as well as reversibility and management of the end-of-life of buildings.

Financially, its rapid implementation on an industrial basis offers controlled costs and reduced capital expenditure. The future inclusion of real carbon costs will demonstrate the benefits of timber construction.

What’s more, in a globalised world, timber construction contributes to France’s sovereignty by promoting its re-industrialisation and the creation of jobs that can hardly be relocated.

Its development is both urgent and welcome if we are to build a more sustainable and beautiful world, with the right balance between safety, environment and cost.

Wood in buildings and facilities for the Paris 2024 Olympic Games

Georges Henri Florentin, Honorary General Engineer of Bridges, Waterways and Forests, Secretary of the Forest and Wood Section of the French Academy of Agriculture, Chairman of France Bois 2024

In September 2017, France won the bid to host the Paris Games. In 2018, the Comité Stratégique de la Filière Bois decided to make it one of its two structuring projects. The aim is to create “exemplary wooden

buildings and facilities, using 50% French wood". In the summer of 2018, France Bois 2024 was set up as a lean project structure to implement this collective project. All the technical and economic results and innovations are available to everyone to prepare for the low-carbon transition in construction in the 21st century, with the aim of catching up with Scandinavia, German-speaking countries, North America, Australia, New Zealand and Japan. The results of six years of action presented here and in the book "2024, le bois sur le podium pour décarboner la construction" published by Les Halles show that this is possible.

Towards an economy of functionality: reuse and recycling

Jean-Louis Louvel, Chairman and founder of PGS GROUP

Wooden pallets are essential to the circular economy, facilitating the transport and storage of goods while representing sustainability through their reusability and recyclability. In use since the early 20th century, they support the functionality economy, minimising waste and maximising use. Their reuse and recycling offer economic and environmental benefits, reducing resource consumption and waste production. Reuse initiatives and technological innovations, such as RFID tracking, improve their management. Recycling transforms end-of-life pallets into new products, supporting sustainable resource management. Government policies and industry practices play a key role in promoting these sustainable practices.

Furnishing with wood: a desirable model for reconciling decarbonisation and re-industrialisation in France

Cathy Dufour, Managing Director of Ameublement français

Furniture holds a central place in the everyday life of French people : at home, into offices, third places, public spaces... Wood plays a major role within the materials used by French furniture and fittings manufacturers : as wood-based panels or solid wood, it accounts for 85% of the total weight of materials used in French manufacturing. Whereas French forests need to adapt to climate change, what challenges face the French furniture industry? Two recent studies, respectively conducted by EY and Carbone 4, shed light on the issues and levers facing manufacturers if they want to meet the 2030-2050 targets for decarbonising the French economy. The major challenge is to extend the lifespan of furniture products to help store carbon and preserve wood resources.

The paper industry: a biogenic carbon converter contributing to the fight against climate change

Paul-Antoine Lacour, Copacel

As a user of the cellulose contained in wood, the pulp and paper industry provides to the society products made out of biogenic carbon (packaging, hygiene good,

molecules), thereby replacing manufactured goods derived from fossil carbon. This industry is also mitigating climate change thanks to an increasing use of bioenergy. However, this capacity to produce bio-based materials depends on the ability of forests to continue supplying wood, and therefore to adapt to the consequences of climate change.

Wood energy, an essential renewable energy for the energy transition

Émilie Machefaux, Jérôme Mousset and Nicolas Tonnet, French Environment and Energy Management Agency (Ademe)

While the directive on renewable energies (RED III) sets an ambitious new target : "Member States shall collectively ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 42,5 %", renewable heat produced from wood represents a strategic challenge for the energetic transition. By creating ways of recovering residues or co-products that would not find a market, wood energy is an essential component of the economic balance of the wood sector as a whole. However, given the uncertainties about the available resource linked to climate change and new uses of biomass, it is necessary to have a systemic vision of the resource and valuations. In France, the wood resource is renewable, the deposit however remains limited, so it is important to use it in an optimized way and where it is most relevant to meet the needs of the ecological transition.

Investing in production tools and capturing added value in France

Sylvain Bordebeure, Head of the Wood Sector at ADEME's Bioeconomy and Renewable Energy Division and **Dominique Weber**, Chairman of the Strategic Committee for the Wood Sector (CSF Bois)

Although France benefits from a large and diversified forestry resource, the primary and secondary processing sectors still lack the capacity and capability to move upmarket and limit France's dependence on imports, with an economic and environmental impact that could therefore be improved to enhance our sovereignty. Support for numerous industrial projects as part of France 2030 should help to gradually rebalance our trade balance and better meet the needs of the construction market in particular, with the production of engineering products. The development of drying capacity is also a major challenge, integrating the on-site recovery of lower-quality by-products to control energy requirements.

The forestry and timber industry has been identified as a priority area for ecological planning, with ongoing support schemes to develop and optimise the use of forestry resources, particularly those from under-utilised, damaged or dying stands and/or those vulnerable to the effects of climate change.

The social benefits of the forest-based sector

Forest, territory and society

Anne-Catherine Loisier, Senator for the Côte d'Or

The French forest is of general interest, as stated in the Forestry Code. It has many assets, including contributing to carbon neutrality, developing a circular economy and jobs that cannot be relocated, providing a resource for biodiversity, using wood as a material or source of energy, and promoting leisure activities and green tourism. But the forest is also under threat from fire and drought, bark beetles, game, under-investment in its renewal and inappropriate practices to ensure its resilience. Responding to these threats requires the mobilisation of funding, appropriate governance including local authorities, and international cooperation. A summit on the future of the forest should raise awareness of the long-term challenges it presents.

The Bibracte - Morvan des Sommets Grand Site de France - An experiment in territorial dialogue in a context of forestry conflict

Marieke Blondet and **Éric Lacombe**, AgroParisTech Nancy Centre and Silva laboratory (UMR 1434), **Jean Cacot** and **Vincent Guichard**, Bibracte EPCC, **Philippe Barret**, DialTer and Geysier, and **Nicolas Le Méhauté**, DialTer

The site of the ancient town of Bibracte, on one of the heights of the Morvan, Mont Beuvray, owes part of its heritage value to the forest that serves as a setting for the archaeological remains. A public domain covering almost 1,000 hectares, it is one of Burgundy's major heritage sites, protected as a Monument Historique and as a Landscape, and welcomes around 100,000 visitors a year. The already significant effects of climate change on the site's forest stands are creating a new situation from every point of view, including raising questions from the public, which can sometimes take the form of vehement criticism of the way in which the forest is managed. To deal with these difficulties, a research programme has been set up as part of a wider territorial experiment conducted under the Grand Site de France initiative, which includes a territorial dialogue component.

Key figures from the Mutualised Economic Watch (VEM) for the forestry and wood industry

Éric Toppan, France Bois Forêt and **Mouchira Lahiani**, FCBA Institute of Technology

The forestry and wood industry has created a unique tool that brings together all existing data to produce key figures for the industry. In 2022, the value of production in the forestry and wood industry as a whole reached €76.6 billion. Value added totalled €24 billion, up 4% on 2021, driven mainly by wood energy and upstream

forestry. The sector's added value is growing faster than the French economy as a whole.

The number of FTEs will rise to just over 417,000 by 2022. The forestry and wood industry thus accounts for 12.9% of employment in industrial-based industries. The wood industry's foreign trade balance will be €11 billion lower in 2022, 24% lower than in 2021 (at a slower rate than the French economy's trade deficit). This is due to very strong demand, particularly in the construction and renovation sectors, and the need for energy diversification against a backdrop of sharp price rises. With a rate of 55% coverage of demand by domestic supply and a low export rate (30%), the French forestry-wood industry is characterised by its focus on the domestic market. The sector's various products are made with a significant proportion of wood from French resources, with associated socio-economic benefits: reduction in carbon emissions, jobs and added value created in the regions, etc.

Forests and the timber industry in the Grand Est region faced with the consequences of climate change: threats and prospects

Jean-Pierre Renaud, Vice-President of Fibois Grand Est

Forests play an essential role in the Grand Est region. The forestry and wood industry provides sustainable activity for the region and generates significant resources that are used by a highly varied network of companies, some of which are national leaders in their field. Since 2018, forests have been suffering the consequences of climate change, with repeated dry and very hot summers. All the region's major tree species are affected, starting with spruce, which has been hard hit by the outbreak of bark beetles that have devastated most low-lying stands. These phenomena are set to continue and are leading to an average deterioration in the products obtained from forest harvests. Conservation measures therefore need to be taken, and processing companies need to adapt in order to process and make the best possible use of this 'crisis wood', which now accounts for a significant proportion of the harvest from our forests. Prioritising the use of forest products for timber will enable the entire sector to improve its carbon footprint by increasing the time it takes to sequester carbon. This will require major investment and research efforts, particularly for hardwood species, which are in the majority in our region.

Conclusion

The forest-wood roadmap in ecological planning

Antoine Pellion, General Secretary for Ecological Planning and **Vincent Hulin**, Biodiversity Programme Director

Ecological planning aims to map out long-term trajectories for achieving our environmental objectives: redu-

cing greenhouse gas emissions, adapting to climate change, preserving biodiversity and resources, and improving human health. The General Secretariat for Ecological Planning (Secrétariat Général à la Planification Écologique - SGPE) is responsible for outlining these perspectives and anchoring them in reality, by translating them into effective levers for action based, in particular, on scientific knowledge.

Forests are essential to the success of our ecological transition, because of their ability to store carbon, harbour a rich biodiversity and provide renewable materials. However, the crises exacerbated by global warming (fires, droughts, health crises) are undermining this ecosystem. And the reality of our forests, particularly private forests, can make it difficult to implement certain public policies.

We are highlighting four levers for forestry planning. Firstly, we need to understand our forests better by supporting data collection and research organisations. Secondly, we need to protect them more effectively from natural hazards by promoting conservation and the emergence of resilient ecosystems. In addition, we need to manage and renew our forests more effectively by leaving the management of these environments in the hands of specialists. Finally, we need to encourage the use of forest products that store carbon.

The conservation and allocation of forestry resources could and should serve as an example of ecological planning, to be extended to all sectors as part of the necessary ecological transition. This is what the SGPE is working on.

Issue editors:

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