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BASAJAUN is a European innovation action about sustainable building with wood. The main objective is to demonstrate how wood construction chains can be optimized to foster both rural development and urban transformation whilst being connected with sustainable forest management in Europe. The consortium comprises 29 partners from 12 countries including 8 leading research and technology organizations, 3 universities, 15 companies and 4 other public and sectoral organizations. The project is coordinated by the Tecnia Research and Innovation Foundation in Spain.

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All project results are accessible on the website <http://basajaun-horizon.eu/> and the open science repository <https://zenodo.org/communities/basajaun>. Further info on the project can be found on the CORDIS website <https://cordis.europa.eu/project/id/862942>.



## Summary

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Building with wood is an emerging industry that can contribute to the reduction of greenhouse gas emissions and help to unlock the low-carbon, circular economy. By maximising the use of wood in new buildings and renovation through optimal hybrid solutions with other materials, the built environment can be transformed into a large-scale carbon sink. However, unlocking the potential of wood as both a sustainable building material and climate solution (the '*forest-carbon-pump*') requires a stronger focus on the regional dimensions of wood construction chains and the whole innovation ecosystem. Regional characteristics are not yet sufficiently accounted for in the European and national policy initiatives and programmes. National and regional initiatives are focussed on their context and are still rather disconnected from the European level. Hence, for example European funding programmes are not well geared towards the needs of wood construction industries.

The H2020 project BASAJAUN aims to build the foundation of an *open innovation platform* for the wood construction ecosystem, which can foster dialogue and co-creation between European regions. The platform shall showcase innovations, demo buildings and other solutions, and support their exploitation in the regional forest-based sector. In this report, a competitive assessment of five pilot regions is described: i) *North Ostrobothnia* and ii) *North Karelia* in Finland, iii) *New Aquitaine* in France, iv) *West Pomerania* in Poland, and v) the *Basque country* in Spain. Each pilot region is described in a background profile that summarizes available information about the regional context, the forest resources and management, its wood construction chain and market trends, and policy programmes. Each region is presented in a value chain stakeholder map and a SWOT analysis, pointing to challenges and possibilities for regional transformation. A set of preliminary conclusions summarises the options for regional roadmaps to be explored with stakeholders in the open platform.

The first accomplishment is the foundation of the *Wood Sector Alliance for the New European Bauhaus (Wood4Bauhaus)*, a coalition of the main EU wood sector umbrella organisations, connecting research, industry and trade unions, which was launched in response to the European Commission's New European Bauhaus movement.

**Keywords:** sustainable wood construction, forest-based bioeconomy, engineered wood products, regional innovation systems, co-creation.

## Tiivistelmä

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Puurakentaminen on kasvava teollisuudenala, joka voi edistää kasvihuonekaasupäästöjen vähentämistä ja auttaa siirtymässä vähähiiliseen kiertotalouteen. Maksimoimalla puun käyttö uudis- ja korjausrakentamisessa hybridiratkaisujen avulla voidaan rakennetusta ympäristöstä saada aikaan kasvava hiilivarasto eli hiilinielu. Puun potentiaalinen vapauttaminen sekä kestävässä rakennusmateriaalina että ilmatoratkaisuna ("metsä-hiilipumppu") edellyttää kuitenkin vahvempaa keskittymistä puurakentamisen arvoketjujen alueelliseen merkitykseen ja alan innovaatioekosysteemiin. Alueellisia erityispiirteitä ei vielä oteta riittävästi huomioon eurooppalaisissa ja kansallisissa poliittisissa aloitteissa ja ohjelmissa. Kansallisissa ja alueellisissa aloitteissa keskitytään omaan kontekstiinsa, ja ne ovat vielä melko irrallaan Euroopan tasosta. Rahoitusohjelmia ei ole suunnattu riittävästi puurakennusteollisuuden tarpeisiin.

BASAJAUN-EU-hankkeen yhtenä tavoitteena on luoda perusta puurakentamisen toimijoiden avoimelle innovaatiofoorumille, joka edistää vuoropuhelua ja yhteistoimintaa Euroopan alueiden välillä. Foorumi esittelee tuoteinnovaatioita, esimerkkikohteita ja muita ratkaisuja ja tukee niiden hyödyntämistä. Tässä raportissa kuvataan viiden esimerkkialueen kilpailukykyarviointi: i) Pohjois-Pohjanmaa ja ii) Pohjois-Karjala Suomessa, iii) Uusi Akvitalia Ranskassa, iv) Länsi-Pommerin alue Puolassa ja v) Baskimaa Espanjassa. Kutakin pilottialuetta kuvataan taustaprofiilissa, jossa esitetään yhteenveto alueellisista metsävaroista ja metsänhoidosta, puurakentamisen ketjusta ja markkinasuuntauksista sekä poliittisista ohjelmista. Kukin alue esitellään arvoketjun sidosryhmäkartalla ja SWOT-analyysillä, jossa määritetään alueellisen muutoksen haasteita ja mahdollisuuksia. Alustavissa johtopäätöksissä esitetään yhteenveto alueellisten etenemissuunnitelmien vaihtoehdoista.

Ensimmäisenä saavutuksena on perustettu Wood Sector Alliance for the New European Bauhaus (Wood4Bauhaus), joka on EU:n tärkeimpien puualan kattojärjestöjen aloite, yhdistäen tutkimuksen, teollisuuden ja ammattiyhdistykset. Liitto perustettiin vastauksena Euroopan komission New European Bauhaus -liikkeeseen.

**Avainsanat:** kestävä puurakentaminen, metsäpohjainen biotalous, rakennepuutuotteet, alueelliset innovaatiojärjestelmät, yhteiskehittäminen.

## Sommaire

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La construction en bois est une industrie émergente qui peut contribuer fortement à la réduction des émissions de gaz à effet de serre et aider à débloquer l'économie circulaire à faible émission de carbone. En maximisant l'utilisation du bois dans les nouvelles constructions et les rénovations grâce à des solutions hybrides optimales avec d'autres matériaux, l'environnement bâti peut être transformé en un puits de carbone à grande échelle. Toutefois, pour exploiter le potentiel du bois en tant que matériau de construction durable et solution climatique (la "pompe forêt-carbone"), il faut mettre davantage l'accent sur la dimension régionale des chaînes de construction en bois et sur l'ensemble de l'écosystème d'innovation. Les caractéristiques régionales ne sont pas encore suffisamment prises en compte dans les initiatives et programmes politiques européens et nationaux. Les initiatives nationales et régionales sont centrées sur leur contexte et sont encore assez déconnectées du niveau européen. Les programmes de financement ne sont pas bien adaptés aux besoins des industries de la construction en bois.

Le projet BASAJAUN vise à jeter les bases d'une plateforme d'innovation ouverte pour l'écosystème de la construction en bois, qui peut favoriser le dialogue et la cocréation entre les régions européennes. La plateforme présentera des innovations, des bâtiments de démonstration et d'autres solutions, et soutiendra leur exploitation dans le secteur forestier régional. Le présent rapport décrit une évaluation concurrentielle de cinq régions pilotes : i) l'Ostrobotnie du Nord (région d'Oulu) et la Carélie du Nord en Finlande, ii) la Nouvelle-Aquitaine en France, iii) la Poméranie occidentale en Pologne et iv) le Pays basque en Espagne (qui a rejoint le projet tout récemment en tant que région supplémentaire). Chaque région pilote est décrite dans un profil de base qui résume les informations disponibles sur le contexte régional, les ressources forestières et la gestion, sa chaîne de construction en bois et les tendances du marché, ainsi que les programmes politiques. Chaque région est présentée dans une carte des parties prenantes de la chaîne de valeur et une analyse SWOT, indiquant les défis et les possibilités de transformation régionale. Un ensemble de conclusions préliminaires résume les options pour les feuilles de route régionales à explorer avec les parties prenantes dans la plateforme ouverte.

Une première réalisation est la fondation de l'Alliance du secteur du bois pour le nouveau Bauhaus européen (Wood4Bauhaus), une coalition des principales organisations de coordination du secteur du bois de l'UE, reliant la recherche, l'industrie et les syndicats, qui a été lancée en réponse au mouvement du Nouveau Bauhaus Européen de la Commission européenne.

**Mots clés** : construction en bois durable, bioéconomie forestière, produits en bois d'ingénierie, systèmes d'innovation régionaux, cocréation.

## Streszczenie

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Budownictwo drewniane to rozwijający się sektor, który może w znacznym stopniu przyczynić się do redukcji emisji gazów cieplarnianych i pomóc w tworzeniu niskoemisyjnej gospodarki cyrkulacyjnej. Dzięki maksymalnemu wykorzystaniu drewna w nowym budownictwie i renowacji, poprzez zastosowanie optymalnych rozwiązań hybrydowych z innymi materiałami, budynki można przekształcić w znaczący rezerwuar węgla. Zwiększenie potencjału drewna jako zrównoważonego materiału budowlanego, wspierającego zapobieganie zmianom klimatu wymaga jednak zwrócenia większej uwagi na regionalny wymiar łańcuchów budownictwa drewnianego i całego ekosystemu innowacji. Poszczególne uwarunkowania regionalne nie są jeszcze w wystarczającym stopniu uwzględniane w europejskich i krajowych inicjatywach oraz programach politycznych. Z kolei inicjatywy krajowe i regionalne głównie koncentrują się na kontekście lokalnym i są raczej oderwane od poziomu europejskiego, a co za tym idzie programy finansowania nie są dobrze ukierunkowane na potrzeby budownictwa drewnianego.

Projekt BASAJAUN ma na celu stworzenie ram dla otwartej platformy innowacyjnej dla ekosystemu budownictwa drewnianego, która może wspierać dialog i współtworzenie wartości między regionami europejskimi. Platforma ta będzie prezentować innowacyjne rozwiązania, budynki demonstracyjne oraz wspierać ich wykorzystanie w sektorze leśno-drzewnym w danych regionach. W niniejszym raporcie przedstawiono ocenę konkurencyjności pięciu regionów pilotażowych: i) Północnej Ostrobotnii (region Oulu) i Północnej Karelii w Finlandii, ii) Nowej Akwitanii we Francji, iii) Pomorza Zachodniego w Polsce oraz iv) Kraju Basków w Hiszpanii. Opis każdego regionu pilotażowego zawiera podsumowanie informacji dotyczących kontekstu regionalnego, zasobów leśnych i gospodarki leśno-drzewnej, łańcucha wartości drewna, trendów rynkowych i polityk regionalnych. Ponadto dla każdego regionu przygotowano mapę interesariuszy łańcucha wartości drewna oraz analizę SWOT, wskazującą na wyzwania i możliwości regionalnej transformacji w kierunku zwiększenia roli budownictwa drewnianego. Wstępne wnioski są podstawą do wypracowania regionalnych map drogowych, które zostaną przeanalizowane z interesariuszami w ramach otwartej platformy innowacyjnej.

Pierwszym osiągnięciem jest utworzenie Sojuszu Sektora Drzewnego na rzecz Nowego Europejskiego Bauhausu (*Wood Sector Alliance for the New European Bauhaus*, Wood4Bauhaus), koalicji głównych organizacji sektora drzewnego UE, łączącej środowiska naukowe, przemysłowe i związki zawodowe, która powstała w odpowiedzi na inicjatywę Komisji Europejskiej Nowy Europejski Bauhaus.

**Słowa kluczowe:** zrównoważone budownictwo drewniane, biogospodarka oparta na lasach, drewno inżynieryjne, regionalne systemy innowacji, współtworzenie.



## Resumen

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La construcción con madera es una industria emergente que puede contribuir en gran medida a la reducción de las emisiones de gases de efecto invernadero y ayudar a desbloquear la economía circular con bajas emisiones de carbono. Al maximizar el uso de la madera en la construcción nueva y en la renovación mediante soluciones híbridas óptimas con otros materiales, el entorno construido puede transformarse en un sumidero de carbono a gran escala. Sin embargo, para liberar el potencial de la madera como material de construcción sostenible y como solución climática (la "bomba de carbono forestal") es necesario centrarse más en la dimensión regional de las cadenas de construcción de madera y en todo el ecosistema de innovación. Las características regionales aún no se tienen suficientemente en cuenta en las iniciativas y programas políticos europeos y nacionales. Las iniciativas nacionales y regionales se centran en su contexto y siguen estando bastante desconectadas del nivel europeo. Los programas de financiación no están bien orientados a las necesidades de las industrias de la construcción en madera.

El proyecto BASAJAUN pretende sentar las bases de una plataforma de innovación abierta para el ecosistema de la construcción en madera, que pueda fomentar el diálogo y la co-creación entre las regiones europeas. La plataforma mostrará innovaciones, edificios de demostración y otras soluciones, y apoyará su explotación en el sector forestal regional. En este informe se describe una evaluación competitiva de cinco regiones piloto: i) Ostrobotnia del Norte (Región de Oulu) y Carelia del Norte en Finlandia, ii) Nueva Aquitania en Francia, iii) Pomerania Occidental en Polonia, y iv) el País Vasco en España (que se ha unido al proyecto recientemente como una región más). Cada región piloto se describe en un perfil que resume la información disponible sobre el contexto regional, los recursos forestales y la gestión, su cadena de construcción de madera y las tendencias del mercado, así como los programas políticos. Cada región se presenta en un mapa de agentes de la cadena de valor y en un análisis DAFO, en el que se señalan los retos y las posibilidades de transformación regional. Un conjunto de conclusiones preliminares resume las opciones de las hojas de ruta regionales que se explorarán con los agentes en la plataforma abierta.

Un primer logro es la fundación de la Alianza del Sector de la Madera para la Nueva Bauhaus Europea (Wood4Bauhaus), una coalición de las principales organizaciones paraguas del sector de la madera de la UE, que conecta la investigación, la industria y los sindicatos, y que se puso en marcha en respuesta al movimiento de la Nueva Bauhaus Europea de la Comisión Europea.

**Palabras clave:** construcción sostenible en madera, bioeconomía forestal, productos de madera técnica, sistemas regionales de innovación, co-creación.

## Laburpena

Uwe Kies<sup>1</sup>, Jean-Luc Kouyoumji<sup>2</sup>, Peter Romih<sup>2</sup>, Henrik Heräjärvi<sup>3</sup>, Mikko Weckroth<sup>3</sup>, Toivo Muilu<sup>3</sup>, Ewa Leszczyszyn<sup>4</sup>, Dobrochna Augustyniak-Wysocka<sup>4</sup>, Gabriela Bidzińska<sup>4</sup>, Aitor Saez de Zerain Albizu<sup>5</sup> eta Javier García Jaca<sup>6</sup>

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Zurarekin egindako eraikuntza goraka doan industria da, eta berotegi-efektuko gasen emisioak murrizten eta ekonomia zirkularra desblokeatzen lagun dezake, karbono-isurketa txikiak eginez. Eraikuntza berrian eta berrikuntzan zuraren erabilera maximizatzean, beste material batzuekiko soluzio hibrido optimoen bidez, eraikitako ingurunea karbono-hustubide handi bihur daiteke. Hala ere, zurak eraikuntza-material iraunkor gisa eta irtenbide klimatiko gisa duen potentziala ("baso-karbonozko ponpa") askatzeko, beharrezkoa da zuraren eraikuntza-kateen eskualde-dimentsioan eta berrikuntza-ekosistema osoan arreta handiagoa jartzea. Eskualdeen ezaugarriak oraindik ez dira behar beste kontuan hartzen Europako eta nazioko ekimen eta programa politikoetan. Ekimen nazionalak eta eskualdekoak beren testuinguruan zentratzen dira, eta oraindik ere nahiko deskonektatuta daude Europako mailatik. Finantzaketa-programak ez daude ondo bideratuta zurezko eraikuntza-industrien beharretara.

BASAJAUN proiektuak zurezko eraikuntzaren ekosistemarako berrikuntza-plataforma ireki baten oinarriak ezarri nahi ditu, Europako eskualdeen artean elkarrizketa eta baterako sorkuntza sustatu ahal izateko. Plataformak berrikuntzak, erakusketa-eraikinak eta bestelako irtenbideak erakutsiko ditu, eta eskualdeko baso-sektorean ustiatzen lagunduko du. Txosten honetan bost eskualde piloturen lehia-ebaluazioa deskribatzen da: I) Iparraldeko Ostrobotnia (Ouluko Eskualdea) eta Iparraldeko Karelia Finlandian, ii) Akitania Berria Frantzia, iii) Mendebaldeko Ponerania Polonian, eta iv) Euskal Autonomia Erkidegoa Espainian (duela gutxi proiektuarekin bat egin duena beste eskualde bat bezala). Eskualde pilotu bakoitza eskualdeko testuinguruari, baso-baliabideei eta kudeaketari, zura eraikitze kateari, merkatuaren joerei eta programa politikoei buruzko informazioa laburbiltzen duen profil batean deskribatzen da. Eskualde bakoitza balio-kateko eragileen mapa batean eta AMIA analisi batean aurkezten da. Mapa horretan eskualdeen eraldaketarako erronkak eta aukerak adierazten dira. Atariko ondorio multzo batek eragileekin plataforma irekian aztertuko diren eskualdeko ibilbide-orrien aukerak laburbiltzen ditu.

Lehen lorpena Europako Bauhaus Berrirako Zuraren Sektorearen Aliantza (Wood4Bauhaus) fundazioa sortzea izan zen, EBko zuraren sektoreko aterki erakunde nagusien koalizioa, ikerketa, industria eta sindikatuak lotzen dituen, eta Europako Batzordearen Europako Bauhaus Berriaren mugimenduari erantzunez abian jarri zena.

**Gako-hitzak:** zurezko eraikuntza iraunkorra, baso-bioekonomia, zur teknikoko produktuak, eskualdeko berrikuntza-sistemak, baterako sorkuntza.

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# 1. Introduction<sup>1</sup>

## 1.1. EU policy context: Wood construction as a driver for regional economic development and rural-urban innovation

### 1.1.1. A main opportunity for transforming the building sector into a carbon sink

Nature-based materials, and especially engineered wood products (EWP), can offer green building solutions that are renewable, recyclable and have a far better environmental performance (lower carbon footprint) during their life cycles than most conventional materials. Prefabrication using wood offers modular possibilities to redesign and modernise buildings in non-invasive and flexible ways (i.e., additional storeys, roof extensions, interior refurbishment), also limiting the need for demolition to a last resort. Wood is becoming recognized as both **a sustainable building material and climate solution**. Building with wood is an emerging industry that can make a high contribution to the reduction of GHG emissions and help to unlock the low-carbon, circular economy. Increasing the use of wood as raw material in buildings will contribute to increase performance, quality and habitability of the European building stock with many benefits for healthier, sustainable cities.



**Figure 1.** Forest-carbon-pump: Transforming the built environment into a carbon sink (own figure).

<sup>1</sup> Author: Uwe Kies, InnovaWood asbl, Brussels, Belgium

The wood construction value chain (Figure 1) has a **trifold impact on climate change mitigation**: i) *Sequestration*, that is carbon capture of atmospheric CO<sub>2</sub> by trees and accumulation in woody biomass, ii) *Storage* of carbon in long-lived wood products, and iii) *Substitution* of energy-intensive materials, e.g., concrete, cement, steel, or plastics. The decisive advantage of the nature-based material wood from a circular economy point of view is that it can be recycled both in the biological and technological cycle, and that the carbon storage time in long-lived wood products can be further prolonged through additional reuse and recycling phases.

- **Wood products can therefore play a big role in the decarbonization of major sectors**, e.g., the building and construction sector alone is responsible for circa 40% of global GHG emissions, the textile and fashion sector for circa 10%. In this context, wood products can offer an alternative, climate friendly, sustainable solutions for building structures (new built, renovation), but also for many interiors (furniture, flooring, doors, stairs, windows, etc.). Wood innovations offer also a huge decarbonization potential in a range of other industries (e.g., wood fibre textiles, bioplastics, other biobased products).
- The scientific evidence around the climate benefits of wood in construction and durable products, the technological progress in building engineering with wood, and the number of showcases, lighthouse projects, and numerous good practices is growing day by day in European countries.
- Support for more visibility and development of the wood sector is provided by national and regional platforms to promote wood industries, campaigns and public relations, special prize competitions in the field of sustainable building, and specific lines of national funding programme for R&I dedicated to wood innovation.
- The decisive potential of nature-based materials including wood as a climate solution has now been recognized in important initiatives and it starts gaining more attention in EU policies and programmes (cf. chapter 1.1.2).
- Wood construction is thus gradually gaining attention in the overall construction sector, and slowly growing market shares in leading countries. However, at present it still represents only a minor average market share of 2.4% in the EU construction sector<sup>2</sup>.

**By maximising the use of wood in new built and renovation through optimal hybrid solutions with other materials, the built environment can be transformed into a large-scale carbon sink.** This also means that the material use of wood should be preferred over early energy recovery, wherever economically and logistically viable, to stimulate higher industrial symbiosis and to sequester more carbon in the long term. Better integration of wood products in the construction sector can thus also become a lever for more sustainable development of rural regions with high forest cover.

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<sup>2</sup> Trinomics, VITO, Wageningen University Research, Technische Universität Graz & Ricardo, 2021. Evaluation of the climate benefits of the use of Harvested Wood Products in the construction sector and assessment of remuneration schemes. Report to the European Commission, DG Climate Action. Trinomics BV. <https://op.europa.eu/s/vBXn>



**The ‘forest-carbon-pump’ is a powerful vision how the built environment can be transformed into a global carbon sink**<sup>3</sup> ((Forest-carbon-pump: Transforming the built environment into a carbon sink (own figure)).). This new sink created through a sustainable built infrastructure can contribute to decarbonise the earth system’s overheating atmosphere and thus emerge as a real inter-generational solution to slow down and possibly revert climate change. At the heart of this vision are the world’s ecosystems which sequester carbon in nature-based materials such as wood and other plant fibres, which then are converted into long-lived products to safely store the carbon in buildings for decades up to centuries. This much more holistic approach for the building sector demands the setup and management of a complete value chain web from rural regions to urban areas, from individual trees to citizens seeking more sustainable lifestyles.

Five important cornerstones of the ‘forest-carbon-pump’ include: 1. Forest ecosystem protection and management, 2. Forest-based products manufacturing and markets, 3. Built environment as final carbon sinks, 4. Circular economy systems prolonging the products’ lifetime, 5. Digitalisation enabling the data-intensive integration of the value chain. Unlocking this visionary potential will rely on three principles:

- **Sustainable forest biological production is the main engine for the ‘forest-carbon-pump’.** Maximizing the timber supply from forests to create a carbon sink in the built environment is not self-evident, given that forests themselves are impacted strongly by climate change and increasing disturbances. Forests provide major ecosystem functions such as soil protection, water- and air quality, regional climate conditions, natural habitats and biodiversity, recreation, health and well-being of citizens. Their economic function is that they already provide a wide range of wood-based and non-wood forest products, both for subsistence of local populations, supply of raw timber to forest-based industries (solid wood products, paper, furniture), and also to more high-end applications such as textiles, bioplastics or biochemicals (e.g., food additives, pharmaceuticals). Maintaining the forests’ ecological integrity and role for biodiversity and climate is however paramount and the first priority. Productivity of growth and fulfilling the increasing demand for raw materials thus needs to be carefully balanced with all other important forest functions.
- **Creating a carbon sink in the built environment requires massive upscaling of hybrid EWP.** Relying on existing, proven and safe technologies, engineered wood products (EWP’s) fulfil multiple uses in everyday life and remain durable when properly used. Their use can be increased to substitute fossil-based, energy-intensive materials in the built environment. EWP’s such as CLT and glulam are showing significant growth but are still only a niche market within the larger construction sector. Wood products are also not yet in particular resource efficient or circular in use, so R&I is needed to enlarge their scope to hybrid applications, to extend their lifetime and to make them fit for the Circular Economy, which is key to maximise their potential for storing embodied carbon. The wood sector has also to open to all relevant disciplines in the built environment, develop a common basis for co-creation

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<sup>3</sup> Buildings as a global carbon sink. Churkina G, A Organschi, C Reyer, A Ruff, K Vinke, Z Liu, B Reck, TE Graedel & HJ Schellnhuber. Nature Sustainability vol. 3, 269–276 (2020). <https://www.nature.com/articles/s41893-019-0462-4>

The ‘forest-carbon pump’ concept is being developed by the Bauhaus Earth think tank: <https://www.bauhausdererde.org/>

and market upscaling of novel solutions that respond to the needs of all involved stakeholders and end users.

- **Digitalization of the whole chain is the key to unlock the ‘forest-carbon-pump’.** Advances in digital sensor technologies, industry 4.0 and new business models have opened the possibility to overcome characteristic barriers of the forest-based sector, which is dominated by numerous landowners, SMEs and quite fragmented in various specific but small industry branches. Connecting the relevant actors along the whole supply chain from forests to buildings and bridging gaps in knowledge, data and communication is a major challenge. But worldwide infrastructures like the railway system, the electricity grid or the internet, which have been built by mankind and which took decades, are proof that this is not an impossible task.

Only when we achieve to **integrate the entire wood construction chain with optimal transparency, performance, circularity, and sustainability**, enhancing resource use in a balanced way over the next decades, and if we allow fast progress using science-based evidence and bold innovative ideas, only then can the ‘forest-carbon-pump’ become the powerful nature-based transformation infrastructure needed to mitigate climate change on a larger scale. This requires more interdisciplinary research, integration of knowledge across disciplines, and advancing innovations hand in hand with the private sector and authorities. It is a gigantic task that aims to ensure sustainable land and resource use in a fair and just manner for the next generations.

### 1.1.2. Tackling climate change: contribution to EU policies

The vision of transforming the building sector in a carbon sink is closely aligned with the main recent EU industrial policies to achieve major progress in the twin green and digital transformation.

- The **European Green Deal** (2019)<sup>4</sup> is the European Commission’s new industrial policy aiming to initiate a deep transformation of all main sectors towards a climate-neutral, resource-efficient and circular economy. Its purpose is to interlink and mutually reinforce economic, social and environmental objectives, e.g., climate neutrality, clean energy, smart mobility, protecting natural ecosystems, improve human health, and green financing. Wood construction contributes especially to the goals “*Mobilising industry for a clean and circular economy*” (2.1.3), and “*Building and renovating in an energy and resource efficient way*” (2.1.4). These aim to strengthen sustainable, circular products, reduce waste, engage in a “renovation wave”, push energy performance of buildings, and strengthen digital technologies as enabler for transformation to a green economy.
- **Renovation wave** (2020)<sup>5</sup>. Given the labour-intensive nature of the building sector, which is largely dominated by local businesses, renovations of buildings also plays a crucial role in the European recovery of the COVID-19 pandemic. To kick-start the recovery, the EC has identified doubling the renovation rate in its dedicated recovery

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<sup>4</sup> European Green Deal. [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en)

<sup>5</sup> A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives. COM(2020)662 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0662>

plan. The goal is to enhance the quality of life for people living in and using the buildings, reduce Europe's greenhouse gas emissions, and create up to 160.000 additional green jobs in the construction sector.

- The new **Circular Economy Action Plan** (2020)<sup>6</sup> confirms the EU's ambition of a circular economy transition towards a regenerative growth model that reduces its consumption footprint and double its circular use rate in the coming decade. The EU aims to lead the way also at the global level. Wood construction contributes mainly to the product chain "Construction and buildings" (3.6).
- The **Fit for 55** package (2021)<sup>7</sup> is the EC's plan to effectively cut greenhouse gas emissions by 55% by 2030 through a mix of market measures, carbon pricing, standards and green targets per all major sectors to speed up emission cuts and spread costs.
- The **New European Bauhaus**<sup>8</sup> (NEB), launched 2021, has started an interdisciplinary, cultural movement to create together a transformative path towards affordable and beautiful living spaces in the urban and rural environment. The NEB is set to co-create future ways of living, connecting art, culture, social inclusion, science and technology. It brings the Green Deal to our living places and calls for a collective effort to imagine and build the future. The NEB has already successfully launched a broad co-creation process engaging various active partner networks, public actors, local communities and citizens.

### 1.1.3. Need for a regional approach to innovation in wood construction

Unlocking the 'forest-carbon-pump' requires a stronger focus on the regional dimension of wood construction chains and the whole innovation ecosystem. Regional characteristics are not yet considered sufficiently in European and national policy initiatives and programmes. R&I must respond to contexts and needs of forest-based industries and the built environment to ensure well-adapted, sustainable solutions fit for market uptake and impacts in urban and rural areas.

- **Forest types in Europe are diverse and depend on regional conditions**, e.g., in terms of tree species composition, ecosystem functions including carbon cycle, and growth and supply potential. Timber is a heavy raw material which limits far-distant transport: wood industries obtain their bulk supply of harvested raw timber usually within a regional radius. Changing climate conditions will lead to alterations of forest types and wood markets in the long term, so regional adaptation strategies will play a key role.
- **Building traditions, regulations and functions of buildings are country specific.** Climatic conditions are a main factor for the design of adapted buildings. Urbanization and demographic trends are setting the long-term societal needs of

<sup>6</sup> A new Circular Economy Action Plan. For a cleaner and more competitive Europe. COM/2020/98 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2020:98:FIN>

<sup>7</sup> 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality. COM/2021/550 final. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0550>

<sup>8</sup> New European Bauhaus. [https://europa.eu/new-european-bauhaus/index\\_en](https://europa.eu/new-european-bauhaus/index_en)

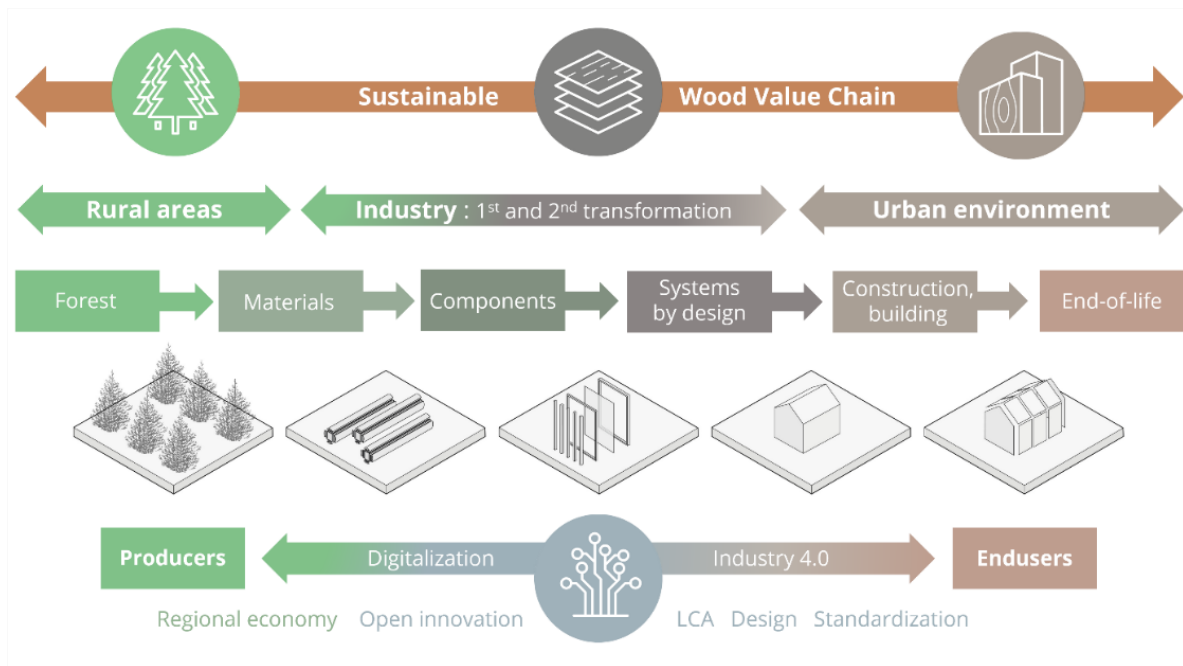
regions, to which the built environment must respond. Construction and architecture operate accordingly in these national-regional contexts.

- **Wood construction is dominated by smaller companies and traditional professions**, e.g., carpenters, wood processing, civil engineers, planners. These can play an important role in the context of a regional/rural economy in terms of companies, employment, and turnover. On the other hand, in many regions of Europe, wood construction is not developed at all. Larger construction companies are also expanding their portfolio to wood construction. The economic impacts of the whole value chain in regions are not well studied and lack evidence and insights.
- **A rich cultural heritage in woodworking and architecture exists in European regions**. Traditional crafts were creating materials in a resource and energy efficient manner for centuries. Out of 260 tree species in Europe, about 60 tree species have a known (traditional) use as material. It is important to recover 'lost' and underutilized traditional knowledge for disassembly and reuse, recovery of materials, reversible connections, etc. and re-valorise it in modern, circular products.
- **National and regional initiatives are focussed on their context and are still rather disconnected from the European level**. Well-established innovation platforms for wood are lacking in most regions. Wood programmes and clusters exist only in a few countries having a long tradition in wood building (e.g., Sweden, Finland, Austria, Switzerland, Southern Germany). Awareness about the benefits and innovations are only spreading slowly across borders. To date, a major European umbrella organisation to represent the entire wood construction industry does not exist. Wider political attention and support is needed to boost the sector in European regions. The EU innovation ecosystem in wood construction needs to grow and expand to more regions.
- **Funding programmes are not well geared towards the needs of wood construction industries**. Wood industries and building with wood are seldomly referred to in industrial and regional development, R&I and education programmes, such as Smart Specialisation strategies (S3), as they often lack critical mass and political representation. Typical business development or innovation support (tech investment, start-up programmes, etc) often fail to address the wood sector, considered to be too low-tech and too traditional.

## 1.2. Purpose and objectives

### 1.2.1. Demonstrating a comprehensive approach to wood construction chains

The BASAJAUN project's main objective is to demonstrate how wood construction chains can be optimized to foster both rural development and urban transformation whilst being connected with sustainable forest management in Europe. The main approach is to integrate the full value chain (Figure 2): all steps from forestry, wood processing, intermediate manufacturing and building are considered, to establish the link from final products in the urban environment back to raw materials in rural areas. The activities of the project can thus be grouped into three main topics: 1. Sustainable wood construction, 2. Innovation and Digitalization, and 3. Rural areas and rural development.



**Figure 2.** BASAJAUN chain linking rural development with forest-based sector innovation (own figure).

The project aims to demonstrate how the entire wood construction chain contributes to the following main impacts at different levels<sup>9</sup>:

- **Increased resource and/or energy efficiency, added value** and minimizing pollution and environmental footprint (GHG emissions, air pollutants) in the urban construction sector
- **Enhanced connectivity of rural-urban areas** and their overall contribution to a resilient, circular and competitive, forest-based bioeconomy
- **Enhanced contribution of forest-based sector** to long-term climate change mitigation, adaptation and rural development objectives
- Prompt a sizeable **positive change to European landscapes and economies**, by keeping the countryside green and to make the cities greener, and increasing both decent and green jobs
- **Advance available solutions** to demonstrate the viability of upscaling the manufacture of innovative wood-based solutions for the built environment.

### 1.2.2. Main objective: Open Innovation Platform for wood construction

The main objective is to build the foundation of an open innovation platform (OIP) for the wood construction ecosystem, which can foster dialogue and cocreation between European regions. The platform shall showcase the BASAJAUN innovations and demo buildings and support further exploitation together with companies, public authorities and funding agencies in the regional forest-based sector of the project regions and beyond.

<sup>9</sup> Horizon 2020 call topic LC-RUR-11-2019-2020:  
[https://cordis.europa.eu/programme/id/H2020\\_LC-RUR-11-2019-2020](https://cordis.europa.eu/programme/id/H2020_LC-RUR-11-2019-2020)

The OIP will be developed in the following steps:

- *Competitive assessment of pilot regions*: The project accomplished several studies addressing the wood construction value chain on a regional and national level. The results of each region are described in the following chapters of this report D7.1. These background profiles serve as basis for developing a set of regional roadmaps for innovation and transformation of the wood construction sector.
- *Launch of the Open Platform for innovations and demonstration projects*: The platform will collect the various results of the previous BASAJAUN work packages and make them widely accessible via a searchable website. The platform is launched as a partnership of several project members and external supporters. The regional roadmaps are elaborated and validated through consultation with public and private stakeholders.
- *Partnering with other platforms and markets*: The platform will be disseminated in the R&I community and industry related to wood construction. Contacts and links to other initiatives and platforms on European and national level will be established to find more partners and regions to identify common interests for joint exploitation of the results.
- *Funding opportunities and assistance for consolidation of the platform*: The platform and its associated partners collaborate to initiate joint follow-up innovation projects fitting with regional strategies and programmes identified in the roadmaps.

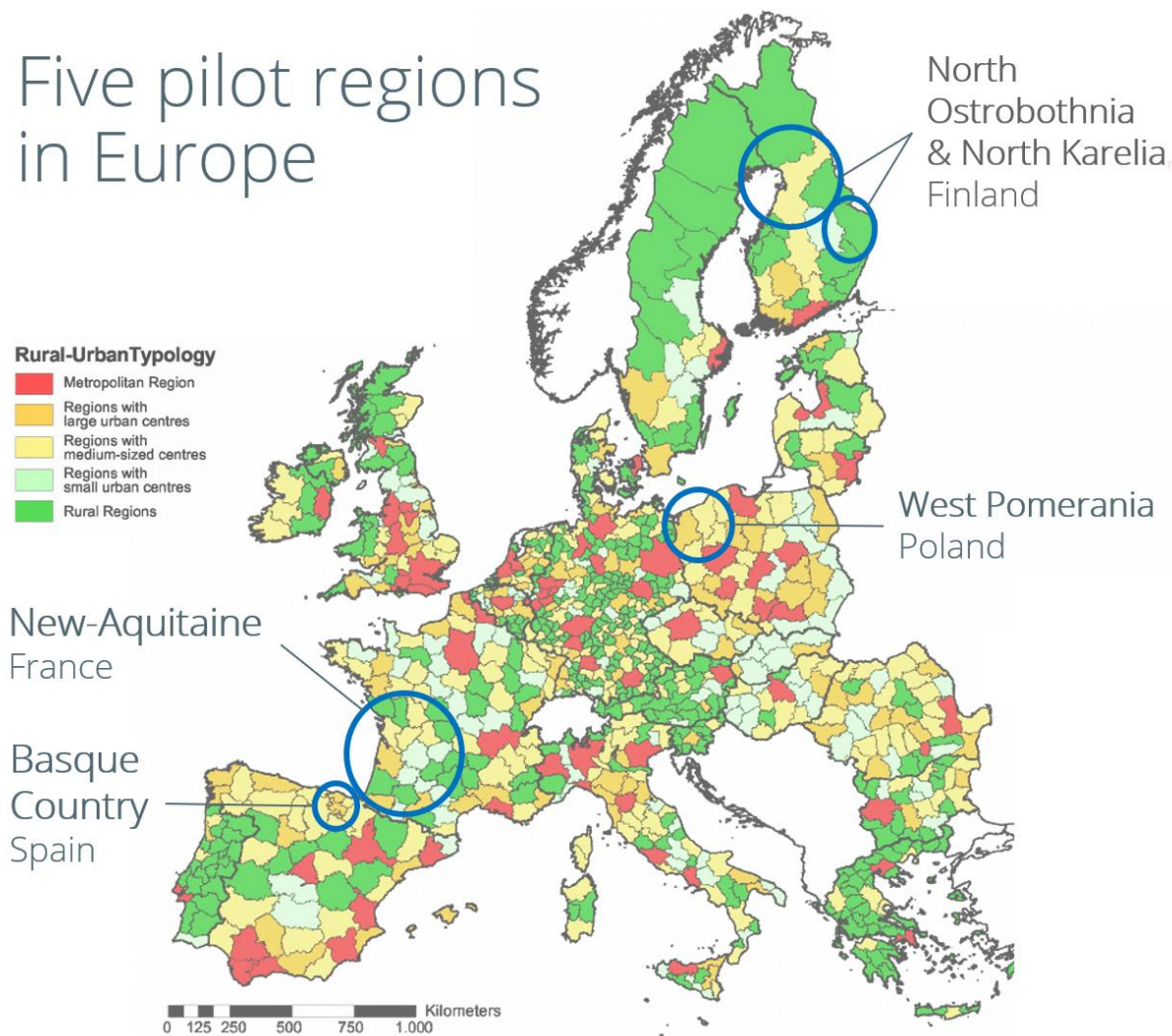
A brief overview of progress and next steps on these tasks is presented in chapter 6.

### **1.2.3. Common approach for competitive assessment of four pilot regions**

This report contains results on *Competitive assessment in pilot regions*. The objective is a consistent mapping of the context and specific innovation ecosystems and infrastructure in the five pilot regions shown in Figure 3 and 4 – jointly assessed by the research team – which include:

- North Ostrobothnia and North Karelia, Finland
- New Aquitaine, France
- West Pomerania, Poland
- Basque Country, Spain

## Five pilot regions in Europe



**Figure 3.** Pilot regions and rural-urban density in Europe (own figure, based on<sup>10</sup>).

The mapping was based on previously collected data and methods, which addressed i) wood supply from forests (D1.1)<sup>11</sup>, ii) regional policy framework and socio-economic importance of wood construction in the regions (D1.2, including a more detailed case study of North Karelia in Finland)<sup>12</sup>, iii) opportunities, barriers, benefits and good practices of wood construction and wood recycling (D1.3)<sup>13</sup>, and iv) a holistic mapping approach of the full value chain (D1.4)<sup>14</sup>.

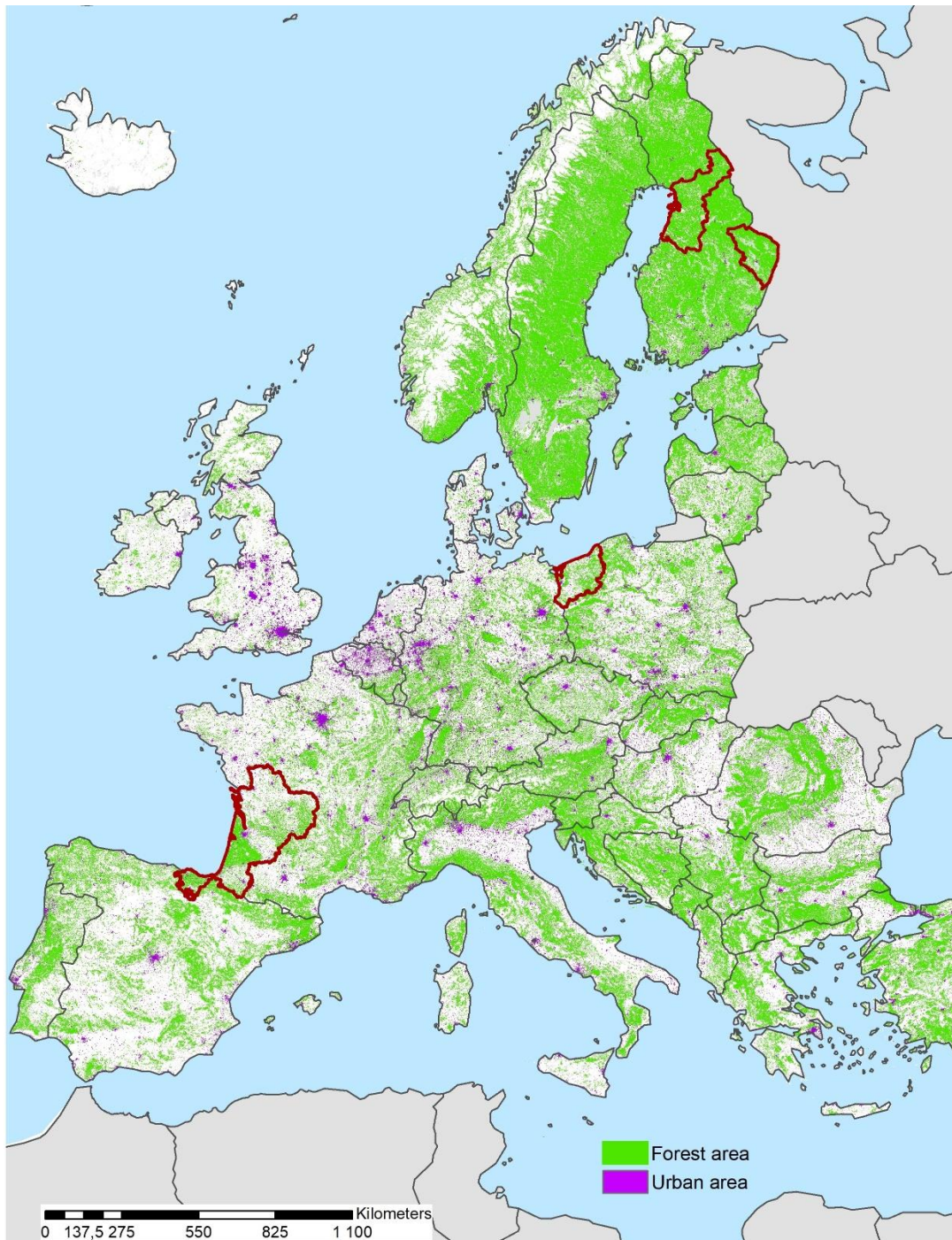
<sup>10</sup> EU urban-rural map from: Zasada et al. 2013. Rural–Urban Regions: A Spatial Approach to Define Urban–Rural Relationships in Europe. In: Peri-urban futures: Scenarios and models for land use change in Europe. Book chapter, pp.45–68. [http://dx.doi.org/10.1007/978-3-642-30529-0\\_3](http://dx.doi.org/10.1007/978-3-642-30529-0_3).

<sup>11</sup> Lanvin et al. 2021. European forest as raw material supplier in the construction sector. BASAJAUN report D1.1. <https://doi.org/10.5281/zenodo.4781145>

<sup>12</sup> Heräjärvi et al. 2021. Building with wood as driver for sustainable development in rural regions. BASAJAUN report D1.2. <https://doi.org/10.5281/zenodo.4781092>

<sup>13</sup> Leszczyszyn et al. 2021. Guidelines to foster building with wood. BASAJAUN report D1.3. <https://doi.org/10.5281/zenodo.4781143>

<sup>14</sup> Lanvin et al. 2021. Holistic approach to the building with wood value chain. BASAJAUN report D1.4. <https://doi.org/10.5281/zenodo.4781275>



**Figure 4.** Pilot regions, forest cover and urban areas in Europe (own figure based on CORINE Land cover data, produced by Luke / Antti-Petteri Hiltunen).

In the first step, a **background profile** of each pilot region was compiled using available information from reports, studies and databases, following a common outline (Table 1). These deliver a basic description of the different regions, also building on data collected in D1.2. A value chain stakeholder map was developed for each region, based on the approach defined in D1.4.

In the second step, a **SWOT analysis** (Strengths, Weaknesses, Opportunities, Threats) was prepared for each region, addressing specific challenges and possible starting points for regional innovation. These analyses and SWOT results were then summarized in a set of preliminary *conclusions* that are considered useful for developing the regional roadmaps.



**Table 1.** Common outline for the pilot region assessment.

<ul style="list-style-type: none"><li>• Context</li><li>• Geography, land use, demographics</li><li>• Economic trends and competitiveness</li><li>• Climate change impacts</li><li>• Forest resources and management</li><li>• Forest stock and ownership<ul style="list-style-type: none"><li>○ Forest management and silvicultural systems</li><li>○ Forest functions and ecosystem services</li><li>○ Forest growth and harvest trends</li></ul></li><li>• Markets and trends of the wood construction chain<ul style="list-style-type: none"><li>○ Forest-based industries and related sectors</li><li>○ Wood markets and products trade</li></ul></li><li>• Policies and support programmes<ul style="list-style-type: none"><li>○ National policies and programmes</li><li>○ Regional policies and programmes</li></ul></li><li>• Regional innovation ecosystem</li><li>• Value chains and stakeholders<ul style="list-style-type: none"><li>○ Competencies, capacities, key actors</li></ul></li><li>• Needs and starting points for development of regional roadmap</li><li>• SWOT analysis</li><li>• Conclusions</li></ul>
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## 2. Regional profile North Karelia and North Ostrobothnia, Finland<sup>15</sup>

### 2.1. Context

#### 2.1.1. Geography, land use, demographics

The two subregions analysed here in the Finnish context are *North Karelia* and *North Ostrobothnia* - also called *Oulu Region* in some documents by its capital - which are located at the eastern/middle part of Finland (Figure 5). The subnational governance in Finland is based on a division into 19 regions - equivalent to NUTS3 level in EU classification - which are governed by regional councils, that serve as forums of cooperation for the municipalities of a region. Within Finnish system of territorial governance, these the two regions, North Karelia and North Ostrobothnia, represent peripheral and scarcely populated areas with large, forested areas, with single dominant regional centre: Joensuu in North Karelia and Oulu in North Ostrobothnia, acting as the agglomeration of economic activities, population and education.

Concerning the EU typology both regions are classified as Predominantly Rural (PR) regions indicating that more than 50% of population in these regions are living in rural LAU2 (Local Administrative Units). Accordingly, regarding the EU structural funding both regions are included to the Northern Sparsely Populated Areas network.

Regardless of their remote locations in the European context, both regions have advanced R&I systems due to the sites of multidisciplinary universities and other research organizations, as well as triple helix cooperation with the key stakeholders.

#### North Karelia

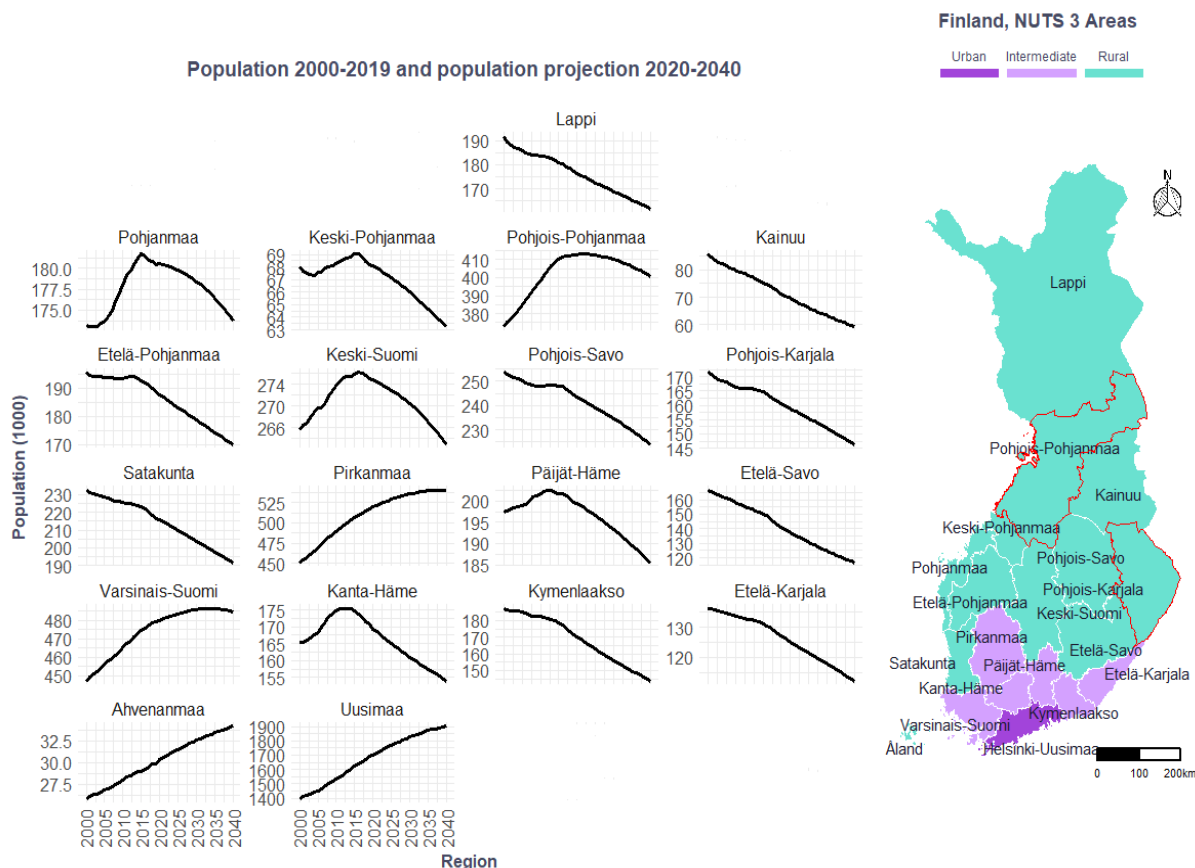
North Karelia is a region (province) in eastern Finland bordering the regions of Kainuu, North Savo, South Savo and South Karelia, as well as Russia (Republic of Karelia). The city of Joensuu is the capital of the region. Total population of North Karelia is 163,000 (females 50.3% and men 49.7%) Within the region, the differences among the population structure and migration are great and the capital city of the North Karelia, Joensuu has a total population of 74,168 (of which almost 20,000 are students). The educational institutions include, e.g., University of Eastern Finland, Joensuu campus (8,300 students), Karelia University of Applied Sciences (4,000 students), and a number of vocational colleges and upper secondary schools.

#### North Ostrobothnia

North Ostrobothnia is a region in Finland with 414,536 inhabitants (2021) and land area of 39,193 km<sup>2</sup>. In terms of population, North Ostrobothnia is the fourth largest region in Finland and the second largest in area after Lapland. The capital of the region, city of Oulu (207,762 inhabitants in 2021) is an important regional centre, not only in Finland, but also in the north-eastern part of Europe (Statistics Finland, Population).

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<sup>15</sup> Authors: Henrik Heräjärvi, Mikko Weckroth and Toivo Muilu of Natural Resources Institute Finland (Luke)



**Figure 5.** Location of the Finnish regions and their regional population projections until 2040: North Ostrobothnia (Pohjois-Pohjanmaa) and North Karelia (Pohjois-Karjala).

North Ostrobothnia embodies the whole of Finland since it stretches across the whole of country from west to east, from the shores and lowlands of the Baltic Sea all the way to the forested and hilly eastern border of Finland, and thus the eastern border of the European Union to Russia. Thanks to the decent transport connections and international networks of expertise, the region now occupies an established position as a gateway between east and west, regardless its remote location from the EU core areas. This includes an emphasis on the Arctic region through Barents cooperation.

Overall, during the last decades the spatial development in Finland has followed the common trend in socioeconomic geography of EU territory characterized by increasing interregional inequalities, and persistent rural-urban migration patterns. These trends have proceeded parallel to narratives of urbanization as a global megatrend and the importance of agglomeration benefits and city regions in the knowledge intensive economy. Within this context, the two regions have been suffering from net population loss as well as within-region pattern in migration from rural areas to regional centre(s). More specifically, the negative net population change in North Karelia is a function of slightly positive net migration but declining birth rate. However, the most recent statistics from the COVID19 era (2020 and 2021) show that these migration patterns might be reversing or at least weakened. Migration pattern to urban areas is slowing down, and in some areas (and population segments) urbanization trend might have even reversed (Lehtonen & Kotavaara, 2021). Furthermore, the last few years have shown pattern slight increase birth rate, which is an anomaly among western societies.

It is still likely that the regional economies will be suppressed by disadvantageous age distribution also in future. The future position and development of these two spatially marginal regions also depends on decisions on regional policy made at the national level. Forests and other resources of the bioeconomy are economically very important for these areas. Here, the general urbanization trend and narrative on triumph of large city areas as drivers of national economy are likely to change in national and EU contexts.

## 2.1.2. Economic trends and competitiveness

### North Karelia

The sectorial structure of business and range of economic activities in North Karelia is rather diverse. Areas of specialisation for the region include the production of plastic and metal products, mechanical and chemical wood processing and the manufacturing of stone products. The structure of the export base has evolved to include a range of manufacturing subsectors.

Services have been increasing due to the growth of the local universities (University of Eastern Finland, Karelia University of Applied Sciences) in Joensuu, and the growing demand for health and social services as the population ages. The proportion of students from the city population in Joensuu is the highest among the Finnish cities. Tourism is an important and increasing sector in North Karelia, but still with lower relative importance than in other regions in Northern Finland, Lapland in particular. In addition, North Karelia has an important base in agriculture where production is mainly in livestock alongside dairy and cereals, berries and vegetables. The GDP per capita in North Karelia was 28,470 € per capita in 2018, which was 77.5% of the national average (Statistics Finland, National Accounts).

North Karelia has set itself the goal of becoming a region, which exceeds its level of self-sufficiency in renewable energy production and phases out the use of fossil fuel both in energy production and in traffic. North Karelia is committed to its objective of reducing the greenhouse gas emissions in its area by 80% from the 2007 level by 2030 as a part of the 'Toward a carbon neutral region' HINKU network.

### North Ostrobothnia

In the North Ostrobothnia Provincial Program (Pohjois-Pohjanmaan maakuntaohjelma 2018–2021) ICT, bioeconomy (pulp, paper and mostly forest-based by-products industry), construction industry, health and well-being technology, metal and engineering industry, the wood products industry and tourism have been identified as strong economic sectors in the region. There are thus many areas of focus, which can be seen as partly problematic, as most of the actors are small or medium-sized enterprises (SMEs).

According to regional and business barometers, turnover growth is expected in industry and private services. New growth is taking place in the ICT sector. This is supported by the region's strong research activities, which generate a large number of ICT start-ups. New players, products and services are entering the sector, aimed specifically at consumer and industrial products.

Growth is expected in industrial products, e.g., new technologies (intelligent data systems, wireless solutions, IoT, 5G, print electronics, artificial intelligence). New digital methods are utilized in product development, production, sales and marketing. The GDP of North Ostrobothnia was

31,050 € per capita in 2018, which was 84.6% of the national average (Statistics Finland, National Accounts).

Competitiveness will be increased in the metal and engineering industries and in the wood products industry by increasing automation and utilizing technology. Growth is expected in the tourism sector from both the Far East and Europe. Before the pandemic, Finland was facing strongly growing international tourism, which brought new business opportunities also to the Northern Finland, especially Lapland. Tourism and other companies are therefore encouraged to target the international market and invest in destinations of interest to international customers.

According to the Provincial Program, North Ostrobothnia is a strong bioeconomy province especially due to its forest resources, and so it is important to promote bioeconomy investments and develop competence in the future. The key bioeconomy sectors for the province are the paper, pulp and by-products industry, agriculture and forestry, and the food industry. The region's strengths are its rich and diverse natural resources and the economic activities based on them.

Exploiting the potential of the bio and circular economy creates jobs and increases the vitality of municipalities, especially those with a primary production. The strong growth of forest resources will enable an increase in the degree of wood processing as well as the increasing use of wood in industry, construction, and energy production. Large bioproduct plants with a raw material supply ring are planned for the surrounding areas extending to North Ostrobothnia, which increases timber harvesting and transportation employment.

### **2.1.3. Climate change impacts**

The Finnish Climate Change Panel published in September 2021 a report on estimated climate change impacts in Finland. The report included a comprehensive information package focusing on adaptation policy, impacts of climate change including economic impacts including also regional adaptation strategies (Suomen ilmastopaneeli, Raportti 2/2021).

According to the report the climate efforts having been largely focused on mitigation, adaptation efforts and their planning are gaining momentum in the regions and cities. Regional climate forecasts and methodological support for participatory planning processes for adaptation as well as the participation of local actors in research projects can promote adaptation efforts in regions. Networks within and between regions and cities can support the promotion of climate efforts as a whole in terms of both mitigation and adaptation.

Due to climate change, average temperatures are rising throughout Finland, especially in the winter. Through warming, average annual rainfall is increasing throughout the country. Regional variation is to be expected, especially in the occurrence of snow and frost. Especially in southern Finland, in areas where temperatures are increasingly above zero in winter, snow and frost occur more rarely. The risk of water system floods has been estimated to increase especially in the large water systems of Southern and Central Finland. On the other hand, further to the north, changes may be minor in near future and the direction of the change is uncertain.

Concerning the forest sector, the report raises certain region-specific impacts of climate change. The report noted that in both North Karelia and North Ostrobothnia the global warming will cause increasing storms and shortening the period of ground frost both of which will cause harm to timber harvesting. On the other hand, the extension of the growing season leads to increase of growth rate of biomass in certain species (Suomen ilmastopaneeli, Raportti

2/2021). In addition to the report by Finnish Climate Change Panel, North Ostrobothnia has also prepared a provincial climate roadmap (Northern Ostrobothnia Climate Roadmap 2021–2030).

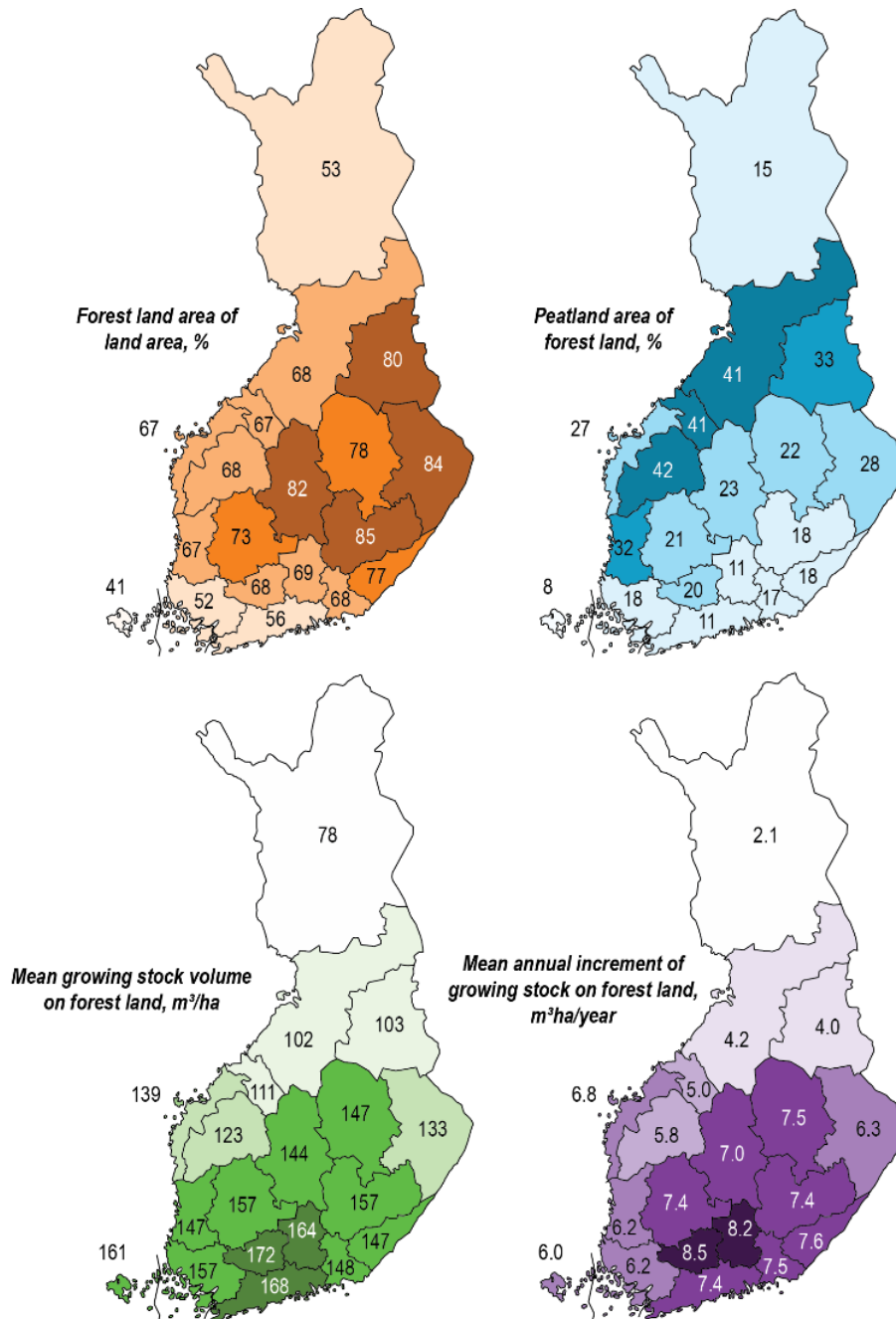
## **2.2. Forest resources and management**

### **2.2.1. Forest stock and ownership**

Around 75% of Finland's total area (land + water) is forest. The forestry land area in Finland is 26.3 million hectares, covering 86% of the land area. Forest land covers three quarters of forestry land. Poorly productive forest land accounts for 10% and completely or nearly treeless unproductive land 12% of forestry land. Forest roads and other forestry maintenance areas account for 1%. Peatlands account for one third and mineral soils for two thirds of forestry land. As much as 53% of all peatlands have been drained during the period between 1950s and 1980s. Regionally, the proportion of peatlands is the highest in North Ostrobothnia, covering more than half of the forestry land area.

The growing stock volume on forest land and poorly productive forest land totals 2,482 million cubic metres. Two thirds of the growing stock volume are located in southern Finland, but Lapland, the northernmost region with the largest surface area, has the largest growing stock among the Finnish regions, i.e., 17% of the growing stock volume. Of the growing stock volume 50% is Scots pine, 30% Norway spruce and 20% deciduous species, predominantly European white birch and silver birch.

In whole Finland, the mean growing stock volume on forest land is 119 m<sup>3</sup>/ha. Of all regions, the highest mean volume is in Kanta-Häme (172 m<sup>3</sup>/ha), while in Lapland the mean volume is 78 m<sup>3</sup>/ha (Figure 6).



**Figure 6.** Forest land shares, mean annual increments, and growing stock volumes by region in Finland. Source: Luke.

The regional distribution of forest resources by tree species are presented in Figure 7. The south-north distance of Finland is 1,150 km, reaching from the temperate region to over 400 km north of the Arctic circle. Most of the forest resources are in south and central Finland, but forest management is occasionally practiced in the northernmost part of the country, as well. Lapland is widely covered by nature conservation areas, and even in the non-protected forests the stem sizes and harvesting removals per hectare are often too small to be profitable to harvest. Large areas of the three northernmost municipalities Inari, Utsjoki and Enontekiö with combined area and population of 31,000 km<sup>2</sup> and 9,900 persons, respectively, are treeless.

		Pine (mill. m <sup>3</sup> )	Spruce (mil. m <sup>3</sup> )	Birch (mill. m <sup>3</sup> )	Other broadleaved (mill. m <sup>3</sup> )	Total volume (mill. m <sup>3</sup> )	Growing stock on land available for wood production (%)
NFI 12/13 (2015-2019)	WHOLE COUNTRY	1,250	741	410	81	2,482	89.6
	SOUTHERN FINLAND	719	573	270	70	1,631	94.8
	NORTHERN FINLAND	531	168	140	12	851	79.6
	Uusimaa	28	34	16	8	86	92.5
	Varsnais-Suomi	46	29	12	4	91	93.1
	Satakunta	35	28	11	3	77	94.5
	Kanta-Häme	17	30	11	4	61	90.9
	Pirkanmaa	52	60	24	6	141	96.1
	Päijät-Häme	15	31	10	3	59	96.8
	Kymenlaakso	25	17	9	3	53	95.9
	South Karelia	27	20	9	3	60	96.5
	Etelä-Savo	80	66	33	7	186	93.9
	Pohjois-Savo	69	79	35	7	190	96.6
	North Karelia	100	55	36	6	197	94.0
	Central Finland	91	69	31	7	198	94.0
	South Ostrobothnia	70	24	14	2	112	97.2
	Ostrobothnia	34	22	12	3	71	96.7
	Central Ostrobothnia	24	7	6	1	39	93.2
	North Ostrobothnia	162	52	44	5	262	92.8
	Kainuu	101	39	28	3	171	85.7
Lapland	268	78	67	4	417	68.8	
Åland	7	2	1	1	12	93.0	

**Figure 7.** Growing stock in Finnish forests by region and tree species, based on National Forest Inventory data from 2015–2019. Source: Luke.

The first National Forest Inventory (NFI) field work was started in summer 1921, and Finnish NFI celebrates its 100-year anniversary in 2021. NFI is a monitoring system producing regional and national information on growing stock, land use, forest ownership structure, health, biodiversity, and carbon storage development. Finland has a continuous time series of 100 years, now running 13<sup>th</sup> NFI. The current NFI is based on ca. 14,000 sample plot measurements carried out by ca. 20 two-person groups per year. Approximately 100 variables are measured or evaluated from each sample plot.

### 2.2.2. Forest management and silvicultural systems

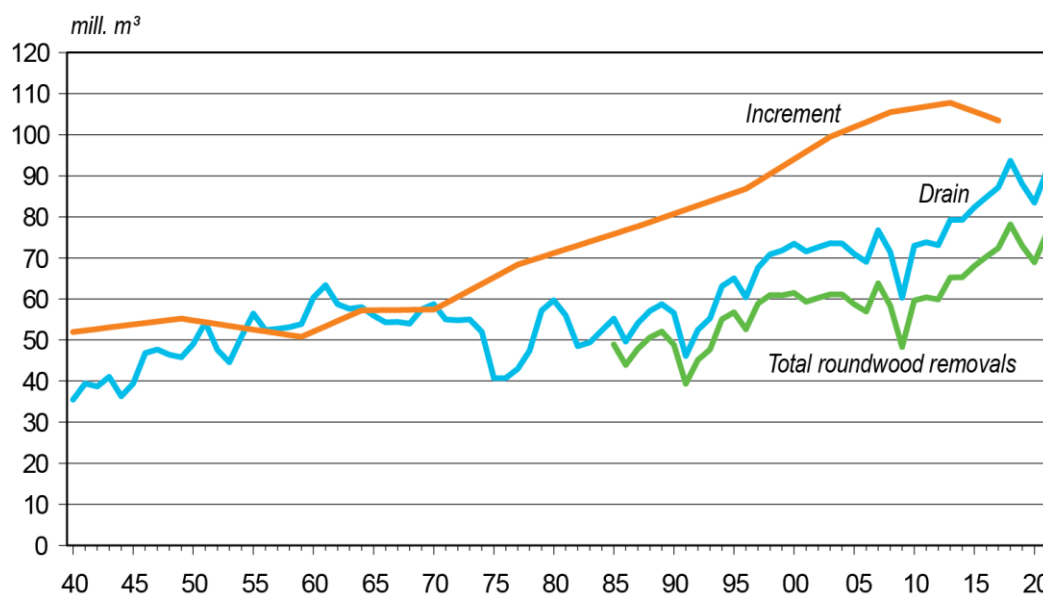
Finnish forests are managed according to tens of different silvicultural regimes based on forest owner's preferences, site type, tree species, growing stock structure, biodiversity conservation



needs, etc. The minimum levels of sustainable forest management and biodiversity conservation are set by forest and environment protection laws. In reality, the voluntary environmental protection practices go far beyond the levels required by laws. The forest management “good practices” are published and regularly updated by Forest Centre Tapio<sup>16</sup>, whereas the forest owner advising is organized by regional Forest Centres<sup>17</sup> and Forest Owner’s Associations<sup>18</sup>. Approximately two thirds of the forests are privately owned, and the average size of a privately owned forest property is 30 hectares. On average, 150 million seedlings are planted every year. There are 600,000 private forest owners in Finland, and approximately 730,000 Finns get income from forests annually.

Approximately 90% of Finnish forests are certified by PEFC (Programme for the Endorsement of Forest Certification) and 10% by FSC (Forest Stewardship Council). Most of the FSC certified forests overlap with the PEFC certified ones, i.e., there are two certificates in the same forest. Thus, the total share of certified forests is not 100% but just a little more than 90% of the forest area.

Figure 8 shows the development of the growing stock and drain in Finland during the past 100 years. Approximately 10% of the land area of the country was lost to the Soviet Union in 1940 and 1944.



**Figure 8.** Annual roundwood removals, drain (harvest + natural removal) and increment of the growing stock in Finland since 1940s. Source: Luke.

Finnish growing stock has increased every year since 1970, making up a major carbon sink. The current annual increment is 108 million m<sup>3</sup>, and the drain (harvest + natural removal) varies approximately between 70 and 90 per cent of the increment. The total drain is predominantly determined by roundwood harvest volume, which, on the other hand, depends mostly on sawlog prices. Furthermore, the sawlog prices are at least partially correlated with sawn timber demand and their price level. Hence, a positive turn in global sawn timber markets, as seen in

<sup>16</sup> <https://tapio.fi/briefly-in-english/>

<sup>17</sup> <http://metsakeskus.fi/en>

<sup>18</sup> <http://mhy.fi/>

2020–2021, will be reflected in the harvest statistics: sawlog prices increased, which urged the forest owners to active timber sales.

At the beginning of 2019, Finland had a total of 2.9 million hectares of protected forests. The area of protected forests consists of forests in statutory protected areas (2.4 million hectares) and biodiversity conservation sites in commercial forests (0.5 million hectares). Compared with the previous statistics compiled in 2016, the area of protected forests in the whole of Finland increased from 12% to 13%. Majority of Finland's strictly protected forests, where no forestry is allowed, are found in nature conservation areas established under the Nature Conservation Act and in areas reserved for nature conservation on the basis of conservation programmes, as well as in wilderness reserves. In 2019, the total area of these forests was 2.2 million hectares, comprising 10% of the total area of forests. More than 50% of Europe's strictly protected forests are Finland (State of Europe's Forests 2015 Report). Majority of protected forest areas, nearly 80%, are in the north Finland (North Ostrobothnia, Kainuu, and Lapland), where their area totals 2.3 million hectares, or 20% of the total forest area in the region. In south Finland, protected forests covered 0.6 million hectares, comprising 5% of the forest area. Compared with the previous statistics compiled in 2016, the area of protected forests increased from 19% to 20% in north Finland but remained at 5% in south Finland.

Of the total area of forestry land (including forest land, poorly productive forest land, unproductive land and forest roads, depots, etc.), protected areas covered 4.7 million hectares, comprising 18% of the area of forestry land. Of this, forests in statutory protected areas covered 4.0 million and in biodiversity conservation sites in commercial forests 0.7 million hectares.

In addition to the protected forests, the over 20 million hectares of managed forests are an important tool to protect the biodiversity. The ecological values of each stand (and even the neighbouring stands) are evaluated before forest management practices such as thinning or final felling are allowed to take place. Untouched zones of 20–30 metres in minimum are left on shores of water areas, around springs, brooks, and other ecologically valuable habitats. The biodiversity values have been considered systematically in managed forests for approximately 25–30 years, and the effects of these practices start gradually becoming visible not until now.

### 2.2.3. Forest functions and ecosystem services

So called *Everyman's right* allows everybody to move in government owned as well as privately owned forests by foot or bicycle, but not with motorized vehicles. Camping (without fire) and picking wild berries and mushrooms belongs to the Everyman's right but living plants should not be damaged. Finns are active users of non-wood forest products, picking wild berries and mushrooms both for own household use but also for sale. In addition to private pickers, commercial producers hire labour for wild berry picking.

Reindeer husbandry is an important livelihood in northern parts of Finland and eastern part of North Ostrobothnia belong to reindeer herding area. Great majority of the stock of almost 200,000 reindeer lives free in wilderness and causes considerable effects on ground vegetation and forest regeneration. There is a constant debate regarding the proper size of reindeer stock in the circumstances of conflicting interests.

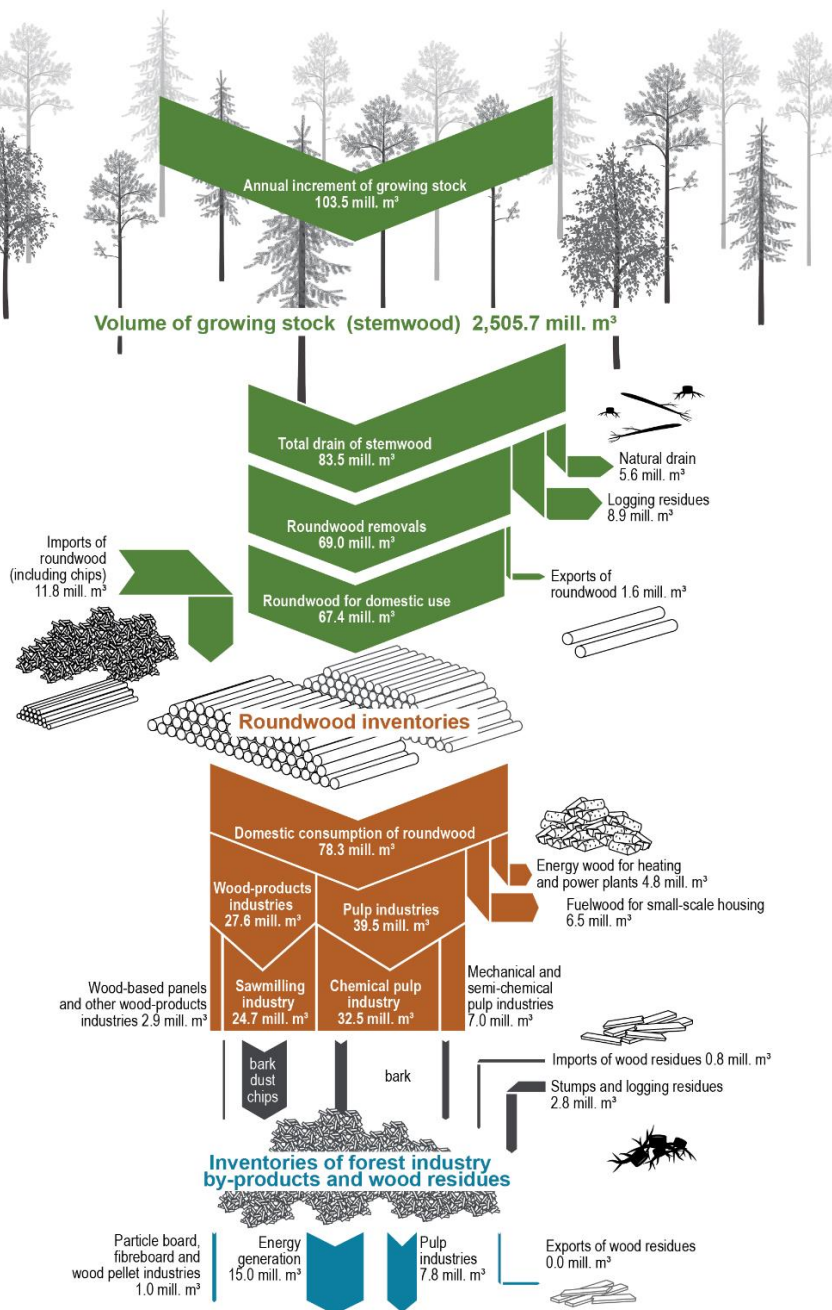
Some valuable fungi, such as chaga (*Inonotus obliquus*) have been used as health-affecting foodstuff for centuries, particularly in far-east Asia and Russia. Natural Resources Institute Finland and University of Eastern Finland have developed a method to cultivate chaga in living birch trees, which is expected to result in steady and predictable chaga raw material production in the future.

Finns are active outdoor people, and the Covid-19 restrictions have further intensified the use of local recreation areas and national parks. On average, Finns go hiking, berry or mushroom picking, jogging, cross-country skiing, snowshoeing, or biking in forests 140 times per year. There is scientific evidence that already 30 minutes forest walk causes positive psycho-physiological and restorative effects on people. This has been well-known in Finland for decades, and children are familiarized with forests already in nursery homes and elementary schools.

Moose (*Alces alces*) is the most important game species in Finland, but the oversized moose stock also considerably influences forestry. Moose browsing risks in pine and birch seedling stands cause bias in forest regeneration species selection: Norway spruce, which is not often eaten by moose, is regenerated in many areas that would be more suitable for other species. In some southern Finnish forestry districts, the percentage of spruce from the regeneration area is over 80, at least half of it being "forced" by moose browsing risk. This will be reflected in the future as a biased tree species distribution and in terms of quality of saw logs (Matala et al. 2020) and resulting wood products.

### 2.2.4. Forest growth and harvest trends

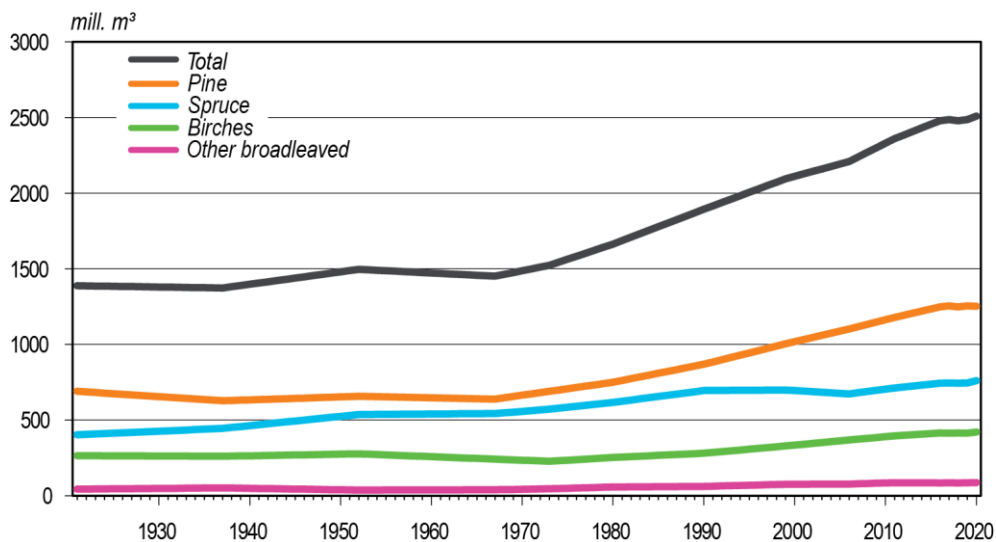
Figure 9. summarizes the wood flows in Finland in 2020.



**Figure 9.** Wood flows in Finland in 2020. Source: Luke.

The increment in Finnish forest growth consists predominantly of increased growth of Scots pine (Figure 10). This is reasoned by two major drivers. Firstly, Scots pine was the dominating regeneration species for a long period from approximately 1940s to 1990s. During the past 25 years, Norway spruce has become more popular, and nowadays Norway spruce is clearly dominating plantation species in south and central Finland. It is obvious that the proportion of

Norway spruce from the annual increment will increase in the coming decades, as the recently planted spruce forests start reaching their maximum net increment speed in larger areas. While Norway spruce is the most important construction wood species in Europe, the recent development in Finnish tree species distribution and growing stock structure is interesting from the wood construction point of view.



**Figure 10.** Volume development of growing stock on forest land and poorly productive forest land in Finland during the past 100 years. Source: Luke.

Both North Ostrobothnia and North Karelia belong to important forest growth regions in Finland. However, the growth conditions (site types, annual temperature sum) and species distribution differ considerably between the two regions, which explains the differences in the mean annual growth: North Karelia is more south, and the proportion of fertile mineral soils is higher in comparison to North Ostrobothnia.

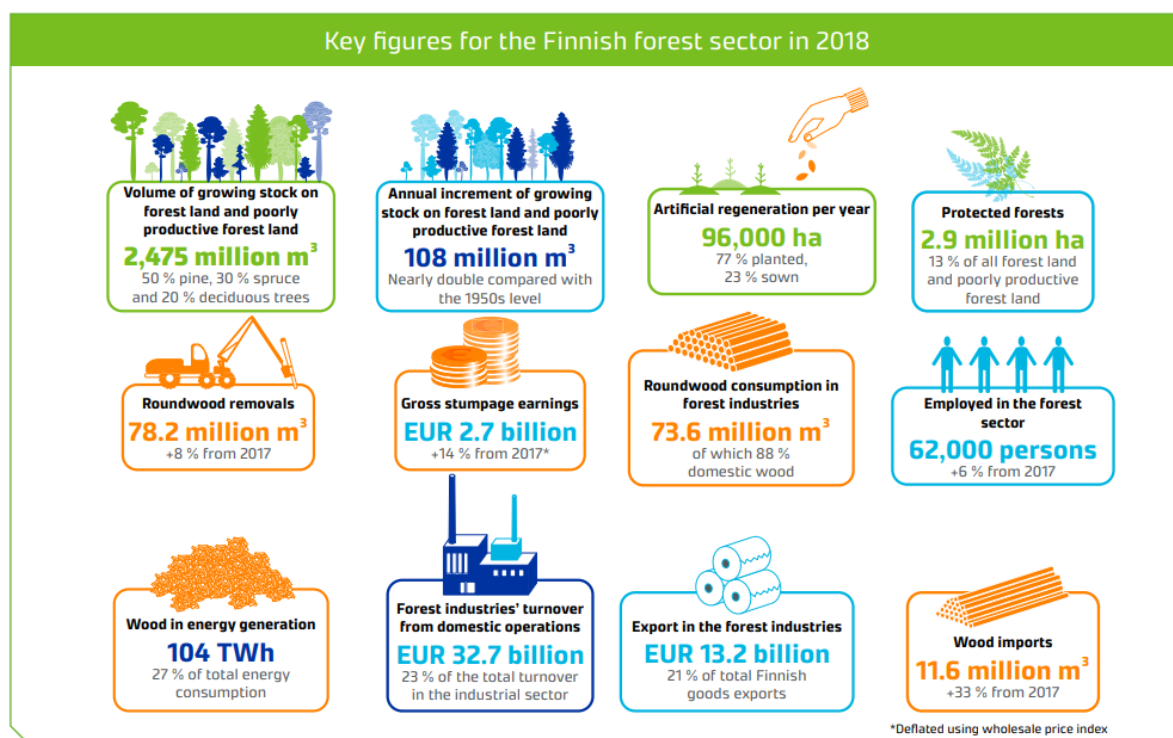
Sawlog harvesting volume has been relatively stable in Finland for the past 35 years and the moderate year-to-year variations have been caused mainly by fluctuation of roundwood prices. Volume of harvested pulpwood, on the other hand, has increased considerably due to increased kraft pulp production and decreased import of pine and birch pulpwood from Russia during the past half-a-decade. This is visible also from the harvested species distribution that indicates increments in Scots pine and hardwood (in practice birch species) removals – both used in large quantities in kraft pulping.

North Karelia and North Ostrobothnia belong to the five biggest regions in Finland with respect to annual roundwood harvests. Both regions are responsible for approximately 5–7 million m<sup>3</sup> annual roundwood removal, which corresponds to roughly 10% of the Finnish industrial roundwood harvest per region.

## 2.3. Markets and trends of the wood construction chain

### 2.3.1. Forest-based industries and related sectors

Figure 11 summarizes the forest raw material supply and use, production, and economy of the Finnish forest sector in 2018. Forest products make up the biggest product group among the Finnish export products. In terms of the economic importance (GDP share), Finland is the most forest-dependent country in the world.



**Figure 11.** Key information of the Finnish forest sector (2018). Source: Finnish Forest Statistics, E-yearbook 2019.

The total value of forest product exports was 10.4 billion € in 2020. The biggest export countries were Germany (14%), China (10%), and Great Britain/United States (both 7%), while Europe covered 58% of the export value.

Sawn timber (including glued products) and plywood (including laminated veneer lumber LVL) were in positions 4 and 5 among the most valuable forest industry export products from Finland in 2018. The top positions were occupied by paper, paperboard, and pulp in this order for many years, but in 2020 paperboard passed by paper in value of exports for the first time. This is understandable due to the dramatic decrease rate in Finnish paper production during the past 15 years. According to the statistics of the Finnish Forest Industries Federation (FFIF), a considerable share of production of all major forest products were exported in 2020: paper (export percentage: 94), paperboard (97), pulp (50), coniferous sawn wood (76), and plywood (83).

Particularly spruce LVL has increased in importance in Finnish forest sector, as well as in European construction sector during the past 40 years. There are three running LVL mills now, and for approximately 30 years Finland was the only producer of LVL in Europe.

The wood product industries wood use has varied approximately between 20 and 30 million m<sup>3</sup> per year, resulting in annual sawn timber and plywood productions of approximately 9–13 million m<sup>3</sup> and 1–2 million m<sup>3</sup>, respectively.

According to Sipiläinen (2020), the value of wood house exports was only 45 million € in 2019, mostly consisting of log houses. This was before the Covid 19 time. Japan was the biggest export market for Finnish wooden houses. The other big export countries were Russia, Germany, and Norway. Wooden houses were imported in Finland mainly from Estonia and Sweden.

While residential houses account for 2/3 of the building stock in Finland, their building and renovation activities stand for great societal, political, economic, technical, and environmental importance. Timber frame and façade are predominant construction principles in single-family and linked houses as well as second homes (summer cottages). Both in terms of wood volumes and business size, the biggest untapped wood construction potential lies in multi-storey apartment buildings, as well as educational and institutional service buildings in public sector. Statistics for 2020 and predicted figures for 2021 indicate an increase in the number of built single-family houses and second homes, which means positive development for the wood use.

According to Statistics Finland, there were almost 2,500 wood product manufacturing companies with joint turnover of approx. 8.8 billion euros and personnel of approx. 24,000 in Finland in 2018. Roughly 1/3 of the number of companies, 1/4 of the personnel, and 1/7 of the turnover were covered by furniture manufacturers.

## 2.4. Policies and support schemes

### 2.4.1. National policies and programmes

The most relevant national policy for future of wood construction, and perhaps for wood industry at large, is the Finland's national climate change policy. Prime Minister Sanna Marin's Government has set as the objective that Finland will be carbon-neutral in 2035 and carbon-negative soon after that. The aim of the present *Climate Change Act* is to reduce greenhouse gas emissions by at least 80% to 2050 from the levels in 1990, but the Act will be reformed in such a way that the targets concerning carbon neutrality, i.e., a balance between emissions and sinks, by 2035 will be reached. (Reform of the Climate Change Act)

The *Medium-term Climate Change Policy Plan* included in Finland's national climate policy presents the measures to mitigate greenhouse gas emissions caused by human activity in building-specific heating and cooling, agriculture, transport and waste management and in terms of industrial F-gases, as well as estimates of the trends in greenhouse gas emissions and impacts of policy actions on these. The wood construction including low-carbon solutions at different parts of value chain, aligns with national plans of reducing greenhouse gas emissions (Medium-term Climate Change Policy Plan, 2020).

In addition to convergence with the national carbon-neutrality agenda, wood construction benefits also from more specific policy support from the national government. The Wood Building Programme (2016–2022) is a joint government undertaking coordinated by the Ministry of the Environment aimed at increasing the use of wood in urban development, public

buildings as well as Strengthening of regional skills bases in wood construction networks<sup>19</sup>. The programme's objectives support the broader Finnish Bioeconomy Strategy by increasing the use of wood in construction and thereby increase the long-term storage of carbon.

Furthermore, the Ministry of the Environment has set ambitious aims for the use of wood in public buildings by 2025<sup>20</sup>. While the share of wooden buildings of all public building construction is currently (2020 data) approximately 15%, it is expected to increase up to 45% by year 2025. If actualized these figures are likely to improve the competitiveness of wood as a building material and add the use of wood in domestic construction value chains.

## 2.4.2. Regional policies and programmes

Numerous regional strategies and programmes guide the use and processing of regional wood resources. These strategies are regulated and coordinated by the EU and national laws via several ministries of Finland, which results in partly sectoral and overlapping approaches. Below are listed some relevant regional strategies related to the present theme.

Regional Forest Programs are statutory provincial forest sector development plans and work programs. They promote the diverse and sustainable use of forests in a way that local starting points, development needs, and aspirations want. Forest Programs implement the EU's and Finland's goals of increasing the complexity of other nature, mitigating climate change and developing rural areas.

- *Pohjois-Karjalan metsäohjelma 2021–2025* (North Karelia Forest Program 2021–2025, in Finnish)<sup>21</sup>.
- *Pohjois-Pohjanmaan metsäohjelma 2021–2025* (North Ostrobothnia Forest Program 2021–2025, in Finnish only)<sup>22</sup>.

Provincial Program is a development program based on the objectives and strategies of the provincial plan, which directs and coordinates regional development work. The provincial program includes development objectives based on the province's opportunities and needs, culture and other special features, a description of key projects and other relevant measures for the province's development, co-operation agreements to be drawn up and, if necessary, a definition of co-operation areas.

- *Pohjois-Karjalan maakuntaohjelma 2018–2021* (North Karelia Provincial Program 2018–2021)<sup>23</sup>
- *Pohjois-Pohjanmaan maakuntaohjelma 2018–2021* (North Ostrobothnia Provincial Program 2018–2021)<sup>24</sup>.

Regional Land Use Plan is a general plan for the land use in a province or subdivision thereof. It presents the principles of land use and community structure and identifies areas necessary

<sup>19</sup> <https://ym.fi/en/wood-building>

<sup>20</sup> see Heräjärvi et al. 2021. Basajaun report D1.2.

<sup>21</sup> <https://metsakeskus.maps.arcgis.com/apps/MapSeries/index.html?appid=3e2b8c3f85b747f0a39ad8261504cf0e>

<sup>22</sup> <https://www.metsakeskus.fi/sites/default/files/document/alueellinen-metsaohjelma-pohjois-pohjanmaa-2021-2025.pdf>

<sup>23</sup> <https://www.pohjois-karjala.fi/documents/33565/34607/POKAT+2021+%23x2013+Pohjois-Karjalan+maakuntaohjelma+2018%23x20132021.pdf/4deb7916-0995-3e38-da76-4dae18bc84b6?version=1.1>

<sup>24</sup> <https://pohjois-pohjanmaa.fi/wp-content/uploads/2020/09/A59.pdf>



for the development of the province. The task of the provincial plan is to resolve national, provincial and regional land use issues. The plans are not single documents but consist of several parts. Information on the Regional Land Use Plans of the case areas is found in Finnish from the websites for North Karelia<sup>25</sup> and North Ostrobothnia<sup>26</sup>.

Regional Rural Strategy is a program that directs funds allocated to agriculture and rural development through the EU (Common Agricultural Policy, CAP). Each EU country draws up one or more Rural Development Programmes. In Finland, the CAP is also important for forestry. Most of the farms under the CAP have forests, thus, for example the machinery investments and harvesting decisions also have an impact on the regional forest economy. Finland is currently (autumn 2021) preparing Rural Development Programmes for the mainland Finland and the Åland Island for the EU programming period of 2021–2027. At the same time, the regional programmes are being prepared.

National and regional authorities across the EU have prepared or are preparing Smart Specialization Strategies (SSS) in the process of promoting entrepreneurship to enable more effective use of the European Structural and Investment Funds and to increase synergies at EU, national, and regional policies, as well as between public and private investments.

- Smart Specialization in North Karelia<sup>27</sup>.
- Oulu Region's Smart Specialization Strategy 2021–2024<sup>28</sup>.

### 2.4.3. Smart specialization

Within the EU context the regional strengths and opportunities are well displayed in a nowadays mandatory Smart Specialization Strategies (SSS). In general, smart specialisation is an EU initiated innovation policy framework where regions identify their strengths and areas for development. The strengths allow regions to stand out and thrive, but in terms of preparedness, the focus must not be too narrow, and regions must also be able to regenerate themselves.

The aim of smart specialisation is to create regional innovation ecosystems that can help the business community to renew itself. Cooperation between research and educational institutions and companies in generating and adopting new innovations is a key pillar of the strategy. It is also important to complement local expertise by working together with others. Partners can still be found in the same country or region, but increasingly in international networks.

### North Karelia

The Smart Specialization Strategy (S3) in North Karelia was prepared in 2017 with focus on three themes/clusters. First, forest-bioeconomy was identified as an essential theme in the North Karelian application of smart specialisation. It is based on innovative utilisation of forest resources. Joensuu, the regional capital, was nominated in 2013 by the Finnish government to be the centre responsible for the coordination of bioeconomy related development activities in Finland. Technology and materials are other themes in the region's smart specialization

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<sup>25</sup> <https://www.pohjois-karjala.fi/maakuntakaava>

<sup>26</sup> <https://www.pohjois-pohjanmaa.fi/kehittaminen/maakuntakaava/>

<sup>27</sup> <https://www.pohjois-karjala.fi/documents/78299/173745/North%20Karelia's%20Choices%20for%20Smart%20Specialisation%202021.pdf/5be69d71-7866-e0b9-4e7f-ce856e28f9aa>

<sup>28</sup> [https://www.pohjois-pohjanmaa.fi/wp-content/uploads/2021/02/SS\\_strategy\\_2021\\_2024.pdf](https://www.pohjois-pohjanmaa.fi/wp-content/uploads/2021/02/SS_strategy_2021_2024.pdf)

strategy. North Karelian enterprises are creating innovative materials, such as films for mobile phone screens and wood-plastic composites. Finally, the third theme was the knowhow related to Russia, as North Karelia shares 300 kilometres of border with Russia. There were approximately 1.6 million annual travellers between North Karelia and Russia before the Covid 19 time. Before the war in Ukraine and subsequent economic sanctions, an important tool in the development work for cross-border cooperation used to be the Karelia ENPI Programme, which was a programme implemented in the regions of Kainuu, North Karelia and North Ostrobothnia in Finland and the Republic of Karelia in Russia. (POKAT 2021, Pohjois-Karjalan maakuntaohjelma 2018–2021).

In sum, the regional economy of North Karelia region is strongly dependent on natural resources, and formerly also businesses across the Russian border. Forest bioeconomy is nominated as one of the three main development sectors of the regional Smart Specialization Strategy. The region is European forerunner in the use of renewable energy and aims at being completely fossil fuel free by 2030.

### **North Ostrobothnia**

North Ostrobothnia has a high level of innovation activity, and expenditure in research and development is above the national average. This is mostly due to the University of Oulu, Oulu University of Applied Sciences and posts of several state research institutes (such as Luke and VTT), but also to the R&D inputs by companies, such as Nokia. However, the commercialisation of research findings and efficient dissemination of innovation are found challenging in the region. The operational environment is developed towards information sharing, networking and making use of international connections. The RDI environments around the regional capital city Oulu are developed to meet the needs of the business community and to ensure greater regional competitiveness.

The North Ostrobothnia's strategy for smart specialisation aims to promote, at the regional level, measures leading to and utilising innovations that meet the challenges posed by climate change, digitalisation and globalisation. The strategy aims to actively disseminate innovations and innovation activities throughout the region and enhance the regional economy and well-being. The strategy supports cooperation across industries and borders. Regional capital Oulu is an international, attractive and networked city, whose competitiveness is based on high know-how, renewables-based industries, well-being and climate wisdom (Oulu Region's Smart Specialisation Strategy 2021–2024).

Priorities for smart specialization in Northern Ostrobothnia include:

- ICT and software sector, incl. integration into the business of different industries.
- Basic industry value chains: mining and metal industry, wood raw material processing.
- Clean technologies, incl. energy.
- Health and wellness technology.

## **2.5. Regional innovation ecosystem**

### **2.5.1. Value chains and stakeholders**

While Finland is very forested and forest bioeconomy dependent country, the sector is rich in different actors and stakeholders. The number of public organizations working in the field of

forestry has been decreased during the past decades, and their overlapping duties have been streamlined accordingly. In addition, private service providers have taken over tasks, such as forest road construction, which were previously solely on the responsibility of public organizations. Despite of considerable streamlining, the stakeholder network in Finnish wood construction sector is still rather complex (see: Figure 12).

## 2.5.2. Competencies, capacities, key actors

### North Karelia

The organization of players in North Karelia on forest industry (incl. wood construction) follows the quadruple-helix model (Puhakka-Tarvainen et al. 2015, 15–16). Key actors are bioeconomy entrepreneurs and primary producers; cities, municipalities and regional development companies; energy, water and waste management organisations; higher educational institutes and other schools, colleges and research institutes; administrative organisations; and NGOs. North Karelia is also coordinating or part of many international institutions and networks, such as European Forest Institute EFI, which headquarter is in located in Joensuu, North Karelia Biosphere Reserve and ENO Environment Online (EFI 2016; ENO Programme 2016; North Karelia Biosphere Reserve 2016). More than 500 research and development experts related to forestry and bioeconomy work in the region.

The companies related to wood construction in North Karelia are mostly SMEs and operate on local level, e.g., in forest and energy management. Only one company (Aatelitalot Ltd) produces prefabricated single-family and linked apartment house elements. Large international companies operating in the region include, e.g., Stora Enso, UPM, and Binderholz that have primary processing units (3 large softwood sawmills with an annual production of each >200,000 m<sup>3</sup>, one birch plywood mill with 60,000 m<sup>3</sup>). There are also two medium-sized (annual production 50–100,000 m<sup>3</sup>) family-owned sawmills (Anaika Lieksa Timber Ltd, Kaivospuu Ltd), and one unit of thermally modified timber (Lunawood Ltd) and glulam production (Anaika Wood Group Ltd). Karelia-Ikkuna Ltd with its two production units is among the largest window frame manufacturers in Finland.

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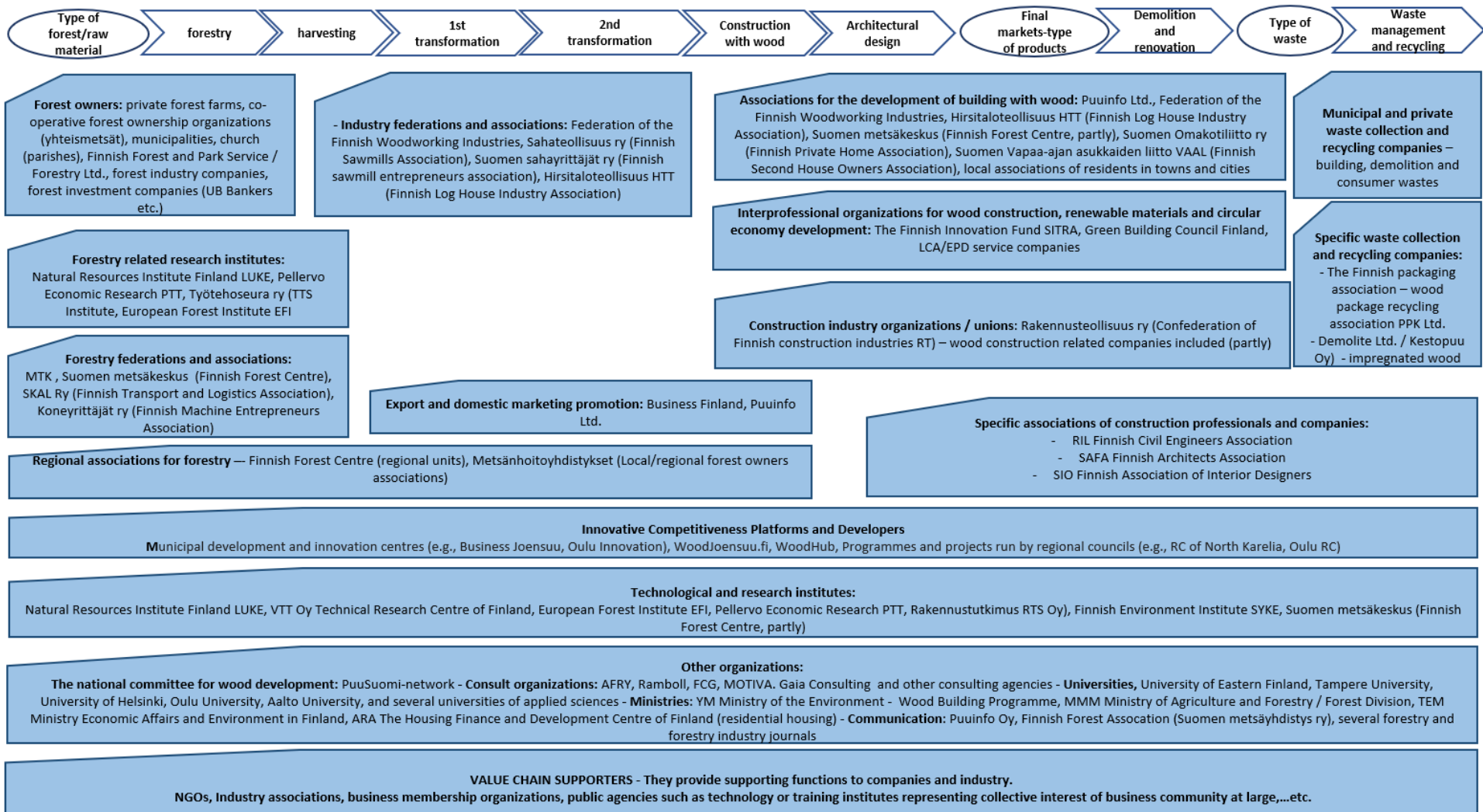


Figure 12. Wood construction value chain stakeholder map of Finland (own figure).

In addition to wood product industries, North Karelia is a centre of forestry related machinery manufacture including world's largest forest machine production factory of John Deere Forestry Ltd, heavy material handling machinery producer Mantsinen Ltd, and crane, chipper and harvester head manufacturer Kesla Ltd. On the software side, Arbonaut Ltd is a global leader in remote sensing data analyses and GIS solutions for forest inventory and natural resource management. See further details in publications<sup>29, 30</sup>.

### North Ostrobothnia

North Ostrobothnia is the leading province in the wood and log house industry in Finland. Of the market shares of detached house manufacturers TOP16 list in the 2015, seven companies were located in North Ostrobothnia. New business has emerged in the construction of wooden apartment buildings with the concept of industrial wood construction, which has a nationwide market. The most significant new players are Rakennusliike Laakso Oy and the SIKLA Group<sup>31,32</sup>.

The sawmill industry in the region is a strong and export-driven field of industry and several SMEs manufacture wooden doors, windows, wooden furniture and various carpentry products. The sawmill industry in the area is investing in the production of sawn and planed goods that increase the use of sawn wood (Junnikkala Oy, Pölkky Oy, Haadex Oy). Investments are being made to increase the production of sawn timber and the manufacture of wood construction elements and log product blanks and glued components in the neighbouring regions of Lapland (Veljekset Vaara Oy, Tervolan Saha ja Höyläämö Oy) and Kainuu (Kuhmo Oy, Pölkky Oy). Pudasjärvi, the "Finnish Log Capital" is located in the North Ostrobothnia and acts as an image locomotive for public timber construction (Metsä- ja puubiotalous uudet arvoketjut – mahdollisuudet Pohjois-Pohjanmaalla, 2018).

The chemical forest industry in the region is based on a strong pulp and paper industry. Significant users and processors of primary wood in Northern Ostrobothnia are sawmills and Stora Enso's mill in Oulu. Although the raw material is also exported to processing plants in other regions, harvested volume is still clearly below the logging potential. The conversion of Stora Enso's paper mill into a board mill further increases the use of pulpwood and sawmill investments increase log recovery capacity. In addition, the region has strong further processing of wood-based products into organic chemicals, such as the tall oil industry (Metsä- ja puubiotalous uudet arvoketjut – mahdollisuudet Pohjois-Pohjanmaalla, 2018).

The decision of the energy company of the city of Oulu, Oulun Energia (Oulu Energy) to use more wood-based fuels increases the use of energy wood in the coming years. In other respects, opportunities to increase the use of the province's wood resources are still in the planning stage and mainly outside the region (Pohjois-Pohjanmaan metsäohjelma 2021–2025).

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<sup>29</sup> Pohjois-Karjalan ilmasto- ja energiaohjelma 2030 (North Karelia climate and energy programme 2030): <https://www.pohjois-karjala.fi/documents/33565/12493606/199+Pohjois-Karjalan+ilmasto-+ja+energiaohjelma+2030.pdf/badd7256-ed25-6041-6cf6-02a9f00e8d5c?version=1.1>

<sup>30</sup> Pohjois-Karjalan strategia 2040 (North Karelia strategy 2040): <https://www.pohjois-karjala.fi/documents/33565/9020841/197+Pohjois-Karjalan+strategia+2040.pdf/ef0a0b6b-8abf-3863-391f-879d6d7c5141?version=1.1>

<sup>31</sup> Metsä- ja puubiotalous uudet arvoketjut – mahdollisuudet Pohjois-Pohjanmaalla, 2018 [https://www.pohjois-pohjanmaa.fi/wp-content/uploads/2020/11/uudet\\_arvoketjut.pdf](https://www.pohjois-pohjanmaa.fi/wp-content/uploads/2020/11/uudet_arvoketjut.pdf)

<sup>32</sup> Katsaus teolliseen puurakentamiseen – puuelementit. 2020 [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162338/TEM\\_2020\\_16.pdf?sequence=1&isAllowed=y](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162338/TEM_2020_16.pdf?sequence=1&isAllowed=y)

## 2.6. Needs and starting points for transformation

### 2.6.1. SWOT analysis

This scrutiny of regional strengths and weaknesses, as well as barriers and potentials, is based on SWOT data (Table 3) and other materials presented above. The SWOT table was first outlined by Luke research group and completed in workshops with the regional public sector stakeholders. Two workshops were organized in December 2021, one for each Finnish region. The stakeholders invited in the two-hour workshops represented the Regional Councils, regional business support companies, local universities, and regional Forest Centres.

**Table 3.** Regional SWOT table for wood construction for the Finnish regions of North Karelia and North Ostrobothnia. Items related specifically to North Karelia and North Ostrobothnia are highlighted with green (NK) and blue font (NO), respectively, while black font indicates items characteristic equally to both regions.

Strengths	
<b>Regional</b>	<ul style="list-style-type: none"> <li>• Good supply of quality timber, logistic solutions, and service providers</li> <li>• High number of house manufacturing firms (log and prefabricated houses)</li> <li>• Know-how and expertise in specific R&amp;D fields and enabling technologies (e.g., forest bioeconomy, photonics, ICT, machine vision, 6G)</li> <li>• Triple Helix collaboration and integration of wood processing and industry parks</li> <li>• Low inter-sectorial and regional mobility of skilled workers</li> </ul>
<b>General</b>	<ul style="list-style-type: none"> <li>• Diverse RDE network in forest science and wood industries</li> <li>• Stable political and socioeconomic environment and commitment to sustainable development, certified wood supply</li> <li>• Large demand for roundwood and industry side streams</li> <li>• Relatively small urban-rural differences in basic infrastructure</li> </ul>

## Weaknesses

### Regional

- Harsh and energy consuming climate conditions
- Aging and declining population
- Sparse and unevenly distributed population, long distances
- Lack of investors and risk capital
- Lack of proof-of-concepts and low commercialization of R&D results
- Shortage of skilled workers particularly in small municipalities

### General

- Distance to markets and dependency on maritime transport
- Path dependency on construction sector
- Lack of new business models in construction sector
- Difficult utilization of construction and demolition wastes

## Opportunities

### Regional

- Industrial symbiosis based on diversified industries and interdisciplinary R&D
- Branding forest-wood value chain and its wellbeing benefits
- Integration of international students in regional businesses
- Shifts in urban-rural migration patterns and housing preferences
- Commitment to support wood construction in regional strategies
- Progress in industrial wood construction and higher added value

### General

- Development in productivity of supply chain and construction activities
- Realization of public wood construction and renovation goals
- Green funding
- Wood construction in spatial planning and modern architecture
- Carbon neutrality advancement in society and product markets
- Deeper understanding of export customer needs and market mechanisms

### Threats

#### Regional

- Regional potentials not recognized in national policies
- Degrading basic rural infrastructure
- Negative population development
- Challenges of SME's, particularly intergenerational shift of ownership
- Changes in local service structure and municipal financing

#### General

- Misinformation and lobbying against wood construction
- Centralization and monocentric policies at national level
- Cost competitiveness of domestic producers
- Unclearly formulated forest, environmental, and climate policy guidance and unpredictable EU and national level regulation
- Rural-to-urban migration of young population
- Lack of knowledge on public procurements among policymakers

## 2.6.2. Main conclusions for a regional roadmap

This section discusses the key elements for construction of regional roadmap for strengthening the role of wood construction in Finnish regions of North Karelia and North Ostrobothnia.

As major *strengths*, both Finnish regions have already a **strong regional innovation ecosystem and networks supporting and promoting wood construction**. This institutional advantage is supported by rather developed supply chain and infrastructure, including supply of quality timber, logistics, and high number of SME's related to wood construction sector. Furthermore, both regions benefit from the strong know-how and expertise in certain R&D fields related to wood construction values chain. Both regions have expertise in forest bioeconomy, research-business collaboration, and business parks related to wood construction and its enabling technologies (e.g., photonics in North Karelia and machine vision and 6G development in North Ostrobothnia). These regional assets are supported and maintained by country specific conditions relevant for wood construction, such as stable political and socioeconomic environment, which attracts foreign investments to wood construction sector in Finland. Other positive institutional condition for advancement of wood construction, also in rural areas, is relatively **small interregional and urban-rural differences in enabling infrastructure** (e.g., broadband coverage).

These regional assets are, however, counterbalanced by certain *weaknesses* related to their psychical and relational locations at the fringes of global and national economic networks. The **peripheral location means long transport distances to international markets** – in practice dependency on maritime transport – aggravated by the unpredictable winter ice conditions in the Baltic Sea. Furthermore, **declining population trends outside the regional capital cities**, as well as unfavourable age distribution, can be internal weaknesses for the regional economies in general, and availability of skilled workers for wood construction sector in particular. Furthermore, **harsh climate** conditions are linked with **high energy consumption** also in the construction sector. Climate, on the other hand, pushes Nordic companies and R&D communities to develop energy efficiency of structures and buildings.

In addition to these region-specific characteristics, the SWOT analysis allows identifying the *opportunities* in operational context of wood construction. First, it can be concluded that the



policy conditions in both regional and national level favour the future of wood construction. National policies, such as the **ambitious carbon neutrality agenda of Finland**, along with agendas of regions, strengthen the role of wood construction both regionally and nationally. Specific potential was identified in the national Wood Building Programme that aims at, among others, implementing the ambitious goals set by the Ministry of the Environment for the share of wooden public buildings. This relates to the **environmental responsibility of the public procurement processes**. Additional region-specific opportunities were identified in **branding the forest management, conservation, and bioeconomy expertise** to boost the sector's acceptability, as well as in improving the **integration of international students in regional businesses**. Finally, potential was seen in the advancement of industrial symbiosis leading to new business opportunities in, e.g., bio-based insulation material production.

The SWOT also defined number of *threats* endangering the abovementioned regional strengths and opportunities. First, **migration of graduates and experts from the regions** affects the availability of skilled labour for different stages in wood construction value chains. In this sense, it is evident that the future of wood construction related industries is linked with the overall attractiveness and vitality of these rural and peripheral regions. Furthermore, in addition to affecting the labour availability in regions, the migration patterns and trends in housing, as well as location preferences, determine where and what types of buildings are built. This is a fundamental issue for increasing wood construction and especially its spatial dimension. Hence, **further urbanization proceeding in parallel with monocentric policies at national level** is a significant contextual threat to the increasing wood construction in the regions and, as such, contribute to the rural renewal and renaissance. However, recent changes in the subnational migration patterns suggest that COVID-19 pandemic might have triggered and surfaced certain preferences for more rural and environmental-friendly living, which would subsequently turn the role of migration trends from a threat into a considerable potential. Finally, additional contextual threats can be seen in **conservatism of construction sector's material selection**, which is partially reflected in **lobbying against wood** as a construction material. Instead of stubborn path dependency, i.e., sticking in conventional non-renewable solutions, the construction sector could see wood as a chance to improve the entire sector's environmental performance and acceptability via, e.g., hybrid structures.

In terms of the development of wood construction sector, the two Finnish regions indicate many similarities but also some differences. Both regions are characterized by vast **forest resources and versatile forest industries**. Furthermore, both regions are single-nodal and sparsely populated, and suffer from population decline in rural areas. For the **North Karelian wood construction value chain, the key development step by 2030 is to fulfil the gap identified in wood element manufacture**, while the research, development, and education expertise, as well as primary wood processing industries stand for internationally acknowledged level already now. **In case of North Ostrobothnia, the industry base is broad, but the RDE activities are focussed on more narrow segments of wood construction value chain**. For both regions, the regional demand for construction products and related services is insufficient to realize the full potential in wood construction value chains. Considering the existing potentials in RDE, as well as available forest resources and primary processing industries, **both regions could develop their wood construction sector with the target on national and international export markets**.

In addition to new wooden buildings, **the markets for renovation are increasing**; in Finland the value of renovation market is already approximately the same than the value of new building market. Approximately 98% of the European insulation product market consists of non-renewable materials. The European Renovation Wave strategy aims at huge improvement in

energy efficiency of the European building stock. To be on sustainable basis, the energy efficiency improvement should be achieved using a greater share of renewable, bio-based insulation materials. This calls for new wood-based insulation solutions. Regions of North Karelia and North Ostrobothnia are rich in wood industry side streams that currently end up in short lifecycle applications, such as pulping or energy production. These side streams (e.g., wet bark, sawdust, and chips, as well as dry planing residues and demolition wood), together with versatile R&D expertise, provide the two regions with **excellent potentials to develop new bio-based insulation solutions.**

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- Statistics Finland. National Accounts. [https://www.stat.fi/til/kan\\_en.html](https://www.stat.fi/til/kan_en.html)
- Suomen ilmastopaneeli. Raportti 2021 (The Finnish Climate Change Panel, Report 2021). [https://www.ilmastopaneeli.fi/wp-content/uploads/2021/09/SUOMI-raportti\\_final.pdf](https://www.ilmastopaneeli.fi/wp-content/uploads/2021/09/SUOMI-raportti_final.pdf)
- Wood Building Programme 2016–2022. <https://ym.fi/en/wood-building>

### 3. Regional profile New Aquitaine, France<sup>33</sup>

#### 3.1. Context

##### 3.1.1. Geography, land use, demographics

New Aquitaine is located in the southwest of France. It is the largest administrative region and largest region by area in France. It covers 84,036 km<sup>2</sup> – 1/8 of the country. It has 5,956,978 inhabitants (municipal population on 1 January 2017) with average age of 43,6 years<sup>34</sup>. It is estimated that municipal population already surpassed 6 million inhabitants in 2021. The region was created by the territorial reform of French regions in 2014, through a merger of three regions comprised of twelve departments (Figure 13):

- Aquitaine (Gironde, Landes, Lot-et-Garonne, Dordogne, Pyrénées-Atlantiques),
- Limousin (Haute-Vienne, Corrèze, Creuse),
- and Poitou-Charentes (Charente, Charente-Maritime, Deux-Sèvres, Vienne).



**Figure 13.** New Aquitaine's location in France (Source: Wikipedia<sup>35</sup>)

<sup>33</sup> Authors: Jean-Luc Kouyoumji, Peter Romih, FCBA

<sup>34</sup> Insee. 2021. Comparateur de territoire: Région de la Nouvelle-Aquitaine (75). Website. Available at: <https://www.insee.fr/fr/statistiques/1405599?geo=REG-75>

<sup>35</sup> Wikipedia. 2021. Available at: [https://en.wikipedia.org/wiki/Nouvelle-Aquitaine#cite\\_note-Population](https://en.wikipedia.org/wiki/Nouvelle-Aquitaine#cite_note-Population)

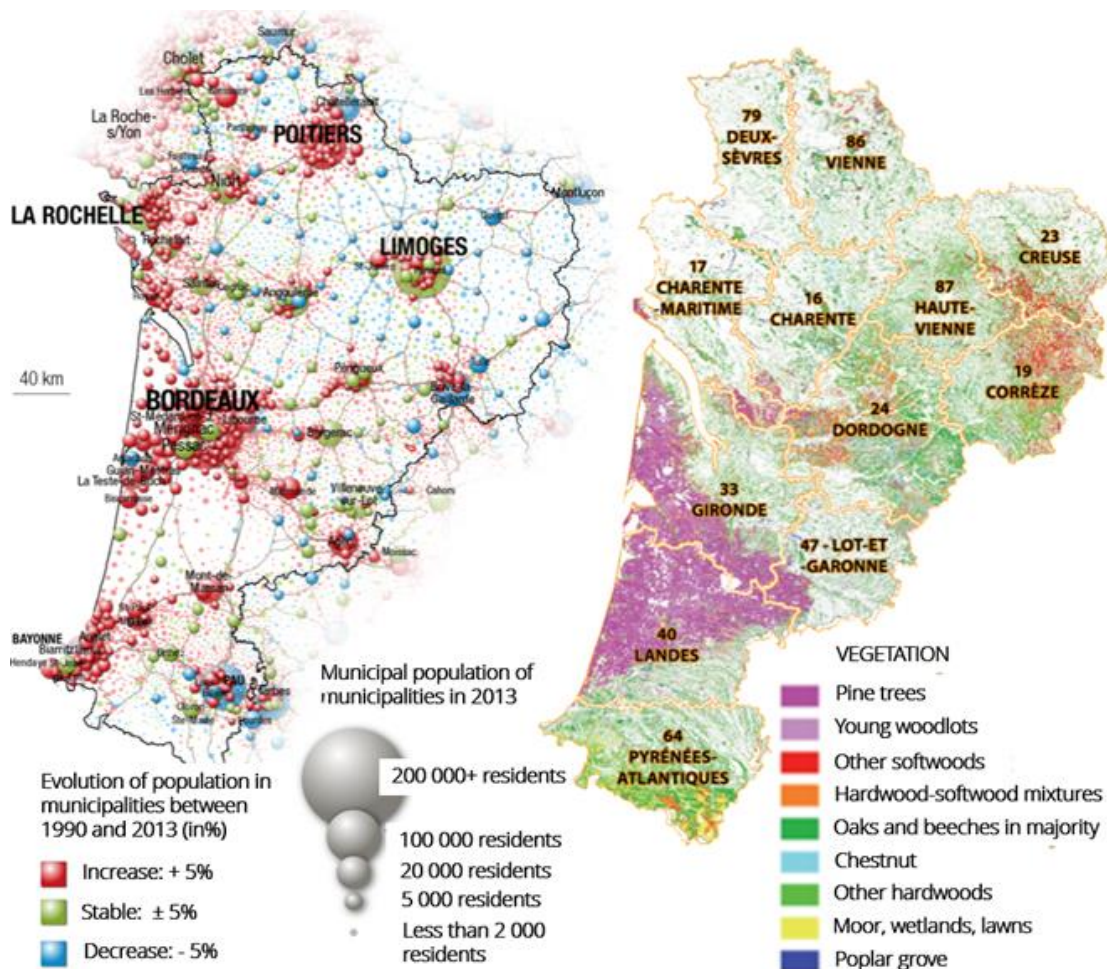
The region has 25 major urban areas (Figure 14, left map), among which the most important are Bordeaux (850,000 inhabitants together with suburbs and satellite cities), Bayonne (288,000 inhabitants), Limoges (283,000), Poitiers (255,000), Pau (241,000) and La Rochelle (206,000). The average population density is 70,3 inhabitants/km<sup>2</sup>. Department of Gironde has the highest population density of 165,8 inhabitants/km<sup>2</sup><sup>36</sup>. In referenced period from 2018–2021 there was 1.1% annual growth of population. The population growth, particularly marked on the coastal and urban areas, makes it one of the most attractive regions in France.

New Aquitaine has large open coastline facing Atlantic Ocean on the west. The coastline is lined with high dunes, large lakes and wetlands and vast pine forests planted in the nineteenth century. The Landes Forest, by far the most extensive, covers approximately 1.5 million hectares. It is the largest artificial forest of Western Europe (Figure 14, map on the right: triangle in purple colour). This vast ecosystem with surrounding regions (Landes, Gironde, Lot-et-Garonne) is called Landes de Gascogne region. Here, forestry activity is spatially dominant, and agriculture mostly takes the form of irrigated islands. Forests occupy approximately 66% of the territory, agriculture 18% and artificial land 7%. Composition of the forest is 85% maritime pines (803,000 ha). The proportion of hardwoods has increased from 8% to 15% in last 10 years. Other important forests in New Aquitaine are located:

- On the borders of the Charente, Charente-Maritime and Dordogne (the Double Forest, punctuated by nearly 500 lakes, spans on around 50,000 ha).
- Dordogne department has varied landscapes and large afforestation rate (45%), making it the third most wooded department in France (dominated by oak and chestnut trees).
- Further east in Limousin region (Haute-Vienne, Corrèze, Creuse), we can also find forests dominated by oak, beech and chestnut trees.
- Further north, near Poitiers - Vienne department (Moulière forest, stretches on nearly 6,800 ha).
- Forests in south mountainous region Pyrenees Atlantiques.

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<sup>36</sup> City population. 2022. Available at: [https://www.citypopulation.de/en/france/reg/admin/R75\\_\\_nouvelle\\_aquitaine/](https://www.citypopulation.de/en/france/reg/admin/R75__nouvelle_aquitaine/)



**Figure 14.** Dynamic of Rural, Urban and Ecosystem areas (Source: Memento<sup>37</sup>)

In view of the current challenges, the uncertainties concerning the future of the New Aquitaine are great. Challenges are even bigger when one considers the long-term issues: consequences of climate change, urbanization dynamics, effect of energy demand on the wood industries and forestry, etc. Sustainable management and preservation of ecosystems while developing rural and urban areas is a big challenge, especially in Landes de Gascogne (a region of Landes Forest within three departments, Landes, Gironde, Lot-et-Garonne). As it is already observable from the Figure 14; this area has the highest population density and the highest growth rate of population on the one hand, while it also has one of the most important and significant ecosystems in region. Rural vs Urban dynamic here is obvious. The rural areas of Landes de Gascogne have been transformed by the expansion of peripheral populated areas (Bordeaux, Bayonne, Mont-de-Marsan) and the repopulation of the coastal and remote rural areas. For the past twenty years, this predominantly rural area, located near metropolitan areas in the North and South and bordered to the West by an attractive coastline, has experienced strong demographic growth and a diversification of its economic activities. There is a growing influence of the Bordeaux and the Bayonne urban areas on rural territory. Due to the decentralization and disengagement of the State on certain competencies, metropolises gaining power in territorial governance. Development of the intercommunity, maintenance of the departments,

<sup>37</sup> Agreste. 2019. Memento de la statistique Agricole La filière forêt-bois. pp. 5. Available at: <http://sg-proxy02.maaf.ate.info/IMG/pdf/R7519C01.pdf>

affirmation of the region, territorial organisation and the modes of governance of the Landes de Gascogne evolve in the direction to strengthen local authorities.

The concept of urban unity is based on the continuity of the built environment and the number of inhabitants. Urban units in metropolitan France departments are identified according to the following definition: a commune or group of communes with a continuous built-up area (no more than 200 meters between two buildings) with at least 2,000 inhabitants represent urban unit. If the urban unit is in a single commune, it is referred to as an isolated town. If the urban unit extends over several municipalities, and if each of these municipalities concentrates more than half of its population in the continuous built-up area, it is called a multi-municipal agglomeration<sup>38</sup>. On the left map of the Figure 14, we can observe the rural areas indicated with the smallest bubble (less than 2,000 residents), and urban areas indicated with bigger bubbles. The Landes de Gascogne region has 386 municipalities that spread over 1,463,470 hectares. 43% of municipalities is in predominantly urban space. Municipalities located in predominantly rural areas have decreased by 15% since 1999. Further, we can observe even higher decrease of population in rural municipalities on the east of the New Aquitaine region (indicated with many small blue bubbles)<sup>39</sup>.

### 3.1.2. Economic trends and competitiveness

New Aquitaine is the French region with the most tourism jobs and it is the large agricultural region. Its economy is based on agriculture and viticulture (vineyards of Bordeaux and Cognac), tourism, a powerful aerospace industry, digital economy and design, para chemical and pharmaceutical industries, financial sector (Niort is the fourth-largest financial center in the nation) and industrial ceramics (Limoges). The region has significant forest resources. The forest-based sector is at the heart of regional and local policies of the territory. It contributes to its dynamism and its success. It generates more than 56,000 jobs, and it offers open space for leisure and recreation activities to citizens. The timber industry consists of two main types of activities that mainly use the wood of the Landes Forest and secondarily of the Dordogne, Creuse, Corrèze and Haute-Vienne.

Primary processing industries (pulp, sawing, veneer, etc.) consists of a large company performing operations that require large investments. The secondary processing industries (paper/cardboard, furniture, construction applications, etc.) do not require as many resources. They are more dispersed geographically and in the hands of smaller-scale enterprises. The timber industry is large enough to get the support of local authorities. It forms national competitiveness cluster like "Xylofutur" whose main purpose is to bring innovative projects to benefit the entire industry.

Forest generates significant economic added value. It is the first link in an economic chain that brings together labour, artisanal, industrial processing entities, wholesale and retail trade, and different services. Harvested timber in New Aquitaine represents a quarter of the overall national harvested volumes, and harvested maritime pine represents nearly 90% of the national harvest of this species. Timber remains the main outlet for forestry in New Aquitaine. Wood

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<sup>38</sup> Insee. 2021. Urban unit. Available at: <https://www.insee.fr/en/metadonnees/definition/c1501>

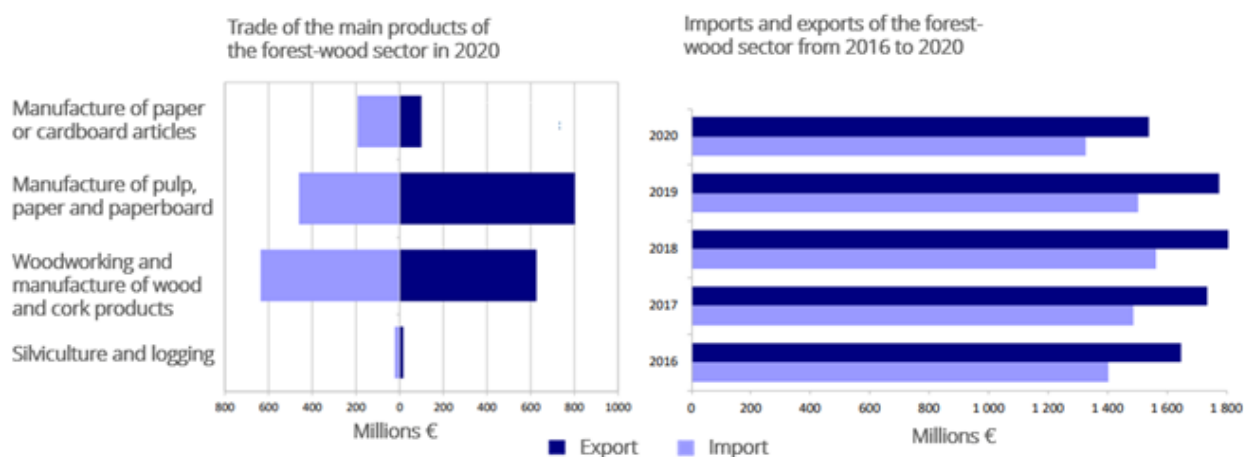
<sup>39</sup> INRA, Region Aquitaine. 2012. Etude prospective Massif des Landes de Gascogne 2050. Available at: <https://hal.inrae.fr/hal-02809771>



energy is gaining momentum, even if its share remains lower than that observed in the rest of France.

New Aquitaine is leading region in terms of forest area in France. It is also the leading region in forestry activities, sawn wood output, and the leader in wood products applications. Companies in the timber industry in New Aquitaine generates a turnover of more than 10 billion euros. Looking at foreign trade of France (Figure 15), the forest and wood products segment suffers a structural trade deficit (-4 billion euros). This is not the case for New Aquitaine, which remains the first of the only three surplus regions. New Aquitaine had more than 200 million euros of annual surpluses in last years, ahead of Grand Est (100+ million euros) and Bourgogne Franche-Comté (40+ million euros).

With 1.8 billion euros in 2018, New Aquitaine was the second French region exporting forest and wood products, behind Grand-Est (2.0 billion euros). These export account for 7.4% of the regional export value (excluding military equipment). In 2020, exports of pulp, paper and cardboard (800 million euros) dominate ahead of wood products and semi-products (sawn products, veneer, panels, parquet floors, frameworks, packaging, etc.; 600+ million euros). In 2019 and 2020 overall export vale declined back to 1,5 billion euros.<sup>40</sup>



**Figure 15.** Trade structure of New Aquitaine region (Source: Memento<sup>41</sup>).

There are many questions about current and future development of the forest-wood sector, its integration into regional territorial dynamics and its future on the national, European, and global level. The forest-based sector is characterized by different interest between other intensive land-use industries and different interests even within its complementary industries (sawn wood, pulpwood subsectors, fuelwood...). There is strong conflict of interests even within forest-based subsectors as they all share the timber biomass. These characteristics of the industrial system cause different questions and challenges<sup>42</sup>:

<sup>40</sup> PRFB. 2020. pp. 12.

Available at: [https://fibois-na.fr/wp-content/uploads/2021/04/PRFB020-COR-Decembre\\_cle86c1f2.pdf](https://fibois-na.fr/wp-content/uploads/2021/04/PRFB020-COR-Decembre_cle86c1f2.pdf)

<sup>41</sup> Agreste. 2020. Memento de la statistique Agricole La filière forêt-bois- New Aquitaine. pp 14. Available at: <https://fibois-na.fr/ressources/la-foret-et-la-recolte-du-bois/>

<sup>42</sup> PRFB. 2020. pp.12.

- a process of industrial concentration causing decline of certain sub-sectors, e.g., furniture
- Effects of competition linked to the development of wood-based energy which led to tensions on the resource use
- uncertainties about the individual strategy of silviculturists and the growing role of sector operators (including forestry cooperatives) in silvicultural management
- a disconnection between sector management which is focused on the exploitation of a forest area and other territorial dynamics (residential, employment, recreation, etc.).

### 3.1.3. Climate change impacts

The "medium" scenario (A1B) of the IPCC and the translation of its consequences for agriculture and forestry within the framework of the Climator program (2010), were retained in the forecast. By 2050, this A1B scenario predicts a temperature increase of nearly 1.5 °C for the south-west France, and around 10% decrease in precipitation. Effect of these climatic changes on the yield of maritime pine is estimated with a yield decrease of -10% by 2050 and up to -40% after 2070.

The main natural hazards that New Aquitaine will face by 2050 in this climatic context:

- **Storms:** In last two decades New Aquitaine was already hit by two very powerful storms (Martin in 1999 and Klaus in 2009) which greatly reduced standing volume of Maritime pine. Storm damage (1999, 2009) corresponds to an approximately 50% decrease in growing biomass stock of this species. The maritime pine forest is also facing recurrent health attacks by pests and the permanent threat of fires. Research has been carried out on forest vulnerability and storm risk management in forests. However, according to the analyses of Hervé Le Treut, the impact of climate change on the occurrence and intensity of storms in the Landes de Gascogne is not clearly established. In the current state of climate models, nothing leads to the conclusion that the occurrence of storms will increase by 2050 in the Landes de Gascogne.
- **Fires:** the degree of fire sensitivity of the New Aquitaine in 2040 will increase due to climate change and it will be equivalent to that of the Southeast zone currently. The increase in temperatures and summer droughts in France will worsen the risk of forest fires in the regions where those already raging and extend it to new geographic areas. Half of the metropolitan forest area could be exposed to the "fire" hazard. National strategies for managing this risk and allocating resources for prevention and control are necessary.
- **Pests:** New Aquitaine could experience a greater sensitivity to opportunistic parasites. Indeed, insects are favoured by an increase to these temperatures; moreover, the adaptation capacities of the parasites are generally superior to those of their hosts (beech, maritime pine), which could result in rapid changes in the parasitic procession of pines in the Landes. Finally, the probability of arrival of new parasites is very high (for example the pine wood nematode). The Aquitaine region has been strongly affected by the pine processionary caterpillar (*Thaumetopoea pityocampa*).
- **Drought:** many areas in New Aquitaine will probably suffer from summer water deficits and longer winter waterlogging. These events and their consequences are already occurring in the region. Rate of their intensity is expected to increase.

## 3.2. Forest resources and management

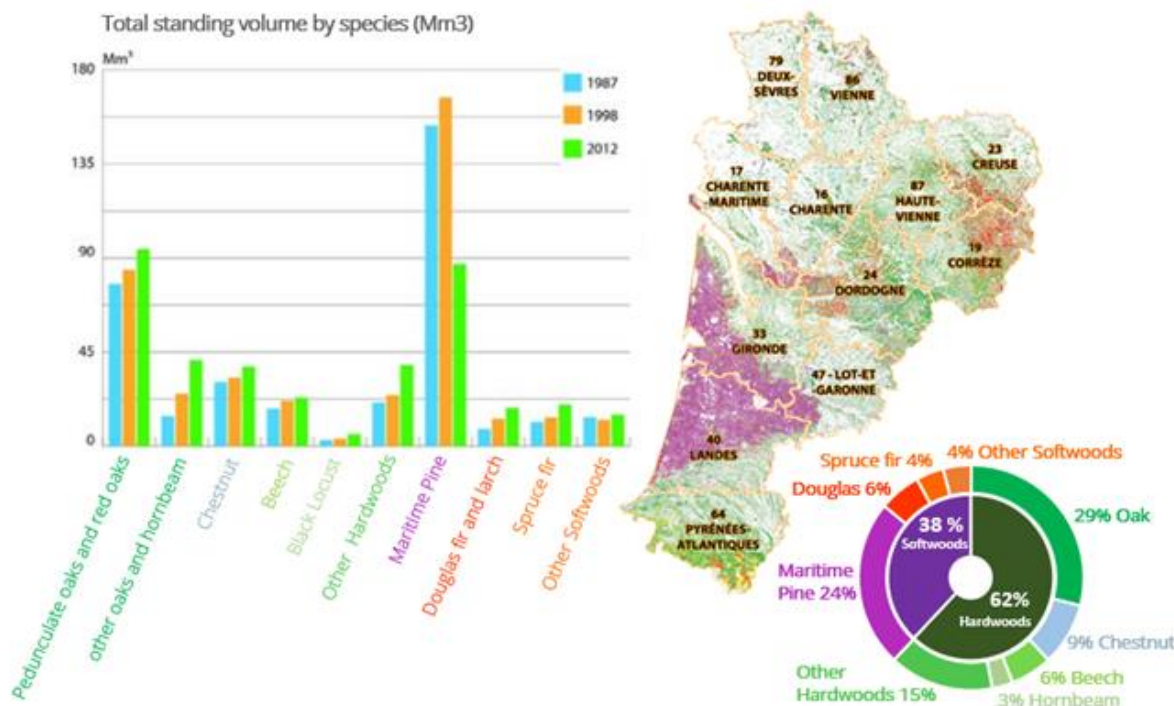
### 3.2.1. Forest stock and ownership

With more than 16.9 million of hectares (covering 31% of the territory) in 2019, France is the fourth country in Europe after Sweden (28.0 Mha), Finland (22.4 Mha) and Spain (18.6 Mha) in terms of forest area. Forest is mostly private in France. Three quarters of the French forest area belongs to private owners, which makes up 12.6 million of hectares. State-owned forests cover 9 percent of forested area, the rest being occupied by other public forests, mainly communal forests. In Europe, France is one of the countries with the highest proportion of privately-owned forest, ranking after Portugal, Austria and Sweden.

The growing-stock volume of the French forests is estimated at 2.8 billion m<sup>3</sup>. This volume calculated by the NFI is the stem volume of live trees having a diameter at breast height superior to 7.5 cm, from the stump to a minimum 7 cm top diameter over bark. The growing-stock volume per hectare is 173 m<sup>3</sup>. Almost 2/3 (72%) of the growing-stock volume are in privately-owned forests. The volume per hectare is higher in state forests (197 m<sup>3</sup>/ha). The French Forest is mainly a broadleaved forest (64% of the growing-stock volume and more than 2/3 of the total forest area). Broadleaved trees are mostly located in flat and low-elevation areas, except the Landes of Gascogne region in South-Western France, which is dominated by maritime pine. Coniferous can be also found in mountainous and Mediterranean areas.

New Aquitaine has the largest forest resource area in France: 2.8 million hectares. Forest covers 33% of the territory of New Aquitaine. The growing-stock volume per hectare is 136 m<sup>3</sup>/ha and the total volume of standing timber in forest stock is 384 million m<sup>3</sup>. Majority of forests is privately owned. In New Aquitaine 9 out of 10 hectares (90%) of forest are owned by private owners, compared to 7 out of 10 hectares (72%) the rest of France. The major feature of private property is its extreme fragmentation of land. More than 80% of the forest area is owned by properties of less than 10 ha.

The territory has a highly variable afforestation rate, and the forests are characterized by a great diversity of species (Figure 16). Majority of species are deciduous (62%, both in surface area and in volume). Maritime pine occupies sandy or acid soils, it tolerates the summer droughts, hydromorphic, and for the Landes, relatively strong winters. The Landes silvicultural systems are characterized by mono-specific stands of maritime pine with rotations of 40 to 50 years. They are exposed to climate change threats like windstorms and forest fires, insect attacks, demand for biomass. In addition, this production forest is faced with the rise of social expectations related to nature, the living environment and leisure activities. The total volume of standing timber (384 million m<sup>3</sup> of standing timber in 2015) (15% of French standing timber volume) is constantly increasing.



**Figure 16.** Total standing volume by species (Based on: PRFB, Memento<sup>43</sup>).

The total standing volume of the different species increased constantly between 1987 and 2012 except for Maritime pine. The Landes of Gascogne area, the main production region for this species, saw its standing stock decrease by almost half following the two storms Martin (1999) and Klaus (2009).

Hardwoods are the majority and represent more than 62% of the resource both in surface area and in volume. They largely dominate in the forest areas of the Pyrénées-Atlantiques, Dordogne and south of Haute-Vienne and Corrèze. Softwoods account for nearly 38% of the resource. Maritime pine, present in the Landes de Gascogne massif, alone represents nearly a quarter of the standing volume of the regional forest and 64% of the national reserves of this species. Douglas fir and Spruce fir, present on the Millevaches plateau, are the other important coniferous species. Together, they represent 10% of the regional resource<sup>44</sup>.

The proportion of large timber (>= 47.5 cm in diameter) in volume is constantly increasing. It increased from 16% to 21% between 1998 and 2012. It is difficult to mobilize these woods because sawmills are not currently equipped to process these dimensions. This non-valuation of large timber is an accentuating factor of the phenomenon. At the same time, there is a real issue concerning the renewal of stands. A significant decrease in young stands is observed.

### 3.2.2. Forest management and silvicultural systems

The current mission of French forest policy is to “harvest more while better protecting the French forest”. This mission is a good summary of the objectives of this policy. The policy is

<sup>43</sup> PRFB, 2020, pp 109.

Memento, 2019, pp. 5.

<sup>44</sup> PRFB, 2020, pp. 108.

oriented towards forest management that more and more considers the environmental aspects. In parallel, the objective of harvesting several hundred thousand additional m<sup>3</sup> of wood per year is clearly stated. Increasing the harvest could meet the requirements of the industry while developing wood construction and wood energy to achieve France's short- and medium-term goals. These additional harvesting volumes should be wood for construction sector and energy sector to valorise the by-products of such wood. The strong fragmentation of forest ownership severely hampers logging. Logging and skidding costs can only be reduced by working on plots representing relatively large volumes. That requires consolidation or at least right of way. This process is very time-consuming, and success is not guaranteed.

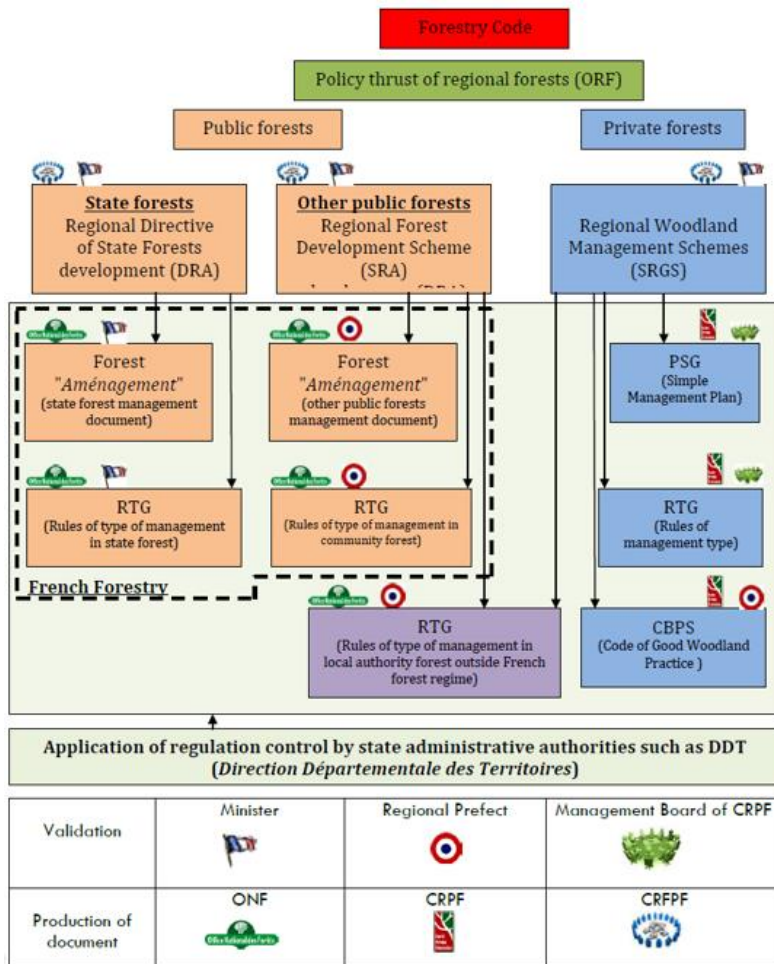
Since 1963, forest owners of more than 25 hectares have been required by law to create a statutory document called the "Plan Simple de Gestion" (PSG), to be validated by the regional centres for forestry property (CRPFs). Each PSG describes the stands and the annual programmes of timber cutting or work to be done by plot or subplot. This document provides an overview of the past management and an analysis of economic, environmental and social challenges. PSG document is described in the forestry code and integrated into the sustainable management policy of French forests. PSGs must comply with the forest code and the Regional Woodland Management Schemes (SRGSs) set up by the CRPFs to define the woodland management practices adapted to each region. The purpose of the forest code is to provide the general orientations of the forest policy and resulting regulations, as well as to present the role of the institutions in charge of its implementation.

The regional strategic documents of sustainable forest management are all approved by the state (Figure 17), for public forests as well as for private forests. The regional forest orientations (Orientations Régionales Forestières or ORF) are documents produced by the Regional Commission of Forest and Forest Products (Commission Régionale de la Forêt et des Produits Forestiers or CRFPF). The composition of these regional commissions reflects the diversity of the actors involved in forestry at regional level. The ORF are strategic documents orienting the regional forest policy according to the regulations of the forest code.

- The *Regional Silvicultural Schemes of Forest Management* (Schémas Régionaux de Gestion Sylvicoles or SRGS) are documents that detail the conditions for a sustainable forest management in private forests for each French region. The PSG, RTG and CBPS must conform with the SRGS. If the harvest methods used strongly contradict the directives of this management document, the DDT11 can request payment of a penalty fixed by the forest law.
- The *Regional Forest Management Planning Schemes* (Schémas Régionaux d'Aménagement or SRA) are documents defining the conditions of a sustainable management in each French region for forests that are under the forest regime of non- state forests. These documents are drafted by the ONF with the contribution of the CRFPF and the prefect of the region. The document is approved by ministerial decree. The forest management must conform with the SRA.
- The *Regional Forest Management Planning Directives* (Directives Régionales d'Aménagement or DRA) are documents that for each region detail the conditions of a sustainable management for the state forests. These documents are realised by the ONF. The document is approved by ministerial decree. The forest management must conform with the DRA. The forest management planning is also approved by ministerial decree.
- The national policy and the regional policies derived from it are based on the work done by CNPF, ONF and the DDT but most of the indicators are provided by National Geographic and Forest Institute (IGN - Institut Géographique et Forestier National).

The ONF is the only authority in charge of implementing the “régime forestier” in partnership with the public owner. 85% of the French forestry regime’s financing plan comes from the central government in the form of compensatory payments designed to cover the ONF’s management costs. The remaining 15% are financed by the local governments when they pay their forest monitoring cost based on the revenue from the sale of timber.

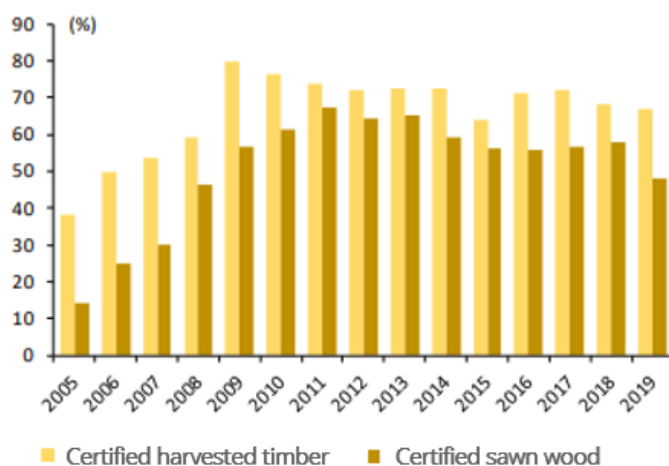
The principle of sustainable management has been included in the Forest Code since 2001. It applies to all forestry operations and engages all stakeholders. The PRFB, as a variation of the PNF, implements the forest policy defined in the forest code (article L 121–1), which aims to ensure the sustainable management of woods and forests. Forest certification is a voluntary process where the independent third-party organization (auditor) certifies that wood comes from sustainably managed forests/woodlands. Among all forest certification systems developed worldwide, the following are highlighted due to their broader dissemination: FSC (Forest Stewardship Council), and PEFC (Programme for the Endorsement of Forest Certification).



**Figure 17.** Organisations of the creation, approval and control of forest management documents (Source: Integration of Nature Protection in Forest Policy in France<sup>45</sup>).

<sup>45</sup> Tissot, W. & Kohler, Y. 2013. Integration of Nature Protection in Forest Policy in France. INTEGRATE Country Report. EFICENT-OEF, Freiburg. pp. 35.

51% of the NA forest is certified by PEFC and FSC (Figure 18). The level of certified maritime pine (Landes de Gascogne) is around 80%. The purpose of this forestry is to preserve a sustainable ecological balance. Forest companies and sawmills in the region are involved in the certification process. Over the entire harvest, just over 7 million m<sup>3</sup> of wood comes from sustainably managed certified forests (majority PEFC label). Thus, 70% of the harvested timber is certified (national average is 50%). In 2016, more than one million ha of the New Aquitaine forests were covered by an approved management document (simple management plan, standard management regulations, code of good silvicultural practices)<sup>46</sup>.



**Figure 18.** Certification of harvested and sawn wood from 2005 to 2019 (Source: Memento<sup>47</sup>).

### 3.2.3. Forest functions and ecosystem services

Sustainable forest management is essential to guarantee the major role of forests in many areas: preservation of biodiversity, provision of many other ecosystem services (carbon capture and storage, quality of water and air resources, preservation of soil erosion, protection against natural risks such as landslides or avalanches,...), creation and organization of recreational spaces (outdoor sports, hiking, green tourism, walks, hunting, gathering, educational outings) and maintenance of the diversity of landscapes.

Forests of New Aquitaine are also places for recreation, relaxation, tourism and education. Each year, they welcome thousands of visitors. The forests of New Aquitaine are a home to a remarkable number of species and wide variety of habitats (wetlands, lagoons, gallery forests, freshwater swamp forests, etc.). Five hundred thousand hectares of forest is under the Habitats Directive or the Birds Directive Natura 2000 site<sup>48</sup>. In addition, nearly 30,000 ha of forest are classified as protected natural areas (nature reserve, biological reserve, national park, biotope protection orders), including 20,000 ha for the Pyrenees National Park. The role of the forest in maintaining regional biodiversity is therefore major<sup>49</sup>.

<sup>46</sup> PRFB. 2020. pp. 110.

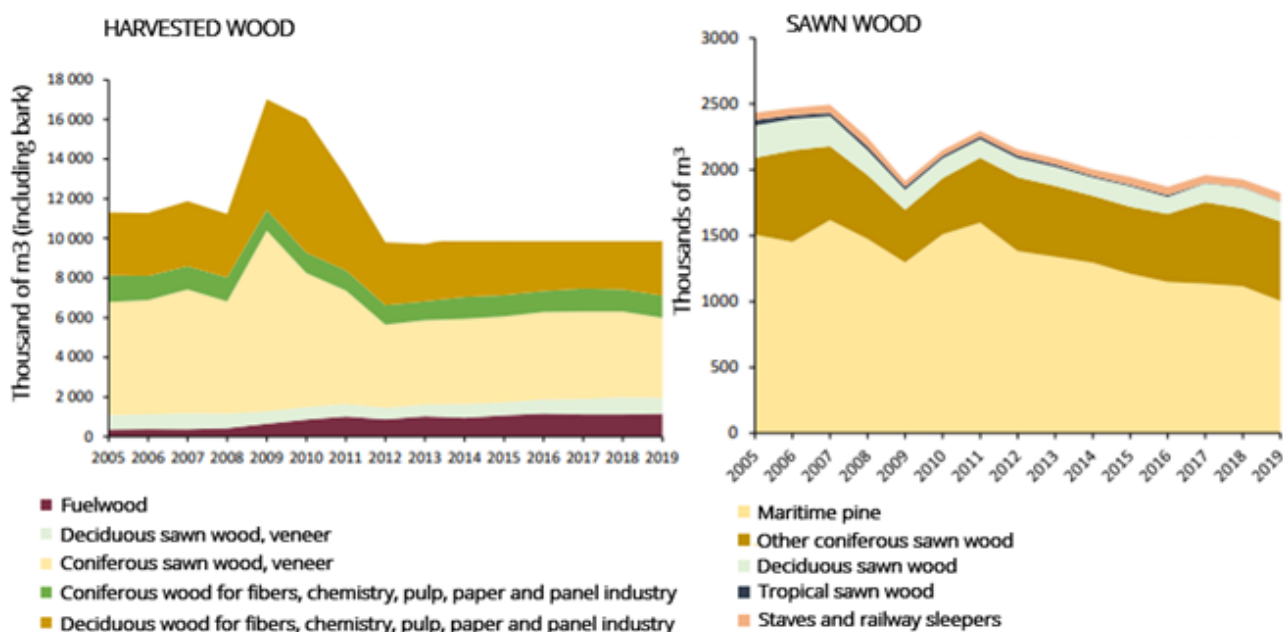
<sup>47</sup> Memento. 2020. pp. 10.

<sup>48</sup> EC. Natura 2000. Available at: [https://ec.europa.eu/environment/nature/natura2000/index\\_en.htm](https://ec.europa.eu/environment/nature/natura2000/index_en.htm)

<sup>49</sup> PRFB. 2020. pp. 13.

### 3.2.4. Forest growth and harvest trends

The annual harvest of 10+ million m<sup>3</sup> / year (Figure 19) has for several years been significantly lower than the annual increment in forest biomass which is 16,8 million m<sup>3</sup> / year. Excluding wood for energy (fuelwood), softwood represents 70% of the harvested volume. Maritime pine alone accounts for more than 56% of the regional harvest and more than 85% of the national harvest for this species. The region also contributes 15% of the French Douglas-fir harvest and 8% of that of spruce fir. With nearly 1.6 million m<sup>3</sup> of hardwood harvested (excluding fuelwood), New Aquitaine ranks third in France behind the Grand-Est and Bourgogne-Franche Comté regions for hardwood species. Poplar, oak, chestnut and beech are the most mobilized species.



**Figure 19.** Regional harvested wood and sawn wood trends from 2005 to 2019 (Source: Memento<sup>50</sup>).

Half of harvest is intended for sawn wood (actual output of sawn wood is lower due to sawing process and efficiency). With 5 million m<sup>3</sup> of logs intended for sawn wood the region supplies 26% of French sawn wood. Softwoods, which represent 86% of these volumes, largely derive the regional forest economy. They are particularly involved in the manufacture of packaging (pallets, crates) and to a lesser extent, construction (carpentry, framework) or the production of profiled wood (strips for parquet, panels, mouldings and rods). Far behind softwoods, poplar, oak and chestnut make up the bulk of the hardwoods harvested for sawn wood. Poplar, mainly used for the manufacturing of packaging, accounts for half of hardwood sawn wood, while oak accounts for more than a third (especially for carpentry). The region contributes 28% of the national chestnut timber harvest and 10% of national oak harvest.<sup>51</sup>

Harvested wood for industrial use represents more than 3.5 million m<sup>3</sup> (35% of French industrial timber). Maritime pine constitutes 65% of this volume. It is used by pulp and paper and particle boards industries, mainly located on the outskirts of the Landes de Gascogne. Due to the two

<sup>50</sup> Memento. 2020. pp. 8–12.

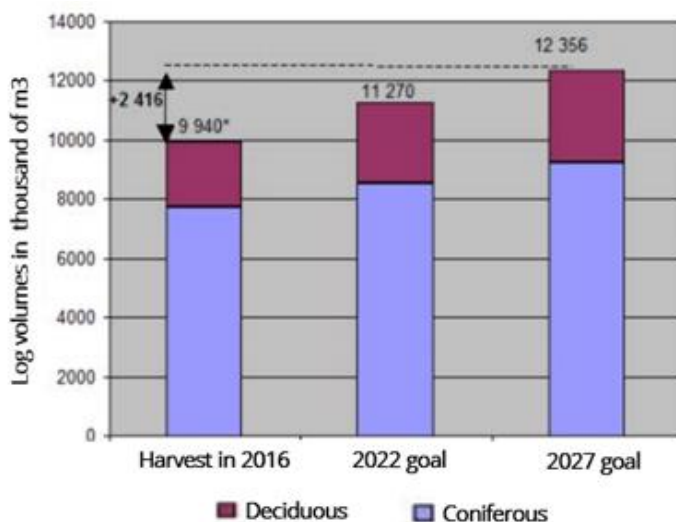
<sup>51</sup> PRFB. 2020. pp. 100.



storms, the annual increment in biomass of maritime pine is estimated at 6.93 Mm<sup>3</sup> and mean annual harvesting of pine is evaluated at 4.5 Mm<sup>3</sup>. No increase in the future is expected.

As at the national level, the harvest of fuelwood (excluding self-consumption by households) has increased steadily over the past few years, testifying to an acceleration in biomass needs for energy. The share of the regional timber harvest intended for energy use (11%) remains much lower than that observed in the rest of the France (21%). With 1.15 million m<sup>3</sup> harvested in 2020 (up 34% since 2010).

The PNFB plan - national objectives for the next 10 years aims at 12 million m<sup>3</sup> of annual wood mobilization (2.4 million m<sup>3</sup> of additional annual harvest compared to current logging, Figure 20). Increase in harvested timber is predicted especially in areas with poor management. The potential for additional wood that can be mobilized in New Aquitaine is estimated at more than 2.4 million m<sup>3</sup> by 2027, including: 890,000 m<sup>3</sup> for sawn wood and veneer, 798,000 m<sup>3</sup> for other industries (pulp, paper, panels, chemistry) and 668,000 m<sup>3</sup> for fuelwood.



**Figure 20.** Harvest volumes 2016 and harvesting objectives for 2022 and 2027 (Source: PRFB<sup>52</sup>).

The additional mobilization of the resource will be done in a sustainable forest management approach, ensuring the renewal of forests and taking into account environmental and social issues. Mobilization of 2.4 million m<sup>3</sup> of wood by 2027 is broken down in different groups of species and specific use for sawn wood, industry timber or fuelwood:

- Mountain softwoods: (for sawn wood: 620,000 m<sup>3</sup>, for other industries: 50,000 m<sup>3</sup>) The increased harvest will mainly concern the regular Douglas-fir forests of the Limousin highlands, planted in campaigns from 1960s to the 1990s. Harvest increases will focus on regeneration cuts of mature stands that need to be renewed.
- Hardwoods: (for sawn timber and veneer: 270,000 m<sup>3</sup>, for Industrial wood and fuelwood: 660,000 m<sup>3</sup>) Current annual logging of hardwoods represent just a third of annual biomass increment in the region. The harvest increase will affect three main types of stands:

<sup>52</sup> PRFB. 2020. pp. 15.

- High forest mixtures (especially oak): a significant proportion of these stands is undermanaged. The mobilization of wood will be part of a silvicultural project: improvement, renewal of mature plots, taking into account the potential of the stands in place in a context of climate change.
- Simple coppice (chestnut in particular): coppices on old stumps experience loss of growth, or even dieback. These coppices in silvicultural dead end will be transformed. In addition, healthy coppices may be improved with operations to harvest more timber.
- Old deciduous trees: many old natural woodlots are not managed. The management of part of these stands will lead to improvement or transformation operations depending on silvicultural and plant potential.
- Maritime pine: (for sawn wood: 100,000 m<sup>3</sup>, for Industrial wood / fuelwood: 700,000 m<sup>3</sup>) The increase in harvest will mainly concern industrial wood and fuel wood.
- Poplar: given the current pressure to harvest and the lack of planting in recent years, the harvest will decrease<sup>53</sup>.

### 3.3. Markets and trends of the wood construction chain

#### 3.3.1. Forest-based industries and related sectors

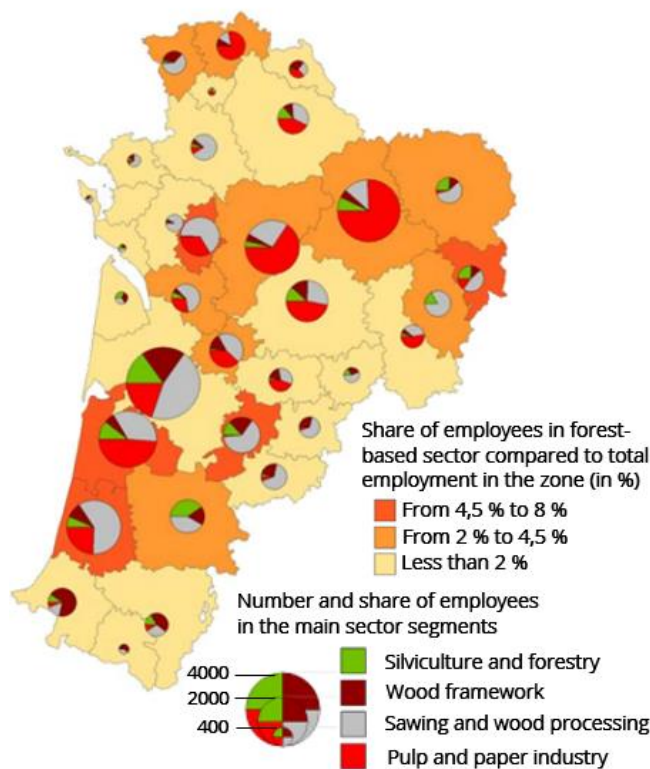
##### Companies and employment

The forest - wood sector is an enormous source of jobs (Figure 21). Forestry and wood sector in France employs nearly 440,000 people. In New Aquitaine, the timber industry from upstream (forestry) to downstream (finished products and trade) employ more than 56,000 people in 19 000 establishments (companies, organizations, etc.). Workforce is accompanied by effective training tools and organizations that links the academics, workforce and industry. Forest and wood-based sector include around 60 diverse establishments (public or private) that offers training and education. This can be initial school education, apprenticeship, or continuing professional training. Finally, the economic activities in forest and wood sector are supported by research institutes, professional organizations, etc. The forest-wood sector is organized around the production, processing, and marketing of forest products. Core activities of the sector are performed by four main segments:

- Silviculture and forestry
- sawing and wood processing
- wood framework
- and the pulp and paper industry.

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<sup>53</sup> PRFB- 2020. pp. 15–17.



**Figure 21.** Employment in forest-based sector in New Aquitaine (Source: Memento<sup>54</sup>).

With nearly 30,200 employees in the main sectors segments, forest-wood industry in New Aquitaine accounts for 1.6% of regional employment. It includes both, establishments with little staff (particularly in the forestry, logging and skidding or wood framework) as well as establishments that can employ more than a hundred employees, particularly in the pulp and paper industry. Distributed throughout the region, the establishments are generally specialized according to the forest type and the dominant species. Forestry and primary processing activities generate the greatest number of jobs. On the other hand, the pulp and paper industry bring together nearly 10,000 employees in 265 entities. Forest-based sector creates jobs in the heart of rural areas. More than 50% of jobs are in rural areas.

However, these main sector segments are joined with other sub-sectors and activities partially involved in the wood industry, such as furniture manufacturing, construction, and trade. These subsectors incorporate also other materials beside wood. If we consider all subsectors activities, sector employs 56,000 people.<sup>55</sup>

### **Total turnover / value added**

Main sector segments generate around 6 billion euros of turnover and if we consider all activities related to sector it generates 10 billion euros of turnover. On the perimeter restricted to the core of the sector alone, the turnover of regional companies amounts to 6.2 billion euros. The pulp and paper industry accounts for 40% of this value, the wood processing sector

<sup>54</sup> Memento. 2019. pp. 16.

<sup>55</sup> PRFB. 2020. pp. 13.

provides 30% and sawmilling 11%. The forestry and wood framework (structural work) each account for 9%.

With 2.5 billion euros in turnover, companies that manufacture pulp and paper - cardboard account for 14% of the national pulp and paper sector turnover and more than 40% of the NA regional forest-based sector turnover. The paper industry is a heavy industry, the most industrial of the secondary wood processing productions. Highly automated, it requires heavy investments. The processing units most often belong to European or international groups.

In the forest sector (forestry, logging, harvesting, etc.), turnover in 2015 amounted to nearly 600 million euros. New Aquitaine alone contributes a third of the national value of this sector. In the forestry sector, fragmentation is just as notable as in the sawmill sector. Many small, often one-person businesses work alongside a few large operators.

With nearly 690 million euros in turnover, the New Aquitaine sawmills account for 20% of the national sawn wood sector's turnover. Sawmilling is distinguished by many small units alongside very large establishments. 10% of the largest sawmill companies in New Aquitaine account for two-thirds of regional saw wood turnover and 65% of added value. Small businesses with an annual turnover of less than 500,000 euros, provide only 5% of regional sawn wood turnover and 7% of added value for this sector.

The wood processing industry (manufacturing of veneer and panels, parquet floors, frames, wooden packaging or various wooden objects) generates 1.8 billion euros in turnover. This places New Aquitaine at the top of the wood processing regions. The region plays a leading role in the manufacturing of wooden packaging, generating 30% of the national packaging sector turnover. Packaging sector includes the manufacturing of light packaging for the food industry, manufacturing of pallets for the transport sector and logistics, as well as cooperage. Located in the heart of the Bordeaux and Cognac vineyards, cooperage companies account for 45% of the turnover of the regional wood packaging industry and two-thirds of the regional packaging sector's export value.

The wood framework – structural work (nearly 600 million euros in turnover) is mainly located in the former Aquitaine (8 out of 10 companies are located there).<sup>56</sup>

### **Wood construction and civil engineering: key benchmarks**

1,878 companies are present on the wood construction market in France, and they employ a total of 28,190 people (in administration, commercial, education/training, supervision, production staff, technical staff, implementation, etc.). 56% of these companies have less than 10 employees, 25% between 10 and 19 employees and 19%, more than 20 employees. This breakdown differs from that of conventional construction. Only 5% of conventional construction companies have more than 10 employees. The average number of employees in wood construction company amounted to 14.3 in 2020. Conventional construction companies in average employs only 2.8 employees. That's 5 times lower compared to wood construction companies. Wood construction companies are thus well structured with an overall more qualified workforce. (Be aware that wood construction companies may have lower number if statistic would include also all one-person self-employed establishments. This analysis included only 1,978 companies but there might be more smaller enterprises involved in wood construction.)

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<sup>56</sup> PRFB. 2020. pp. 111–112.

Companies in the wood construction market can exercise other activities related to wood (carpentry, wood framework, cladding, etc.) or not (roofing, zinc work, etc.). In 2020, these 1,978 companies achieved a total turnover (all activities combined, not just wood construction) of nearly € 4.1 billion before tax (2.5% up compared to 2018 turnover). They employ a total of 28,190 people (2.7% up compared to 2018). These figures represent 3% of the national construction sector turnover and 2.5% of the national construction sector workforce (benchmarks with civil construction sector in 2019: 403,000 companies - Total turnover: € 148 billion before tax - Employed workforce: 1,121,000 (source: French Building Federation – The building in figures). Companies in wood construction remains focused on new construction (75% of their total turnover, or € 3.1 billion excluding tax in 2020), with housing as the main market (up to € 1.89 billion excluding tax). The maintenance-renovation activity is on a downward trend in 2020 (€ 1.02 billion before tax, - 5% compared to 2018). The average turnover per company in the timber construction sector is significantly higher than that of the building sector. Productivity (average turnover per employee) is also 10% higher for timber construction companies. The specific activity of wood construction requires significant investments in design or production tools, as well as a significant proportion of prefabrication.<sup>57</sup>

In New Aquitaine, 7.78 million m<sup>2</sup> of buildings are constructed each year, which corresponds to approximately 40,000 filed building permits. Around 10% (depending on the referred year, in 2020 only 6,2%) of these buildings are made of wood. According to an observed average ratio, a wood building consumes around 0.3 m<sup>3</sup> of wood per m<sup>2</sup> of surface area. Therefore, we can estimate that 233,000 m<sup>3</sup> of wood-based products are utilised in this market.<sup>58</sup> The share of timber for construction is negligible If we compare these volumes to the regional harvested timber annually (10 million m<sup>3</sup>), or to regional sawn wood annually (2 million m<sup>3</sup>). Besides, big proportion of construction wood/products is imported. Local production isn't completely sufficient in quality and quantity to supply local wood construction sector demands.

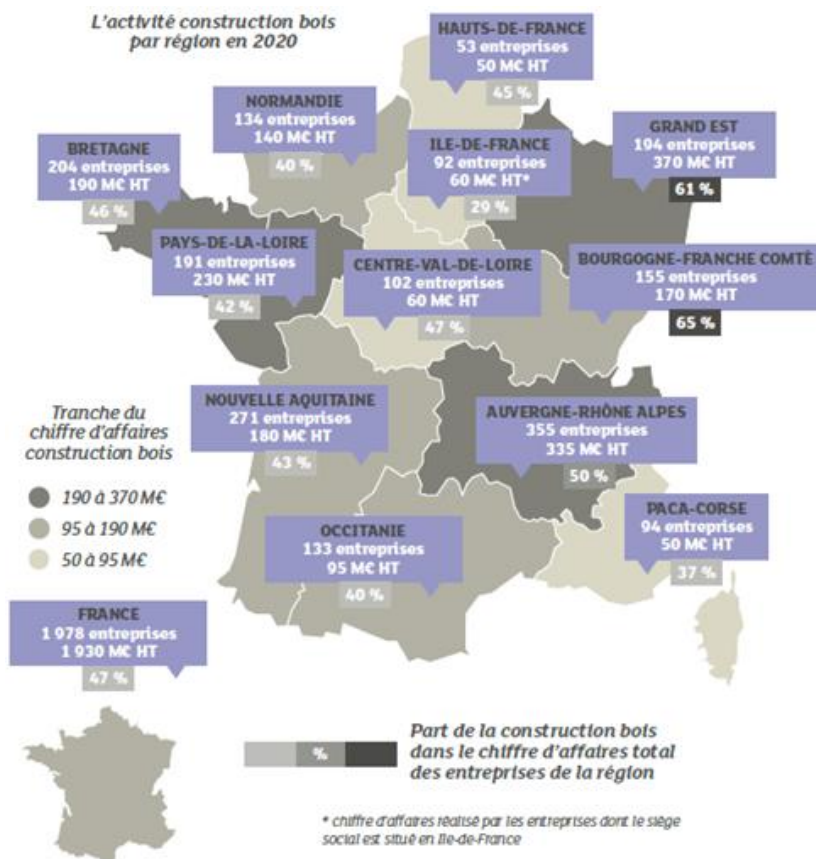
### 3.3.2. Wood construction markets and products trade

After building crisis of 2014 and 2016, the wood construction market experienced very good growth in 2018. In 2020 health and economic crisis (supply chain crisis) linked to Covid-19 had a major impact on the entire construction sector including wood construction. Out of 1,000 surveyed wood construction companies in France, more than half (59%) declared an impact of the health crisis on their 2020 turnover. Average decrease in their turnover is estimated at 14%. Housing market was extremely constrained by the health crisis and several electoral deadlines slowed down building permits. In 2020, 1978 companies achieved a total turnover of nearly € 4.1 billion (all activities combined, not just wood construction). Despite the health crisis which had a strong impact on the economic situation in 2020, turnover related to wood construction grew for 2% (1.93 billion euros excluding tax). The maintenance-renovation activity is on a downward trend in 2020 (€ 1.02 billion before tax, - 5% compared to 2018). If we look at specific region, growth trends are more contrasted. Unfortunately, New Aquitaine's wood construction turnover in 2020 (180 M€) decreased for 9% compared to turnover in 2019 (196 million €) (Figure 22).

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<sup>57</sup> CODIFAB, France Bois Foret, Veia Institut Economique des territoires. 2021. Enquête Nationale de la Construction Bois 2020. Available at: <https://www.uicb.pro/wp-content/uploads/2021/07/ENQUETE-CONSTRUCTIONBOIS-ACTIVITE2020.pdf>

<sup>58</sup> PRFB. 2020. pp. 22.



**Figure 22.** Wood construction turnover in French regions, 2020 (Source: Enquête nationale de la construction bois<sup>59</sup>).

The Grand Est region remains the leading French region for timber construction, with a timber construction turnover of € 370 million achieved by 194 companies. That’s a 19% of the national wood construction turnover. For companies in this region, wood construction represents a major part of the total turnover (61%). This share is the highest at the national level, after that of Bourgogne-Franche Comté. Companies in these regions have a strong tradition in timber construction and they are characterized by greater specialization in wood construction.

After the Grand Est region, the most important regions in timber construction are Auvergne-Rhône Alpes (335 M€ carried out by 355 companies), Pays-de-la-Loire (230 M€ by 191 companies) then Brittany (190 M€ by 204 companies) and then New Aquitaine (180 M€ by 271 companies). The turnover of the Ile-de-France region (i.e., 60 M€ HT) corresponds to the activity of companies in timber construction whose head office is located in Ile-de-France (92 companies in 2020). This turnover does not reflect all of the timber construction activity in Ile-de-France because a significant portion is carried out by companies having their headquarters outside the region. Activities are carried out mainly by companies from the Normandy, Pays de-la-Loire, Grand Est, New Aquitaine and Auvergne-Rhône-Alpes regions. In total, the timber construction activity in Ile-de-France reached 255 M€ (24% carried out by companies in the Ile-de-France region and 76% by companies outside the region). Compared to the national timber construction turnover, Ile-de-France accounts for 13% of the timber construction activity<sup>60</sup>.

<sup>59</sup> Enquête nationale de la construction bois 2020. pp. 3.

<sup>60</sup> Enquête nationale de la construction bois 2020. pp. 1-3.

To study wood construction market in New Aquitaine, available data on number of companies, employment in the sector, turnover, volume and market share of particular type of wood construction are provided, based on two main reports<sup>61, 62</sup>. Some data refer to national level, to put regional wood construction sector in perspective, or because there is no regional data available.

To get precise picture of wood construction sector size, we need to understand basic terms-terminology of sector segments (see: Figure 23):

- "Bios construction" - "Wood framework" (green colour)
- "Construction Bois" - "Wood construction" (purple colour)
- "Secteur bâtiment" - "Building sector" (black colour).

"Bios construction / wood framework" refer to company's activities classified as:

- 1623Z: fab. de charpentes et autres menuiseries / fab. of frames and other joinery
- 4120A: construction de maisons individuelles / construction of individual houses
- 4332A: travaux de menuiseries bois et PVC / wood and PVC joinery work
- 4391A: Travaux de charpente / Structural work.

Numbers and statistic of New Aquitaine "Wood framework" sector (green colour) account for all activities related to that segment. Therefore, we can't recognize actual role of "Wood construction sector" within those numbers. Actual share of wood construction turnover is not known if we look at data on the left side of below figure 10. CODIFAB and France Bois Forêt collected more precise statistics related to wood construction sector as part of the National Wood Construction Observatory. "Enquête nationale de la construction bois" is published every second year so data and performance of wood construction sector can be benchmarked over longer time. This work, carried out by the Economic Cell of Construction of Brittany, was engaged with the active participation of regional interprofessional organizations; Fibois France, the Union des Métiers du Bois - Fédération Française du Bâtiment (UMB FFB) and of the Union of Industrialists and Wood Builders (UICB).

Their statistics are related to activities in "wood framework" and "wood construction" sector, including exact share of turnover resulting from "wood construction" activities:

- 1623Z: fabricants de charpente et menuiserie / frame and joinery manufacturing
- 4120A: constructeurs de maisons individuelles / construction of individual houses
- 4120B: construction d'autres bâtiments / construction of other buildings
- 4391A: Travaux de charpente / Structural work
- 4332A: travaux de menuiseries bois / joinery-carpentry work
- 4391B: travaux de couverture / roofing work
- 4399C: travaux de maçonnerie générale / general masonry work.

Timber construction refers to all the wood-based construction techniques used to create a new building, residential and non-residential (these are the wooden frame, the post-beam system, solid laminated panels, traditional half-timber construction and stacked solid wood). Exterior thermal insulation work also wood framework is not taken into account in this definition. Wood

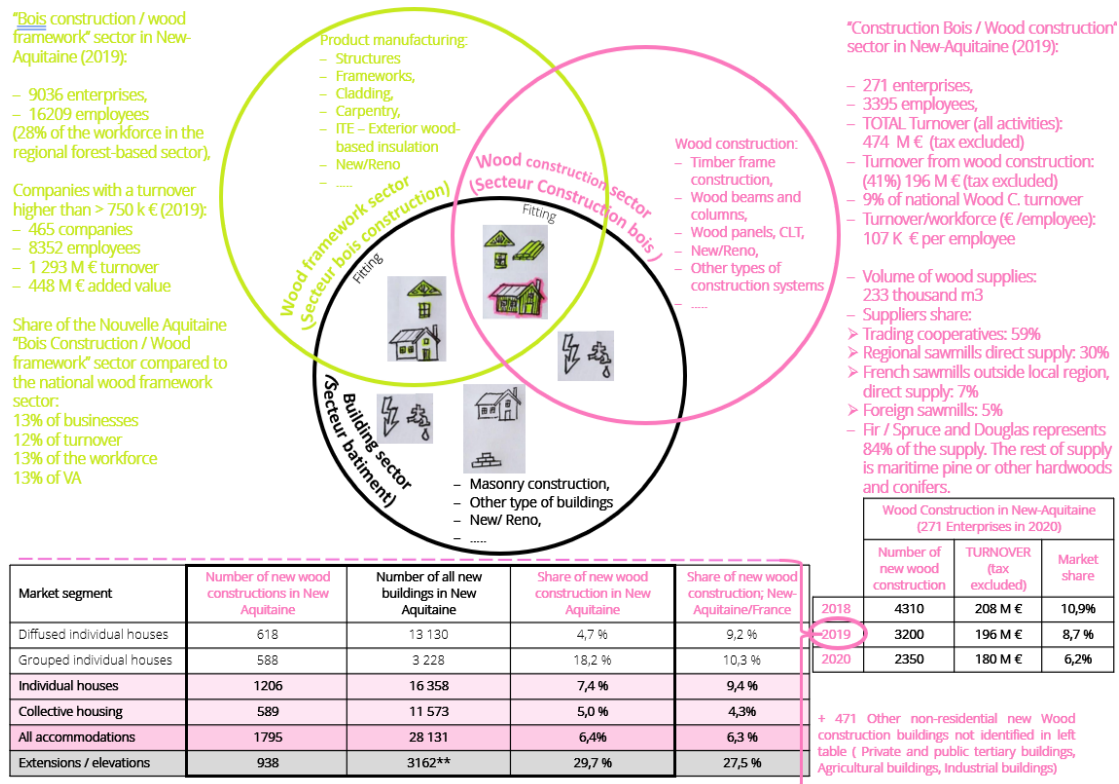
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<sup>61</sup> CODIFAB, France Bois Forêt, Veia Institut Economique des territoires. 2021. Enquête Nationale de la Construction Bois 2020. Available at: <https://www.uicb.pro/wp-content/uploads/2021/07/ENQUETE-CONSTRUCTIONBOIS-ACTIVITE2020.pdf>

<sup>62</sup> Fibois Nouvelle Aquitaine. 2021. Observatoire de la filière forêt bois en Nouvelle-Aquitaine (synthèse édition 2020). Available at: <https://fibois-na.fr/wp-content/uploads/2021/07/Rapport-synthese-Observatoire-de-la-filiere-Foret-Bois-en-Nouvelle-Aquitaine-FIBOIS-Nouvelle-Aquitaine-2020.pdf>

construction companies are not necessarily all specialized only in wood construction; some carry out other activities, whether or not related to wood (carpentry, cladding, ITE External Thermal Insulation, etc.).

Data and statistic of “Enquête nationale de la construction bois” are very reliable if one is interested only in wood construction sector size. Data are collected from 1978 French wood construction companies, 271 of them are in New Aquitaine. Data on below figure are based on activities of those 271 wood construction companies in New Aquitaine. Data specifies type, market share and number of new wood constructions in the region. Data also specifies exact number and percentage of turnover related to wood construction activities. Therefore, data on the right side (purple colour) of below figure offers better perspective on the size of wood construction sector while data on the left side (green colour) offer perspective of whole “wood framework” sector in New-Aquitaine.



**Figure 23.** Wood construction sector in New Aquitaine (Based on: Observatoire de la filière forêt bois en Nouvelle-Aquitaine, and Enquête Nationale de la Construction Bois <sup>63</sup>).

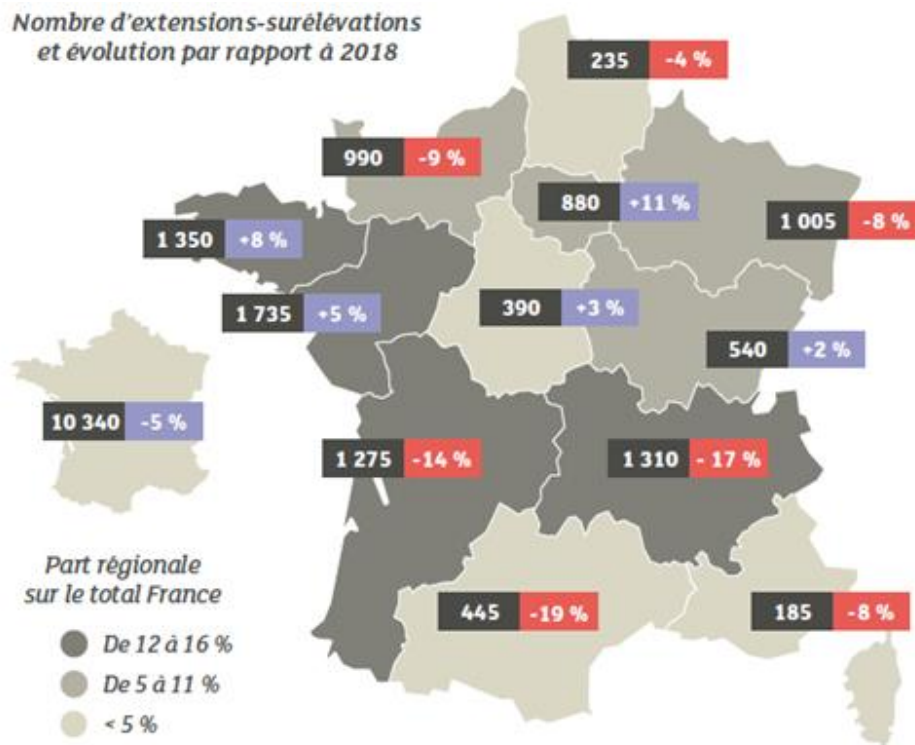
Percentages of different wood construction system are valid for national level of whole France, but regional data may differ to some extent. Whatever the market, the wooden frame remains the most widely used construction technique even if its share is decreasing (83% in the construction of single-family houses, 68% in collective buildings and 69% in tertiary buildings). The use of beam posts increased in the single-family home market compared to 2018 (from 8% to 10%) (it may include a certain proportion of wood frame / beam column mix). The use of post beams in construction of tertiary buildings increased from 17% in 2018 to 20% in 2020. The

<sup>63</sup> Observatoire de la filière forêt bois en Nouvelle-Aquitaine (synthèse édition 2020). pp. 57– 64. Enquête Nationale de la Construction Bois 2020



use of solid laminated panels (including CLT) is most important for the construction of collective housing buildings; it also increased from 10% in 2018 to 15% in 2020.

Looking at all extensions-elevations systems combined (Figure 24), their share decreased for 14% between 2018 and 2020 (whole France, all types of extensions). The decrease of wood extensions decreased only for 5%. Because of that dynamic, market share of wood extensions increased to 30.5% in 2020 from 27,5% in 2018. Speaking for New Aquitaine, there was huge decrease in wood extensions (it was -14%, not only -5% which is average for whole France). Nevertheless, market share of wood extensions compared to conventional systems in New Aquitaine is 29,7%.



**Figure 24.** Wood construction Extension market in French regions, 2020 compared to 2018 (Source: Enquête Nationale de la Construction Bois<sup>64</sup>).

Wood construction is also present on market of non-residential buildings (tertiary, agricultural, industrial) with a market share reaching 16.8% (16.3% in 2018). Wood is therefore no longer confined to the individual house and is gaining ground in all segments of construction. Two segments (that of agricultural buildings and industrial buildings) have market shares in timber construction of over 20%. In a context of municipal and inter-municipal elections, wood is consolidating its market share in public and private tertiary buildings (from 10.6% in 2018 to 10.9% in 2020).

In whole France, turnover achieved by wood construction companies in maintenance-renovation was over € 1 billion. It is on a downward trend in 2020 (-5% compared to 2018). (ITE) Exterior Thermal Insulation activity represents 28% of the maintenance-renovation market. ITE market is valued at € 288 million in 2020 (whole France), 12% up compared to 2018. Out of 271 companies in New Aquitaine, 40% say they have carried out ITE - External thermal insulation

<sup>64</sup>Enquête Nationale de la Construction Bois 2020. pp. 7.

work under renovation in 2020. They were 47% in 2018, so that means 7% of companies abounded ITE work (average for whole France is also down from 48% to 45% of companies involved in ITE market). Even if there are fewer wood builders carrying out such work in 2020, the ITE market have 12% of growth in turnover. The decrease of companies dealing with ITE work is consequence of an increasingly complex energy renovation market. ITE activity qualified as complementary in 2016 is becoming a specialization, so only dedicated companies can keep the market share and stay competitive.

The total of 271 wood construction companies in New Aquitaine employ 3,395 persons. 18% of those employees are experts in technical design, 31% in manufacturing and 51% in implementation. Majority of companies (80%) have more than 10 years of experiences on wood construction market. Experiences remains a pledge of confidence for project owners. Experiences also lead to the necessary grouping of timber construction companies which are then able to enter new or larger markets. The share of companies with less than five years of experience in timber construction is decreasing, illustrating the low share, or even the absence of new entrants in the timber construction market. Requiring high initial investment remains difficult to access and companies with between 5 and 10 years of seniority encounter difficulties to persist (from 22% in 2018 to 16% in 2020). The average radius of project work is 118 km. In 2020, companies with more than 10 employees widened their radius of intervention, which is not the case for companies with less than 10. employees.

At national level, 70% of companies have an integrated design office or use specific technical design software. Wood construction companies maintain a high level of technicality, with a large majority of companies increasingly offering a global offer, ranging from technical design to implementation. This professionalism allows wood construction companies to position themselves on large-scale projects: over the past two years, 11% of these companies have carried out a project where the wood structure lot was greater than € 0.5 million excluding tax; 6% of them have carried out a site where the wood structure lot was greater than € 0.8 million excluding tax.

Concerning the share of French timber purchased by companies, this fluctuates between 62% (from cooperatives) and 64% (from traders). These shares of French timber also evidence insufficiency of French timber supply chain. The wood used by companies is mostly certified, up to 96%: 89% of them are PEFC wood and the remaining 11% are FSC, a breakdown almost identical to that of 2018 (88% PEFC and 12% FSC).

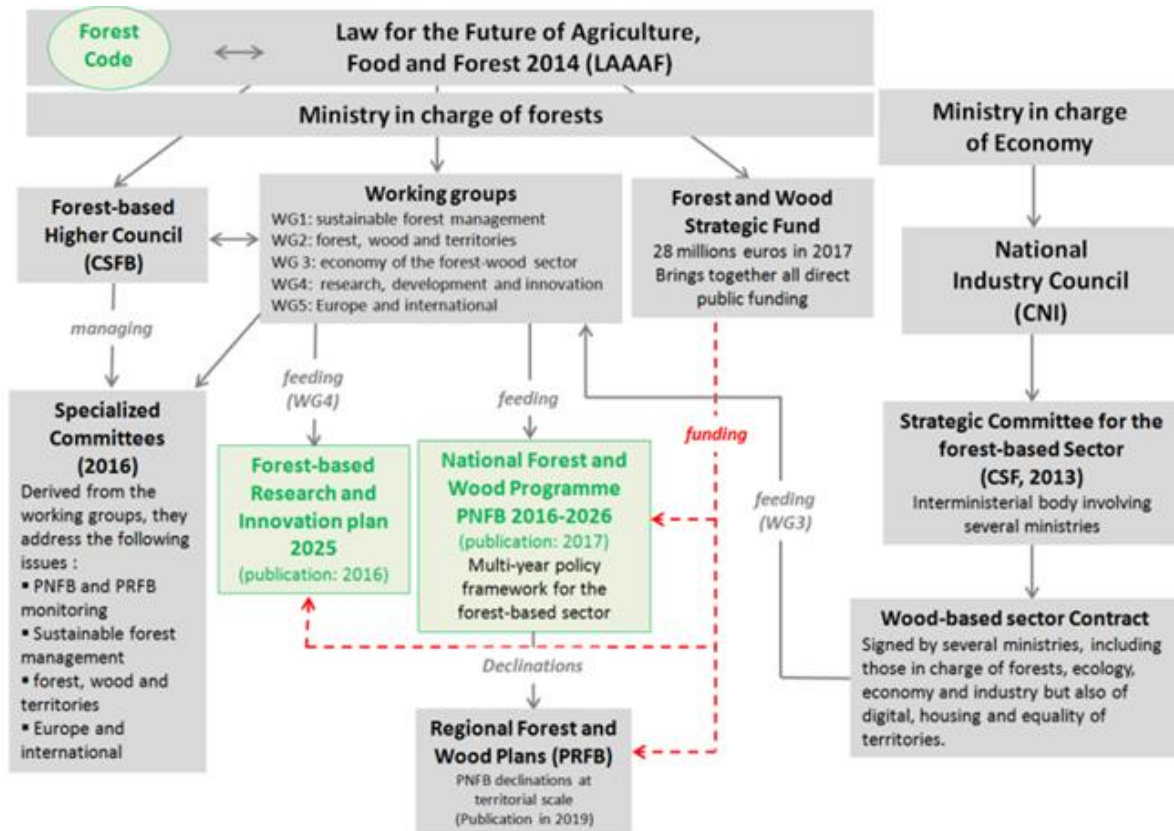
Industrialization of wood construction sector allow wood builders to count on a rapid return to growth: 64% of companies with more than 20 employees plan an investment to increase their production over the next 2 years and 60% of companies plan to hire new employees (survey by "Enquête nationale de la construction bois" – survey of 1,000 companies in wood construction sector).

### **3.4. Policies and support schemes**

The aim of this chapter is to describe and review existing policies and support schemes in French forest-based sector and wood construction industry. Previous study of ECOFOR outlined a simplified governance of the French forest-based sector including main policy documents (Figure 25). This study provides a useful framework overview. However, to get the clearer picture of regional development roadmap in New Aquitaine, this chapter includes additional policies and support programs on national and regional level. Specific focus was on wood

construction sector, its role in forest-based sector, its funding opportunities and existing support for innovation in sector.

At the national scale, the forest-based sector is steered by several public policy processes and actors like Ministry in charge of forests, Ministry in charge of Economy, National Industry Council (CNI), Forest-based Higher Council, Strategic Committee for the forest-based Sector (CSFB) and other Specialized Committees. They issue the main national policy documents related to the forest-based sector; like the French forest code, the French National Forest and Wood Programme (PNFB) and the French forest-based Research and Innovation plan. Here is a simplified diagram showing their integration into the National policy landscape (Figure 25).



**Figure 25.** Simplified governance scheme of the French forest-based sector<sup>65</sup>.

The French Forest Code is a collection of legislative and regulatory articles related to the forest management and operations activities and to the protection of forests and human societies depending on them. Furthermore, Figure 25 shows that forest industries and products were the subject of a strategic approach of the former National Forest program (2006–2015). National Industry Council monitor and recognize the Wood-based industry as a strategic sector. This resulted in a Wood-based sector strategic contract published in 2013, with which the National Forest and wood program (PNFB 2016–2026) was drawn up in 2015 (and formalized in 2017 in an agreement). To define its strategic objectives, actors of the forest-wood sector have been consulted through the implementation of Working Groups (WG) on "sustainable forest management" (WG1), "forest-wood and territories" (WG2), "economy of the forest-wood sector"(WG3), "research, development and innovation" (WG4) and "Europe and international"

<sup>65</sup> Carnus, J.M., Jallais, A., Peyron J.L. and Nivet, C. 2017. Improving the effectiveness of Forest-based research results - France report. ECOFOR Ecosystemes forestiers. pp. 3.

(WG5)<sup>66</sup>. Furthermore, regional policies and programs (PRFB – Regional Forest and Wood Plans) are developed out of national programs and strategies (PNFB). More precise description of PNFB, PRFB and other supporting or development programs follows.

There are many existing supporting programmes and strategic development roadmaps on national as well as on regional level. We briefly present some of most important, influential, and relevant programmes for wood construction sector. First, we considered policies and supporting programmes on national level. Some programmes are strictly focused on forest-based sector or wood construction sector, while other national policies and programmes refers to many industries and only partly cover our field of interest (wood construction). Our review tries to recognize all important outputs, even of those more general programmes. Each programme objectives refer to different aspects, challenges, opportunities. Again, our biggest focus is on wood construction, its funding opportunities and support for innovation. However, BASAJAUN project takes wider perspective and pallet of aspects, like rural and urban development, digitalization, technology development, renovation, circular economy, ecosystems, optimal utilization of forest resources and open innovation. All those topics are correlated and important for the future development of wood construction value chains. If programmes consider any of it, we briefly presented it. Referenced period of programme is also included, so we can immediately see its relevance and if the programme is in final stage or just at the beginning. Short description of the programmes follows, including references and links for more information.

### 3.4.1. National policies, support programmes and strategic development roadmaps

[A.a] **The National Forest and Wood Programme 2016–2026 (PNFB)**<sup>67, 68</sup> has been designed in close consultation with all stakeholders in the forestry & wood sector as well as with several government ministries. It has been put in place under the French Law on the Future of Agriculture, Food and Forestry (LAAAF). It defines directions for forestry policy over the next ten years. The PNFB comprises four objectives and an action plan along with detailed arrangements for its roll-out at national and regional levels:

- **OBJECTIVE 1: Increase the harvesting of wood in France while at the same time ensuring forest stands renewal.** French forests are currently under harvested and have been constantly expanding over the last century. Improved management will help develop the economy of the forestry & wood sector and prepare for the future.
- **OBJECTIVE 2: take fully into account what the general public expects from forests.** Forests are both a place for recreation and a space for preservation of the biodiversity. It is also a source of territorial employment and economic wealth. Lastly, forests provide wood as a material and energy production. This means that it is important to raise the awareness of the general public through communication on forestry issues, particularly by means of educational initiatives. The national programme fit each French region by being rolled out as a series of Regional Forest and Wood Programmes (PRFB). The PNFB involves regional government bodies in local, sustainable projects.

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<sup>66</sup> Improving the effectiveness of Forest-based research results. pp. 3–5.

<sup>67</sup> Improving the effectiveness of Forest-based research results pp. 4–5.

<sup>68</sup> Programme national de la foret et du bois 2016-2026.

Available at: [https://agriculture.gouv.fr/sites/minagri/files/160307\\_plannational\\_foretbois\\_03.pdf](https://agriculture.gouv.fr/sites/minagri/files/160307_plannational_foretbois_03.pdf)

- **OBJECTIVE 3: Address climate change.** Climate change and increasing risks are major concerns for French forests and their sustainable management. Forest fires are responsible for large damages in the Southern regions but are rather under control to the exception of large drought conditions. Destructive windstorms have hit France several times in the last two decades. The levels of insect populations and diseases are supposed to increase in the future. Woodland has a major role to play in absorbing carbon, thereby reducing greenhouse gases. Climate change will also have a direct impact on forests and their biodiversity.
- **OBJECTIVE 4: Develop synergies between forestry and industry.** While France has one of the world's most attractive national hardwood forests (oak, beech, poplar...) and ranks as the second-biggest producer of sawn hardwood in Europe, the Forest-Wood sector contributed up to 1% to the gross domestic product (GDP) and the balance of trade remain negative. Matching actual market needs with products coming from French forests is therefore a major issue.

Furthermore, one of the 15 key actions of the PNFB concerns the development and implementation of an ambitious plan for research and innovation for the forest-based sector.

[A.b] **Plan ambition bois-construction 2030**<sup>69</sup> - To achieve the carbon neutrality goal set for 2050, France is accelerating the pace of the ecological transition and the decarbonisation of the economy. The Filière Forêt-Bois (2018) renews its support for the Government's ambition with the future Environmental Building Regulations - known as RE2020. These regulations should enable the building sector (19% of carbon emissions) to play its part in decarbonising the economy. The Wood Construction Industry is mobilizing its collective effort to make contributions toward decarbonization of French construction. This is why the actors of the forest and timber construction are now launching the "Plan Ambition Bois-Construction 2030". They are making 10 concrete commitments to facilitate the building sector's transition to carbon neutrality, from harvesting to the end of the timber lifecycle. These strategic commitments relate to training, employment, investment, research and development, the development of the French wood supply, the establishment of the territories, the composite materials, the sustainable management of the forest, cost reduction and finally recycling of wood at the end of its use.

The timber construction sector is convinced that the issue of decarbonization will bring together all the construction actors around a sustainable and circular vision of the life of the building. Wood construction sector will benefit economically from it. For the wood sector alone, this mixed construction market already represents more than 10 billion euros in created added value annually and 205,000 direct jobs in the end markets of sustainable and low-carbon construction. RE2020 should enable the building sector to accelerate its transition to carbon neutrality and to participate in the collective effort to completely decarbonise the economy. This transition and this ambitious objective accelerate innovation and use of biobased materials. Simultaneously, added value of the construction value chain and economy increases. The stakes are high for the building sector, still governed by a standard that predates the Paris Climate Agreement - RT2012 - and hit by the COVID health and economic crisis. The success of this transition therefore requires the RE2020 through innovation and an increasing use of

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<sup>69</sup> Plan ambition bois construction 2030.

Available at: <https://cndb.org/actualite/plan-ambition-bois-construction-2030/>

biobased materials. In this context, the share of wood and bio-sourced materials is inevitably set to increase rapidly.

[A.c] **Development of wood construction and renovation 2018–2022**<sup>70</sup> - By 2022, industry professionals set themselves the ambition, particularly in connection with public environmental transition policies, to:

- doubling the market share of wood in new collective housing (from 3% to 6%)
- going from 10% to 15% in single-family homes. It has gone from 2% of the single-family home market in 2000 to 12% today
- increasing the share of wood solutions used in the renovation of collective buildings to 15%
- 20% increase of market share of wood for the renovation of individual dwellings.

[A.d] **France Relance – [the country’s recovery plan]**<sup>71</sup>, which has a budget of €200 million for forests and wood sector. Plan implemented an ambitious strategy to renew French forests and improve its adaptation to climate change. Forests needs to become more resilient in the face of rising temperatures and climate change.

[A.e] **Forest-Wood Innovation Research Plan 2025**<sup>72, 73</sup> - The aim is to accelerate the digital transformation of companies and to strengthen the innovation in accordance with the Forest-Wood Innovation Research Plan 2025. The mission combines various pre-existing sources (the work of the PNFB and the CSFB - Comité Stratégique de Filière Bois) with individual or collective consultations of the various actors in the sector. This approach leads to two sets of proposals:

- 13 RDI projects grouped together according to 3 complementary main priorities:
  - increase the overall performance of the sector through systematic approaches,
  - developing the uses of wood in a future bioeconomic context,
  - adapt the forests and prepare the forest resources of the future.
- This plan also includes an analysis of RDI mechanisms and funding instruments in the sector, supplemented by recommendations:
  - mapping of these mechanisms,
  - characterization and development of innovative financing methods.

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<sup>70</sup> Contrat Stratégique de la filière bios 2018-2022.

Available at: [https://www.conseil-national-industrie.gouv.fr/files\\_cni/files/csf/bois/dossier-presse-signature-contrat-de-filiere-bois-16nov18.pdf](https://www.conseil-national-industrie.gouv.fr/files_cni/files/csf/bois/dossier-presse-signature-contrat-de-filiere-bois-16nov18.pdf)

<sup>71</sup> France relance recovery plan: building the France of 2030.

Available at: <https://www.diplomatie.gouv.fr/en/french-foreign-policy/economic-diplomacy-foreign-trade/promoting-france-s-attractiveness/france-relance-recovery-plan-building-the-france-of-2030/>

<sup>72</sup> Forest-Wood Innovation Research plan 2025.

Available at: [https://agriculture.gouv.fr/sites/minagri/files/synthese-ri2025\\_bois-foret.pdf](https://agriculture.gouv.fr/sites/minagri/files/synthese-ri2025_bois-foret.pdf)

<sup>73</sup> Le plan recherche-innovation 2025.

Available at: <https://agriculture.gouv.fr/filiere-foret-bois-le-plan-recherche-innovation-2025>

### 3.4.2. Regional policies and programmes

[B.a] **The regional forest and wood programme of New Aquitaine 2020–2030**<sup>74</sup> – regional policies and programs (PRFB – Regional Forest and Wood Plans) are developed out of national programs and strategies (PNFB). Under LAAF (Law of the Future of Agriculture, Food and Forestry), each region had to develop a Regional Forest and Timber Program (PRFB) within 2 years of the approval of the PNFB. The Regional Forest-Wood Program is intended to serve as a strategic framework for State and community interventions for the next 10 years. Each PRFB must adapt the orientations and objectives of the PNFB to its region. The PRFB doesn't intend to create a regulatory framework additional to the existing framework (forest code, environmental code, etc.), it only displays guidelines in the form of an incentive. Associated documents such as the Regional Silvicultural Management Scheme (SRGS) for private forests, the Regional Development Directives (DRA) for state forests and the Regional Management Scheme (SRA) for other public forests, must therefore be updated. The PRFB defines the main orientations to be accounted for in these framework documents. Specific example of project in wood construction sector:

Starting in 2019 -2027 lead by forest-wood interprofessional org. (DREAL / DRAAF).

Associated Regional Council Partners: Public contractors, FFB, CAPEB, URCOFOR, Clusters in the construction sector, France Bois Régions, promoters and social landlords, FCBA, CRANA, DIRECCTE.

Beneficiaries: Project owners primarily public but also private. Companies concerned by the "act of building": architects, design office, carpenters, joiners, builders, lessors, promoters, 1st and 2nd transformation companies.

Budget and provisional financing of the action: 5 prescribers across the region (€ 350,000 per year).

Result indicators – monitoring:

- Volume and share of wood in construction in New Aquitaine. Volume of wood intended for the construction, supplied by local processing companies.
- Share of local wood in projects.
- Number of cubic meters of timber in construction generated by the prescription.

Taking into account environmental issues:

- 1 m<sup>3</sup> of wood in construction represents 1 ton of CO<sub>2</sub> stored. If the share of wood construction increases to 30%, approximately 700,000 tons of CO<sub>2</sub> will be stored each year in New Aquitaine alone (current annual market share of wood construction is between 6–10%).
- Valorisation of forests and wood products CO<sub>2</sub> sequestration over long cycles which are favourable to the carbon footprint.
- Promotion of local raw material reducing transport footprint.

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<sup>74</sup> Programme Régional de la Forêt et du Bois 2020/2030 Nouvelle Atlantique.

Available at: [https://draaf.nouvelle-aquitaine.agriculture.gouv.fr/IMG/pdf/Rapport\\_final\\_Etude\\_disponibilites\\_Aquitaine\\_cle8f8416.pdf](https://draaf.nouvelle-aquitaine.agriculture.gouv.fr/IMG/pdf/Rapport_final_Etude_disponibilites_Aquitaine_cle8f8416.pdf)

[B.b] **Néoterra**<sup>75</sup> - **ecological and energy transition in New Aquitaine 2019–2030** - significant work has been carried out through the NeoTerra regional roadmap adopted in July 2019 by the New Aquitaine region to support and accelerate the energy and ecological transition. Thus, "Preserving agricultural, forest and natural lands" constitutes one of the 11 ambitions of NEO TERRA. Promoted actions:

- setting up a regional network of forest pilot sites to adapt them to climate changes
- increasing carbon sequestration of forests
- promoting wood material and increasing the use of local wood in construction.

In addition, another Néoterra's ambition - "Preservation of natural resources and biodiversity", incorporates the challenge of reconciling biodiversity and human activities by promoting those that have a positive impact. To do this, it is particularly proposed to promote forestry that contributes a net biodiversity (in the same way as agriculture and fishing).

[B.c ] **Le massif des Landes de Gascogne à l'horizon 2050**<sup>76</sup> - The Landes de Gascogne Massif, Aquitaine Regional Council and INRA had jointly launched foresight of the development and evolution scenarios in Landes de Gascogne region by 2050. They identified some cross-contradictions of territorial scenarios regarding rural-urban dynamics. In view of trends, three major issues have been retained as structuring the prospective reflection on the future of the Landes de Gascogne:

1. the territorial integration of the forest and the timber industry with other land uses associated to the expansion of urban areas and demographic attractiveness of the Landes de Gascogne.

How to account for the diversification of forest uses? How does the transformation of the territorial development affect the forest and the wood industry in the territories (in particular, a strong development of the residential economy)? What are the links between territorial governance and sectoral policies in the timber industry?

2. the organization of the wood sector and the interdependencies between industrial sub-sectors. Future evolution of the interactions and roles between industries depending on the wood resource? How will the energy needs challenge the industrial organization of the wood industry? How to increase the added value of the products of the sector and enhance the value of the wood material? How will this industrial transformation consequence the forestry? What will be the strategies of the forest owners?

3. Issues related to silvicultural practices, and the resilience of the forest to climate change and its effects. How to strengthen the resilience of forests in the face of increasing natural risks? How to develop ecosystem services for forests while maintaining economic value? How to manage the forest and the land to limit the impact of natural risks?

[B.d ] **Prix Régional de la construction Bois**<sup>77</sup> - the Regional Prize for Wood Construction is organized each year, to promote the actors in the wood construction sector, at regional and national level. It is initiated by two interprofessional organizations, FIBOIS Nouvelle-Aquitaine

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<sup>75</sup> Neoterra. Available at: <https://www.neo-terra.fr/>

<sup>76</sup> Le massif des Landes de Gascogne à l'horizon 2050 Available at: <https://www.inrae.fr/sites/default/files/pdf/prospective-massif-des-landes-de-gascogne-chapitre-1.pdf>

<sup>77</sup> Prix Régional de la construction Bois. Available at: <https://constructionbois-na.fr/actualites/>



and FIBOIS Landes de Gascogne. This project is supported by many regional and national partners.

## 3.5. Regional innovation ecosystem

### 3.5.1. Value chains and stakeholders

The value chain describes the full range of activities, which are required to bring a product or service from concept, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. Generally, we can divide stakeholders of value chain into three different groups:

- private sector enterprises/value chain operators
- the support service providers (meso-industry level)
- selected government units and public agencies performing a regulatory function (macro level).

Furthermore, the value chain supporters are divided into two main groups:

- Public research and training institutes, and specialized units of public administration. They provide information and other support services to the business community and assist enterprises.
- Private industry associations and business membership organizations. They provide support services to groups of value chain operators or for the entire value chain, such as export promotion or contributions to regulatory decisions.

In the value chain map, these elements are connected in a visual form. Value chain mapping was the task of report 1.4. In this report we will review existing regional innovation ecosystems and support providers (Figure 26). The competitiveness of value chains strongly depends on the availability of support services<sup>78</sup> like:

- Sector-specific vocational training and education,
- Applied research and technology development,
- Publication of market and price data and other sector-specific general information,
- Services of shared technical facilities, e.g., reference laboratories, research institutes,
- Export promotion, trade fairs, exhibitions and business delegations,
- Public relations and joint marketing of products,
- Advocacy for common interests of the value chain business community.

In many cases, support providers are the leading actors in implementing and introducing sector policies, support and development programs. Role of some actors, like CSF – French Strategic committee for the forest-based sector (square - [13]), is crucial in the implementation of policies and programs.

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<sup>78</sup> Springer Heinz, A. 2018. Manual on Sustainable Value Chain Development – Value Links 2.0, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2018, Vol. 2, Module 7, pp. 106-108.

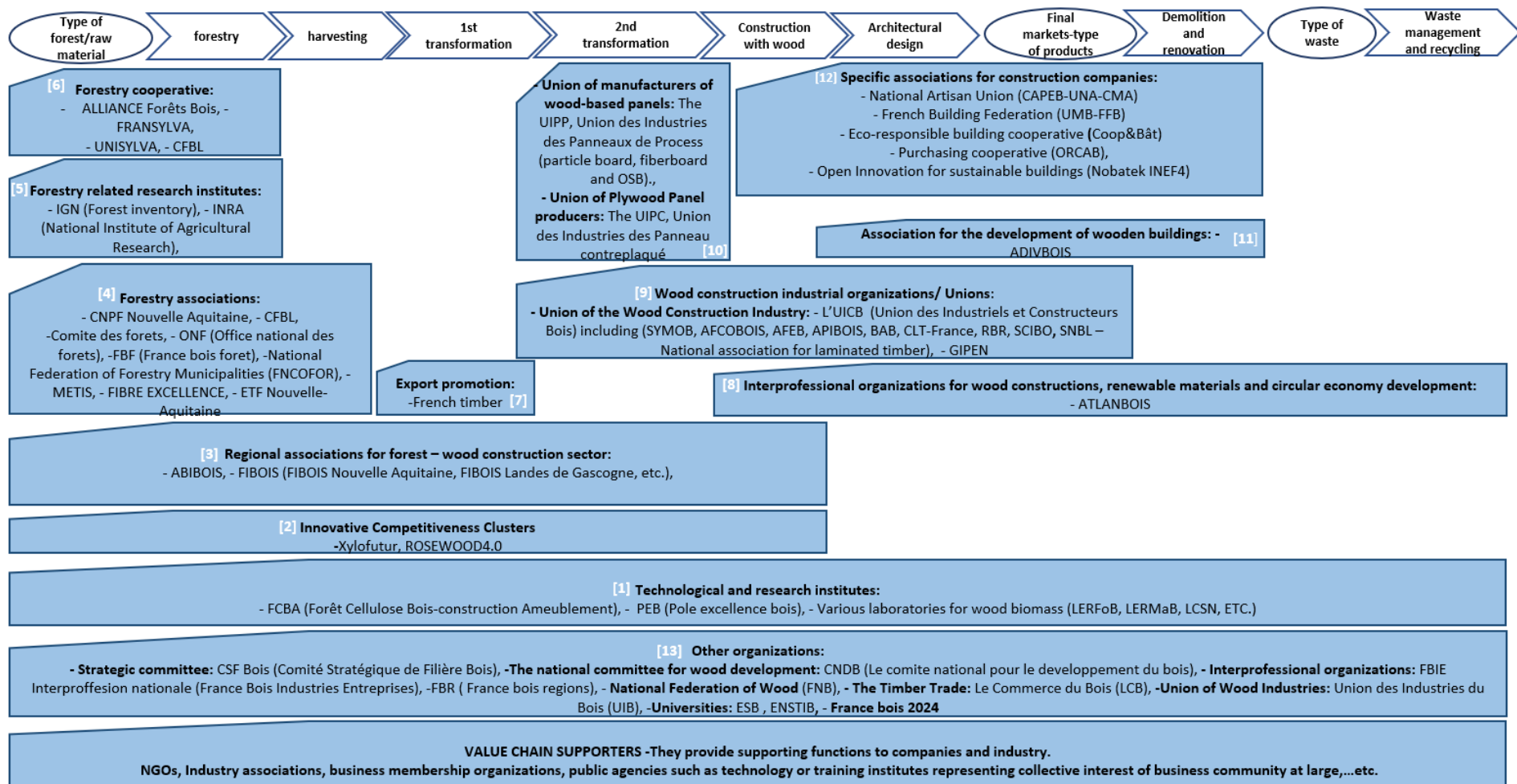


Figure 26. Wood construction value chain stakeholder map of New Aquitaine, France.

### 3.5.2. Competencies, capacities, key actors

Specific examples of activities, services and development programs of institutes, clusters and associations in France:

[1,5] **Technological and research institutes.** Their role can be related to technological, innovation, development, training, or research aspects or a combination of those aspects. They are one of the most important supporters of value chain. They cover a large scope of the value chain from forest owners to the end of the use of products and recycling. They can cooperate with all links of value chain on different levels. With some stakeholders, they have opportunity-based cooperation. With others, they establish partnerships or strategic alliances. They cover a wide scope of activities, depending on the needs of companies. They provide technical solutions and operational improvements. Besides that, they provide assessment analysis of processes and product performance. Some institutes issue certificates, with internal standardization groups working on standards and collaborating with standard committees. For example, they can issue PEFC, FSC, product standards and compliance, or even processes standards like ISO 9001 and ISO 14001. They have a mandate for activities like issuing and auditing compliance to certifications. Besides, institutes have high levels of cooperation with public bodies and local communities. They can be a link between companies and other mentioned stakeholders (standard organizations, public organizations, local communities). They are active partners participating in European and international networks, so they can help companies with networking and entrance on foreign markets.

[2] **Xylofutur**<sup>79</sup> - mobilizes its networks and partnerships to provide solutions adapted to SMEs in the wood sector. It primarily targets SMEs in the industrialization phase of R&D projects. It provides financially supported actions aimed at the digital transformation of SMEs in the timber industry, both in terms of infrastructure and management, to ensure competitiveness on the national and international levels. Its mission is to create durable links between the different actors: companies, education and research, communities, institutions, investors, the aim being to bring out innovative projects to create added value. Examples of activities:

- Innovation in technologies (robotization, digitalization, etc.) or innovation in processes in the wood industry.
- Increase of digital design (BIM) and associated digital construction techniques.
- Development of new marketing methods.
- Designing connected products (integration of wood and digital solutions).
- Optimizing of logistics chains and tools.
- Processing data and improving customer relations.

[3] **FIBOIS New Aquitaine**<sup>80</sup>. A network for development of the regional sector. Established from the merger of the four "historic" associations of the sector present in the Aquitaine, Limousin and Poitou-Charentes territories. Aims to represent and gather all the players in the regional forest wood and paper sector in an open dialogue to establish common and ambitious vision for the future.

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<sup>79</sup> Xylofutur. Website. Available at: <http://xylofutur.fr/les-projets-2/>

<sup>80</sup> FIBOIS New Aquitaine. Website. Available at: <https://www.fibois-na.fr/>

[4] **CNPF New Aquitaine**.<sup>81</sup> The Regional Forest Ownership Center - supports silvicultural management of the forest. Driving force for sustainable management. It drafts a Regional Sylvicole Management Scheme for private forests. This document sets out the main rules for the management of private forests, accounting for the specific human, geographical and natural features of the region. It participates in the implementation of the PEFC certification of the forests of New Aquitaine. It provides most of the development and forestry extension in the region, in collaboration with the Chambers of Agriculture and the local associations. It is the key player in supporting forest growers in the reconstitution of stands affected by natural disasters. Organizes technical meetings, training.

[6] **Alliance Forêts Bois**<sup>82</sup> is the leading forestry cooperative group in France, created and administered by private forest owners, serving 40,000 forest owners who are members, through 13 regional agencies. 3 key professions:

- Forestry Council: Managing and making a sustainable profit from the member's forests.
- Forestry work: Plant, maintain, improve-"cultivate forests".
- Commercialization of timber to meet the needs of industry and to create added value.

Key annual figures of the Alliance group:

- 20 million trees planted, i.e., 17,000 ha of reforestation, 55,000 ha of silvicultural work, 3 million m<sup>3</sup> of wood mobilized and marketed (whole France).

[6] **Fransylva** is the cooperative of "Private Foresters of France". It represents forest owners and private forests with French and European public authorities. It is a partner in the forest-wood sector and non-governmental organization. Cooperatives are an important link between forest owners and the wood processing industry. Cooperatives guarantee wood supply to the industry and now develop other skills. They set up environmental quality certifications.

[8] **ATLANBOIS** - Interprofessional organizations for wood constructions, renewable materials and circular economy development- whose mission is to develop different uses of wood in the construction and energy sector. Their activities combine the renewal of the resource, training, communication, providing expertise and know-how of regional companies. They have information flow with companies, individuals, project owners, communities, regulators.

[9] **Union of wood construction Industry (UICB)**<sup>83</sup> brings together nine associations or merged unions, three professional organizations and 11 business branches around the interests of wood construction and the wood construction industries. They have a lot of members like builders, constructors, or wood industrial product producers from 2nd transformation (glulam producers, CLT producers, etc.). Their projects depend on the requirements of companies. It includes work on different projects like fire safety, environmental aspects, testing, costs of buildings and building materials, financing of projects, etc. They have information flow with companies, architects, local authorities and sometimes with final consumers.

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<sup>81</sup> CNPF New Aquitaine. Website. Available at: <https://nouvelle-aquitaine.cnpf.fr/n/le-role-du-crpf/n:2388>

<sup>82</sup> Alliance Forêts Bois. Website. Available at: <https://www.allianceforetsbois.fr/>

<sup>83</sup> Union des industriels et constructeurs bois. Website. Available at: <https://www.uicb.pro/>

[9] **Syndicat National du Bois Lamellé (SNBL)**<sup>84</sup> - National association for laminated timber - brought together French industrial manufacturers and builders of laminated timber, to defend their interests and develop the use of laminated timber in France. The SNBL has been integrated within the UICB since 2019. All members are committed to a quality approach, validated by an ACERBOIS-Glulam certification. They are also proactive when it comes to respecting the environment. As a result, used wood is guaranteed "from sustainably managed forests", mainly from Scandinavian and France. The proportion of French wood has increased significantly in recent years. The adhesives used are low emissivity and guarantee maximum respect for air quality, meeting and exceeding the regulatory constraints. Their activities:

- Realization of life cycle analyzes (LCA) of laminated timber.
- Technical actions on fire resistance (publication of a technical note) and smoke toxicity test campaign, highlighting the qualities of laminated wood in the event of a fire.
- Research actions on VOC emissions (tests carried out by the FCBA); on the mechanical behaviour.
- Action with public authorities to increase the presence of wood in the French construction.
- Sustained communication with contractors and project management.
- Communication campaign "Laminated wood in the city".

[9] **CLT France**<sup>85</sup> - France association was created in July 2014 to contribute to the development of cross-laminated wood panels in France. It allows its members to work collectively to develop a common quality policy through technical and economic research actions. Association integrated into the UICB in 2019. CLT France, therefore, benefits from a guarantee of representation of its interests, both in terms of standardization work and in terms of regulation. It intends to bring together all the actors of the CLT in France. The members come from different professional backgrounds but share the same ambition of developing CLT products and processes. The association, therefore, bringing together different professional profiles: i) Industrial panel manufacturers, ii) Builders and design offices, iii) Owners, promoters and developers. Actions aims at increasing the outlets for CLT with technical, standardization, quality and promotion activities.

[9] **APIBOIS**<sup>86</sup> - The wood-based I-Beam Industrial Union was created in 2001 with the objectives of integrating this innovative product into French constructions and developing its market. In 2019, the union joined the UICB. Its main mission is oriented towards technical actions, allowing the characterization of the various "I-beam" systems and therefore their enhancement (fire resistance, thermal characteristics, acoustic performance, etc.). Beyond national action, the UICB aims for European ambitions with a gradual harmonization of procedures, thus authorizing standardization. APIBOIS has set up an annual statistical follow-up in order to better understand the development of this innovative product on the French market. Some concrete actions:

- Realization of the FDES with an environmental characterization of I-beams.
- Production of a Technical Prescription Book (CPT), harmonizing the prescriptions according to the systems.
- Action to characterize I-beam systems (fire, acoustics, environment, thermal ...).

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<sup>84</sup> Syndicat National du Bois Lamellé. Website. Available at: <http://www.uicb.pro/snbl/>

<sup>85</sup> CLT France. Website. Available at: <http://www.uicb.pro/clt-france/>

<sup>86</sup> APIBOIS. Website. Available at: <http://www.uicb.pro/apibois/>

- Production in partnership with CAPEB and distribution of a Memento guide intended for construction professionals, supporting the choice, design and implementation of the material.
- The profession is also very involved in the CTB-PI brand, managed by the FCBA.

[9] **SCIBO**<sup>87</sup> - Union of Manufacturers of Industrialized Wood Structures and Frameworks - brings together industrial companies producing industrialized wooden frames and other products (industrial beams, floors, walls). Together, these manufacturers are committed to a quality approach, validated by certifications such as CTB-CI, Socotec Qualité, etc. Activities of the union:

- facilitating progress and allowing effective promotion of industrialized timber structures.
- Active participation in standardization actions of manufacturing products and its implementation at national and European level (NF EN 14 250; NF DTU 31.3; EC5).
- Seat in committees (collective agreement).
- Research programs, giving rise to technical publications on the themes: seismic safety, wind, acoustics, fire risk.
- Environmental assessments, Life Cycle Analysis (LCA).
- Environmental and Health Data Sheet (FDES).
- Communication and documentation.

[10] **UIPP**<sup>88</sup> brings together almost all French manufacturers of wood-based panels, particleboard, fiberboard (MDF) and OSB. The overall turnover of this industry in France is over 1.2 billion euros and directly employs around 3,000 people. There are currently 20-panel production sites, spread across the country.

[11] **ADIVBOIS** - Association for the development of wooden buildings – example of association where architects, project designers and other developers have discussions during meetings. They share ideas and development perspectives for the future. Association provides an environment for knowledge flow.

[12] **ORCAB**<sup>89</sup> - Organization of Building Artisans Purchasing Cooperatives- provide technical exchanges between members of the purchasing cooperative. Group purchasing is based on scale purchases for craft businesses, through a competitive and modern network of cooperatives. It allows the distribution of national brand products exclusively to professionals. Operational and strategic information is exchanged, there is also a flow of knowledge – know-how.

[13] Identified other organizations. Most of them represent specialized units of public administration, which provide information and other support services to the business community and assistance to enterprises. Especially committees are in charge of promotion and communication along the whole value chain. Committees hold coordination of activities along whole value chain and communicate common policies.

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<sup>87</sup> SCIBO. Website. Available at: <http://www.uicb.pro/scibo/>

<sup>88</sup> UIPP. Website. Available at: <http://www.uipp.fr/uipp-presentation.html>

<sup>89</sup> ORCAB. Website. Available at: <http://www.orcab.coop/front>

Those are not all the actors and development projects in wood construction value chain in France. Those examples only provide better understanding of the role of service providers and principles behind development projects.

### 3.6. Needs and starting points for transformation

#### 3.6.1. SWOT analysis

New Aquitaine region has many opportunities and strengths but also challenges and potential threats mostly related to economic and environment risks. Review of its geographical, demographic, environmental and economic contexts indicate strong potential and attractiveness of the region. Its strategic position, natural resources, strong regional economy, positive trend of migration on coastal and urban areas, promises bright future for inhabitants of this region. Outdoor and indoor living space is important factor while assessing standard of living for inhabitants. Affordable, zero carbon, sustainable and human health-oriented housing is crucial for green cities of the future. Wood constructions met all those criteria. Therefore, our mission is to study its current impact and future opportunities to support that transition toward more sustainable housing and living space.

There is also the question related to development of forest-based sector in parallel with other industries, other land use and trends in the region. Strategies needs to be realistic and predict potential conflict of interests or opportunities for cooperation. Climate change impact needs to be accounted in those strategies from both perspectives; forest-based sector as a victim of climate change related risks, and forest-wood based sector as a mitigator of climate change effect. Main goal of this report is to assess current position and impact of wood construction market with opportunities for its future development. SWOT analysis (Table 4) summarizes report and other findings that needs to be considered while planning actions in the future. SWOT analysis is based on this report and two other reports about regional forest-wood sector in New Aquitaine (PRFB report<sup>90</sup>, FIBOIS New Aquitaine report<sup>91</sup>). We also included findings of BASAJAUN workshop with partners and opinion of other professionals and stakeholders in region.

**Table 4.** Regional SWOT table for wood construction in New Aquitaine region.

Strengths
<ul style="list-style-type: none"> <li>• The share of turnover devoted to R&amp;D programs remains twice as high in New Aquitaine as the national average</li> <li>• Wood sector contributes to surplus in trade balance of New Aquitaine</li> <li>• Sawmills in region represent 25% of national sawn wood production</li> <li>• Forest stands with quality and diverse forest species desired by the wood industries</li> <li>• A very diversified range of regional timber construction products</li> <li>• Companies increasing offer for global markets, ranging from technical design to implementation</li> <li>• Strategic location bordering Spain. Presence of ports on the Atlantic coast - to promote the export of finished products.</li> <li>• Modern research and higher education structures (xyloforest, xylosup, irstea, universities...), technical institutes (FCBA...),</li> <li>• applied research organizations and competitiveness cluster entirely dedicated to the forest-wood sector (xylofutur, L'UICB...)</li> </ul>

<sup>90</sup> [https://fibois-na.fr/wp-content/uploads/2021/04/PRFB020-COR-Decembre\\_cle86c1f2.pdf](https://fibois-na.fr/wp-content/uploads/2021/04/PRFB020-COR-Decembre_cle86c1f2.pdf) (p. 115–119)

<sup>91</sup> <https://fibois-na.fr/wp-content/uploads/2021/07/Rapport-synthese-Observatoire-de-la-filiere-Foret-Bois-en-Nouvelle-Aquitaine-FIBOIS-Nouvelle-Aquitaine-2020.pdf> (p. 64)



### Weaknesses

- Decrease in production and increase of company's insolvency in New Aquitaine.
- A reduction of internal staff and increase of temporary staff.
- Insufficient supply, because there is lack of candidates for wood construction jobs.
- Forestry certification issues – misunderstanding between forestry practices and social acceptance.
- Mismatch between the quality of sawn wood supply and business demand with regard to industrial expectation.
- Insufficiently links between 1st and 2nd processing: -causing import of non-local wood and products for wood construction.
- The Maritime Pine industry must overcome the consequences of the two storms which greatly reduced the volume of standing timber.
- Lack of forestry and forest mechanization for deciduous forests and logging on sloping lands.
- The overall market share of timber construction fell to only 6,2% in the New Aquitaine region.
- Difficulties in the construction markets; linked to a higher price positioning than foreign competitors.
- Health and economic crisis lengthened supply times and product availability + higher prices.

### Opportunities

- Arguments in the face of the climate change: wood construction = renewable material –carbon capture and storage / less energy in production processes / lower energy consumption in winter and summer.
- High needs for energy efficiency improvements in region (renovation projects).
- Rising importance of local production and consumption.
- The regulatory context of the "RE 2020" and other programs are favourable to wood products.
- Emergence of major construction programs (Euratlantique, ADIVBOIS, Prix Régional de la construction Bois).
- Mobilization of biomass (increase of harvesting and sawn wood in future).
- Wood construction sector can offer attractive jobs.
- New Aquitaine is very attractive region – positive trend of migrations into region – increased housing demand (Huge potential to increase market share in all type of buildings (multistorey, single-family, public and private non-residential buildings,)).
- Factory 4.0 of the future, with increased automatization and digitalization of data

### Threats

- Current economic context has strong impact on price of wood and the cash flow of companies.
- Insufficient contracting of local resources (only few long-term guarantees), there is also potential competition on the resources with the energy sector; need for collective mobilization strategies.
- Lobbyists from conventional building sectors are very active.
- Tensions over the availability of wood products could lead to market losses.
- Strong competition on international markets.
- Regulatory constraints that make access to certain markets very complex.
- Difficulties in recruiting and keeping staff.
- Lack of continuity in the funding of R&D programs.
- The impact on the financial health of companies that may affect repayment capacity and lead, among other things, to an increase in margins and inflation.
- Climate Change threats: droughts, forest fires, storms, insect attacks...

### 3.6.2. Main conclusions for a regional roadmap

The forest-wood based sector in New Aquitaine is very strong. New Aquitaine is positioned as one of the most productive regions in France for this sector. It is positioned as the first region in forest surface area with the highest annual increment in forest biomass. The standing volume of wood in forests is also significant, positioning it amongst top three regions with highest forest stock volume. Region is amongst leading producers of pulp and paper products, panels, and sawing timber.

However, the region lacks behind in wood constructions sector. It is right behind the other leading regions. Looking at wood construction turnover in 2018, it was already positioned as 2<sup>nd</sup> region out of 13 French regions (with 208 million € of turnover and 290 companies). The region faced the decrease in wood construction activities. So, in 2020 it was positioned only at 5<sup>th</sup> place out of 13 regions (with turnover of 180 million € and 271 companies in wood construction). Looking at it from positive perspective, the region has a potential to be one of the leaders in wood construction sector if it deals with its weaknesses and threats. It has local resources (Douglas fir, spruce, maritime pine,) that can be turned into construction applications with high added value. Harvest of this species is expected to increase. Market is there, with increasing population and demand for housing at its coastal areas and major urban centres. Renovation market is also increasing significantly, and this trend is expected to continue in the future. Wood is already recognized as a great sustainable construction material and many successful projects speaks for itself (not just residential buildings but also sport halls, industrial constructions, schools, etc.). With adequate support to local wood processing companies (1<sup>st</sup> and 2<sup>nd</sup> transformation) and construction companies, this sector could meet and exceed its once already reached potential.

To respond to the construction dynamic in New Aquitaine and to use local wood in construction, it is essential to develop processing capacities and support the modernization of timber companies. It is also necessary to develop the use of regional wood in construction by supporting the project management and strongly promote wood in those projects (architects, designers and control offices). Private developers and social landlords have been increasing local wood in their constructions for several years, especially in major urban renewal projects (Euratlantique project, ADIVBOIS, Prix Régional de la construction Bois...).

To meet these increasing needs, the strategic improvement of the local wood supply is necessary. Further, technical standards for the appropriation needs to be facilitated. Indeed, the prescription and promotion of the use of wood are essential. Woodrise-type operations were carried out for this purpose. In this sector, public procurement must play a driving and exemplary role in promoting the structuring of primary and secondary processing companies. The multiple year actions put in place by the inter-professional organizations and their partners (Order of Architects and ENSAP, FFB, CAPEB, Cluster Eco-Habitat, "100 public buildings in local wood" program) serves as a basis: network of wood specifiers, awards for regional wood construction, meetings with elected officials, training of professionals, company visits.

New Aquitaine regional plan PRFB<sup>92</sup> – was set up in 2017 for a period of next 10 years until 2027. PRFB program has a specific objective to develop the use of local wood in construction and other markets. To do that, representatives of the timber industry and the public authorities have put in place several "timber construction plans" which must be implemented in the regions. These actions will be carried out in New Aquitaine by a network of professionals, field representatives, and with private and public contractors. The actions carried out will respond to a double challenge: informing / supporting project owners and improving the skills of professionals, in particular:

- Raising awareness and supporting project owners in their construction projects in order to use local resources by local producers as much as possible (example of an existing approach: "100 public buildings in local wood" program).
- Informing companies about technical developments in wood construction (technical meetings, technical and regulatory observation, training, etc.).
- Promoting exemplary public buildings (pivotal points for energy transition and climate change mitigation) in order to amplify the commitment of local authorities in local wood construction. Developing the uses of wood in construction and renovation.
- Listing the demonstration projects in order to enhance and duplicate these operations.
- Bringing together construction stakeholders (project managers, builders, promoters, social landlords).
- Promoting wood in public procurement to communities and EPCIs. Likewise, to promote the interest of wood in the construction of agricultural buildings.
- Developing the awareness of wood construction materials produced in New Aquitaine. Likely to be implemented in ERP (Public Receiving Establishments) - structuring of the local wood supply (grouping - 1st and 2nd transformation partnership).
- Encouraging grouping of companies to respond to markets.
- Developing partnerships between 1st and 2nd transformation.
- Making public project management a driving force for the development of wood construction: technical and regulatory support, emergence of demonstration projects in the regions.

As studied in this report, there are many policies, programs and roadmaps oriented toward sustainable development, improvement of domestic supply and processing, increase of forest's carbon sequestration and improving its resilience and adaptation to climate change. Besides, region promote use of wood material and use of local wood in construction as well as wood-based solutions on renovation market. Wood construction has an attention on both, national and regional level. There is also emphasise on increase of circular practices (reuse, recycling,

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<sup>92</sup> PRFB. 2020. pp. 67.

circular solutions), acceleration of digital transformation and innovation. If wood construction market share would increase up to 30% (from current 6,2%), would meant approximately 700,000 tons of CO<sub>2</sub> stored each year in New Aquitaine alone. Region has the potential to reach this goal and realise this positive impact of sustainable, carbon negative construction material - wood.

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## 4. Regional profile Basque Country, Spain<sup>93</sup>

### 4.1. Context

#### 4.1.1. Geography, land use, demographics

The Basque Country is a region located in the north of Spain, at the eastern end of the coast of the Cantabrian Sea, bordering France. It limits to the east with Navarra and the French region of New Aquitania, to the south with La Rioja and to the west with Cantabria and Castilla y León (Regions or Autonomous Communities of Spain) (Figure 27).



**Figure 27.** Geographical location of the Basque Country in Spain.

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<sup>93</sup> Authors: Aitor Saez de Zerain Albizu, BASKEGUR, Zamudio and Javier García Jaca, Fundacion Tecnalia Research and Innovation, Derio, Spain



**Figure 28.** Administrative divisions of the Basque Country. Source: Joan M. Borràs (ebrenc), CC BY-SA 2.5, (<https://commons.wikimedia.org/w/index.php?curid=2510748>).

The Basque Country is made up of three provinces: Araba/Álava, Gipuzkoa and Bizkaia. These are divided into 251 municipalities, 51 in Araba/Álava, 88 in Gipuzkoa and 112 in Bizkaia, which are grouped into 20 comarcas (traditional region or local administrative division) (Figure 28). The territory of Araba/Álava is divided into seven regions. The regions of Gipuzkoa and Bizkaia, however, do not act as administrative divisions.

The most populated city is Bilbao (Bizkaia), followed by Vitoria-Gasteiz (Araba/Álava) and San Sebastián (Gipuzkoa), which make up a metropolitan area of one million inhabitants, approximately half of the total population of The Basque Country; 2.199.711 inhabitants (municipal population on 2020) with average age of 46.7 years (Basque Government, 2020)[1] and a population density of 300.38 inhabitants/Km<sup>2</sup> (Basque Government, 2017)[2].

Bizkaia contains 52.4% of the population, Gipuzkoa 32.7%, and Araba/Álava, being the largest territory, has the smallest population, 14.9%. In the Basque Country are six municipalities with a population between 40,000 and 100,000 inhabitants, which are home to 16.9% of the total population of the region. 10 municipalities are with a population of between 20,000 and 40,000, which represents 12.5% of the total population and 23 municipalities with between 10,000 and 20,000 inhabitants, 15.4% of the population. All these municipalities are in the provinces of Bizkaia and Gipuzkoa, except Llodio and Amurrio, which are in Araba/Álava and have between 10,000 and 20,000 inhabitants.

The urban area coexists with the primary sector. There are a multitude of industrial zones scattered throughout the Basque Country (Figure 29), where wood processing companies abound. Therefore, the wood is extracted from the forest and in a short time it is transferred to industry. In this way, local wood is obtained without traveling long distances.



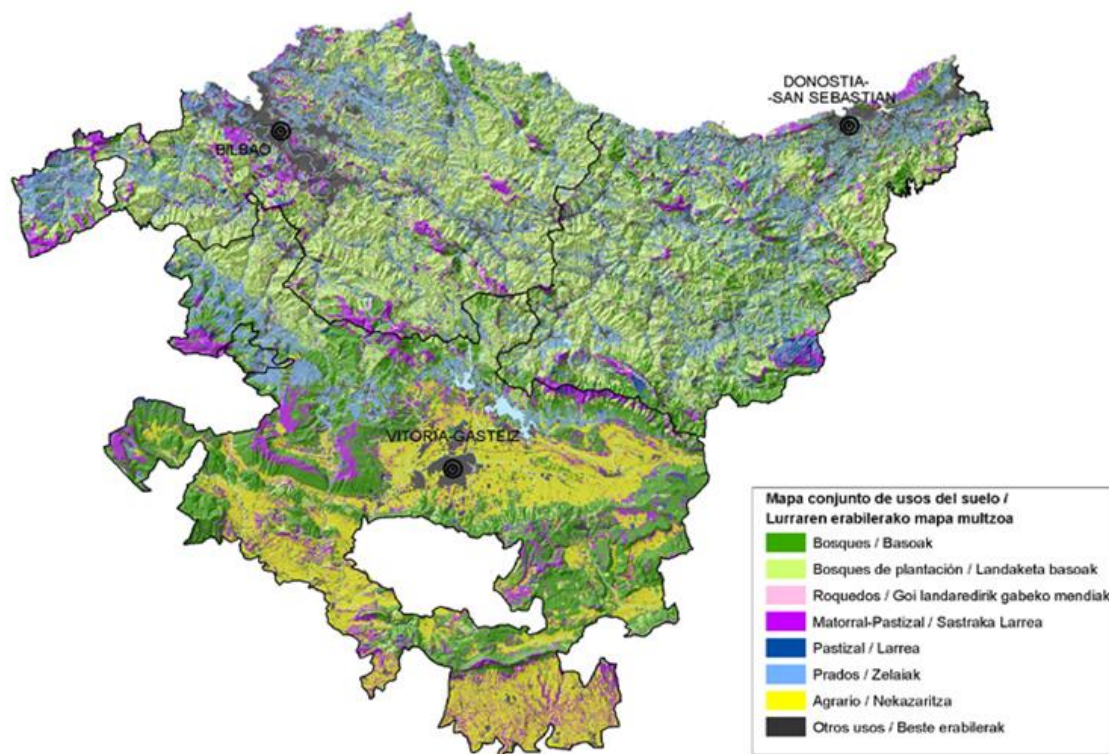
**Figure 29.** Industrial areas situated throughout the Basque Country<sup>94</sup> Source: Sprilur (<https://sprilur.spri.eus/es/sobre-sprilur/>).

Terrestrial ecosystems occupy more than 90% of the surface of Basque Country and it is divided into two slopes: the Atlantic, which includes the provinces of Bizkaia and Gipuzkoa, and the Mediterranean, which covers most of the area of Álava/Araba. The Atlantic side, which represents 453,000 ha, has an average annual rainfall of 1.323 mm per year and is characterized by having large slopes (62% of its surface on slopes greater than 30%). The Mediterranean side, which has 270,000 ha, has annual rainfall of 874 mm and lower slopes (26% of its surface on slopes greater than 30%).

Repairing land uses, the forest area, including the wooded and ungrown (pasture, scrub, rocky areas...) reaches 490,051 ha, 68% of the total area of the Basque Country. It is followed in importance by the agricultural area (crops and mowing meadows), with 180,029 ha, the urban or infrastructure area (47,474 ha) and the unproductive areas linked to water (5,341 ha). Araba/Álava is the territory with the largest forest and agricultural area, Bizkaia dominates the urban area and Gipuzkoa has the highest percentage of forest area (72.4% with respect to its surface) (Figure 30).

<sup>94</sup> The first symbol represents those managed by Sprilur (the entity of the Department of Economic Development, Sustainability and the Environment of the Basque Government to promote Basque industry) and with the second those that adhere to the "Industrialdeak" program (inter-institutional collaboration between different agents).





**Figure 30.** Land use cover map of the Basque country<sup>95</sup>.

Agricultural activities are represented on the Atlantic side by the mowing meadows and on the Mediterranean side by extensive crops, being in the Llanada Alavesa, Valles Alaveses and especially in Rioja Alavesa where they reach larger surface percentages.

The wooded forest area is 54.7% of the total area of the Basque Country. The percentage varies according to the territory; 46.7% in Araba/Álava, 59.5%, in Bizkaia and 61.5% in Gipuzkoa. According to the ownership of this wooded forest land, 58% is privately owned and the rest is publicly owned.

Figure 31 presents the distribution of the main tree species in Basque Country.

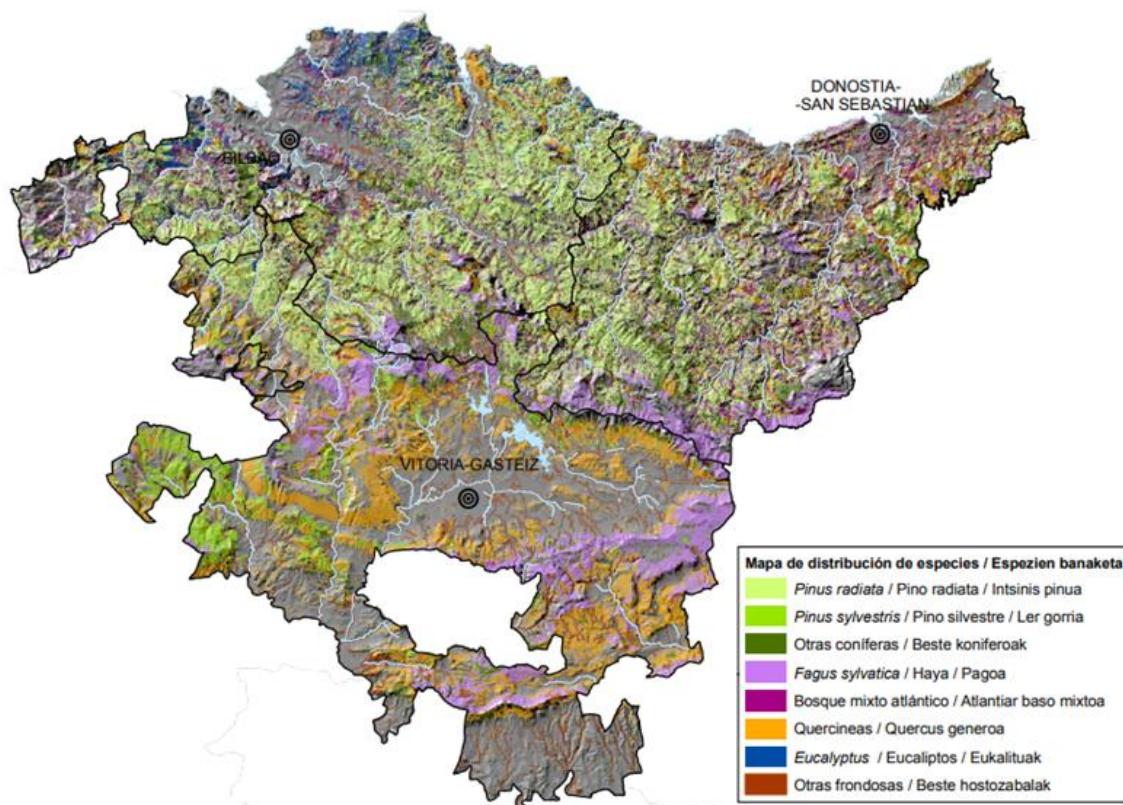
The hardwood area exceeds the conifers area, although the extension of forest plantations is slightly greater than natural forests. Radiata pine (*Pinus radiata* D. Don) is the species that covers the largest area (109,440 ha, which represents 28% of the total wooded forest area) and the most used (about 80–85% of the annual fellings). It is usually planted on land with an elevation of less than 600 meters, with deep soil and not waterlogged. 85% of its surface belongs to private owners.

The common beech (*Fagus sylvatica* L.), with 55,114 ha and 14% of the wooded forest area, is the hardwood which occupies a greater extension in the Basque Country, centered on Araba/Álava (60%) and Gipuzkoa (32%). Three-quarters of the beech area is in public forests. The next important vegetation community is named as "Atlantic mixed forest" (37,435.5 ha),

<sup>95</sup> Basque Government 2007. [https://www.euskadi.eus/contenidos/informacion/if\\_mapas\\_usos/es\\_dapa/adjuntos/usuarios\\_del\\_suelo\\_3.pdf](https://www.euskadi.eus/contenidos/informacion/if_mapas_usos/es_dapa/adjuntos/usuarios_del_suelo_3.pdf)

mostly privately owned (90.1%). This type of forest is home to a heterogeneous set of arboreal and shrub species that grow spontaneously without any type of management after a final cut not replanted or an agricultural abandonment, for example. The main species that make up this type of forest are hazel (*Corylus avellana* L.), oak (*Quercus robur* L.), chestnut (*Castanea sativa* Mill.), birch (*Betula pendula* Roth), holly (*Ilex aquifolium* L.), beech (*F. sylvatica*), wild cherry (*Prunus avium* L.), country maple (*Acer campestre* L.), alder (*Alnus glutinosa* L.) or ash (*Fraxinus excelsior* L.).

The gall oak (*Quercus faginea* Lam) and the holm oak (*Quercus ilex* L.) are the next two most important species, occupying an area of 26,6646 ha the first and 26,364.3 ha. (6.6%) the second. These two hardwoods are mostly found in publicly owned forests (72%).



**Figure 31.** Distribution map of main tree species in the Basque Country.<sup>96</sup>

After the radiata pine, the Scots pine (*Pinus sylvestris* L.) is the largest conifer in the Basque Country (17,468 ha, 14,000 of them natural stands). However, its distribution is radically different from that of the radiata pine, since it is a species of the Mediterranean site (which gathers 90% of its extension) and located in public forests (80% of its extension).

The black pine (*Pinus nigra* Arnold) covers an area of 13,709 ha, with a predominant distribution in Gipuzkoa (51%) and at altitudes between 600 and 1,200 meters. The larch (*Larix decidua* Mill.) has about 7,715 ha essentially distributed in Gipuzkoa (80%), in altitude ranges similar to those of the black pine, but in higher quality soils. Douglas fir, *Pseudotsuga menziesii* (Mirb. Franco), is a species that is used more in deep soils between 450 and 1,000 meters, and

<sup>96</sup> [https://www.euskadi.eus/contenidos/informacion/inv\\_for\\_mapa\\_forestal\\_2005/es\\_dapa/adjuntos/especies\\_4.jpg](https://www.euskadi.eus/contenidos/informacion/inv_for_mapa_forestal_2005/es_dapa/adjuntos/especies_4.jpg)

occupies 7,949 ha (68% in Gipuzkoa). Maritime pine (*Pinus pinaster* Ait.) is mainly located at low altitudes in Bizkaia and close to the coast (7,068 ha).

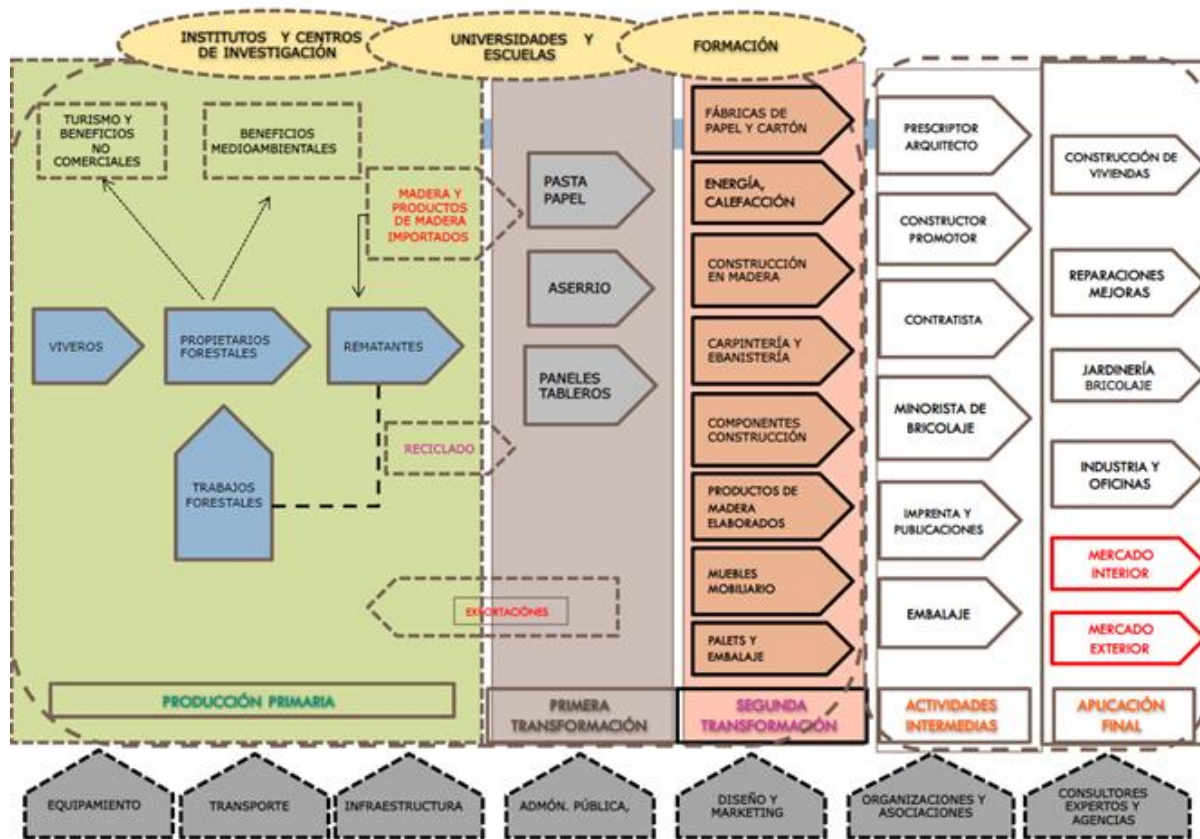
The area occupied by new forest species is growing, with the area of *Cryptomeria japonica* (Thunb. ex L.f.) D.Don reaching 2,075 ha, 761 ha for *Sequoia sempervirens* Endl. and 140 ha for *Pinus taeda* L.

#### **4.1.2. Economic trends and competitiveness**

The Basque Country concentrates a large volume of industries, it has changed from 89.6% in 1990, to 117.1% of the European average of GDP per capita in 2002, to 125.6% in 2005 and to 137.2% in 2008 (industry and construction account for 38.18% of GDP), growth only surpassed in the European Union by Luxembourg and Ireland. Despite its relatively small extension and a population of 4.9% compared to Spain, at the national level the Basque Country contributes 6.2% of GDP.

The wood sector is of great importance in the economy of the Basque Country, it contributes almost as much wealth and employment as the banking and insurance sector. The wood sector contributes 1.53% of GDP with an impact on the economy of 1,010 million euros per year. The effects on the estimated income of the Public Administrations as a result of the development of this activity amount to more than 309 million euros, above the subsidies or aid that this sector may receive. Wood is the main natural and renewable resource in the Basque Country and the processing industry is committed to local wood. 68% of the wood that is used comes from the Basque Country and the rest of neighbouring regions.

The sector forms an interconnected structure from the basic unit (the nurseries, forest workers and owners) with the research institutes and centers. The first and second transformation is supported by the training given by universities and schools. Figure 32 outlines the hierarchy of the forestry sector in the Basque Country.



**Figure 32.** Hierarchy scheme of the Basque forest-based sector (supply chain map). (Source: Basque Government<sup>97</sup>).

Regarding company size, the average for the more than a thousand companies that make up the sector in the Basque Country is distributed as follows: 12 employees per company in the wood and cork sector, 60 employees in the case of the paper industry and 40 in the furniture industry. The wood business fabric is dominated by small companies. Almost 95% of companies have fewer than 20 employees, and 4,8% are medium-sized companies, while large companies with more than 200 workers are exclusively in paper mills. The forestry-wood sector employs around 18,000 full-time people, 11,760 work directly in the sector and 6,247 are induced jobs in other economic activities (9.5% of industrial employment in the region).

To try to be more competitive, the Basque Forestry-Wood sector is committed to innovation and the development of Industry 4.0. The companies are part of the Basque Alliance for the Bioeconomy and Basotek, a multidisciplinary R+D+i consortium that seeks to respond to current and future challenges.

However, the Basque Forestry-Timber sector is immersed in a double crossroads that will guide its future. On the one hand, the globalization of the trade in raw materials and manufactured materials, and on the other, the circular bioeconomy, which demands materials of biological origin to replace those of fossil origin, are two forces that put pressure on the sector. Society's demand for forests exacerbates this pressure. Although none of these drivers of the economy

<sup>97</sup> [https://www.euskadi.eus/contenidos/proyecto/pema/es\\_def/adjuntos/PEMA\\_2015.pdf](https://www.euskadi.eus/contenidos/proyecto/pema/es_def/adjuntos/PEMA_2015.pdf)

is merely contemporary, it is at present that globalization and the bioeconomy are of crucial importance for the development of markets for forest products.

#### 4.1.3. Climate change impacts

Due to climate change, a future of great uncertainties is expected. Sustainable forestry and the use of products based on materials from the forest are a useful tool to mitigate global warming. The products from the forest will also serve to replace other products made with materials of fossil origin, contributing to a low-carbon society. But, in addition, it is necessary to know the development requirements of the forest to face the unknown consequences that this climate change will impose. Also, resilient forest stands are needed to produce the necessary biomass. The expansion of pests and diseases is expected due to the displacement of the suitable conditions for their development to the north, as well as the appearance of new threats derived from the global trade in wood and forest products.

By the end of the century, an increase in the average annual temperature in winter and summer is expected in the Basque Country, this being higher for the Mediterranean side. Extreme minimum temperatures at the end of the century may rise between 1 and 3°C during the winter months. Furthermore, climate models for the Basque Country show a 50% decrease in the number of icy days ( $T. \min < 0^{\circ}\text{C}$ ) which, together with the decrease in duration and frequency, is predicting the disappearance of cold waves by the middle of the century. With respect to extreme maximum temperatures, the projections show a positive trend with an increase at the end of the 21st century of 3°C during the summer months. The average of these maximum temperatures for the period 1978–2000 is 35°C while for the period 2070–2100 it is expected to be 39°C, producing an anomaly (4°C) much higher than for the extreme minimum temperatures.

As a result of the anticipated changes, longer heat waves and a slight increase in their frequency are expected. During the reference period, only 10% of the summer days were registered in periods of heat waves. However, between 2020 and 2050 this number will rise to 30% and may reach 50% by the end of the century.

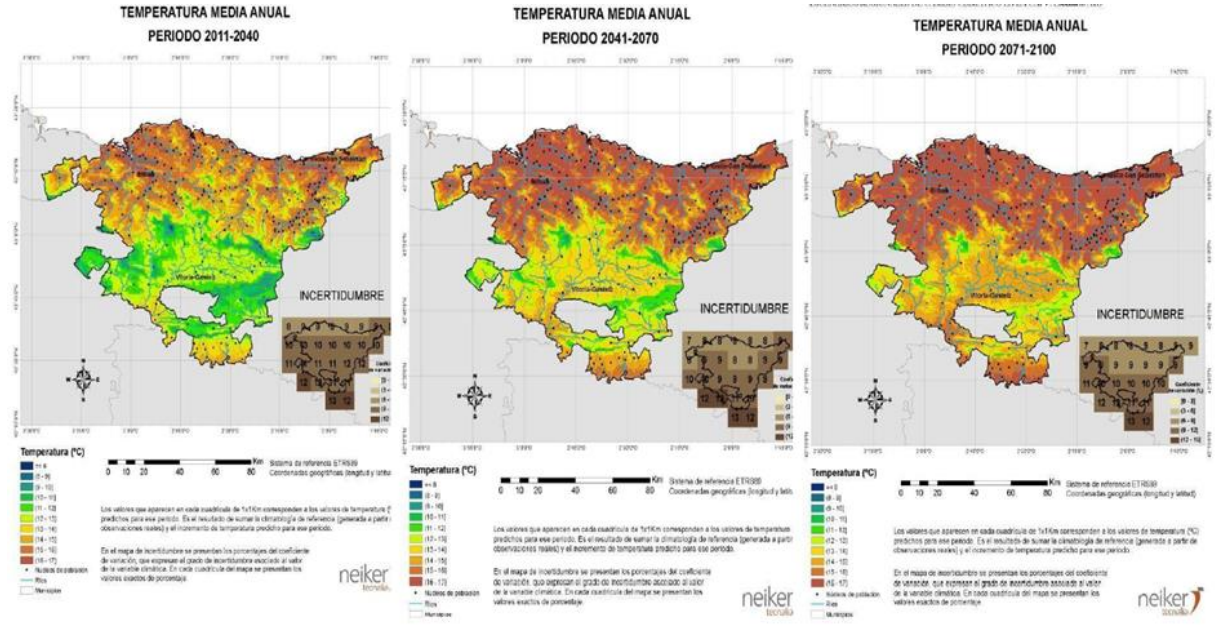
In the case of precipitation, a slight and progressive decrease of around 15% in annual precipitation is expected by the end of the century. A homogeneous spatial pattern is expected for the entire territory of the Basque Country, with the northeast region undergoing less changes than the rest.

Neiker, the Basque Institute for Agricultural Research and Development, has worked on the development of the future climate scenario. In it, the climatic data for the entire area of the Basque Country have been calculated by the Regional Climate Models (RCM) included in the ENSEMBLES project, considering a set of 19 RCMs and the RCP 6 climate change scenario for a simulation horizon up to the year 2100. A further step has been taken and regionalized considering orographic and local variables until reaching a resolution of 1km\*1km (Figure 33 and Figure 34).

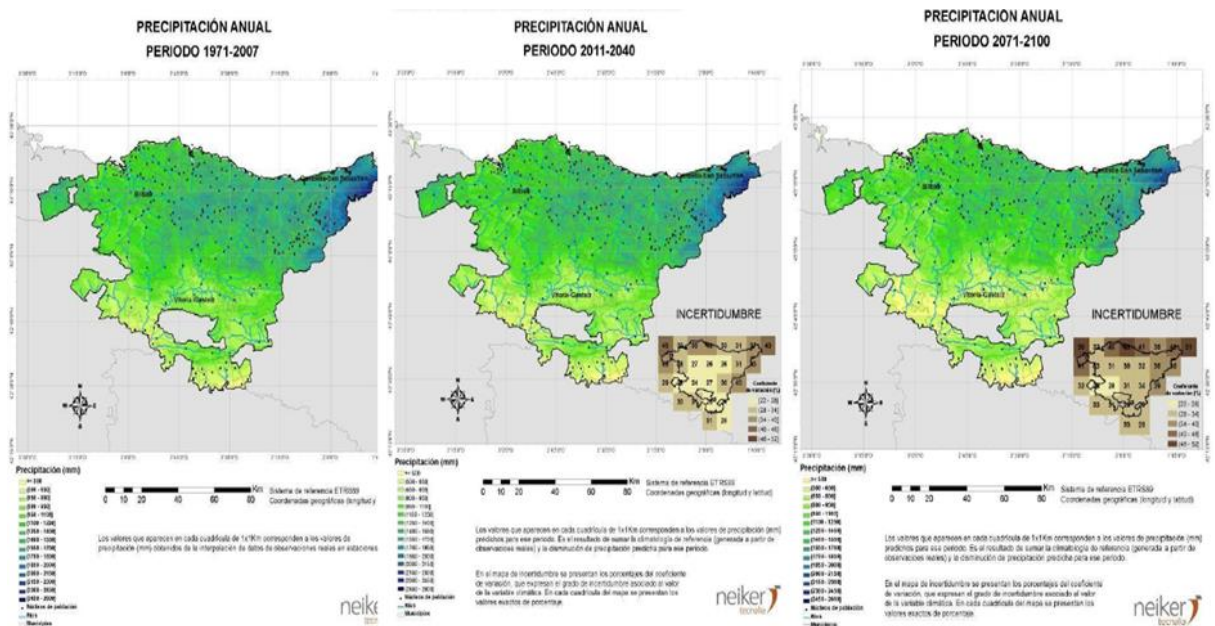
Terrestrial ecosystems, which represents the greatest fear for the forestry sector, the predicted variation in rainfall and the thermal increase could, a priori, facilitate the “mediterraneanization” of the forest ecosystems of the Basque Country, leading to changes in the composition specific to them. The predictions show a significant impact on native three representative species of the Basque forests: common oak (*Q. robur*) and beech (*F. sylvatica*). The almost total disappearance of their niches is expected by the year 2080 and a progressive displacement of them towards northern Europe throughout this century. On the other hand, it is expected that this

process of "mediterraneanization" favors the development of species from totally Mediterranean environments such as the cork oak (*Q. suber* L.).

The increase in extreme events (storms, gales, explosive cyclogenesis, etc.) will significantly increase the annual volume of wood damaged by natural disturbances. The balance between insect pests and their natural enemies will be affected. The increase in temperature will favour, in general, the development of insects and their survival during the winter.



**Figure 33.** Average annual temperature projections for the present and future periods (Source: Neiker).



**Figure 34.** Average annual precipitation projections for the present and future periods (Source: Neiker).

## 4.2. Forest resources and management

### 4.2.1. Forest stock and ownership

The EU has 182 million ha of forest, which cover 43% of its surface; 28 million ha belongs to Spain. Focusing on European forests, they occupy more than 159 million hectares, of which 27,980 are in Sweden, 22,409 in Finland and 18,572 in Spain (Spain thus ranks third in wooded area in 2020). Together with France, Norway and Germany, these countries account for more than two-thirds of the forested area of the EU. The Basque Country is the region of Spain with the highest relative quantity of standing wood, with the highest average stocks per wooded hectare.

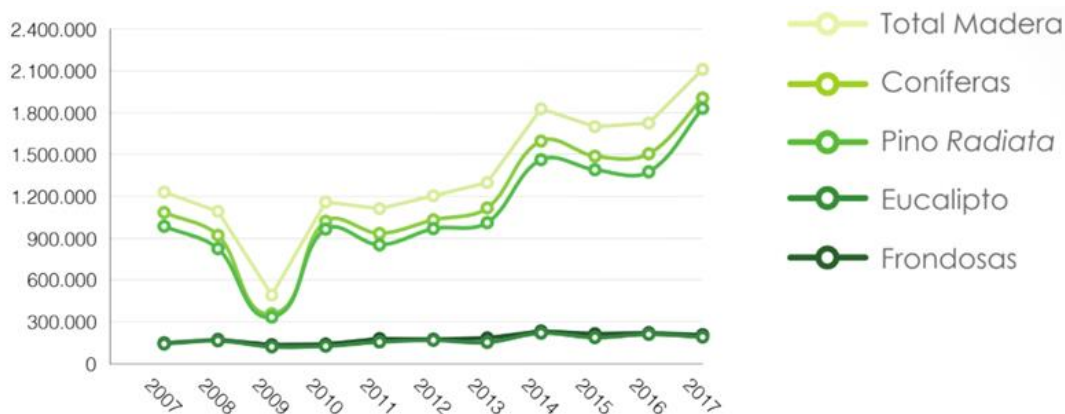
As already mentioned, the radiata pine is the species that occupies the largest area in the Basque Country with 115,000 ha, which represents 29% of the total wooded forest area (85% belongs to private owners) and 85–90% of forest fellings. The Forest Map of the Basque Country (2019) quantifies the total timber stock at 74,5 million m<sup>3</sup>, spread over 393 688 ha of wooded area, that is, 189.2 m<sup>3</sup> per ha. The radiata pine is the species with the largest stocks. In fact, 43% is radiata pine, 14% beech, and 4.5% eucalyptus. These 3 species, together with the black pine (*P. nigra*) and the maritime pine (*P. pinaster*), account for 70% of the total stocks in the forest.

Comparing them with those of previous inventories, a continuous growth is observed, achieving an increase of 79.1% in stocks between 1996 and 2019. This generalized increase not only occurs in radiata pine (45.7%) but also in the rest of forest species (conifers and hardwoods), and in eucalyptus (310.7%) in particular.

However, the logged area of radiata pine is increasing (Figure 35). Since the 2011 Forest Inventory, this area has increased progressively, and the increase recorded in recent years is very notable (especially in 2019). The affection of the pine forests by the disease of the brown and red needle blight has contributed to this massive felling, therefore the felled area that is recorded in the 2020 forest map (corresponding to the area felled and not reforested due to cuts made in 2019 and 2020) is 15,570.7 ha, a figure considerably higher than the registered in previous years. The immediate consequence of this increase in felled area is the high volume of wood extracted; around 2,5 million m<sup>3</sup> of radiata pine wood harvested in 2018, and probably a similar number in 2019.



**Figure 35.** Evolution of the radiata pine area in the Basque Country (1986–2016, in hectares). (Source: Murua et al., 2018).



**Figure 36.** Forest felling authorizations by species (2007–2017, in m<sup>3</sup>). (Source: Murua et al., 2018).

The second most felled species is eucalyptus (*E. globulus*, mainly), which accounts for 5.3% of fellings (in 2005 it only accounted for 2%) (Figure 36). These activities mainly take place in the province of Bizkaia since it is where the largest area of eucalyptus in the Basque Country is located (about 20,000 ha, 90% of the total). In recent years, more than 150,000 m<sup>3</sup> of eucalyptus wood have been harvested per year. Nevertheless, despite the notable increase in eucalyptus wood felling in recent years, local production is well below the needs of the industry as eucalyptus fibre has multiple uses, from pulp to textiles. For this reason, imported wood is used, mainly from Cantabria, Asturias, Galicia, Portugal and even South America.

Regarding ownership, the entire private forest area of the Basque Country is distributed among some 20,000 owners, so that each owner corresponds to about 5.6 ha of forest. Half of the parcels with forest hectares are in Bizkaia and only 11% in Álava/Araba, but the latter group supposes 42% of the forest area. This is due to the high total and average surface of the public, communal and municipal forests of Álava/Araba. In Gipuzkoa and Bizkaia, the most numerous forest parcels (29% of the cases in both territories) are those between 2 and 5 ha. In contrast, in both territories the number of forest holdings with a considerable forest area, greater than 100 ha, is less than 1% of the total number of forest holdings. In Álava/Araba the situation is quite different. The most frequent forest holdings are those between 0,1 and 1 ha (23% of the total) and those with an area greater than 100 ha reach 11% of the total.

A high percentage of forest holdings (88%) have coniferous areas. This percentage is most notable in Bizkaia and Gipuzkoa (91%) and lower in Alava (65% of the forest holdings). The most frequent size of coniferous surface within the forest holdings of the Basque Country it is between 2 and 5 ha: 30% in Bizkaia and Gipuzkoa and 22% in Álava/Araba. The number of coniferous holdings larger than 100 ha is the same in Bizkaia and Alava (74), but they are relatively more frequent in Alava (5% of all, only 0,7% in Bizkaia).

#### 4.2.2. Forest management and silvicultural systems

Associationism is very present in all activities related to wood in the Basque Country. There are, to name a few, associations of nurseries, forest owners (Associations of Foresters of Bizkaia, Gipuzkoa and Álava/Araba, the Union of Foresters of Southern Europe or USSE...), sawmill industry (Sogesa, Secoma...), auctioneers (Arefor), forestry workers (Basolanak Elkarte), second transformation (Egurlandua). Due to their relationship and membership in the expanded wood cluster, the Paper, Energy and Construction clusters must also be added to this ecosystem of companies in the sector.

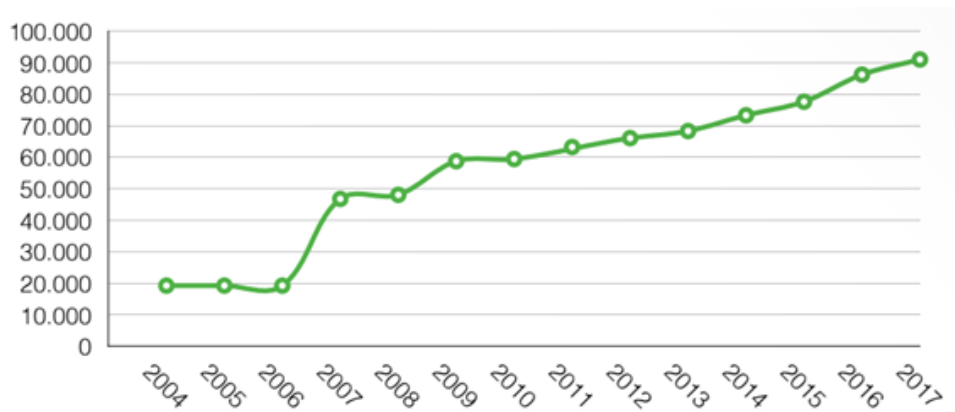


According to the Rural Development Agency "Hazi", dependent on the Basque Government, in the Basque Country are more than 47,000 hectares of public forests, all of them with PEFC certificate.

Regarding private forests, aid is available for the drafting of Management Plans in Gipuzkoa and in Bizkaia, and in both territories the aid is conditioned on the existence of a Management Plan. It is mandatory to have a Management Plan for more than 20 continuous ha or 35 ha altogether. In Bizkaia, the Management Plan is mandatory from any condition to obtain subsidies. At the level of the Basque Country, through the PDR (Rural Development Programs), the Plan from 5 ha is mandatory for owners to access subsidies. In public forest, it has been maintained in 20 continuous hectares and 35 discontinuous hectares.

The rules regarding Management Plans, Exploitation and Aid for forestry and management practices depend on the Provincial Councils, so they are not necessarily homogeneous throughout the Basque Country. In the past, more complex management plans were required, now are indicators at the provincial level. Simplified itineraries in Bizkaia intend to flexibility (cleaning and thinning are requested by age intervals - for example in case of radiata pine, three thinning and final felling).

A Regional Certification, managed by the Regional Applicant Entity BASALDE, groups slightly more than 100,000 ha of more than 3,000 owners. Since this certification system was put into operation in 2004, the certified surface has grown constantly (Figure 37).



**Figure 37.** Evolution of the certified area (ha). (Source: Murua et al., 2018).

This attached forest area represents 23% of the total forest area although its importance varies considerably from one historical territory to another. Thus, the attached forest area represents 41% of the total forest area of Bizkaia, 19% of that of Gipuzkoa and only 9% of that of Álava/Araba.

The pricing of timber in public forests, mostly those of Local Entities, varies greatly between forms of adjudication, although many are by auction and the specifications are prepared by the forest administration. There are also negotiated and by invitation procedures.

In private forests, cutting permits are usually processed by the owner or manager of the plot, and to a lesser extent by the operator or auctioneer. The processing of applications for the final fellings requires the presentation of a form signed by an appraiser registered with the Provincial Councils, which contains cadastral information, the number of trees of each diameter class and the heights of the trees. The process is moderately agile and does not usually generate inconveniences that affect harvesting programs, although according to COSE (Confederation

of Organizations of Foresters of Spain) (2011) it can be improved, since it is common for the permit to take a month and a half. According to this source, the administration is considered very interventionist. The forestry agents check 100% of the harvests, and in the case of work surfaces greater than 5 ha, a simplified environmental assessment study is required that will be supervised by the administration technicians.

Most of the appraisals are made by the forest owners association. The marking of trees is generally carried out by the owners, although the administration reserves the right to do so in the event of exploitation with special ecological interest.

Forest rangers do not have a specific manual to evaluate harvests according to zones, species and types of forestry work, but rather apply their personal criteria (based on extensive tested training).

The fact of having an approved management plan does not entail a great simplification in the procedures, in fact, even if the forest has an approved management plan, it is not exempt from needing an authorization to carry out the work. The uses made in protected areas present many more limitations and greater control. In some cases, these limitations are considered exaggerated, even making it impossible to use them.

### Methodology to harvest and mechanized clearing of *Pinus radiata*

Of the total amount of radiata pine wood exploited, 68% is processed in sawmills in the Basque Country, and almost all of the rest is sold to sawmills of Burgos and Soria. The largest consumer of wood destined for paper is the Smurfit Kappa paper mill in Iurreta (Bizkaia). The harvest of radiata pine in the Basque Country is carried out in 3 phases (Figure 38).



**Figure 38.** Harvest procedure for radiata pine in the Basque Country. (Source: Ugarte and García, 2012).

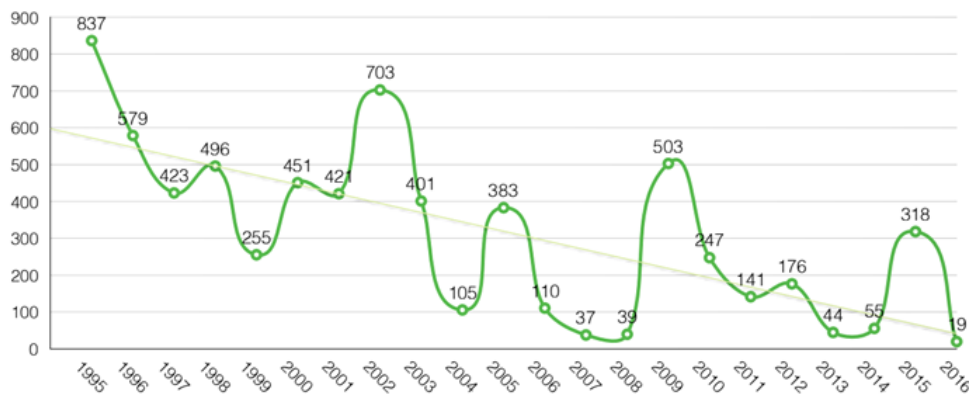
- **First thinning:** It is done at approximately 10–12 years of age. The felling, bucking and stacking of the cuttings is done by hand. Later the packages are removed with the skidder to the track. It is not surprising that in often the first thinning is not carried out, because it does not result in economic benefit.
- **Second thinning:** It is executed at the of approximately 17–19 years. Both felling and bucking are carried out by hand or with a processor, depending on the availability of resources.

- **Final harvest:** With 30–35 years. It is usually done by hand with chainsaw operators, skidders, and self-loading rigs.

The most common method today is made up of four manual operators and two machine operators. Two chainsaw operators are required for felling and delimiting, a skidder, a cutter / mower with a chainsaw, a crane truck or forwarder, and a sixth person to support all operators (help with chainsaw, clean of stumps before felling, cable hitch, regulates traffic...). This pattern is used mainly in final cuts and first thinning, with the variable that in first thinning more people can be used either with a chainsaw or making packages.

The most mechanized and with less manpower is the one for which a person working by hand and three operators with a machine is needed: a chainsaw user, a skidder, a harvester and a logging truck or forwarder. This is normally applied in second and third thinning. The harvesters used in these farms with steep slopes and reduced dimensions work on the track, processing the trees dragged at the foot of the track by the skidder.

On the other hand, the fire prevention policies carried out in recent years by the Provincial Councils have considerably reduced the number of fires. Since the mid 1990s forest fires have followed a decreasing trend, until their number has been reduced to 25% of those suffered at the beginning of the period (Figure 39).



**Figure 39.** Wooded forest area burned between 1996 and 2016. (Source: Murua et al., 2018).

### Barriers to harvesting

- Small size of the property, high age, absenteeism, and lack of initiative of the owners, exacerbated by the drop in prices of quality radiata wood.
- Lack of understanding of the importance of forest management in a significant part of urban public opinion, which sometimes causes electoralist political measures that harm the forest sector and rural development.
- Phytosanitary problems, mainly due to the red and brown needle blight.
- Lack of coordination and divergence between forest policies in the different territories (some of them include fees for individual felling, oppose coniferous plantations or prioritize strict conservation over sustainable management, others do not develop simplified management regimes, etc.)

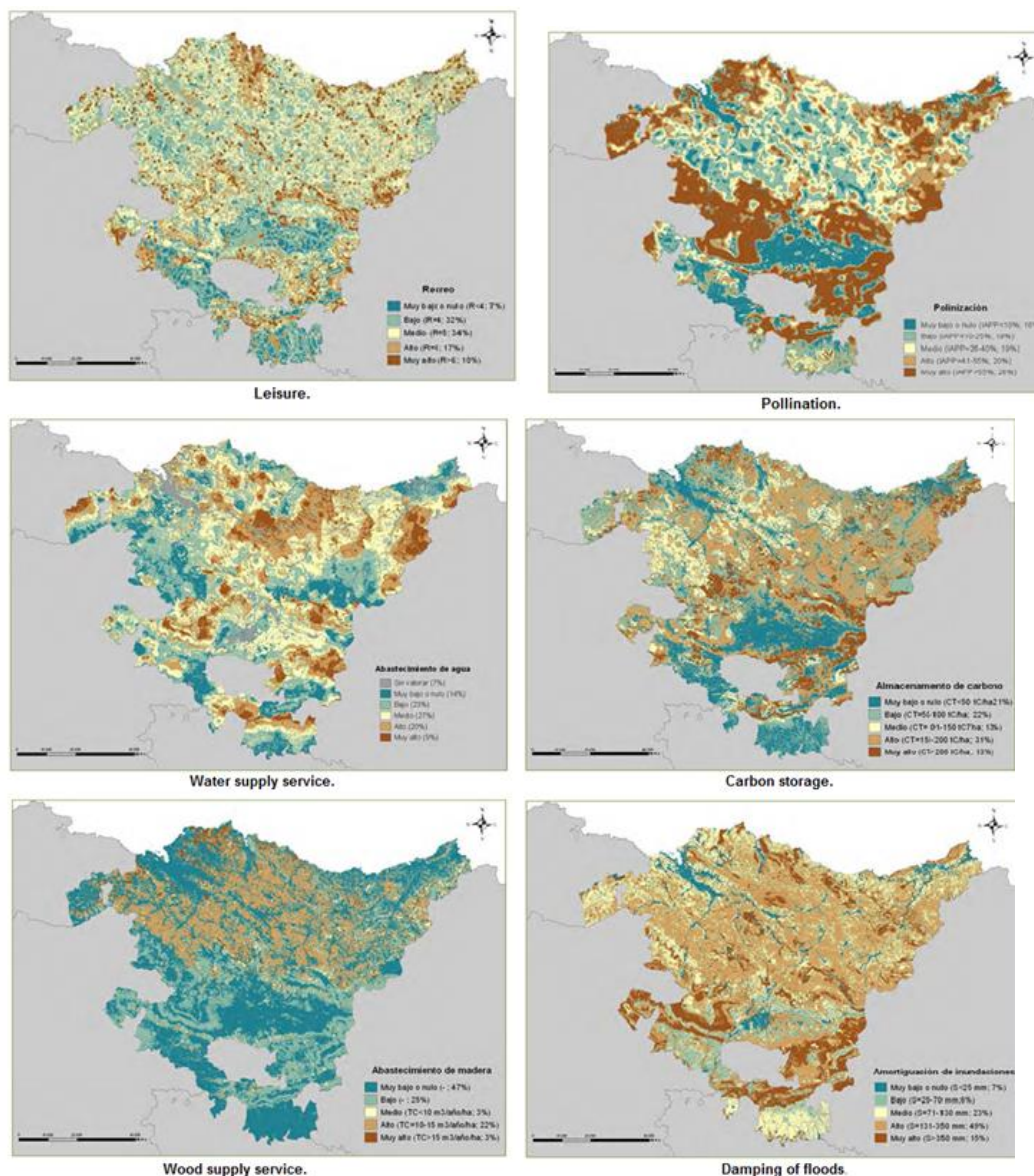
### 4.2.3. Forest functions and ecosystem services

Terrestrial ecosystems occupy more than 90% of the surface of the Basque Country, with natural habitats (forests, meadows and bushes) being the most abundant group (368,000 ha), followed by forest plantations (209,000 ha), mainly conifers, and agricultural crops (80,000 ha).

The UNESCO Chair on Sustainable Development and Environmental Education of the University of the Basque Country (UPV/EHU) [3][4], with the support of the Basque Government, has developed a mapping of the ecosystem services present in the Basque Country. The quantification and mapping of ecosystem services are considered essential requirements for the implementation of the concept of ecosystem services in decision-making on planning and sustainable management of the territory. Knowing the spatial distribution of the different services offers very important information to identify key areas to conserve and / or restore that should be part of the green infrastructure network.

So far, the following services have been mapped (Figure 40).

- Supply services: Food (agriculture and livestock), Wood/paper, Others (mushrooms, hunting...).
- Regulatory services: Habitat maintenance, Climate regulation: carbon storage, Regulation of air quality, Water regulation, Pollination.
- Cultural services: Leisure, Aesthetic enjoyment of the landscape.



**Figure 40.** Ecosystem services of forests. (Source: Basque Government<sup>98</sup>).

The terrestrial ecosystems of the Basque Country supply the population with a large amount of food, some of which are wild (mushrooms, hunting, fruits, etc.). These different ecosystems offer suitable conditions or habitats to feed, reproduce, rest or live for a certain number of species of flora, fauna or microorganisms. The conservation of these habitats is necessary for the survival of these species.

The arboreal communities make up the ideal environment for the development of highly perfected forms of animal and plant life. Various factors favoring wildlife can be found in forest masses: milder climatic conditions in their interior, greater possibility of sustenance and protection for fauna, etc. The existence of various biological niches in the forest creates favorable conditions for the maintenance of biocenosis. The Cantabrian Coast is one of the peninsular regions with the greatest diversity of plant species (Lobo et al., 2001), with some 2,300 plant

<sup>98</sup> [https://www.euskadi.eus/contenidos/documentacion/cartografia\\_ecomilenio/es\\_def/adjuntos/Guia-Methodologica\\_2020.pdf](https://www.euskadi.eus/contenidos/documentacion/cartografia_ecomilenio/es_def/adjuntos/Guia-Methodologica_2020.pdf)

species present in the Basque Country (Campos & Herrera, 2009), making it one of the Spanish areas with greater importance for the conservation of biodiversity. 64% of the natural habitats of the Basque Country are of community interest and are part of the Natura 2000 Network (Council Directive 92/43 / EEC of May 21, 1992, on the conservation of natural habitats and fauna and the wild flora).

The existence in the Basque Country of several species of endemic plants of the Cantabrian coast such as *Apium graveolens subsp. butronensis*, *Armeria pubinervis subsp. orissonensis*, *Armeria cantabrica subsp. vasconica*, *Cytisus commutatus* and *Soldanella villosa* (Loidi et al., 2009), shows the importance of these ecosystems in the conservation of biodiversity.

In addition, vegetation acts as a store or sink for carbon by extracting CO<sub>2</sub> from the atmosphere and fixing the carbon in its biomass. Carbon storage in the ecosystem is mainly distributed in three compartments: living biomass (trunks, leaves, branches and roots), dead biomass (branches and fruits, litter, stumps) and soil (humus and organic matter).

At the same time, the vegetation has a certain capacity to capture air pollutants, which can be calculated based on the leaf area index or the opening of the stomata, based on the pollutant being analyzed. Pollination is another process that takes place in ecosystems, by wind, animals or water. Insects are one of the main pollinators.

On the other hand, forests offer the possibility of carrying out recreational and leisure activities in the open air, which depend on the capacity of the territory for recreational use (infrastructure for recreation and the accessibility of the places to be used) as well as its potential (intrinsic characteristics). Around 20% of the population in winter and 30% in summer, use, to some degree, during weekends, the natural environment. Due to the pandemic situation, the use of forests has increased, offering a market opportunity.

#### 4.2.4. Forest growth and harvest trends

The diseases of the brown and red needle blight, caused by the pathogens *Lecanosticta acicola* Sydow and species of the genus *Dothistroma* (*D. septosporum* (Dorogin) M. Morelet and *D. pini* Hulbary), have indisputably conditioned the current forest panorama in the Basque Country. These pathogens seriously attack the radiata pine, the most abundant species in the Basque Country, which has led to drastic decisions in recent years: from cutting large areas of young pines to committing to the production of other species.

The area in timber state of radiata pine has gone from 46.3% in 2005 to 68.5% in 2016, reflecting the increase in the average age of the wood stands. In successive years, this percentage has decreased slightly, reaching 58% in 2020, probably due to the incentives for cutting extra-mature masses of this species and the rapid spread of the brown and red needle blight disease.

Likewise, the area felled by stands of radiata pine trees is increasing. Since the Forest Inventory of 2011, it has increased progressively, the increase registered in recent years (especially in 2019) being very notable, 15,570 ha, a figure considerably higher than that registered in previous years. In Gipuzkoa in 2020, the logged area was 6,618 ha and the reforested area is just over a third (2,404 ha).

On the other hand, the area of young stands is showing, in general, a continuous decline, since young stands affected by the diseases have also been felled. In 2005 these accounted for 27% of the total area, a percentage that is limited to 10% in 2020. The few replanting of radiata pine

in recent years, in favor of others such as cryptomery, Douglas fir, sequoia and eucalyptus, along with increase in the Atlantic mixed forest, explain this evolution.

Cryptomeria (*Cryptomeria japonica*) has made its appearance in Basque forests, mainly in Gipuzkoa (77.4%), mostly in the Urola Costa region (35.3%) but also in Alto Deba (11.3%) and Bajo Deba (14.5%). The same happens with the Sequoia (*Sequoia sempervirens*), hardly present in the Basque Country, and which today takes more than 700 ha (93.5% in Gipuzkoa).

The maritime pine (*Pinus pinaster*) is another species that is being used as an alternative to radiata pine, mainly in Bizkaia and Gipuzkoa and to a lesser extent in Álava/Araba. Eucalyptus has also been used in recent years in Bizkaia but the Provincial Council of Bizkaia (the administrative entity) has launched plans to encourage the use of native hardwoods and regulate the use of eucalyptus, which Gipuzkoa had previously done.

Therefore, the Basque forestry challenge currently focuses on tackling the different forest diseases and on adequately planning the existing and future forest resources to guarantee the provision of the resources provided by the forest. In recent months there has been an increase in the prices of wood, so if this phenomenon is transferred to the owners, it may be a good time for the forestry sector.

#### 4.2.5. Climate change and forest resilience

The increase in average temperatures and the concentration of carbon dioxide in the atmosphere has a fertilizing effect on trees. In the Cantabrian-Pyrenean areas where the availability of water is sufficient, the productivity of the forests could increase as a consequence of climate change. However, the increased number of heat waves and droughts forecast for the next few decades is likely to limit the availability of water in the soil, reducing both the productivity and health of many forests.

Increased extreme events (storms, fires) and a higher prevalence of pests could negatively influence the ability of forests to act as a carbon sink. Therefore, it is expected that if the health status of forests worsens, their growth will also be reduced, and as a consequence, also their ability to capture atmospheric CO<sub>2</sub> and contribute to the mitigation of climate change.

Thus, with atmospheric CO<sub>2</sub> availability equivalent to the current one, various possible trends in forest productivity can be broadly highlighted:

- In areas with increased temperatures but without water limitations (the evolution of rainfall is particularly uncertain), a possible increase in forest productivity can be expected.
- In areas affected by an increase in temperatures and a decrease in rainfall (or at least a modification of the rainfall pattern in terms of frequency), a decrease in forest productivity can be expected.
- In all cases, the greater frequency and intensity of extreme climatic events will tend to weaken the stands, which can lead, if tolerance thresholds are exceeded, to reduce the volume of standing timber.

The forest plays an important role in protection against the natural phenomena that we find in the mountainous massif (snow avalanches, torrential floods, debris currents, detachment of blocks and landslides). Forest cover limits landslides (fixing the soils and snow cover in areas where avalanches are triggered, limiting surface streams...) and reduces the resulting impacts (braking, channeling or stopping rocks or avalanches on medium slope...).

Although in the Basque Country fires are not frequent, the normalization of extreme phenomena together with increases in temperature and droughts make the risk increase, so forest management will be key to their prevention.

## 4.3. Markets and trends of the wood construction chain

### 4.3.1. Forest-based industries and related sectors

The construction industry in the Basque Country is made up of 27,100 companies with an approximate turnover of 16,870 million euros and employs 62,051 workers directly. It is a fragmented sector, where 96% of companies have fewer than 9 workers.

Within the construction sector, three main subsectors stand out: building, civil works and rehabilitation and conservation. With a turnover of 5,783 million euros, the building represents 74% of the sector as a whole. Civil works invoice 1,884 million euros, while rehabilitation and conservation represent only 2% of the turnover. The construction sector accounts for 11% of the Basque Country's GDP, and more than half is concentrated in the province of Bizkaia.

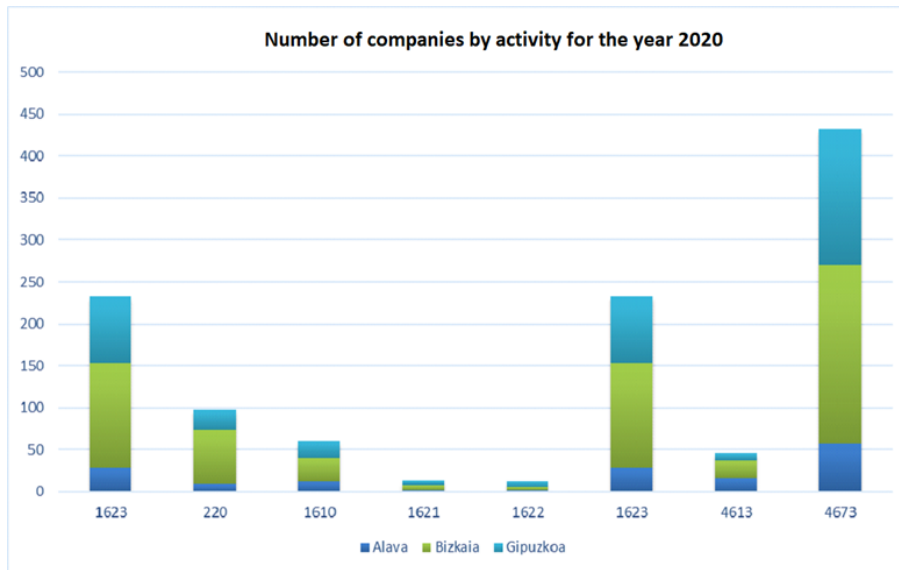
Despite being the subsector that represents the least turnover, an upward trend has been observed in recent years, and it is expected that the trend will continue to grow promoted by European, national and local strategies, which are committed to the rehabilitation and conservation of the built park.

Within this broad sector, the wood construction companies in the Basque Country focus on the following catalogued activities:

- **1610** Sawing and planning of wood.
- **1621** Manufacture of veneers and panels of wood.
- **1622** Manufacture of assembled wooden floors.
- **1623** Manufacture of other wooden structures and pieces of carpentry and joinery for construction.
- **4613** Intermediaries involved in the trade of wood and construction materials.
- **4673** Wholesale of wood, construction materials and sanitary equipment.

And the number of companies linked to wood construction by activity is presented in Figure 41.





**Figure 41.** Number of companies by activity for the year 2020. (Source: Murua et al., 2018).

At the state level, the wood industry employs 53,465 people, of which 29,125 develop products mainly for the construction sector. 9,573 companies have their activity associated with the wood and cork industry, of which 5,808 are closely linked to the construction sector. More specifically, 5,225 companies have their activity associated with 1623 "Manufacture of other wooden structures and pieces of carpentry and joinery for construction". Therefore, 54% of companies in the wood and cork industry have their activity associated with the construction sector. Regarding turnover, the wood industry mobilized € 7,823.54 million, of which € 4,232 million are mainly associated with the construction sector. This value increased between 2018 and 2019 by 5%.

The main products offered by companies are:

- Exterior and interior carpentry.
- Floors, platforms and baseboards.
- Wooden stairs.
- Structural wood.
- Glued laminated wood.
- Boards and slatted boards.
- Wood insulation.
- Timber frame.
- CLT.
- Facades and interior cladding.
- Laminate structure.

The main services provided by companies are:

- Design and calculation of the solutions demanded by customers.
- Manufacture and machining of structures.
- Logistics and on-site assembly.
- Some of the companies begin to provide after-sales services.

### 4.3.2. Wood markets and products trade

The business volume of the wood industry has been on the rise since 2016, increasing in the case of the Basque Country by 10.93% in four years, and in the case of Spain by 20.76%. This increase shows the increase in the use of wood in the construction sector nationally and in the Basque Country.

Regarding the market for Basque companies, 25% of wood construction goes to public works and 75% to private works. 50% of the projects are new construction and 50% are residential housing rehabilitation. 75% is for residential use, and of that percentage, 75% is low-rise. The developments in height are under development and still only represent 25% of the total activity of the residential work. The main constructive solutions used in this type of work are the wooden frame, the CLT and the Contralaminated wood. The remaining 25% is allocated to endowment facilities (hospitals, educational, sports centers...), tertiary use (offices, shops, hotels...) or industrial (agro-livestock), where the most used material is CLT or Timber Frame.

Regarding the location of wood construction works/projects carried out by Basque companies, 65% are carried out in the Basque Country, 25% on a state level and the remaining 10% on an international scale, a large part in the south of France by proximity.

On the other hand, it is a reality that the edifications in Spain, and more specifically that of the Basque Country, is one of the oldest in the EU. It should be noted that 63% of the Basque Country's built stock dates from before 1980 and is therefore the second oldest in the EU.

Considering the volume of buildings that require rehabilitation and knowing that currently the volume of activity in the sector that is allocated to rehabilitation is 28.1%, a new opportunity niche associated with housing rehabilitation is clearly identified.

### 4.3.3. Future outlook and needs for transformation

In recent years there has been an increase in the demand for wood by society in the Basque Country. Currently, although there is still much to improve, awareness of sustainability, caring for the environment and people's health, has led to an increase in the demand for homes made of wood and natural materials. It is expected that this trend will continue to rise over the next few years.

The development of constructive solutions that are as industrialized as possible in wood, will allow interventions to be carried out in a more agile way and with more sustainable parameters than if they were carried out with other materials.

New construction of residential buildings in 2021 had a 7.5% increase, and it is expected to start 2022 with starting levels similar to 2019. Another aspect to highlight is the increase in demand compared to 2019 by 4.5% more homes during 2021. The rehabilitation, associated with the Recovery Plan, should make 2022 a year of high growth, expecting an annual growth of 7% during the period 2021–2023.

Wood construction has undergone a significant change over the last few years. Resources have been allocated to increase research, technical development, construction industrialization, and quality controls.

Despite the fact that the use of wood in the most common construction has begun to increase, there is still a lack of culture in society to accept wood as a material as valid as concrete and steel.

## 4.4. Policies and support schemes

### 4.4.1. National policies and programmes

At the national level, the main instrument for the development of the bioeconomy is the Spanish Bioeconomy Strategy: Horizon 2030[5], published in 2015. It defines the bioeconomy as: “the set of economic activities that obtain products and services, generating economic value, using, as fundamental elements the resources of biological origin, in an efficient and sustainable way”. Its objective is the production and commercialization of food, as well as forest products, bioproducts and bioenergy, obtained through physical, chemical, biochemical or biological transformations of organic matter not intended for human or animal consumption and that involve environmentally friendly processes, as well such as the development of rural environments.

This strategy was developed by the then Ministry of Economy and Competitiveness, with the collaboration of the then Ministry of Agriculture, Food and Environment and coordinated by the director of the National Institute for Agricultural and Food Research and Technology (INIA).

The strategy integrates as sectors targeted at the agri-food sector (made up of agriculture, livestock, fishing and aquaculture, and food processing and marketing), as well as others such as the forestry sector, industrial bioproducts, bioenergy obtained from biomass, and that related to services associated with rural environments.

According to data from the Joint Research Center, the bioeconomy sector generated in Spain in 2017 a business volume of 219,366 million euros (9% of the total for the EU-28), 65,132 million euros of added value (10% of the EU-28 total) and 1.42 million jobs (8% of the EU-28 total).

At the regional level, various Autonomous Communities have or are working on some type of bioeconomy planning through specific initiatives (such as the Andalusian Circular Bioeconomy Strategy), while others address it within the framework of the circular economy or through other types of regulations.

On the other hand, recently, Law 7/2021, of May 20, on Climate Change and Energy Transition[6] has been approved at the Spanish state level. In it, express mention is made of the importance of the role of foresters as protective agents of forest resources and their services. Likewise, this Law serves to develop old laws that were not fully operational for the owners to receive incentives for the environmental externalities of their forests.

Furthermore, the law recognizes the need to invest in forests in relation to their function of carbon stocks, in addition to recognizing the importance of bio-construction with materials with a minimum carbon footprint, sequestration of the same and optimal insulation, which places wood and other forest products in a strategic location.

The importance of renewable energies is also included in it. This places biomass of forest origin, especially that which has no other possible material use, as a key element.

Although the mere approval and existence of this law represents a great advance for the Spanish and Basque forestry sector, it is necessary to move towards a series of firm commitments that materialize all these aspects that are discussed in the law, as well as the development of plans and strategies that gradually give a transition to the use of wood as a sustainable material.

#### 4.4.2. Regional policies and programmes

At the Basque Country level, there are different tools to promote the use of wood and develop the bioeconomy - the Basque Country has been working on circular economy for years. Since 2000, the Basque economy has grown by 26%, while the consumption of materials has decreased by 25% and the volume of urban waste that ends up in landfill has been reduced by 56%.

The first actions around the bioeconomy in the Basque Country took place in 2017 and 2018, with visits to European countries such as Germany and Finland, a benchmark in this matter. The main objective of these visits was to learn first-hand about the successful experiences in both public and private circular forest bioeconomics in these two countries. As a result, in addition to obtaining a model and knowledge to advance, a collaboration network is created with top-level international experts who actively accompany the Basque Country in the next steps to advance in the bioeconomy.

After it, in 2019 the Circular Forest Bioeconomy Roadmap was launched, with the vision to make the Basque Country a benchmark European region in terms of circular forestry bioeconomy, based on a balanced and sustainable development model, which encourages the generation and consolidation of business activity with high added value from the use of optimal forest resources of the territory.

At the end of 2019, the Basque Alliance for the Bioeconomy [7], an initiative carried out by the Department of Economic Development and Infrastructures of the Basque Government, in collaboration with a group of companies, was created. Through this, it is intended to generate a network of business agents that contributes to reinforcing this economic model of generation of products based on biological resources and to establish a structured collaboration between institutions, technology centers and companies that collaborate in developing this model of production and generation of economy.

Bioeconomy projects are based mainly on wood resources, although there are cases of products based on other types of bio resources, such as grape seeds. The main companies involved are Glefaran, Biotermiak, Cikautxo, Egoin, Maier, Papresa, Skunfunk, Lana, SmufitKappa and BaskEgur. In addition to these companies, the public entities EVE, SPRI, HAZI and NEIKER are members of this Alliance under the endorsement of the European Forest Institute (EFI).

Recently, in 2020, EFI launched the *Bioregions Facility* [8], a project in which the Basque Country assumes the presidency and in which Finland (North Karelia) and Germany (Westphalia) participate. This project is only open to interested European regions that have a clear objective in the field of bioeconomy and is based on the following four pillars: i) innovation: support for innovation in bioeconomy through specific programs and start-up events. launch and escalation; ii) institutions: exchange of experiences, discussing science-informed policies to support the creation of markets for biobased products; iii) regional business infrastructure and ecosystems: raising awareness of successful cases, connecting relevant actors, facilitating changes; and finally iv) investments: connecting regions to existing public-private associations, facilitating dialogue between SME's entrepreneurs, investors and those with political responsibility.

The public environmental management company, Ihobe [9], has a plan aligned with the Action Plan for the circular economy of the European Commission, the Circular Economy and Bioeconomy Plan of Euskadi 2024 establishes four strategic axes: production, consumption, waste management and secondary raw materials, and competitiveness and innovation.

On the other hand, there is the Strategic Plan for the Wood Sector of the Basque Country (PEMA)[10], with the aim of creating synergies between the forestry sector and the policies of the government administration.

Therefore, it is a strategic plan that seeks that the forestry sector activities and the actions of the government administration are common and in the same sense, so that what is written in it is proposed by and for the sector with the help of the Basque Government. Different activities and projects are framed within the PEMA that seek to promote the Basque forestry sector. These activities and projects are adjusted to the reality and needs of the sector and are developed in different areas of action. Five areas of action are distinguished: competitiveness, training, environment, communication and internationalization.

- In the area of competitiveness, the activities developed are the following: calculation and improvement of profitability, improvements in the competitiveness of the company, maintenance of technological leadership at the state level, positioning the Basque wood-forestry sector at the forefront help in proposing viable business projects, development of the bio-economy based on the forestry sector, minimizing bureaucratic and administrative obstacles in forestry activity, providing the Basque forestry sector with management tools, participation and knowledge of what is performed outside its scope and borders.
- In the training area, the aim is to provide the forestry sector with trained personnel to help improve the sector's competitiveness, disseminate, and publicize the environmental and economic potential of the forestry sector in schools, professional and university training.
- In the environmental field, promote the use of wood in all areas, use the most important certifications as a badge of the values of the sector.
- In communication, try to value the sector by clearing up doubts and existing topics, achieve greater use of local wood, and give Basque wood a brand image.
- And finally, in internationalization, to value Basque wood and the rest of the products that the Basque sector generates internationally, to acquire knowledge of advanced technologies and products abroad, to search for market opportunities abroad, to attract marketers and economic agents to the Basque Country.

To achieve all of them, this plan includes different activities, which have been carried out in recent years and it is intended to continue. The most representative are: EUTR project for the traceability of legal wood, professional and university training in collaboration with companies and universities (COAVN-UPV/EHU), sectorial EDPs, PEFC certification, attendance and presence in European fairs (Carrefour du Bois, Elmia wood , Hannover...), creation of new technologies such as a radiata pine seed collection system, agreements with forest owners associations, agreements with the Basque Institute for Occupational Safety and Health for the prevention of occupational accidents, construction works of a public nature with wood as the base material (VISESA), outreach events (Wood Week, Egurtek, Berdeago, Bioterra, festivals in schools...).

From this, it should be noted that the Basque Country has the only sawn wood table of radiata pine in Europe[11] and the work of a public nature built in Hondarribia (Basque Country), the largest wooden building in Spain.

In addition, there is the Euskadi Wood Observatory, a collaboration between Hazi, the Basque Government, BaskEgur and the Department of Economics and Business of the University of the Basque Country to analyze the reality of the forestry sector and lay the foundations for its development. An annual report is prepared that analyzes the socioeconomic and

environmental situation of the sector; characterization of the forest area, timber stocks, timber prices, macroeconomic data on timber production, analysis of the companies that make up the value chain, environmental aspects, current market and trends.

On the other hand, Euskobasoa 2050[12] is a project that aims to achieve a restructuring of the sector with initiatives to further advance knowledge, research and dissemination of local wood. It is a program led by research centers, Basque government and BaskEgur in collaboration with nurserymen, forest owners, processing industry and marketers. One of the lines of research focuses on the genetic improvement of the radiata pine from the genetic base of this species obtained through the work begun in 1984. Other lines of action are the selection of alternative species to radiata pine resistant to climate change, zoning of the Basque forest area based on management objectives, fertilization tests, study of epidemiology of forest diseases.

BaskEgur plays an important role within the Basque forestry sector as a catalyst for the activities of the PEMA, manager of the PEFC certificate, cohesive of all the sector associations and representative body of the sector, among other functions.

## **4.5. Regional innovation ecosystem**

### **4.5.1. Value chains and stakeholders**

The Basque innovation ecosystem is formed by a diverse and multifunctional number of entities with a wide range of capacities, functions and responsibilities (Figure 42). In this ecosystem different types of entities are present:

- Public agencies of the Basque Government
- Clusters of private companies
- Regional associations
- Universities and Educational Centers
- Technological Research Centers
- Regional Chambers of Commerce

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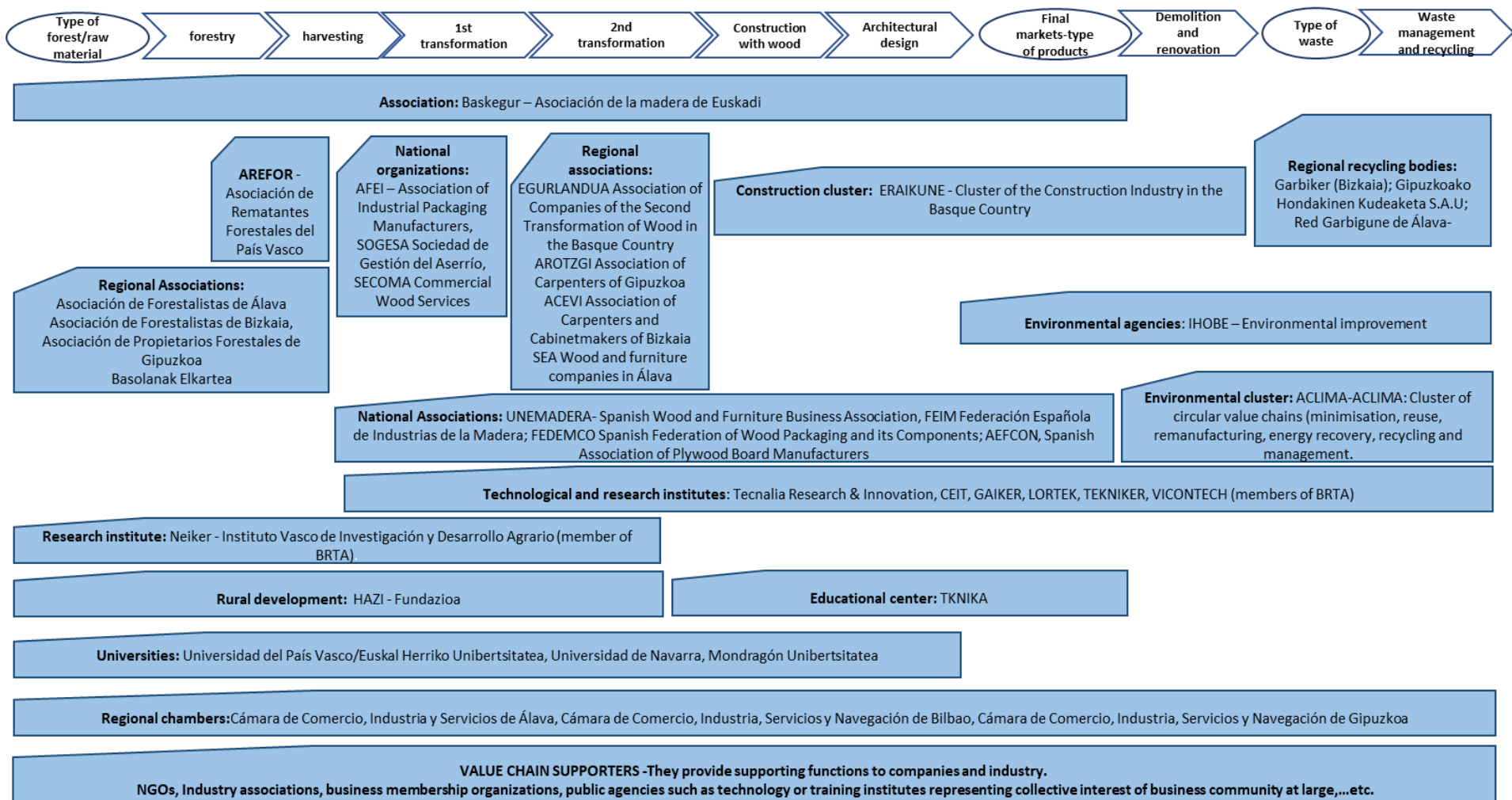
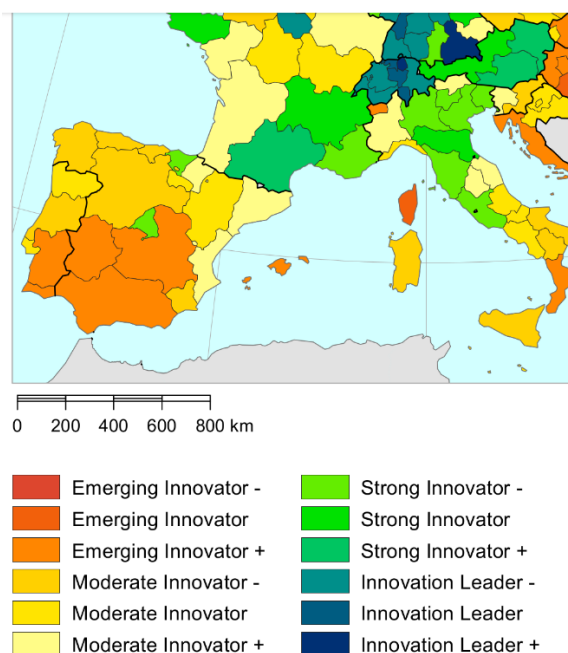


Figure 42. Wood construction value chain stakeholder map of Basque Region, Spain (own figure)

#### 4.5.2. Competencies, capacities, key actors

The Basque Country is a Spanish region with a high degree of innovation that is above the European average according to the latest statistics (Figure 43). Three key factors have contributed to this position: capacities and research infrastructures, a highly skilled human capital and a stable funding framework for research and innovation. The Basque Country is the region of Spain that allocates the highest percentage of spending on R&D activities over GDP, with 1.86%. The province with the highest percentage of R&D spending is Gipuzkoa, which in 2019 was 2.4% of GDP, above the European average (2.18% for that same year). The Spanish average is 1.25% of GDP.



**Figure 43.** Spain: details of the European Innovation scoreboard (2021).

Several approaches have been defined to create and organise the ecosystem to enable new research and innovation initiatives to take off.

In terms of forestry-wood research competencies, the BASOTEK consortium of research entities was created in 2019 with the objective of responding to the current and future challenges of the forestry-wood value chain in the Basque Country. It is composed of technology centres and entities that bring together the main agents in the forestry-wood value chain in the Basque Country (BaskEgur, HAZI, NEIKER, Tecnalia, University of the Basque Country/Euskal Herriko Unibertsitatea (UPV/EHU) and Vicomtech). This consortium is supported also by the Housing Directorate of the Basque Government and the Provincial Councils of Araba, Bizkaia and Gipuzkoa. The European Forest Institute (EFI) and the Union of South European Foresters (USSE) also collaborate in BASOTEK.

The main approach to integrate all the research capacities in the Basque Country has been the creation of the *Basque Research & Technology Alliance* [brta.eus](http://brta.eus) that integrates many of the Basque technological research institutions except for Universities and Industry R&D entities. This alliance comprises 3,700 researchers, 300 MEUR annual budget, 1,300 annual scientific publications and 100 annual patents. It is highly multidisciplinary and includes all the activities



related to bioeconomy research. This alliance includes the following research centres related to bioeconomy value chain:

- AZTI, Marine and food science and technology [azti.es](http://azti.es)
- CEIT, Industrial research projects [ceit.es](http://ceit.es)
- CIDETEC, Applied research [cidetec.es](http://cidetec.es)
- CIC NANOGUNE, Cooperative Research Centre in nanotechnology [nanogune.eu](http://nanogune.eu)
- CIC ENERGIGUNE, Cooperative Research Centre in electrochemical and thermal energy storage [cicenergigune.com](http://cicenergigune.com)
- GAIKER, Research and the provision of Technological and Innovative Services for companies [gaiker.es](http://gaiker.es)
- LORTEK, Manufacturing processes and their digitisation [lortek.es](http://lortek.es)
- NEIKER, Agricultural research, innovation and development [neiker.eus](http://neiker.eus)
- TECNALIA, Centre for Research and Technological Development [tecnalia.com](http://tecnalia.com)
- TEKNIKER, Advanced Manufacturing technologies, Surface Engineering, Product Engineering and ICTs [tekniker.es](http://tekniker.es)
- VICOMTECH, applied research in digital technologies [vicomtech.org](http://vicomtech.org)

The Basque University System is comprised of three universities:

- Universidad del País Vasco/Euskal Herriko Unibertsitatea University of the Basque Country. Is the only public university in the Basque Country, and has an exclusive offer of degrees in Experimental Sciences and Health Sciences. It has 45,000 students and 5,000 employees ([ehu.eus](http://ehu.eus))
- Universidad de Deusto It has a religious nature and has a programme traditionally focused on social sciences, economics and law. It has 10,000 students and 500 employees ([deusto.es](http://deusto.es))
- Mondragon Unibertsitatea. It is part of the Mondragón Corporation and is specialised in Technical Education/ Engineering, Business Studies, Educational Sciences and Audiovisual Communication ([mondragon.edu](http://mondragon.edu), [mondragon-corporation.com](http://mondragon-corporation.com))

In terms of education and training, a postgraduate master entitled “Master in wood structures, design and construction” is taught in the University of the Basque Country. It is specialised in the sector of wood construction. This is a School of Architecture’s own degree. Teaching is complemented by master classes given by internationally renowned architects. Students also can get to know first-hand the reality of Basque companies specialising in wood for construction ([mastermadera.com](http://mastermadera.com)).

Other relevant actors in the Basque Innovation Ecosystem system are the Professional training schools that offer around 170 different qualifications aimed at enabling people to achieve professional competence and aspire to qualified jobs. It includes the Dual Professional Training programme focused that takes place in a shared manner between the training centre and the company. In this sense, Teknika has been created with the objective of making research and applied innovation the backbone of professional training ([tknika.eus](http://tknika.eus)).

As mentioned above, the research funding framework is stable, with a continuous increase in resources in recent years. Several government agencies are involved, the most relevant being the SPRI Group (Entity for the Promotion of the Basque Industry). A wide range of funding programmes are available ([spri.eus](http://spri.eus)).

Among other, the following can be used in the forestry-wood value chain:

- ELKARTEK, grants for collaborative research in the strategic areas of Smart Industry, Energy and Health, and research projects with high industrial potential.
- HAZITEK, Industrial Research and Experimental Development, for the development of new products, processes and services, improvement of existing ones through R&D.
- AZPITEK, acquisition of research infrastructures and equipment.
- BASQUE FONDO, public investment instrument for micro-enterprises and industrial SMEs less than 3 years old that facilitates the maturation of a business idea.
- INTRAEMPREDIMIENTO 2021, support to companies in the development of new businesses and diversification towards new activities, products and services arising from new opportunities.

In addition, there is a specific annual call for proposals for the bioeconomy which aims to stimulate and incentivise the implementation of pilot and demonstration projects for innovation in the field of the bioeconomy<sup>99</sup>.

## 4.6. Needs and starting points for transformation

### 4.6.1. SWOT analysis

The following SWOT analysis arises after having analysed by different agents (research centres, companies, owners ...) the context in which the Basque Forest-Wood sector currently exists (Table 5).

**Table 5.** Regional SWOT table for wood construction for the Basque Country region.

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>• Universities, technology and research centers that can help propose solutions to the challenges facing society and the sector.</li> <li>• Well-structured forestry-wood sector that will favour the incorporation of the knowledge-innovation generated by this plan.</li> <li>• Specialization in the forest-wood chain that improves the competitiveness of the industry.</li> <li>• PEFC Regional Certification.</li> <li>• Support from administrations.</li> </ul>	<ul style="list-style-type: none"> <li>• Complex orography.</li> <li>• Smallholding and age of the owners.</li> <li>• Lack of sectorial incentives to achieve adequate timber mobilization.</li> <li>• Industries mostly far from industry 4.0, and great dependence on commodities.</li> <li>• Research centers have failed to capture the trust of the forestry-wood sector.</li> <li>• Unprofessional mountain management and lack of machinery adapted to mountainous terrain.</li> <li>• Small forestry research teams without infrastructure to establish long-term trials.</li> </ul>

<sup>99</sup> [https://www.euskadi.eus/ayuda\\_subvencion/2021/innovacion-en-bioeconomia/web01-tramite/es/](https://www.euskadi.eus/ayuda_subvencion/2021/innovacion-en-bioeconomia/web01-tramite/es/)

OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>• Ability to create national and international strategic alliances.</li> <li>• Nature Tourism to complete rents in rural areas.</li> <li>• Carbon market.</li> <li>• Circular Bioeconomy and Green Economy.</li> <li>• Payments for Ecosystem Services</li> <li>• Scientific-technological capacity to increase the added value of forest products.</li> </ul>	<ul style="list-style-type: none"> <li>• Abandonment of forestry investment.</li> <li>• Possible loss of interest due to long waiting cycles.</li> <li>• Inconsistencies in planning instruments to manage the territory.</li> <li>• Climate change: uncertain future.</li> <li>• Health status of forest stands.</li> <li>• Need to intensify wood production due to increased demand.</li> <li>• Strong industry specialization in radiata pine and eucalyptus, which makes it difficult to put other species of interest on the local market.</li> </ul>

#### 4.6.2. Main conclusions for a regional roadmap

- It is true that there is a commitment to wood in the European framework. However, in order to achieve the objectives set in the Basque Country, it is necessary that the bet be at the regional level and not just European. In other words, a strong commitment by the Country towards wood as one of the central axes of the development model is necessary.
- It is necessary to continue working on the perpetuation of a consolidated market that allows the development of a broad, diverse and versatile ecosystem of companies and agents (strong market = strong ecosystem). At the national level, the Basque Country can be a benchmark because it has a sector that is capable of closing the cycle from the forests to the product that comes out of the industry, but the companies need to be strengthened. In a globalized market, the size of the company is important, which forces it to specialize.
- It is necessary to continue working with the population in educating and raising awareness about the importance of the sector, as well as with the members of the forestry sector and their training. Just as it is not the same point of appreciation of the European central and northern countries on the forestry sector with respect to those of the south, neither is their degree of professionalization of both.
- In the Basque Country the tradition of building with wood that existed for decades and centuries has been lost, contrary to what happened in other countries where this custom has persisted. The professionals who traditionally worked with wood have disappeared, also losing the knowledge they held. Currently, there is a profound lack of knowledge in the construction sector about wood as a construction material, in addition to many prejudices that must be overcome, and the only existing knowledge is concentrated in very few professionals or companies. Therefore, the reconstruction and dissemination of this knowledge is necessary.
- Currently, approximately 70% of the wood used in the Basque Country is from local sources, so there is a sound resource efficiency. However, there is still a great deal of room for improvement. Much of this wood is used to produce boards, paper and other low-medium value-added materials. If this wood were for other uses, such as construction, it would create greater added value throughout the value chain, the CO<sub>2</sub> would be accumulated for longer and a more sustainable economic model would be established.

- The efficiency in the use of local wood in the Basque Country can be a benchmark in southern Europe and is recognized at European level linked to quality radiata pine wood. However, hard work is required on two lines. On the one hand, in achieving a framework in which there is a serious commitment to wood with engagement of minimum use of wood in construction, and on the other, in establishing at the same time a model based on the long-term circular bioeconomy, for example with the recyclability of wood.
- The conditions imposed by forest diseases must continue to be studied, their evolution analysed and alternatives developed. Currently, work is being done with alternative tree species with similar aptitudes to radiata pine.

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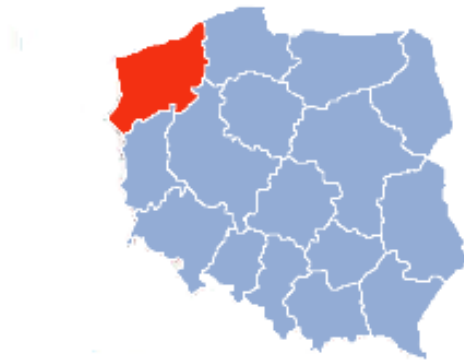
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## 5. Regional profile West Pomerania, Poland<sup>100</sup>

### 5.1. Context

Geography, land use, demographics

West Pomerania is a region located on the Baltic Sea coast, in north-western Poland, with a coastline of 185 km (Figure 44). West Pomerania is the fifth largest voivodeship in Poland and covers over 7% of the country's area (22,892 km<sup>2</sup>). The population was 1,675,502 in 2019<sup>101</sup>, which is almost 4.5% of Poland's population. The northern and western borders of the region, almost 200 km each, are at the same time the state borders. The maritime border with the Baltic Sea and Germany is a unique and key development driver for the whole Pomerania. The regional capital city is Szczecin, which is also its main administrative, economic and cultural centre with over 398,000 inhabitants in 2020<sup>102</sup>



**Figure 44.** Location of West Pomerania in Poland.

Due to its location, international regional cooperation is of significantly influences for West Pomerania Voivodeship. The most intensive are the region's relations with the German border states of Mecklenburg-Vorpommern and Brandenburg, and with Sweden's Scania province. Polish-German cooperation is of particular importance in the areas of economic and tourist use of the Odra River, cooperation of rescue services, cooperation in spatial planning and environmental protection, development of communication infrastructure and development of joint curricula and education.

Factors influencing the voivodeship economy include its location (coastal and near the border), as well as high economic activity of its inhabitants, which makes Western Pomerania a good starting position for development in the Baltic Sea region and the Western Poland macro-region. Specific natural conditions determine the development of certain sectors of the economy, differently than those having place in the rest of Poland. West Pomerania excels in blue economy, including all activities related to the maritime economy (manufacturing activities and

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<sup>101</sup> Eurostat, 2020, <https://ec.europa.eu/eurostat/data/database>

<sup>102</sup> Statistical Office in Szczecin, 2021, <https://szczecin.stat.gov.pl/en/>

related transport branches) and in green economy, aimed at improving the quality of human life while reducing the risks to natural environment, including tourism, agriculture and forestry, as well as production of energy from renewable sources<sup>103</sup>.

## Demographics

The population of West Pomeranian Voivodeship amounts to 1.7 million people (as of December 31, 2019), which is about 4.4% of the country's population. The population density in this region is 74 people per 1 km<sup>2</sup> and is one of the lowest in Poland. The feminization rate is almost 106 with the highest values in Szczecin, Koszalin and Kołobrzeg district. Over the last few years, the population of the voivodeship has been systematically declining. In the overall balance, this decrease concerns both city and rural dwellers, and it is predicted to continue deepen in the future (according to the statistical office, in 2050 the number of inhabitants of the West Pomeranian Voivodeship may amount to 1.5 million people, which will mean a decrease of 14.3% compared to 2019).

Two trends are clearly visible in the migration processes - drawing population out of cities to suburban areas within functional areas (these processes intensify especially in large cities) and the depopulation of small and medium-sized cities that are losing importance in the existing functional system of urban - rural areas. The share of emigrants in relation to the voivodeship's population is, in the case of Western Pomerania, the 5th highest in the country. Economic emigration has a negative impact on the number of the voivodeship's population and is one of the development problems, especially in the context of low unemployment resulting in workers shortage<sup>104</sup>.

**Rural areas** cover 94% of the voivodeship's area. The share of rural residents in the total population of the region amounts to 31.6% and is clearly lower than in other parts of the country. This is mainly due to the high forest cover and high concentration of the rural settlement network. A low percentage of the rural population, living mainly from work in agriculture, may in the future be the cause of stronger migration processes from rural areas. The constant outflow of young people from rural areas related to problems on local labour markets is worrying. The specificity of the voivodeship is the large number of former state-owned farming estates, which are often places of accumulation of various social problems. In the 90's on the territory of West Pomerania, in connection with the privatization of over 200 state-owned farms, nearly 30 thousand people directly lost their jobs<sup>105</sup>.

The development of rural areas is impossible without the leading role of city centres. Its specificity is largely determined by the uneven distribution of the city network. As a result in West Pomerania the vast area in the centre of the region is devoid of sufficient development impulses and characterized by the accumulation of many unfavourable socio-economic phenomena.

The share of the **urban population** in West Pomerania voivodeship (68.5%) is higher than the average national indicator, which in 2018 was 60.05%. This region ranks third in Poland, in

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<sup>103</sup> Action Plan for West Pomerania, 2018, [interregeurope.eu/fileadmin/user\\_upload/tx\\_tevprojects/library/file\\_1526023109.pdf](https://interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1526023109.pdf)

<sup>104</sup> Ibid.

<sup>105</sup> Zachodniopomorskie Voivodeship Development Strategy up to 2030, 2019, Ed. Geblewicz O., [http://eregion.wzp.pl/sites/default/files/srwz\\_2030\\_en\\_size.pdf](http://eregion.wzp.pl/sites/default/files/srwz_2030_en_size.pdf)



terms of the percentage of population living in cities. In 2018, there were 3,081 localities in the West Pomerania Province: 3,015 rural localities and 66 towns, of which 2 have more than 100,000 inhabitants (Szczecin – 398,000, Koszalin – 106,000). These two largest agglomeration areas, inhabited by 58% of the total population of the region, are located close to its external borders west and north. The communes located in the vicinity of Szczecin and Koszalin have the most favourable conditions in the sphere of socio-economic development. These two agglomerations are the primary source of growth impulses for their surroundings. Flows of people in urban areas of large towns are mainly related to the phenomenon of suburbanization. In recent years, all rural communes bordering larger cities in the region have shown a positive migration balance. Demographic forecasts provide for the continuation of the depopulation process of all towns (in the case of large towns, also intensified by decreasing natural growth) and concentration of the population around large towns.

Demographic changes related to the aging of the population and related to the increasing life expectancy and low fertility are of great importance for the entire economy, not only in the voivodship, but also throughout Poland. In the region, the life expectancy of a new-born child and people aged 60 is one of the lowest in the country (11th place out of 16 voivodships).

### 5.1.1. Economic trends and competitiveness

#### Labour market

Since 2012, the situation on the labour market has improved significantly in Western Pomerania. This tendency was much stronger than the national average. In the years 2012–2018, in terms of registered unemployment, the region moved from 15th to 10th place in the country. In turn, the average unemployment level at the end of 2020 was 8.3%, while the average for Poland was 6.2%. One of the lowest in the country is unemployment among young people, which means a very good prospect of improving the indicators in the coming years. The labour market of the voivodeship is more exposed to seasonal fluctuations than in other regions of Poland, which is particularly visible in tourism, agriculture and construction.

The labour market of the West Pomerania voivodship is characterized by a deep imbalance of supply and demand for labour, especially in the district structure. One of the key development barriers of West Pomeranian enterprises is the lack of suitably skilled workforce, or even the lack of workforce in general. The value of the employment rate in the range of 15–64 years in Western Pomerania is the third lowest in Poland and does not exceed 60%. However, the offer of vocational education in the region is still not adjusted to the current and future needs of the labour market, which partly translates into the structure of unemployment<sup>106</sup>.

The structure of the labour market in the region is influenced by a relatively small number of large enterprises and production plants and a predominant number of small and micro enterprises (in many cases this means self-employment), as well as a high level of seasonality (related to the important role of the tourism sector, especially in the coastal zone and its surroundings).

Western Pomerania is consistently ranked among the leading regions in terms of entrepreneurship. For every 10,000 inhabitants of this region, there are almost 1,300 national economy entities registered in the Polish Business Registry (REGON). It is the second highest rate among all voivodships in Poland. The structure of entities by size class is dominated by micro and small

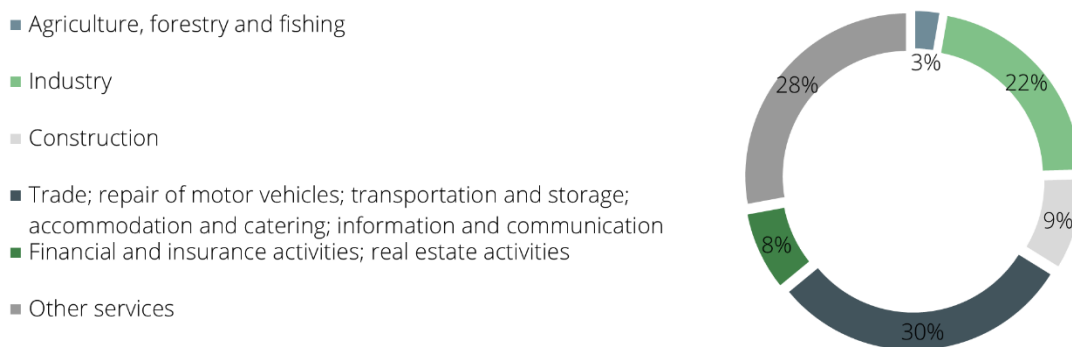
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<sup>106</sup> Ibid.

enterprises, which constitute 99% of the total number of economic entities. They employ 1/3 of the total number of employees in the voivodeship. However, the domination of micro and small enterprises, having mainly a service profile, is a barrier for the region's economy in obtaining the desired level of expenditure on innovation and increasing the overall investment capacity. It's also not conducive to the formation of productive economic links, networking, as well as, not increasing the competitiveness of the region<sup>107</sup>.

### Gross domestic product

The region's gross domestic product (GDP) reached €18.263 billion in 2018, an increase from €17.298 billion in 2017 and €15.899 billion in 2016, but for the last 3 years it constituted about 3.7% of the national GDP in current prices. In 2018, the gross domestic product per capita in the voivodeship amounted to €10,600 (18,100 PPS). Gross value added generated in the West Pomerania Voivodeship in 2018 amounted to €15.8 billion (in current price). The largest share in its structure was achieved by trade; [...] (30%) and industry (22%) (Figure 45).



**Figure 45.** Gross value added by kind of activity in West Pomerania Voivodeship in 2018 (current prices). Source: Statistics Poland.

### Export

The main partners in trade in Western Pomerania are European countries, among others: Germany, Denmark, France, Sweden, Great Britain and Norway. This is largely due to the geographical location of the region. The voivodeship's highest export revenues come from the following industries: chemical, wood and furniture, agri-food, and transport and logistics. The largest share in exports is generated by the city of Szczecin and Goleniów district, which together generate over 50% of export revenues for the region. However, the value of exports of the West Pomeranian Voivodeship on a national scale is only 3%. Despite many advantages, mainly the geographical location on the map of Poland, Western Pomerania still uses its potential to a small extent in the interregional relations of the Baltic Sea region, especially in cooperation with Germany (both in economic and social terms).

<sup>107</sup> Action Plan for West Pomerania, 2018, [interregeurope.eu/fileadmin/user\\_upload/tx\\_tevprojects/library/file\\_1526023109.pdf](https://interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1526023109.pdf)

## 5.1.2. Leading sectors

### Transport

The development of the region's economy depends to a large extent on properly functioning transport, especially transport at the interface between land and water. The region is severely affected by poor intra-regional and inter-regional transport accessibility. At the same time, the major European growth centres are more easily accessible from West Pomerania than from other Poland's regions. The region has the most favourable system of inland waterways in Poland, linking estuary ports Odra River with European Union countries, especially Germany. However, the current condition of the hydrotechnical buildings as well as the infrastructure of road and rail bridges does not allow the full use of the Odra's transport possibilities for transport to the south of the country.

There are international and national transport routes running through the voivodeship in the system north-south and east-west. The junction where most of them cross is Szczecin. The densities of public roads and the railway network are slightly lower than the national average, which results from the large area of the voivodeship, lower population density and the nature of the settlement network. The use of the potential of the Szczecin-Goleniów airport, the only passenger airport in this region, is very low. In Poland, the rate of using air transport is three times lower than the European average, and in the case of the West Pomerania Voivodeship it is four times lower than the Polish average. It is influenced, among others, by proximity of airports in Berlin, Gdansk and Poznan (in each of them, there is a wider range of destinations) and still insufficient coordination of transport connections with the airport<sup>108</sup>.

### Maritime economy

The main branch of the West Pomeranian economy is the broadly understood maritime economy. As a result of organisational transformations and new infrastructure investments, the water-related metalworking industry is being developed, including construction of specialist large-size structures. Shipbuilding is developing in the region, and the growing demand for shipbuilding and ship repair services are aligned with the support instruments introduced at the national and regional level, as set out, among others, in the Strategy for Responsible Development. Also the yacht industry is developing.

Western Pomerania is one of the few regions in Europe where sea, rail and road routes connect with inland shipping routes, which is important for transport over very long sections from Scandinavia to southern Europe. Inland waterway transport in the voivodeship is the largest in Poland and remains at a stable level, although it has a downward trend. The further development of this form of transport depends on the improvement of the navigability of the rivers, mainly the Odra Waterway.

### Tourism

West Pomerania has unique natural conditions on national scale: huge water and underground resources (of which over 150 reservoirs exceed the area of 50 ha). It has one of the highest percentages of forest area in the country, as well as a large protected areas. The region's unique

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<sup>108</sup> Zachodniopomorskie Voivodeship Development Strategy up to 2030, 2019, Ed. Geblewicz O., [http://eregion.wzp.pl/sites/default/files/srwz\\_2030\\_en\\_size.pdf](http://eregion.wzp.pl/sites/default/files/srwz_2030_en_size.pdf)

natural heritage is located in 2 national parks, 7 natural landscape parks and over 100 nature reserves. West Pomerania has an exceptionally clean natural environment compared to the rest of the country, including air, with one of the lowest pollution levels in Poland.

The uniqueness and richness of natural values and the cultural resources of the region make tourism one of the most important areas economic sector of West Pomerania. The large spa potential and the largest in the country, diverse accommodation base (mainly concentrated in the coastal zone) as well as good accessibility for tourists make the West Pomeranian Voivodeship an absolute national leader in the field of tourism. In West Pomerania, 1/6 of all overnight stays in Poland and 1/5 of overnight stays provided to foreigners are granted. West Pomerania is the most frequently place to choose by tourists to spend their long annual vacation.

Despite the region's domination in terms of tourism as compared to the rest of the country, it is important that there is still a huge potential for tourism development, without endangering the quality of the environment. The south-eastern part of the voivodeship, i.e., almost the entire Pomeranian Lake District (i.e., the second largest lake complex in Poland after Masuria), remains unused for tourists. This area includes over 1,600 lakes with an area of over 1 ha each. In addition to the water tourism, the ideal conditions for the development of active tourism are also created by green areas surrounded by water bodies - forests and parks with cycling, horse-riding and hiking trails. Thanks to these advantages, the season in the West Pomeranian Voivodeship is gradually extended, which indirectly affects other areas of the region's economy, including for trade, services, transport or construction.

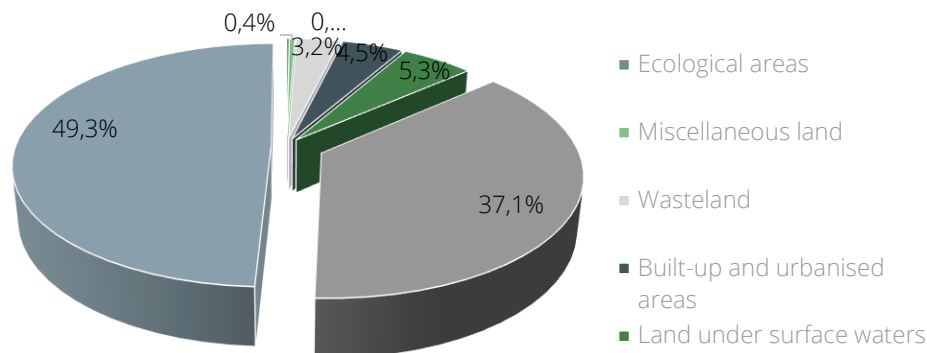
## **Agriculture**

Approximately half of the land used is agricultural land in the West Pomeranian Voivodeship (Figure 46). West Pomeranian agriculture is characterized by a large area of farms, the lowest percentage of agriculture workers in the country, a high degree of mechanization and the best conditions for large-scale production. Average size of farms exceeds 30 ha and is three times higher than in the entire country, even higher than the EU average. There is a decrease in the number of the smallest farms with an area of up to 1 ha of agricultural land and a significant increase in farms over 100 ha. Their number already exceeds 1600, and their size, as nowhere else in Poland, allows to specialize, concentrate production, use economic of the scale, generate high income, and disseminate the best practices of large-scale farms<sup>109</sup>.

The West Pomeranian Voivodeship is the third largest exporter in the agri-food industry among all regions in Poland. The agriculture in this voivodship is characterized by orientation towards plant production, very low value of animal production and a very low level of agricultural processing (which results, among others, from to a very small number of agri-food processing plants). This causes the almost the lowest in Poland effectiveness and competitiveness of the West Pomeranian agricultural sector. A chance to change this situation is the fact, that this region has the highest percentage of area allocated to ecological production in the country, which is characterized by high profitability of production, however, investments in processing activities are still too small.

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<sup>109</sup> Ibid.



**Figure 46.** Breakdown of land use in West Pomerania Voivodeship as at 31.01.2020 (Source: Statistics Poland).

### Forestry

Forestry is a very important branch of the economy for the West Pomeranian Voivodeship. The region is the fourth most forested voivodeship in Poland, and also characterized by the largest wood resources in Poland. Its forest land covers 9% of the forest land area in Poland, from which almost 11% of domestic timber harvest is obtained (the most in Poland). The industrial use of the forest is very high - more than 1/4 of the domestic consumption of sawn timber is in the West Pomeranian Voivodeship. Moreover, the region is the absolute leader in Poland in terms of the production of fibreboards (half of the national production), and in terms of the consumption of particleboards and production of paper and cardboard, it ranks 4th in Poland<sup>110</sup>.

#### 5.1.3. Climate change impacts

The climate of Poland is characterized by a high changeability of weather and a significant diversification of the course of the seasons in consecutive years. The values of the average annual air temperature range from slightly above 5°C to nearly 9°C. The warmest part of Poland is the south-western part, while the coldest - the north-eastern part of the country and mountain areas. The temperature distribution in summer is latitudinal, the values decrease from south to north, with the exception of mountainous areas. In winter, there is a marked drop in temperature from west to east: the meridional isotherms exceed 0°C in the west, dropping to below -°C in the east, while the lowest values are in the mountains. The annual amplitudes of the average monthly temperature range from 19°C on the coast to 23°C in the eastern part of the country.

A characteristic feature of Poland's climate is also the varied number of frosty days ( $T_{max} < 0^{\circ}C$ ) from November to March (most in January). The number of days with frosts (temperature min below 0°C), usually occurring in late spring and early autumn, ranges from 80 days at the seaside to over 120 days in the north-eastern areas of Poland and over 200 days in the mountains. Hot days ( $T_{max} > 25^{\circ}C$ ) occur in Poland from May to September. Their number increases with distance from the sea (from 10 to more than 40 days), in the mountains their frequency decreases with height. Absolute maximum temperatures reach almost 40°C, and the lowest

<sup>110</sup> Action Plan for West Pomerania, 2018, [interregeurope.eu/fileadmin/user\\_upload/tx\\_tevprojects/library/file\\_1526023109.pdf](https://interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1526023109.pdf)

temperatures in Poland were recorded at  $-41^{\circ}\text{C}$ . The duration of the seasons varies regionally: summer lasts from 60–70 days in the northern part of Poland to 100 days in the south-east, in the central, western and south-western parts; winter - from 10–40 days at the seaside and in the west, up to 3–4 months in the northeast, and up to 6 months in the mountains.

Precipitation is highly dependent on the topography. The average rainfall is nearly 600 mm but ranges from less than 500 mm in the central part of Poland to almost 800 mm on the coast and over 1,000 mm in the mountains. The highest sums of precipitation fall in the summer months and in this period are 2–3 times greater than in winter. Snowfall accounts for 15 to 20% of the annual rainfall and occurs from November to April, and in the mountains already in September. The number of days with snow cover extends from the west and south-west to the north-east of the country from 30–60 to 80–90 days and more than 200 days high in the mountains<sup>111</sup>.

The results of the analysis of climate scenarios for Poland show that the temperature will have a clear upward trend throughout the country. However, greater warming is expected towards the end of this century. Temperature increases will be regionally and seasonally differentiated, on average for Poland this increase may amount to about  $2^{\circ}\text{C}$  at the end of the 21st century - Table 6 (with some regions a temperature increase of over  $4.5^{\circ}\text{C}$  is forecast). The number of frosty days ( $T_{\text{max}} < 0^{\circ}\text{C}$ ) will be reduced by about 33%, while the number of hot days ( $T_{\text{max}} > 25^{\circ}\text{C}$ ) may be increased by almost 49%. There is also a clear tendency to extend the growing season, which at the end of the century may be longer by about 30 days, its earlier beginning is also noticeable. In the case of precipitation, the trends of change are less pronounced, although the simulations show some increase in winter rainfall and a decrease in summer rainfall. The Polish climate will also be characterized by an extension of the periods without precipitation, an increased number of maximum rainfalls and the shortening the period of snow cover.

**Table 6.** Changes in selected climate characteristics in Poland in the 21st century<sup>111</sup>.

Specifications	Years				
	2011–2020	2021–2030	2041–2050	2061–2070	2081–2090
Annual average temperature [ $^{\circ}\text{C}$ ]	8.6	8.7	9.3	10.1	10.6
Number of days with $T_{\text{min}} < 0^{\circ}\text{C}$	97	97	82	72	65
Number of days with $T_{\text{max}} > 25^{\circ}\text{C}$	36	35	37	46	52
Growing season $T > 5^{\circ}\text{C}$ [days]	223	224	237	247	253
Maximum precipitation (24h) [mm]	30.3	31.3	32.2	32.9	33.7
Longest dry period precipitation (<1mm) [days]	22	22	22	24	24
Longest wet period precipitation (>1mm) [days]	9	9	9	9	9
Number of days with snow cover	71	71	58	49	42

<sup>111</sup> KLIMADA project “Development and implementation of a strategic adaptation plan for the sectors and areas vulnerable to climate change”, <http://klimada.mos.gov.pl/zmiany-klimatu-w-polsce/przyszle-zmiany-klimatu/>  
Source: KLIMADA project

Climate change has and will have a large direct and indirect impact on the human economy by affecting the physical and biological components of ecosystems. In Polish agriculture, projected climate changes will affect crops, livestock farming and the location of production. Climate change will bring about significant changes in the quality and availability of water resources, affecting a number of sectors, including food production where water plays a pivotal role. Fluctuations in the frequency and intensity of floods and droughts are to be expected, causing significant financial damage and increasing the number of fatal accidents. The increase in the frequency of extreme weather events may have health implications: an increase in morbidity and fatalities related to weather conditions, such as: excessive heat-related mortality, the presence of invasive infectious disease carriers, an earlier onset and an increase in seasonal production of allergic pollen. In addition, extreme climatic events cause significant social and economic losses to infrastructure (construction, transport, energy and water supply), posing a particular threat to land use in densely populated areas and urban areas. In the energy sector, an increase in demand, with a simultaneous reduction due to reduced resources and limited availability of cooling water in power plants, can disrupt the electricity supply.

The construction sector is most affected by sudden weather events as a result of climate change. These are phenomena such as: inundation, groundwater or flood water inundation, water deficit, landslides or wind damage. Some of the phenomena resulting from climate change may directly reduce the safety of the structure. These include, first of all, the increase in the violence of gusts of wind, an increase in the frequency of tornadoes and storm squalls. In addition, increasing the frequency and sum of heavy rainfall, rising groundwater level, sea level, with the possibility of flooding coastal areas, and river levels create new threats to existing buildings and new investments. A critical element requiring changes in the entire construction process are also sewage networks, which must be prepared to receive more rainwater. A factor that should also be taken into account at every stage of the facility's life is high temperature, primarily affecting the human factor. In the event of further temperature increases, it will be necessary to update the currently applicable standards in the field of thermal insulation, rules for heating and air conditioning of buildings or rules for snow removal from roofs. Temperature changes must also be taken into account when designing a wastewater treatment plant due to its influence on the course of biological pollutant removal processes. Extending periods with high temperature and sunlight, with simultaneous increased evaporation, may lead to the appearance of frequent droughts, increasing the risk of fires.

### **Climate change impacts in West Pomerania Voivodeship**

The predicted climate changes may have a very negative impact on the coastal zone in Poland, and even cause difficulties in the functioning of the maritime economy. Apart from the sea level rise, the unfavourable anticipated changes also include an increase in the number, strength and duration of storms and an increase in their irregularity, which will particularly accelerate the coastal erosion in the winter months, when a series of rapidly successive storms occurs after long periods of relative calm, making it impossible to regenerate the coast. As a result of the sea level rise, negative changes in the coastal zone can be expected i.e., the narrowing of the beaches and the shifting of the coastline to the present land, as well as the erosion of dunes and cliffs.

The increase in the frequency of storm floods and more frequent flooding of low-lying areas cause a strong pressure on the entire infrastructure located in these areas and increasing periodic shortages of drinking water caused by contamination or salinity of groundwater, which are the main sources of drinking water in many coastal towns. In addition, flooding of municipal and industrial wastewater treatment plants by flood waters will lead to an uncontrolled runoff

of pollutants to the marine environment. Another possible impact of climate change on the coast and the entire Baltic Sea are changes in salinity and temperature of sea waters. They favour the development of thermophilic phytoplankton species, threaten biodiversity, and causing the invasion of alien species.

## 5.2. Forest resources and management

### 5.2.1. Forest stock and ownership

At the end of 2019, the area of forest land in Poland amounted to 9.5 million ha, of which 9.3 million ha were forests (7.1 million ha remained under the management of the State Forests PGL). The forest cover was 29.6 (when measured by the ratio of the forest area to the total area of the country) and remained at a similar level from the previous years. Standing timber resources in forests (according to the multi-area forest inventory carried out in 2015–2019 and 2014–2018) amounted to 2,645 hm<sup>3</sup>, while forest resources managed by the State Forests National Forest Holding constituted 78.2%, and in private forests - 17.0%. The average stock of standing timber per 1 ha of forest area was 286 m<sup>3</sup>, including 290 m<sup>3</sup> in forests managed by the State Forests, and 252 m<sup>3</sup> in private forests<sup>112</sup>.

### 5.2.2. Forest management and silvicultural systems

In 2019, 43.3 million m<sup>3</sup> of wood raw material (net, without bark) was harvested in Poland. Almost 98% of the harvested wood, including forest chips, came from the forest (42.6 million m<sup>3</sup>). 0.9 million m<sup>3</sup> of wood from trees and shrubs outside the forest was also harvested. The wood removal structure, as in the previous year, was dominated - with a share of 96% - by raw material from public forests (41.6 million m<sup>3</sup>), mainly (98%) from forests managed by the State Forests National Forest Holding (40, 9 million m<sup>3</sup>). Only 1.9 million m<sup>3</sup> of wood (about 4%) came from private forests (where 1.3 million m<sup>3</sup> was wood from the forest, and 0.6 million m<sup>3</sup> came from trees and shrubs outside the forest).

### 5.2.3. Forest functions and ecosystem services

Forests, thanks to their diversified structure, have a beneficial effect on the human environment. Taking into account the environmental and social functions of the forest in forest management, often referred to as non-productive, has found its definition as protective forests. In 2020, the status of protective forests in Poland, i.e., performing non-production functions, it had 3,914.4 thousand ha of forests (42.3% of the country's forests), of which 97.6% were forests managed by the State Forests (3,820,000 ha). Also 4.0% of private forests (72,300 ha) and 25.9% of communal forests (22,100 ha) are considered as protective forests. The greatest number of protective forests were isolated in mountain areas and in areas under the influence of industry<sup>113</sup>.

The ecological functions of forests in Poland include the stabilization of the water cycle in nature, shaping the climate, stabilization of the atmosphere's composition and its purification,

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<sup>112</sup> Statistical Yearbook of Forestry. (2020). Statistics Poland. <https://stat.gov.pl/obszary-tematyczne/roczniki-statystyczne/roczniki-statystyczne/rocznik-statystyczny-lesnictwa-2020,13,3.html>

<sup>113</sup> Ibid.



protection of soil against erosion, etc. However, the most important function of Polish forests is climate protection. Based on the available data on wood resources, the carbon storage in the wood biomass of Polish forests was estimated at 923 million tonnes, including 37 million tonnes in dead wood<sup>114</sup>. In turn, the amount of CO<sub>2</sub> absorbed annually by forests (including soil and taking into account the use) was estimated at 34 million tonnes, which roughly translates to 9.3 million tonnes of carbon<sup>115</sup>.

Polish forests are also a natural place for recreation and relaxation, especially for residents of large urban agglomerations. They are also the destination of numerous trips organized mainly by schools, during which children and young people have the opportunity to have personal contact with nature. Rest in the forest is therefore an excellent opportunity to achieve the goals of forest education. The health properties of forest ecosystems favour the development of tourism and recreation, especially in areas recognized as health resorts.

Numerous promotional forest complexes were created in the area of the State Forests, which were part of the implementation of the state forest policy and the provisions of the Forest Act. A well-developed teaching and tourism infrastructure, often made available free of charge to the public, is made up of numerous centres forest education, educational chambers, educational sheds, educational paths, educational points, parks and dendrological gardens, cultural and tradition sites, etc., the total area of which exceeds 1.2 million hectares. Educational activities in the State Forests are financed primarily from the own resources of forest districts, as well as provincial funds for environmental protection and water management and the National Fund for Environmental Protection and Water Management.

In the West Pomerania Voivodeship, in order to familiarize the inhabitants with the functions of the forest and its sustainable use, promotional forest complexes (LKP) were established: "Puszcze Szczecińskie" in the region of Szczecin and "Lasy Śródkowopomorskie" in the north-eastern part of the voivodeship. One of the goals of this project is common forest education. For example, in the first promotional forest complex, classes are conducted in prepared educational facilities: the Nature and Forest Education Centre, a nature and forest information point, two forest education chambers, three forest educational sheds, 11 forest educational paths and 29 forest field education points. It should be noted that activities related to forest education and recreational provision of forests are also carried out in other forest districts, apart from promotional forest complexes.

In addition, the forest area in the West Pomeranian Voivodeship is characterized by extensive tourism and recreational development. Identifying and managing a huge number of objects for various purposes (e.g., forest parking lots, rest areas, camping sites, clearings, dog runs) will visibly reduce uncontrolled penetration of the forest and the related problems, while protecting the most valuable fragments of forest areas. Nature reserves and forests constituting refuges for animals subject to species protection are excluded from tourist penetration<sup>116</sup>.

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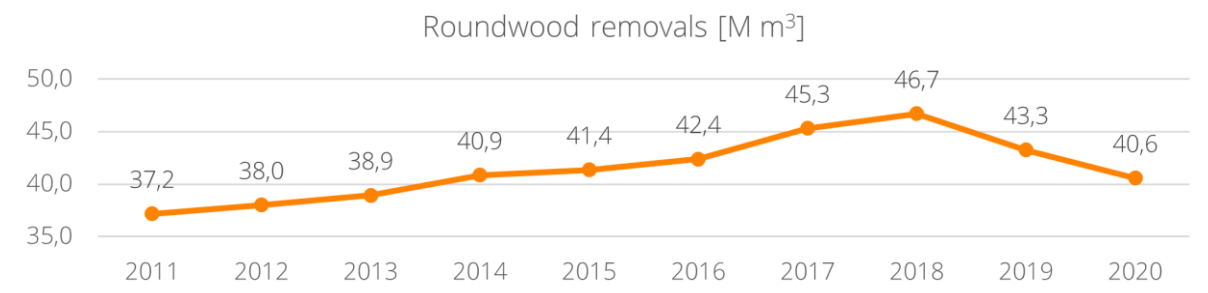
<sup>114</sup> State of Europe's Forests 2020 Report (SoEF), 2020, Ministerial Conference on the Protection of Forests in Europe - FOREST EUROPE Liaison Unit Bratislava, [https://foresteurope.org/wp-content/uploads/2016/08/SoEF\\_2020.pdf](https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf)

<sup>115</sup> Forests in Poland, 2013, State Forest, National Forest Holding, [http://eregion.wzp.pl/sites/default/files/lasy\\_w\\_polsce\\_2013.pdf](http://eregion.wzp.pl/sites/default/files/lasy_w_polsce_2013.pdf)

<sup>116</sup> Spatial Development Plan for the Zachodniopomorskie Voivodeship, Vol. I, Conditions for the Forming Spatial Policy of the Voivodeship, Regional Office for Spatial Management of the West Pomeranian Voivodeship in Szczecin, Szczecin, June 2020, [http://eregion.wzp.pl/sites/default/files/zaln1xvii21420pzwptomiuarunkowania\\_0.pdf](http://eregion.wzp.pl/sites/default/files/zaln1xvii21420pzwptomiuarunkowania_0.pdf)

#### 5.2.4. Forest growth and harvest trends

The harvest of roundwood in Poland over the last ten years has increased by 9.2% (from 37.2 million m<sup>3</sup> in 2011, to 40.6 million m<sup>3</sup> in 2020: Figure 47). Raw material removal was characterized by a growing trend until 2018 year (when it reached the highest level in the last decade - 46.7 million m<sup>3</sup>). With the onset of the coronavirus pandemic, from 2019, the removals of wood raw material in Poland began to decline and in 2020 it reached a level of 6.1 million m<sup>3</sup> lower than the maximum one. Over 88% (35.9 million m<sup>3</sup>) of the total amount of wood obtained in 2020 was industrial roundwood, and it was mainly coniferous wood (79.8%) - Table 7. In its structure 51.2% (18.4 million m<sup>3</sup>) was pulpwood, 47.1% (16.9 million m<sup>3</sup>) sawlogs and veneer logs, and about 1.7% (0.6 million m<sup>3</sup>) was the other industrial roundwood. In 2020, 4.7 million m<sup>3</sup> of wood fuel (including wood for charcoal) was also harvested in Poland.



**Figure 47.** Roundwood removals in Poland in 2011–2020. Source: FAOSTAT.

**Table 7.** Removals of roundwood in Poland in 2020. Source: FAOSTAT.

Removals of roundwood	Quantity [1000 m <sup>3</sup> ]
<b>Roundwood (wood in the rough)</b>	40,592.780
<b>Wood fuel (including wood for charcoal)</b>	4,713.304
Coniferous	2,297.226
Non-Coniferous	2,416.078
<b>Industrial roundwood</b>	35,879.476
Coniferous	28,625.096
Non-Coniferous	7,254.380
<b>Sawlogs and veneer logs</b>	16,913.142
Coniferous	14,166.568
Non-Coniferous	2,746.574
<b>Pulpwood, round and split (including wood for particle board, OSB and fibreboard)</b>	18,354.593
Coniferous	13,886.434
Non-Coniferous	4,468.159
<b>Other industrial roundwood</b>	611.741
Coniferous	572.094
Non-Coniferous	39.647

### 5.2.5. Forests in West Pomerania Region

In 2019, the forest area in the West Pomeranian Voivodeship was 817,100 ha (which placed the region in third place in terms of forest cover in Poland). The ownership structure of forests was dominated by public forests (over 97% of the total forest area), mostly managed by the State Forests National Forest Holding, while private forests accounted for less than 3%. According to the Central Statistical Office data, at the beginning of 2019, the area of wood resources in the West Pomerania Voivodeship amounted to a total of 4.6 million m<sup>3</sup> of net timber.

The most roundwood removals was obtained from conifers wood (about 71%), of which pine constituted almost 64% and spruce for 6%. On the other hand, less than 29% of roundwood removals was obtained from deciduous trees, most of which, about 9%, came from beech, 6% each from birch, alder and oak, and the rest were hornbeam and aspen species.

### 5.2.6. Wood raw material trade

In 2019, 4.6 million m<sup>3</sup> of wood raw material was exported from Poland, i.e., 17% less than in the previous year. The wood that was sell to foreign markets accounted for about 11% of the domestic removals (including removals from trees and shrubs outside the forest). The exports were dominated by wood for industrial purposes, accounting for 96% (4.4 million m<sup>3</sup>). 90% of it was coniferous wood (3.9 million m<sup>3</sup>). Pulpwood dominated in the assortment structure of the coniferous wood sold abroad with a share of 54% (2.1 million m<sup>3</sup>). The share of sawlogs and veneer logs exports was 46% (1.8 million m<sup>3</sup>). In the species structure of exported industrial

coniferous wood were pine (with a share of 66%) and spruce and fir (with a share of 21%). The coniferous industrial roundwood was partly sent to the European Union countries (69%), mainly to Germany (36% of its volume) or to the Czech Republic (7%), but also to non-EU countries, mainly China (31%). In turn, in the case of industrial hardwood, 0.5 million m<sup>3</sup> of it was exported from Poland in 2019 (exports decreased by 27%). It was mainly beech (with a share of industrial hardwood exports of 73%) and birch (12%). This raw material was mainly sold in the European Union (89%), mainly in Sweden (28%), Slovakia and Germany (22% each). The export of wood fuel in 2019 amounted to 0.2 million m<sup>3</sup> and was approximately 16% lower than in 2018 (more than 2/3 of the export of wood fuel was coniferous roundwood).

In 2019, 1.7 million m<sup>3</sup> of wood raw material was imported to Poland, i.e., 47% more than in 2018. It was largely the result of an increase (1.9 times) in the import of industrial coniferous wood (including mainly spruce and fir pulpwood). Imported wood accounted for 4% of domestic harvest (including trees and shrubs outside the forest). Almost all of it (1.6 million m<sup>3</sup>) was raw material for industrial purposes (96% of total wood imports). Coniferous wood for material processing accounted for 59% (0.9 million m<sup>3</sup>). It came to Poland mainly from EU countries (96%), mainly from the Czech Republic (67%), as well as from Germany (16%) and Lithuania (9%). Also 0.7 million m<sup>3</sup> of industrial hardwood was brought to the country. Its species structure was dominated by birch (61%) and poplar (19%). More than 80% of the imported industrial hardwood was sourced from the Community. This wood came to the Polish market mainly from Latvia (41%), Belarus (19%) and Finland (12%). Imports of firewood remained at a similar level as in the previous year and amounted to 62,300 tons.

### **5.2.7. Climate change and forest resilience**

The effects of climate change on forests are likely to include changes in the condition and productivity of forests and the geographic range of some tree species. Mountain ecosystems are the most vulnerable to climate change and are predicted to lose up to 60% of their tree species and stand productivity and durability may collapse sharply. The increase in field evaporation associated with the increase in temperature, as well as duration of snow cover deposition, will cause a decrease in humidity in forests, accelerating the processes of soil mineralization and increasing the risk of drought, as well as the development of diseases and pests, including invasive species. The extended growing season will increase the survival rate of insects and speed up their reproduction. Reduced snow cover and a shorter period of ground freezing may, on the one hand, make it difficult to felling trees, especially on light and wet soils, and, on the other hand, facilitate the transport of wood. This will require more work and resources to maintain forest roads in a trafficable condition. The aging of forests can be beneficial, for example in terms of biodiversity and some social aspects (recreation). However, in view of climate change, the direction of extending the cutting time adopted in Poland is debatable. Physiological weakening together with the pressure of deteriorating growth factors and biotic threats may cause mass death of coniferous stands over 100 years old (e.g., spruce stands), which may pose a threat to forest sustainability in the future.

## **5.3. Markets and trends of the wood construction chain**

### **5.3.1. Forest-based industries and related sectors**

It is estimated that in 2019 forestry in Poland employed 44.6 thousand people. people and it was a level similar to the previous years. About 78% of the employed in Polish forestry is based

on units employing 10 or more people. The economic and financial condition of the Polish forestry sector has been relatively good so far. In 2018, revenues from total activity amounted to € 2.4 billion and were 6% higher than in the previous year (in current prices). In 2019, forestry generated a gross profit of € 143.1 million, and a net profit of € 137.7 million (in current prices).

It is estimated that the wood sector employed around 350 thousand people in 2019 and it was a level comparable to previous years. It accounted for 12% of the average employment in industry in general and 14% in manufacturing. Approximately 50% were employed in the furniture industry, 32% in the wood industry, and 18% in the pulp and paper industry, including paper processing. Similar to previous years, the majority of employees in the sector (about 90%) were employed in medium-sized and large enterprises (employing 10 or more people).

In 2019, the sold production of the wood sector amounted to € 34.0 billion and in relation to the total industry it accounted for 9%, and the processing industry for 10%. In its value structure, the furniture industry had the highest share (35%), the share of the pulp and paper industry (including paper processing) was 34%, and the wood industry nearly 31%. Approximately 90% of the value of sold production of the wood sector was attributed to "medium and large" entities employing more than 9 people.

### **Sawnwood**

In 2019, the production of sawnwood (including sleepers) amounted to 5.0 million m<sup>3</sup>, and it was the similar level to the previous years. Coniferous materials dominated in their generic structure with a share of almost 89%.

### **Veneers sheets**

The production of veneers (including veneers and facing boards) in Poland in 2019 amounted to 47.1 thousand m<sup>3</sup> and decreased by 20% compared to the previous year. More than a half, i.e., 56% of its structure, were veneers of deciduous species.

### **Wood-based panels**

In 2019, the production of wood-based panels in Poland increased by 3% compared to 2018 and amounted to 11.7 million m<sup>3</sup>. However, the increase in production concerned only particle board, the production of which amounted to 6.3 million m<sup>3</sup> (including 0.9 million m<sup>3</sup> of OSB boards). In turn, the production of fibreboards decreased by 1% and amounted to 4.9 million m<sup>3</sup>. In the assortment structure of their production, medium fibreboards (MDF/HDF) had the largest share (75%). On the other hand, the production of other fibreboards amounted to 1.1 million m<sup>3</sup>, and the production of hardboards - 0.1 million m<sup>3</sup>. Also, the production of plywood decreased by 11% in 2019 and amounted to 0.5 million m<sup>3</sup> (they were mainly deciduous species - 51%).

### **Wood pulp**

In 2019, the production of wood pulp in Poland amounted to 1.2 million tonnes. The production volume of wood pulp was dominated (with a share of 77%) by chemical wood pulp (0.9 million tonnes). Mechanical and semi-chemical wood pulp (in total 0.2 million tons) accounted for 18% of the production of wood pulp, and the dissolving grades (0.06 million tons) - less than 5%.

## Paper and paperboard

In 2019, the production of paper and paperboard in Poland amounted to 4.9 million tonnes and reached a level similar to the previous year. Its product structure was dominated by packaging materials with a share of 69% (3.4 million tonnes). Graphic papers accounted for approximately 17% of the production (0.8 million tonnes). There were also produced 0.5 million tons of household and sanitary papers (they accounted for 11% of the total paper and paperboard production) and 0.2 million tons of other papers and paperboards (3%).

## Construction

Construction and assembly production in Poland in 2020 increased in real terms by 0.9% (compared to 4.8% in the previous year) and amounted to € 51.9 billion. The highest increase was recorded in the case of construction of civil engineering structures (by 3.9%), relatively small - in the case of specialized construction works (0.3%), and a decrease in sales (by almost 1%) in the case of construction of buildings. The average employment in construction also decreased by 1.7% compared to the previous year (to 651 thousand people). On the other hand, there was a relatively good economic situation in 2020 in housing construction. The number of completed flats (220.8 thousand) increased by 6.5% compared to the previous year (in the case of construction earmarked for sale or rent, the increase was 8.6%). There was also an increase (by 2.9%) in the number of dwellings for which construction permits were granted or for which a construction design application was submitted. On the other hand, the number of flats under construction decreased (by 5.7%), which should be considered an unfavourable phenomenon.

## Role/benchmarking of wood in construction

Due to the strong links between the wood sector and construction in Poland (construction is a stimulus of demand for wood materials and products and their main recipient), all activities undertaken to support construction are important for wood companies. In recent years, however, there has been an increasing phenomenon of substitution of wood materials and products with other non-wood substitutes. The main area of occurrence of wood substitution in Poland is the broadly understood construction (construction of houses / house structures and non-structural elements, such as joinery, floors). Wood substitutes in construction include cement, concrete, stone, various types of metals (mainly steel and aluminium) and plastics (such as polyethylene, polypropylene, polystyrene and polyvinyl chloride). As of today, the phenomenon of substitution in Poland does not pose a threat to the development of the wood market and wood enterprises, but it limiting the possibility of using wood in certain directions or in certain places, and also may be danger to the natural environment. Wood products, thanks to the unique properties of wood, generally favour the environment and human health, have a natural competitive advantage over their non-wood substitutes. In addition, they contribute to the generation of additional economic effects in companies, industries and the entire wood sector, while improving the condition of the natural environment, improving the living conditions of society and their health.

### 5.3.2. Wood markets and products trade

The forest and wood sector also plays an important role in Polish foreign trade. In 2019, wood and wood products accounted for almost 9% of Poland's exports (€20.7 billion) and 4% of total imports (€9.5 billion). The most important group in the exported wood products was furniture - with a 54% share in its value (€11.1 billion) and almost 5% in the value of the entire Polish

exports. The share of furniture in the import of wood products is relatively lower and amounts to 26% (€2.5 billion). The products of the pulp and paper industry and paper processing are also of great importance in foreign trade in wood products. Their share in the export of wood products in 2019 amounted to 23% (€4.7 billion), and in imports it was 54% (€5.2 billion). Also about 23% of exports of wood products (€4.8 billion) are products of the wood industry (including, among others: sawn materials, wood-based panels, products of wooden joinery, wooden packaging). In imports, it was around 20% (€1.9 billion). In 2019, as in the previous years, Polish wood products were delivered mainly to European Union countries (85%), mainly to Germany (33%), Great Britain (7%) and France (7%). Also, the majority of imported wood products came from the Community (73%), including Germany (27%), Finland (6%), Sweden (6%) and Austria (5%). China, on the other hand, is becoming an increasingly important supplier, where 9% of imported wood products came from in 2019.

In 2019, the value of production of builder's joinery and carpentry of wood amounted to €2.0 billion (in constant prices). 19.6 million m<sup>2</sup> (13.7 million units) of wooden windows and doors were produced, of which 76% were doors (10.4 million units). 2.4 million m<sup>2</sup> of mosaics and 55.8 million m<sup>2</sup> of other floor panels were also produced. About 65% of the products of this group (in terms of value) were exported (1.3 billion €). Mainly windows and doors were exported to foreign markets (2.8 million of windows with a value of €0.6 billion and 3.7 million of doors with a value of €0.2 billion). In total, they accounted for nearly 59% of the value of exports of joinery products. About 5% of the share in foreign deliveries of this group of products was made by prefabricated wood buildings of €0.1 billion. The demand for Polish products of builder's joinery and carpentry of wood was generated mainly by European Union countries (in terms of value; in 88%). These were countries such as: Germany (27%), Great Britain (19%), Sweden (9%) and France (8%).

In turn, the products of this group with a value of €0.2 billion were imported on Polish market. Builder's joinery and carpentry of wood products import was 17% higher than in the previous year (in current prices; in the national currency) and accounted for 9% of the production value. Mainly wooden windows were brought into the country. There were 234 thousand of them in 2019 with a value of €23.8 million and accounted for almost 14% of total imports of joinery products. About 3% of it accounted for prefabricated wood buildings of €5.4 million. The builder's joinery and carpentry of wood products for the construction industry were delivered to the country both from the EU (53%) and non-EU countries. The main suppliers in 2019 were such countries as: Ukraine (35%), Germany (11%), Austria (6%), Russia (6%).

### **5.3.3. Future outlook and needs for transformation**

Due to the significant deficit of flats in Poland, all measures taken to support their construction, including flats for rent, are important, especially for the less affluent (mainly as part of the National Housing Program). The key solutions recently introduced in this area include: financial support in the form of grants from the Subsidy Fund for municipalities for the construction of social and communal housing, bonuses for the renovation of buildings of Towarzystwo Budownictwa Społecznego (Association of Social Housing) older than 20 years, the possibility of obtaining the ownership right to a social housing under a lease agreement with ownership, the establishment of the Government Housing Development Fund, providing financial support to municipalities whose budgets suffered as a result of the COVID-19 pandemic, housing allowances increased by subsidies from the COVID-19 Countermeasures Fund for tenants who lost their income as a result of the pandemic coronavirus, financial support for the creation of additional usable space intended to meet the needs of the elderly. The intensification of the activities of Polskie Domy Drewniane S.A. (Polish Wooden Houses), whose goal is to build

energy-saving residential wooden houses in the prefabricated wooden skeleton technology, is also of great importance (further investments are already being built and planned - single houses, also of a service nature, and entire housing estates).

## 5.4. Policies and support schemes

### National policies and programmes

Due to the global economic slowdown caused by the Covid-19 pandemic, various types of intervention packages have been launched in Poland. These are among others: Crisis Shields (from 1 to 6, with various forms of support for many industries), Financial Shields of the Polish Development Fund, Industry Shield, financial support from Bank Gospodarstwa Krajowego and the Industrial Development Agency. The value of support under the anti-crisis and financial shield - mainly for the protection of jobs and employee safety, financing of entrepreneurs, health protection and strengthening the financial system as well as public investments - is estimated as of May 2021 at around €70 billion. These funds were supplemented with EU funds (under operational programs of the cohesion policy). Producers of wood products are also beneficiaries of these support programs.

The directions of the country's socio-economic policy, as well as the basis for the development of the draft budget act for 2022, was influenced by the State's Multiannual Financial Plan for 2021–2024. It focuses primarily on the expected impact of reforms and investments included in the National Plan for Reconstruction and Increasing Resilience (KPO) on the Polish economy in the 2021–2026 perspective. The primary goal of the KPO is to strengthen the social and territorial cohesion of the country in the post-pandemic period with numerous specific objectives. Importantly for the wood sector, KPO provides support for investments in green construction (construction of 12.4 thousand flats with a higher energy standard is assumed), mainly multi-family ones, so it can be assumed that this will also translate into an acceleration in the development of wooden construction. As part of the KPO, Poland will have around €58 billion at its disposal (negotiations with the European Commission were completed in July 2021).

A comprehensive strategy for the reconstruction and development of the country in the next decade and the epochal leap in civilization in this period is presented in the Polish Deal program. As part of the Polish Deal, it is planned to spend approximately EUR 145 billion by 2030. It contains elements important also for entrepreneurs from the wood sector and the future of their companies. It includes 10 areas, they are:

- "Plan for health" - assumes, first of all, better organization and appropriate financing of the health service (increasing outlays to 7% of GDP within 6 years).
- "Fair work-decent pay" - provides, inter alia, increase in the minimum wage, tax reduction, limitation of the use of junk contracts, regulation of remote work rules, new rules for paying health insurance contributions.
- "A decade of development" - such as investments in 500 thousand new jobs, investment subsidy for local governments, development of modern road, rail, water and sewage, IT infrastructure, expansion of the power grid, additional € 500 million for investments in wind farms.
- "Family and a house in the centre of life" - mainly concerns the increase of funds financing access to one's own flat, flat without own contribution, the possibility of building a house up to 70 m<sup>2</sup> only on the basis of a notification, etc.



- "Poland-our land" - include release of agricultural retail trade, reimbursement of excise duty on agricultural fuel, adoption of the Agricultural Code (separation of small farms from agricultural farms).
- "Friendly school and culture for the new century" - it is, inter alia, Program of Equalizing Opportunities after Covid-19, 1000 green, zero-emission schools, digitization of programs.
- "Good climate for companies" - in the case of small companies, incl. lowering taxes, tax breaks, or supporting the development of family businesses; for medium-sized enterprises, support for foreign expansion, easier access to venture capital financing and tax reliefs are foreseen; on the other hand, large enterprises (both domestic and foreign investors) will be able to take advantage of the so-called Interpretation 590, i.e., an investment agreement (concluded directly with the Minister of Finance) on binding tax interpretations related to the investments undertaken, Investor Tax Service Centre - established at the Ministry of Finance, simplification of transfer pricing settlements and support in employing innovative employees.
- "Clean energy-clean air" - is an improvement of the Clean Air program, the introduction of the Governmental Small Island Gasification Program, the development of photovoltaics, the development of hydrogen technology, the construction of offshore wind farms and a nuclear power plant, energy certification of buildings, development of low-emission transport, activities supporting investments in green zones in cities, easier creation and expansion of national parks, creation of a fund promoting environmental education for children and youth.
- "CyberPoland 2025" - concerns, inter alia, facilitating/extending access to broadband internet, exempting e-services from stamp duties, create local digital competence centres, cybersecurity.
- "Golden Autumn of Life" - the lowest untaxed pensions, zero PIT for people working in retirement age, flexible forms of work for people in pre-retirement age.

Future directions of development in the perspective of 2050, including forestry-wood sector is to be determined by the National Development Concept 2050, on the preparation of which began in 2021. This document is to indicate the most important challenges (economic, social, environmental and spatial) facing Poland, formulate possible scenarios for the country's development in the perspective of 30 years and recommend strategic directions within public policies until 2050. Elements relating to the labour market and employees in the forest and wood sector are also included in the Human Capital Development Strategy 2030, updated at the end of 2020. It responds to the challenges of improving the use of human potential and ensuring social cohesion - labour market development, investments in new, permanent jobs and an increase in the level of employment. This strategy is to contribute, inter alia, to increase the competences and qualifications of the society, including digital ones, improve and fuller use of labour resources, increase the competitiveness of the economy, reduce poverty and social exclusion, and improve access to services provided in response to demographic challenges.

In 2021, the Government Program of the Polish Craft Incubator was launched and work is underway on a new law on crafts, which will be of great importance especially for small businesses, including wood companies, e.g., carpentry and furniture factories. The aim of the Incubator is to support the organization of the economic self-government of crafts in the field of human and social capital and institutional potential for the implementation of statutory activities, including the development of entrepreneurship and dual education, as well as strengthening the cooperation of craft organizations with entities from the public sector, enterprises and non-governmental entities. It will operate in the years 2021–2030, and the funds obtained in open competitions can be allocated by craft organizations, inter alia, to for additional technical

equipment, purchase of software, organization of professional competitions for young people, as well as consultations and training for employees and members of the organization<sup>117</sup>.

Research and development activities are of great importance for the development of the wood sector, growth of its innovativeness and competitiveness. The State Science Policy is a strategic document indicating the priorities for the functioning of the Polish system of higher education and science, also in relation to the wood industry. The currently consulted draft of the Policy defines actions aimed at the optimal use of the potential of science and higher education, increasing social trust in the results of research and scientists, development of the science and higher education system in line with current trends and challenges, constant improvement of the quality of research (reliable and ethical) and the growing importance of Polish science in the international arena. Its task is to provide optimal conditions, including financial ones, for the implementation of the cognitive function of science and for stimulating economic and social growth and overcoming emerging problems and challenges.

Due to a great shortage of dwellings in Poland (the estimate is 1.3–2.2 million), established National Housing Programme, which was adopted on the 27th of September 2016. It is a strategic programme document comprehensively describing the issues of the state's housing policy until 2030 (in this period the number of flats per 1,000 inhabitants should increase from 363 to 435). This is an instrument for the implementation of the Responsible Development Strategy, which is based on the Dwelling Plus package. The program provides for the construction of less expensive apartments for rent, as well as with the option of buying a flat, and is aimed at people with lower incomes and families with many children. The aim of the programme is construction of single-family wooden houses and apartments in multi-family wooden houses. These investments are being executed by Polskie Domy Drewniane company (PDD S.A.), whose main line of business is „energy-saving wooden construction encompassing erection of residential buildings, management of these buildings and letting of residential buildings or apartments with the option of their sale”. The company was also established to intensify wooden construction in Poland (ecological and energy-saving) and to promote the use of wood in construction (as one of the possible ways of achieving climate neutrality).

For the last few years, the construction policy in Poland has also been supported by the National Housing Programme, which sets forth principles and procedures of preparation and execution of housing investments. It's including investments on agricultural lands within city limits, on post-industrial lands, on post-military lands and on post-railway lands etc. In addition, there are few more programmes regarding housing policy, like: Mieszkanie na Start (Apartment for a Start), which provides state aid regarding housing expenses in the first years of rental, and a Support Programme for Social Tenement Housing, which based on preferential returnable financing granted by bank. It concerns not only new investments, but also refurbishments and adaptation of existing buildings.

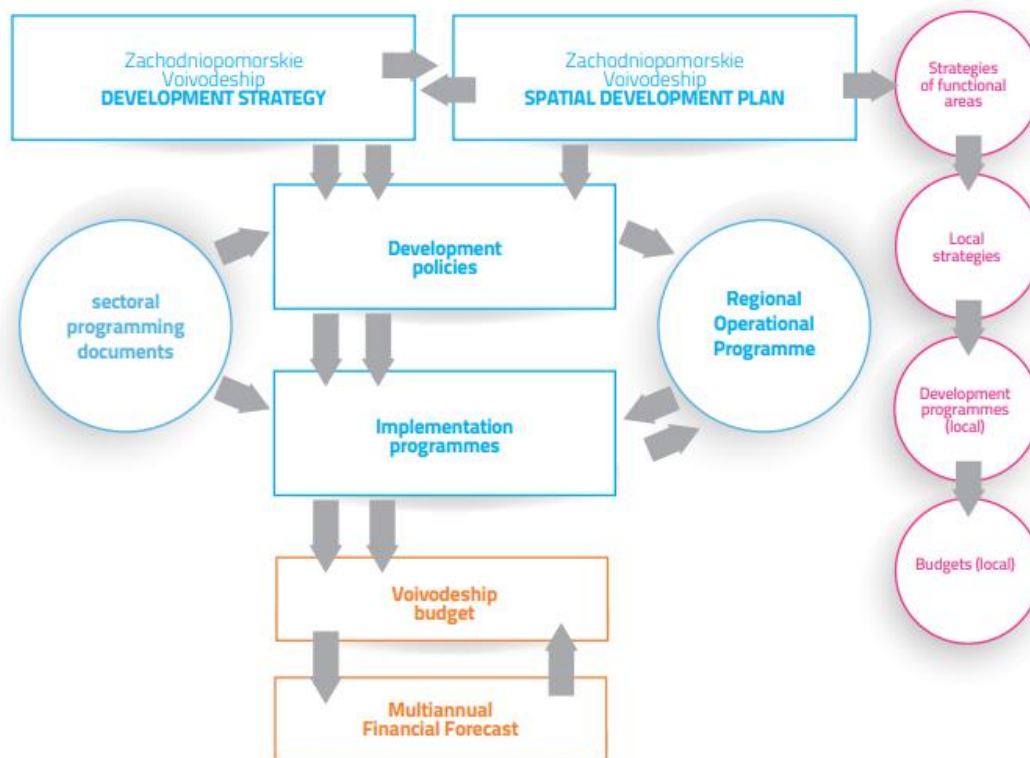
#### **5.4.1. Regional policies and programmes**

Due to the conditions resulting from legal regulations, the self-government of the West Pomeranian Voivodeship adjusts the practice of programming the development and management

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<sup>117</sup> West Pomeranian Social Economy Development Program for the years 2018 - 2022. (2017). Regional Center for Social Policy of the Marshal's Office of the West Pomeranian Voivodeship, Szczecin.  
[http://eregion.wzp.pl/sites/default/files/zachodniopomorski\\_program\\_rozwoju\\_ekonomii\\_spolecznej\\_na\\_lata\\_-2018\\_-\\_2022.pdf](http://eregion.wzp.pl/sites/default/files/zachodniopomorski_program_rozwoju_ekonomii_spolecznej_na_lata_-2018_-_2022.pdf)

of the voivodeship to the needs of the regional community. This process is dynamic, depending on the policy of the European Union and the national policy in relation to voivodships. In order to optimize this process, the West Pomeranian Development Programming Model has been developed (Figure 48).



**Figure 48.** Scheme of West Pomeranian Development Model<sup>118</sup>.

The West Pomeranian Development Programming Model consists of a three-tier system of relevant strategic documents. Its basic feature is the orderly ability to shape an active, sustainable development policy focused on the good and respect for the interests of all inhabitants of the region. The first level of strategic programming consists of the Development Strategy for the West Pomeranian Voivodeship and the Spatial Development Plan for the West Pomeranian Voivodeship.

The basic document defining the directions of development policy and goals in the West Pomeranian Voivodeship until 2030 and the most important document prepared by the voivodeship self-government, superior to other programming and operational documents at the regional level, is the “Zachodniopomorskie Voivodeship Development Strategy up to 2030” (SRWZ) adopted in 2019. This strategy identifies priority areas for which strategic goals of the development policy of the West Pomeranian Voivodeship have been formulated. The SRWZ is included in 4 strategic objectives, from which 14 directional objectives have been derived. All other directional sectoral activities implemented within the broad area of activity of the local

<sup>118</sup> Zachodniopomorskie Voivodeship Development Strategy up to 2030, 2019, Ed. Geblewicz O., [http://eregion.wzp.pl/sites/default/files/srwz\\_2030\\_en\\_size.pdf](http://eregion.wzp.pl/sites/default/files/srwz_2030_en_size.pdf)

government of the West Pomeranian Voivodeship remain consistent with this strategic vision or complement it.

### **1. Strategic Objective: Open Community.**

Aware inhabitants and involved communities - open and prepared for the challenges of the future

- 1.1 Strengthening demographic potential and family function,
- 1.2 Social inclusion and ensuring development opportunities for all inhabitants of the region,
- 1.3 Development of the sense of community and creation of social capita.

### **2 Strategic Objective: Dynamic Economy**

Shaping the high quality of life of the inhabitants and strengthening the competitiveness of the region (see also Table 8)

#### **2.1 Development of the economic potential of the voivodeship based on smart specializations, including:**

- undertaking activities for identification and development of regional smart specializations,
- developing instruments to support innovation and research and development zones,
- providing enterprises with access to tools for financing innovative ventures and technology transfer.

#### **2.2 Strengthening of the economy using the natural potential of the region, including:**

- strengthening the development of the blue and green economy,
- fuller use of the tourist and natural potential of the region,
- further development of renewable energy sources.

#### **2.3 Improvement of strategic management of economic development of the region, including:**

- supporting the development of innovation in enterprises,
- increasing the investment attractiveness of the region,
- supporting entrepreneurship in the region,
- strengthening the network of economic ties in the cross-border and macroregional system,
- internationalization of entities operating in the region.

**Table 8.** Indicators of implementation of 2nd strategic objective „Dynamic Economy”.

No.	Indicator name [%]	Base value 2017	West Pomerania Voivodeship			
			Projected value		Target values	
			2020	2030	2020	2030
1	Average share of innovative enterprises in total number of enterprises	13.7	14.0	17.4	17.5	21.4
2	Gross domestic expenditure on R&D	0.3*	0.6	1.1	0.7	1.3
3	Share of human resources in science and technology core (HRSTC) within the economically active population	19.9*	21.6	26.7	23.8	29.5
4	Foreign capital per capita (Poland = 100)	72.0	85.0	100.0	93.0	110.0
5	Employment in large and medium enterprises in relation to total employment	36.0	36.1	38.1	40.9	41.5
6	Percentage of students in science and technology majors (excl. foreigners) – according to ISCED-F 2013 classification	24.2	32.0	34.0	35.0	38.0

\* Base year 2016. Source: Zachodniopomorskie Voivodeship Development Strategy up to 2030<sup>119</sup>.

### 3. Strategic Objective: Efficient Self-government

Effective self-government – an integrated region. Territorial equality in access to high-quality public services

- Development of major urban centres,
- Development of non-agglomeration areas,
- Ensuring integrated and efficient infrastructure,
- Ensuring efficient and effective systems of public services,
- Strengthening competences for development management.

### Strategic Objective: Partner Region

Strong position and active role in interregional and cross-border relations

2.4 Strengthening the position of the region in the Baltic Sea Region,

2.5 Development of relations with the German Lands,

2.6 and the Berlin agglomeration,

2.7 Using the potential of the Western Poland macro-region.

Another strategic document in the voivodeship is the **Spatial Development Plan for the Zachodniopomorskie Voivodeship**, adopted in June 2020. Its goal is balanced spatial development of the voivodeship, serving the integration of the regional space with the European and national space, the internal cohesion of the voivodeship, increasing its competitiveness and raising the level and quality of life of its inhabitants to the average level in the European Union. To achieve this strategic goal it is necessary to:

<sup>119</sup> Ibid.

- deepening the integration of the West Pomeranian Voivodeship with the national and European space and the Baltic Sea Region, favouring the increase of the voivodeship's competitiveness,
- protection of the environment and its values, rational management of natural resources and minerals, waters, soils and forests,
- protection of cultural heritage resources, monuments, contemporary cultural assets and landscape,
- developing and strengthening the metropolitan functions of Szczecin, striving to give them scope supra-regional and cross-border,
- development of social infrastructure, especially in the field of housing, health protection and education,
- stimulating economic development with the use of the existing economic potential, human resources and natural resources, supporting sectors of the economy based on knowledge and innovation,
- developing a transport system integrated with the national and European system,
- development of technical infrastructure systems ensuring an adequate standard of living for residents and environmental protection,
- supporting transformations in rural areas towards the development of non-agricultural economic activity,
- elimination of development problems in stagnant areas and creating new areas of growth.

The plan formulates the objectives of spatial management of the voivodeship and the principles of its shaping and specifies directions of spatial policy in the long term. It is the basis for constructing operational programs for the development of the voivodeship<sup>120</sup>.

The second level of programming consists of sectoral development policies and implementation programs. Development policies cover detailed areas of regional self-government activity, important from the point of view of the voivodeship community. Policies define the thematic scope of the activities of local governments and build the doctrine of regional development without prioritizing and operationalizing them. The process of implementing the Strategy is carried out by designating and implementing specific actions in a specific time perspective and indicating the methods and means of their implementation. The implementation program appropriate for a given thematic area is a selection of specific investment projects and their tasks carried out by the voivodeship self-government, key to achieving development goals. It also indicates the sources and scope of financing for individual projects<sup>121</sup>.

The third level of strategic programming are sectoral programming documents binding at the regional level, both on the basis of the provisions of the relevant acts and due to the implementation of development policy by the self-government in various areas of life. They are dedicated to uniform thematic areas. It is assumed that there are no programming documents that go beyond the framework of one development policy. The implementation of the development objectives of the regional policy is based on the implementation of objectives and directions defined in individual development policies, taking into account the supremacy of the objectives of the Strategy, and in the operational dimension through undertakings indicated in

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<sup>120</sup> Environmental Protection Program of the West Pomeranian Voivodeship for 2016-2020 with a perspective until 2024, 2016, <http://eregion.wzp.pl/sites/default/files/programochronysrodowiska.pdf>

<sup>121</sup> Economic Policy of the West Pomeranian Voivodeship. (2021). Marshal's Office of the West Pomeranian Voivodeship. Szczecin, January 2021, [http://eregion.wzp.pl/sites/default/files/polityka\\_gospodarcza\\_wz\\_2021\\_0.pdf](http://eregion.wzp.pl/sites/default/files/polityka_gospodarcza_wz_2021_0.pdf)

implementation programs. If necessary, also development policies can be modified, adjusting their scope to the subject and possibilities of taking actions by the voivodeship self-government. Preparation, approval and implementation of development policies and implementation programs is the responsibility of the voivodeship board<sup>122</sup>.

#### 5.4.2. Smart specialisation<sup>123</sup>

In the West Pomeranian Voivodeship, the principle of multi-stage, evolutionary designation of Smart Specializations has been adopted. The starting point is the identification of Regional Specializations, on the basis of which, as a result of the Entrepreneurial Discovery Process and further detailed analyses, Smart Specializations are selected. The areas indicated as regional specializations are distinguishing areas against the background of the economy voivodships, and often against the background of the national economy. Companies from the areas of regional specialization are responsible for generating most of the revenues in the voivodeship, including almost all revenues from exports. However, their share in the value of sold industrial production shows that, apart from a few areas, there is still a great development potential. The area of innovation, which requires both financial and human resources support, is of particular importance here. A good prognosis seems to be the planned support from EU funds aimed at innovative development and cooperation of companies with research units, which gives an opportunity to transform regional specializations into smart specializations and increase their creative role in the national and international economy.

The following 8 Smart Specializations of West Pomerania have been identified:

- large-size water and land structures
- advanced metal products
- wood and furniture products
- environmentally friendly packaging
- chemical and materials engineering products
- modern agri-food processing
- multimodal transport and logistics
- information technology based products.

#### Wood and furniture products

The specialization is derived from the bioeconomy and covers both activities related to forestry, timber harvesting and the recovery of recycled wood, as well as the production of furniture and other wood and furniture products, including the production of wood-based elements for production of furniture, floors, walls, etc. The specificity of the links in the value chain indicates that the condition of the forestry-wood sector is strongly dependent on the quality and availability of wood. However, it should be expected that the development of this sector will be largely related to the use of innovative solutions in the field of design, wood-based materials

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<sup>122</sup> Ibid.

<sup>123</sup> List of the Smart Specializations in the West Pomerania Voivodship, Department of Strategic Management, Marshal's Office of the West Pomeranian Voivodeship, Szczecin 2016, available at: [http://smart.wzp.pl/sites/default/files/wykaz\\_inteligentnych\\_specjalizacji\\_pomorza\\_zachodniego\\_20160928.pdf](http://smart.wzp.pl/sites/default/files/wykaz_inteligentnych_specjalizacji_pomorza_zachodniego_20160928.pdf) [02.11.2021]; Regional Development Strategy for Intelligent Specializations in the West Pomerania Voivodship 2020+ RIS3 WZ, Strategic Management Department, Marshal's Office of the West Pomeranian Voivodeship, Szczecin 2016, available at: [http://eregion.wzp.pl/sites/default/files/ris3\\_wzp\\_0.pdf](http://eregion.wzp.pl/sites/default/files/ris3_wzp_0.pdf) [08.11.2021].

processing and processing technology, as well as recycling of recycled wood and its re-use in the production of wood-based materials. The forestry-wood sector existing in the region has many years of tradition and strongly influences the condition of the West Pomeranian economy. The analysis of the economic potential indicates a significant concentration of the industry against the background of the country and its significant share in the voivodship. The sector is very competitive, including on the international market. Attention is also drawn to the high research and development and innovative activity of enterprises engaged in activities covered by the specialization. In this case, the main factor in the development of innovation is the pursuit of increasing the quality and attractiveness of new products, the effective use of raw materials and the use of pro-ecological and energy-saving solutions. The implemented innovations directly translate into the observed dynamic development of the industry, which allows forecasting its durability in the coming years. Most of them are micro and small enterprises, although there are also medium and large enterprises with significant innovation potential and interested in the development of research activity and having the ability to create network connections<sup>124</sup>.

The directions of development of the specialization are:

- Technological innovation and improvement of the efficiency of natural resources and energy management.
- Intensification of cooperation between the economic and scientific circles.
- Increasing the number of implementations of new technologies.
- Developing a recognizable brand associated with durability and reliability of products,
- Intensification of cooperation between enterprises.
- Increasing the design attractiveness of products.
- Striving to obtain products with new and improved physicochemical properties and better quality and strength parameters.
- Changing the properties of wood and wood-based products to extend the range of applications.
- Creation of a scientific base in the region for the development of specialization.
- Development of the didactic base at the professional and higher level.
- Innovative solutions in the field of environmentally friendly material substitutes.
- Increasing the material efficiency of production by reducing waste and the share of damaged products as well as increasing the use of recycled materials.

Relationship with National Smart Specializations:

- NSS 4: Innovative technologies, processes and products of the agri-food and forestry sectors.
- NSS 6: Biotechnological processes and products of specialized chemistry and environmental engineering.
- NSS 11. Minimization of waste generation, including non-recyclable waste, and the material and energy use of waste (recycling and other recovery methods).

Linkage with research areas in the region:

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<sup>124</sup> Analysis of development trends in the field of technologies and new technical thoughts in Poland, Europe and the world for the wood and furniture industry, [http://www.wzs.wzp.pl/sites/default/files/files/19702/74558400\\_-1412985208\\_Analiza\\_trendw-\\_drewno.pdf](http://www.wzs.wzp.pl/sites/default/files/files/19702/74558400_-1412985208_Analiza_trendw-_drewno.pdf)



- Coating technologies in terms of, among others their energy efficiency and testing of paint coatings.
- Robotization and computerization of production processes.
- Operation and modification of forest machines.
- Design and design of furniture, devices and equipment for the furniture industry.
- Modern materials with improved fire properties for applications in the furniture industry.

## 5.5. Regional innovation ecosystem

In Poland, innovative activities are regulated by two laws on innovation of November 2016 and November 2017. They introduced a number of changes removing barriers to innovation in the country, including the improvement of the legal environment for innovative activities and the creation of a support system for innovative solutions. They are especially beneficial for companies willing to invest in research and development (R&D) and innovation. The most important assumptions of the act include:

- increasing the amount of tax relief for research and development activities to 100% and 150% for Research and Development Centres
- clarification and extension of the catalogue of costs eligible for R&D relief
- enabling the use of R&D relief for some enterprises operating outside Special Economic Zones
- extending the exclusion of the so-called double taxation of capital companies and limited joint-stock partnerships involved in R&D activities
- facilitating the financing of start-ups
- increasing the scope of operation of special purpose vehicles established by universities and scientific institutes of the Polish Academy of Sciences by economic activity<sup>125</sup>.

In the period 2014–2020, several programs financed by the European Union were available to support the development of innovation in enterprises by initiating or conducting research and development activities and cooperation with the science sector, among others in the field of commercialization of innovations. These included, among others:

- Regional Operational Program for the West Pomeranian Voivodeship 2014–2020 (RPO WZ)
- Intelligent Development Operational Program 2014–2020 (OP IR)
- Operational Program Knowledge, Education and Development 2014–2020 (PO KED)
- Horizon 2020 - Framework Program for Research and Innovation 2014–2020 (Horizon 2020).

For the years 2021–2027, Poland is to receive funds from the European Union EUR 76 billion from cohesion policy and the Just Transition Fund in the new financial perspective. It is expected that the national operational programs will be thematically similar to those currently implemented. Support for R&D and innovation is envisaged particularly in programs such as:

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<sup>125</sup> A favorable law, <https://www.gov.pl/web/edukacja-i-nauka/korzystne-prawo>

- Smart Growth - EUR 8 billion (support for, among others, innovation and cooperation between science and business)
- Knowledge, Education, Development - EUR 4.3 billion (support for, among others, innovation, science and education)
- Digital Poland - EUR 2 billion (support, inter alia, for broadband networks and the digitization process as well as innovative solutions in this area).

Under the new financial perspective, the West Pomeranian Voivodeship will receive EUR 1.311 billion for the implementation of the Regional Operational Program 2021–2027, a significant part of which will be allocated to supporting and implementing innovative solutions in the region<sup>126</sup>.

Innovation has a huge impact on the development of the economy. Innovative economy is an important instrument for shaping the high quality of life of the inhabitants and strengthening the competitiveness of the West Pomeranian Region. Cooperation between science and business is one of the basic directions of the voivodeship in the field of innovation policy. It assumes creating conditions for a stable, sustainable economic growth based on the development of innovation, particularly in the areas of smart specialization<sup>127</sup>.

Technological progress is a determinant of the competitiveness of regions, both in Europe and in the world. Market requirements for enterprises require constant improvement of the quality of their goods and services based on new, unique solutions. The indicator of this trend is the cooperation of research centres with the business community. Joint initiatives between science and business raise the level of development of entrepreneurship and innovation in regions, while favouring the construction of a knowledge-based economy. In terms of the economic development of the region, it is also important to actively involve the society in the process of building the regional innovation system.

In recent times, the importance of open innovation (such as joint ventures, contracts, outsourcing), eco-innovation and public sector innovation has started to grow. On the other hand, in innovative activity the importance of users, both subsequent links in the value chain, and consumers increases. Increasingly, customers and users of a product or service become co-authors of innovations. Enterprises from the West Pomeranian Voivodeship most often use proven innovations from Western countries or other regions of Poland. Moreover, the infrastructure environment of innovative activity is still at the stage of creating and adapting to the standards of the European Union.

Research on the innovativeness of Polish enterprises, published just before the pandemic, shows that nearly 35% of companies operating in Poland in 2017–2019 were innovative (introduced or tried to apply at least one innovation), while over 30% of companies could be described as innovative (introduced at least one innovation). The structure of the size of innovative companies was dominated by large companies (almost 57%). Polish enterprises most often introduced business process innovations (nearly 25%) and product innovations (13%). These

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<sup>126</sup> Find out more about European Funds. <https://www.funduszeuropejskie.gov.pl/strony/o-funduszach/fundusze-na-lata-2021-2027/dowiedz-sie-wiecej-o-funduszach-europejskich-na-lata-2021-2027/#Programy>

<sup>127</sup> Regional Innovation Strategy of the Westpomeranian Region for 2011 – 2020, Development programme, 2011, [http://www.rsi.wzp.pl/sites/default/files/files/19684/69348500\\_1412985179\\_RSI\\_en.pdf](http://www.rsi.wzp.pl/sites/default/files/files/19684/69348500_1412985179_RSI_en.pdf)

were mainly investment outlays in fixed assets - 65% of innovatively active companies undertook such activities<sup>128</sup>.

The region's area is characterized by a relatively low number of large companies, which is not conducive to increasing private expenditure on innovation and R&D. This translates into a weak position of the region in relation to other parts of the country. In 2019, 7.5% of enterprises from the service sector and 8.8% of industrial enterprises in the West Pomerania voivodship incurred expenditure on innovative activities which amounted to EUR 22 million and EUR 86 million, respectively<sup>129</sup>. In 2019, expenditure on innovative activities in enterprises per 1 professionally active person in the West Pomeranian Voivodeship was EUR 150, while the national average was over 3 times higher<sup>130</sup>.

Unfortunately, an important factor hampering the development of innovations in the region is the fact that entrepreneurs must finance them mainly with their own funds. This results in a relatively low gross value added in Western Pomerania as compared to other regions of Poland. Moreover, the voivodeship is characterized by a low level of knowledge and technology transfer to the economy, insufficient awareness of the impact of R&D activities on innovation and competitiveness of enterprises, as well as the lack of an adequate commercial offer of R&D institutions, including universities. In recent years, the region has achieved one of the lowest rates of internal expenditure on R&D per capita in Poland. Taking into account the size of expenditure on innovative activities in enterprises in relation to GDP in the West Pomeranian Voivodeship in 2019, this ratio was at the level of over 1% and was lower than the national average, placing the region among the lowest in the country.

In the region, as in the whole of Poland, no coherent system of institutions supporting innovation and technology transfer was established, which, like in Western Europe, would increase the number of innovative solutions. The mechanisms of information and cooperation in this area are not adjusted to the needs of the market, and the level of involvement of business-related institutions in the provision of services in this area should be assessed as low.

The challenges of the West Pomeranian Voivodeship in the area of implementing innovative solutions for the economy are primarily:

- building stable and sustainable economic growth based on innovation, particularly in smart specializations of the region
- increasing the awareness of the inhabitants and entrepreneurs of the region regarding the importance of innovation in the modern economy
- improving cooperation between stakeholders in the identification and implementation of innovative solutions
- creating a system of institutions supporting innovative activities and technology transfer
- improvement of procedures for commercialization of research results, including administrative services
- improvement of the innovative process from the laboratory phase, through semi-technical phases, to further phases of inventions development

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<sup>128</sup> Monitoring of innovativeness of Polish enterprises - results of the third edition of the 2020 survey. (2021). PARP, Warsaw, [https://www.parp.gov.pl/storage/publications/pdf/Raport\\_Monitoring-innowacyjnoci-polskich-przedsiębiorstw-III-edycja-2020.pdf](https://www.parp.gov.pl/storage/publications/pdf/Raport_Monitoring-innowacyjnoci-polskich-przedsiębiorstw-III-edycja-2020.pdf)

<sup>129</sup> Enterprises that incurred expenditure on innovative activities. (2019). Local Data Bank, Central Statistical Office

<sup>130</sup> Innovativeness of enterprises, <http://eregion.wzp.pl/obszary/innowacyjnosc-przedsiębiorstw>

- increasing the availability of funds for the protection of intellectual property and the implementation of inventions.

### **5.5.1. Value chain and stakeholders**

The scope of the Polish value chain covers the forestry-wood sector with products and/or services in all stages of production, through delivery to individual consumers, up to waste management and recycling (Figure 49). More than 70 stakeholders in the value chain have been identified and divided into four main groups:

- The State Forests National Forest Holding [1]
- Bureau for Forest Management and Geodesy [2]
- national and regional associations, organizations, clusters, chambers, platforms, foundations [3]
- research and training institutes, universities and education centres [4].

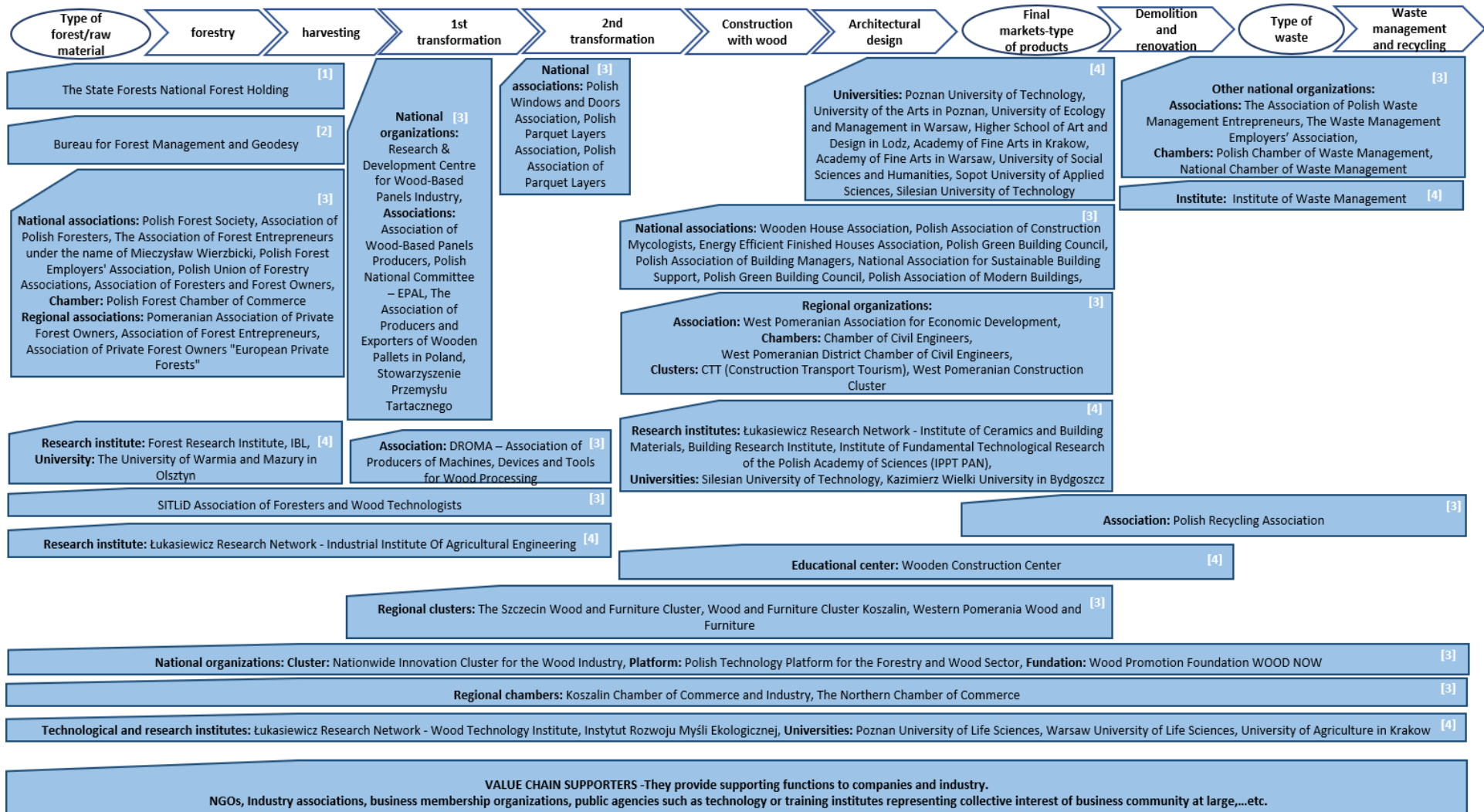


Figure 49. Wood construction value chain stakeholder map of Poland (own figure)

## 5.5.2. Competencies, capacities, key actors

### State organizations

#### ***The State Forests National Forest Holding*<sup>131</sup> [1]**

The State Forests National Forest Holding was established over 90 years ago and, despite many historical and organizational changes, the company operates to this day, combining tradition with modernity. The State Forests is a self-financing organization and does not use taxpayers' money. Forest districts operate at the national, regional and local level, employing nearly 25,000 people. The State Forests is the largest organization in the European Union managing the State Treasury forests. They manage almost one third of Poland's forest area.

#### ***Bureau for Forest Management and Geodesy*<sup>132</sup> [2]**

Bureau for Forest Management and Geodesy is a planning company and an expert company at the same time, which is one of the pillars of forest management in Poland. It operates throughout the country, offering a variety of services in the field of forestry, nature protection and the environment. Company was established over 50 years ago and has been at the service of Polish forests ever since. It also sets directions in forest management and participates in the development of forestry in Poland. Bureau is the main contractor of forest management plans, including mainly habitat inventories and analyses. It conducts periodic national forest inventory, updates forest resource assessments, and is the creator of a data bank on forest resources and the condition of forests in Poland (<https://www.bdl.lasy.gov.pl/portal/en>). In addition, he supervises tasks in the field of environmental monitoring, preparation of protection plans for national parks and nature reserves, inventory of Natura 2,000 protected areas and other studies related to nature protection and environmental protection.

### **National and regional associations, organizations, clusters, chambers, platforms, foundations [3]**

The ***Polish Chamber of Commerce of the Wood Industry*<sup>133</sup>** is one of the largest national economic self-government organizations in the wood industry. It was founded in 1992 and associates approximately 150 companies. Most of the stakeholders are companies from the wood industry, but there are also producers of garden architecture, floors, pallets, wooden houses, machines and tools, etc. It brings together the largest entities in the country, as well as small and medium-sized ones. All companies are equal members of the Chamber. Its mission is to actively support the development of the broadly understood Polish wood industry, along with the integration of producers and cooperation between them.

The ***Association of Wood-Based Panels Producers*<sup>134</sup>** has been operating in Poland since 1992, representing the interests of Polish wood-based panels plants and communities cooperating with the industry. Currently it brings together producers of: fibreboards produced by wet and dry methods, particle boards, plywood, veneers and other board products, as well as

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<sup>131</sup> <https://www.lasy.gov.pl/en>

<sup>132</sup> <https://www.buligl.pl/web/en/home>

<sup>133</sup> <https://pigpd.pl/en/home/>

<sup>134</sup> <https://sppd.pl/en/strona-glowna-english/>

scientific circles related to the board and wood-based materials industry and companies working for this industry.

**Polish Technology Platform for the Forestry and Wood Sector**<sup>135</sup>. The platform supports the activities of the forestry industry and research units operating in its area, cooperating with chambers and economic associations of all sectors of the wood, furniture and pulp and paper industries, as well as ministries responsible for economy, science and the environment. The platform was established in 2005 and is a member of the Forest-Based Sector Technology Platform - FTP. The platform is open and accepts new members on the basis of an appropriate Membership Declaration. It currently associates about 50 entities, including companies, industry self-government units, research units and other institutions. The aim of the platform is to increase the competitiveness of the Polish economy in the forest and wood sector and to promote innovation and scientific and technical development in the forest and wood sector.

**Wooden House Association**<sup>136</sup> was established in 2003. It is an organization operating throughout Poland and abroad. He cooperates with national and international organizations and institutions. The association unites about 60 members, including producers of wooden houses and companies producing and selling materials used in wooden construction. The association provides information on companies building wooden houses, technologies used and initiatives taken for the development of wooden construction in Poland. The aim of the Association is to promote the idea of wooden construction, to promote wood as an ecological material and to cooperate with other organizations to develop Polish standards for wooden houses.

**Energy Efficient Finished Houses Association**<sup>137</sup> was established in 2017. It is an organization of about 60 companies dealing in energy-saving prefabricated construction and / or producers of materials dedicated to this type of structure. It emphasizes the promotion of prefabricated wooden construction, energy efficiency and passivity of buildings. The aim of the Association is to support the timber construction industry by organizing exhibitions, fairs, conferences and publishing articles in the press. In addition, it cooperates with banks, facilitating the availability of loans dedicated to prefabricated construction. Thanks to joint activities with the Ministry of the Environment and the State Forests, the Association promotes the idea of ready-made houses in Poland.

#### **Research and training institutes, universities and education centres [4]**

**Łukasiewicz Research Network - Wood Technology Institute**<sup>138</sup>. The Institute is the only research institution in Poland which deals in a comprehensive manner with theoretical and practical issues of wood processing, its application and creation of new composites based on wood. The Institute's mission is to conduct research aimed at production of modern materials and improvement of production technologies and processing techniques, which leads to harmonious and sustainable development of the wood industry and to achievement of high international competitiveness of the Polish wood sector. Through implementation of research results in the form of innovative, energy-saving and hygienic materials using both wood raw material and wood waste, which help to improve the quality of life, have positive influence on the

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<sup>135</sup> <https://itd.lukasiewicz.gov.pl/en/activities/technology-platform/training-2>

<sup>136</sup> <http://domydrewniane.org/>

<sup>137</sup> <https://www.sedg.pl/>

<sup>138</sup> <https://itd.lukasiewicz.gov.pl/en>

environment and health, and increase the share of renewable energy carriers in the national energy balance, the Institute strives to create modern wood sector which meets the requirements of the 21st century society.

**Forest Research Institute**<sup>139</sup>. The Institute conducts research and development works in the fields of forestation and restoration of forests, care, use, as well as ecology, nature protection, genetics, and forest economics and policy. In addition, he actively participates in the development, for state authorities, of legal acts and other documents, including those resulting from international conventions and agreements, as well as the State Forest Policy. It is the organizer and co-organizer of many international and national meetings, seminars, trainings, workshops and conferences, and also conducts nature and forest education for children and youth.

**Poznan University of Life Sciences**<sup>140</sup> is a university with a 100-year tradition of agricultural and forestry studies. Currently, the University of Life Sciences in Poznan is one of the most important science universities in the country. Every year it educates about 8 thousand students, in 25 fields of study (including: forestry, furniture design, wood technology), employs over 800 academic teachers, including over 135 professors. Education at the University takes place on three levels: bachelor's / engineering studies, supplementary or long-cycle studies, and doctoral studies. There are 6 faculties at the university (including the Faculty of Forestry and Wood Technology) that offer a wide range of attractive study programs.

**Warsaw University of Life Sciences**<sup>141</sup> is the oldest agricultural and natural science university in the country, dating back to 1816. The school is a thriving academic centre, enjoying recognition and unwavering interest of young people and teaching staff at home and abroad, valued for their care for the quality of education, faithfulness to the best university traditions, openness to changes and dynamic development. The university educates at 14 faculties (including: forestry, wood technology, construction and environmental engineering), offering 40 study programs (including 9 conducted in English): from natural and technical, to veterinary, social and economic faculties, and educates nearly 16,000 full-time, part-time, doctoral and postgraduate students as well as international student exchange.

### **Key companies in the forestry-wood sector in the West Pomerania region**

The following industries play the greatest role in industry development in West Pomeranian Voivodeship: metal and machinery, chemical, shipbuilding, wood and furniture, energy, construction and agri-food production, including fishing. The ICT sector, a leading industry in the area of Industry 4.0, is also becoming more and more important. Until now, the main clusters of industrial plants were located in larger cities of the region, but as industrial zones are established, production is gradually dispersed and located in communes on the outskirts of cities and in developing industrial zones.

In the area of planned investments and the development of the wood and furniture industry, the West Pomeranian region shows the best conditions in relation to other regions in Poland. Below there are presented the most important companies from forestry-wood sector in West Pomeranian from the processing industry, and they are producers of wood, wood products,

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<sup>139</sup> <https://www.ibles.pl/>

<sup>140</sup> <https://puls.edu.pl/en/>

<sup>141</sup> <https://www.sggw.edu.pl/en/>



wood-based panels, paper and furniture manufacturers. These companies use modern technologies and are innovative in their production processes.

**Kronospan Szczecinek Sp. z o.o.**<sup>142</sup> The company is the largest producer of medium/high density fibreboards (MDF/HDF) and particle boards. In addition, the company also offers its customers wall panels in a wide range of colors and patterns. The company mainly addresses its offer to the construction industry, furniture and wood-based manufacturers in Poland and Europe. The company, thanks to significant investments in the expansion of production capacity, has become one of the most significant companies in the wood-based materials industry, with its logo of the highest quality products and a wide range of designs. An additional advantage of the company is functioning within an international group, which significantly improves the process of implementing innovative processes and technological methods influencing the company's development. Kronospan Szczecinek has a universal production technology that enables the implementation of even large and extremely complex orders. In addition, the company carries out numerous investments in the field of environmental protection, aimed at reducing energy and water consumption during production and reducing gas emissions resulting from the combustion of fossil fuels.

**IKEA Industry Poland Sp. z o.o.**<sup>143</sup> The company belongs to IKEA Industry, which is its representative in Poland. Its main task is to ensure production capacity for the IKEA Group. For the production of its products, it uses wood of the highest quality. Production is based on extensive technology, using one type of raw material to optimize efficiency and capacity. This ensures short design and implementation times as well as efficient distribution. Swedwood Poland is constantly investing in modern production lines and technological production processes, incl. technical development of R&D, distribution networks, logistics. The company's assets are long-term investments and ambitious goals of increasing competitiveness and production efficiency. The company respects all environmental requirements. The wood comes from properly managed forests, in accordance with the international standards of the FSC certificate.

**Koszalin Wood Industry Enterprise Szczecinek S.A.**<sup>144</sup> The company is one of the largest producers of sawnwood in Poland. It operates on the wood, sawmill and garden market, producing about 300 thousand. m<sup>3</sup> of sawnwood. The main activity of the company is wood processing in the broadly understood scope. It produces its products in 9 plants processing coniferous sawmill material, 2 plants processing hardwood and 1 plant producing glued boards. The main assortments of production include lumber, construction elements, glued elements, railway sleepers, floor boards, panelling, finishing strips, elements for the production of furniture and other products, small wooden architecture products. The basic raw material is pine, beech and oak wood. The company constantly invests in modern technologies to meet the requirements of its customers. New technological processes mainly concern the processing of sawnwood - drying, planning, gluing, optimization of the process of cutting sawn timber defects, impregnation and steaming. The company sells its products in Poland and abroad. The recipients are manufacturers of construction joinery, furniture factories, commercial warehouses, producers of small wooden architecture, manufacturers of glued wood, carpentry workshops.

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<sup>142</sup> <https://pl.kronospan-express.com/pl>

<sup>143</sup> <https://www.industry.ikea.pl/>

<sup>144</sup> <https://www.kppd.pl/en/start-eng/>

**Andrewex wood processing group – ABWood<sup>145</sup>**. The company is a dynamically developing factory in the wood industry. It has 3 sawmills with a total sawing capacity of 900 thousand. m<sup>3</sup> of round wood per year and at the same time produces a wide range of products: furniture, furniture elements, glued boards, pallets, wood briquettes, paper chips. The organizational structure of the company includes a sawmill department, a furniture department, a mechanical department and a quality department, which supervises the functioning of the quality system and final inspection of finished products. The company uses all waste from wood processing to produce modern, ecological fuel - wood briquettes. In addition, the company constantly invests in technological processes and machinery in order to improve quality, efficiency and competitiveness on the wood and furniture market. Large capital expenditure is also allocated to projects related to the development and launch of new products.

**FURNIKO SP. Z O.O<sup>146</sup>**. The company specializes in the production of modern and functional office furniture. The company is at the forefront of Polish office furniture manufacturers. The main goal of the company is to provide a high-quality product with a modern design. The technological process of production in the FURNIKO factory is carried out with the use of modern, numerically controlled machine tools, which ensure precise and error-free processing of all details at every stage of production. The company sells its products through a network of authorized distributors on the domestic and EU market. The company constantly invests in modernizing its machinery park. The company has been awarded many awards, prizes and certificates for its activities, confirming the high quality of its products.

**Meblokwen<sup>147</sup>**. The company is a manufacturer of kitchen, lounge and garden furniture, and also deals with the production of furniture and garden gazebos, benches, tables and chairs, and comprehensive renovation of stylish apartments. It offers projects and their implementation to its clients. The company, as one of the few in Poland, deals with laying reed thatch. Manufactures and installs reed hoods over windows and doors. For the production of its products, the company uses only ecological raw materials: wood, reed, stone.

**Pomeranian Timber<sup>148</sup>**. A manufacturing and trading company dealing with the import and export of hardwood, joinery profiles and tropical wood lumber. The leading area of the company's activity is the production and trade of sawn timber, flooring materials and furniture elements from domestic and European deciduous trees. The company bases its production of wood products in 80% on the raw material obtained from the Polish State Forests, cultivates cultivation in accordance with international ecological standards and documents it with the Forest Stewardship Certificate. The production department is equipped with three sawmills processing 45 thousand. m<sup>3</sup> of hardwood per year. The company is a significant supplier of high-class veneer logs to the Far East market, 90% to China, Japan and Indochina (Vietnam, Malaysia, Thailand) and Western Europe. European beech dominates the export of veneer logs.

**Rega sp. z o.o<sup>149</sup>**. The plant was established in 1992 and due to family carpenter traditions, almost from the very beginning, it produces houses of wood both in building and half-timbered frame. Company offer prefabricated wooden houses of the highest quality and has a strong position on the manufacturers of wooden houses. Rega build both houses, depots,

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<sup>145</sup> <https://andrewex.pl/en/home/>

<sup>146</sup> <https://www.furniko.com/>

<sup>147</sup> <http://www.meblokwen.pl/>

<sup>148</sup> <https://pomeriantimber.pl/eng>

<sup>149</sup> <https://www.rega.pl/en/>

sheds, garages as well as roof trusses, from small structures to large stately mansions. Houses are in traditional and modern structures, build in Poland and abroad, both for expansion and on turn-key basis, according to the customer's expectations and preferences. The priority in the business run by company is increasing the value of company through continuous development and systematic dissemination of the latest technology contained in the products offered.

**Wood-House<sup>150</sup>**. A construction company with family traditions, founded in 2012. He has many years of experience in the construction of Canadian houses, and the current area of activity is the West Pomeranian Voivodeship. In recent years, the company has built about 50 wooden frame houses in Poland and abroad, as well as about 100 Canadian houses in the country. The company provides high quality and professionalism of its services, constantly increases the level of service performance, combining many years of experience with the use of the latest trends. It also uses high-quality products and machines and has many certificates. Gap analysis in the regional innovation ecosystem.

The regional innovation ecosystem in the West Pomeranian Region is complex and long-term. The complexity of this ecosystem consists, first of all, of economic factors, i.e. the dependence on access to financing for individual activities, as well as social, organizational and formal-legal factors, which determine the success in the implementation of individual ventures. The diversification of entities responsible for the implementation of individual activities is also of great importance, in particular the nature and type of units responsible for individual investments, i.e., government and local government units, non-governmental organizations, private entities as well as natural persons. The most important barriers that may prevent or delay the process of introducing innovations in the region include:<sup>151</sup>

- Economic barriers - they are related, for example, to the lack of incentives to apply ecological solutions, the inability to finance certain activities (small retention, afforestation of land), constantly increasing prices of wood raw resources or too low penalties and fees for illegal use of the environment (i.e., illegal logging),
- Organizational barriers - in this case, insufficient human resources may be of great importance, e.g., those responsible for environmental protection in local and regional self-government units, inadequate education programs to the needs of the labour market, as well as shortages in some fields of study, i.e., wooden construction, lack of professionals specializing in high wooden construction or wooden public buildings,
- Social barriers - include insufficient public awareness of ecology, including air, water and soil pollution, the benefits of wood and other natural resources in building houses, schools, hospitals, kindergartens, but also in the field of waste management (the consumer lifestyle of society is becoming more and more common),
- Formal and legal barriers - among them, we can mention: the lack of direct and clear legal provisions (e.g., obliging specific entities to implement appropriate actions regarding fire safety in wooden buildings), large fragmentation of companies from the forestry-wood sector which hinders the development of the industry and innovative solutions, ownership problems of investment areas,
- Information barriers - which are mainly related to the inconsistency of data from various sources (no uniform database on the environment), including unreliable completion of declarations by individual units provided for the purposes of monitoring and compiling national statistics.

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<sup>150</sup> <http://wood-house.net.pl>

<sup>151</sup> Environmental Protection Program of the West Pomeranian Voivodeship for 2016-2020 with a perspective until 2024, 2016, <http://eregion.wzp.pl/sites/default/files/programochronyrodowiska.pdf>

## 5.6. Needs and starting points for transformation

### 5.6.1. SWOT analysis

This chapter aims to identify the key elements for creating a regional roadmap for increasing the use of wood in construction in the West Pomeranian Voivodeship. For this purpose, the SWOT analysis was used (strengths and weaknesses of the region as well as the opportunities and threats to its development (Table 9 and the background information on the region above).

**Table 9.** Regional SWOT table for wood construction in West Pomerania.

Strengths
<ul style="list-style-type: none"> <li>• development potential related to the cross-border and coastal location</li> <li>• the possibility of supra-regional expansion in the Baltic Sea region and the Western Poland microregion</li> <li>• large natural and landscape resources</li> <li>• leading position in regional specializations (maritime economy, tourism, large-scale agriculture, forestry processing industry)</li> <li>• great potential of the maritime economy</li> <li>• well-developed tourism industry</li> <li>• good conditions for spa tourism, active and specialized</li> <li>• very good condition of the natural environment</li> <li>• potential for active investment for new enterprises</li> <li>• two academic centres in the voivodeship</li> <li>• high economic activity of the inhabitants</li> <li>• well-developed wood and furniture industry</li> <li>• well-developed municipal network infrastructure</li> <li>• large share of forests in the voivodeship's area (indicator forest cover about 36%)</li> <li>• good health condition of forests in the voivodeship (the lowest index defoliation of stands in the country)</li> <li>• relatively little forest fire damage</li> <li>• establishing new forms of nature protection</li> <li>• systematic activities in the field of nature education (development educational and didactic base / infrastructure, educational paths).</li> </ul>

### Weaknesses

- location on the country border and poor transport accessibility in the regional structure of Poland
- insufficient transport accessibility of ports
- not fully used potential in the interregional relations of the Baltic Sea basin
- insufficient cooperation in the economic and social dimension with foreign agglomerations
- insufficient level of innovation in the region and the number of large and medium-sized entities
- relatively low level of competitiveness of the sector agricultural (as a whole), due to the lack of agricultural processing
- low professional activity of the inhabitants and educational offers in the area of vocational education inadequate to the needs of the labour market
- demographic problems, especially within city limits and in rural areas
- relatively high level of unemployment in rural areas
- relatively low navigability of rivers and poor condition of water and inland waterway infrastructure
- loss of development potential by medium-sized cities
- problems in cities - concentration of negative socio-economic phenomena
- urban pressure and fragmentation of natural space
- incomplete degree of development of protection plans and task plans protection for Natura 2000 areas, National Parks and landscaping
- no arrangement documentation for all forests private in the voivodeship.

### Opportunities

- increasing activity of external investors, in particular, medium and large entities economic
- focus on regional specializations, in particular the blue and green economy
- development of innovation and internationalization of West Pomeranian enterprises
- development of networking and cluster initiatives
- new forms of financing innovation
- improvement of the demographic situation in the region
- intensification of economic ties in the Baltic Sea region
- increasingly effective use of cross-border and interregional cooperation
- increasing sea and land accessibility of major seaports
- development of inland navigation based on the Odra Waterway
- development of large-scale agriculture
- effective urban-rural and public-private partnership
- favourable trends for the development of tourism
- availability of funds for the development of plans for protective tasks
- for Natura 2000 areas and protection plans for parks
- national
- availability of funds for active protection of species and habitats
- support for projects related to increasing retention
- support for sustainable agriculture and afforestation.

### Threats

- intensification of barriers to economic development and the resulting reduction of the investment attractiveness of Poland and Western Pomerania
- further depreciation of the importance of Western Pomerania in the national and European systems
- weakening of the EU position on the global market and thus the competitive position of Poland and the region
- reducing the stream of aid funds flowing into the region
- inadequate educational offer to the changing conditions on the labour market
- deepening of unfavourable changes in the demographic structure of the society; increase in the demographic dependency ratio
- the widening of the development gap in the field of ICT between the voivodship and its global surroundings
- disturbance of the hydrological regime and reduction of capacity
- retention
- expansion of alien species
- climate changes
- no arrangement documentation for all forests
- private in the voivodeship
- ever-increasing threat in forests of all forms of ownership from
- damage caused by deer and beavers
- periodic high threat from leaf-eating insects.

Source: Regional Development Strategy for Intelligent Specializations, 2016; Environmental Protection Program of the West Pomeranian, 2016; Zachodniopomorskie Voivodeship Development Strategy up to 2030, 2019; Analysis of development trends in the field, n.d.

### 5.6.2. Main conclusions for a regional roadmap

Based on the SWOT analysis and information about the region, barriers and stimulators have been identified that may affect the increase in the use of wood in construction sector in West Pomerania Voivodeship. They result from the specific features of the construction industry, as well as the general conditions for its operation in Poland. The barriers indicate the existing limitations in the development of this industry, and the stimulators - determine the positive impulses of this development. Both barriers and stimulators have a different character and strength of impact on the condition and development of wooden construction in the region<sup>152</sup>.

The most important barriers include:

- low demand for wooden buildings; in a significant part of society there is a belief that a house made of wood is of a low standard and is a temporary structure, not resistant to e.g., fire

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<sup>152</sup> The list of barriers and stimulators for the development of wooden construction in the West Pomeranian Voivodeship was based on: Bidzińska, G., Szostak, A., Leszczyszyn, E., Augustyniak, D., 2019. Budownictwo drewniane stymulatorem rozwoju rynku mieszkaniowego w Polsce [Wooden construction as a stimulus for the development of the housing market in Poland] in: *Ekodom – Innowacyjne Biomateriały i Rozwiązania dla Budownictwa Drewnianego [Ekodom – Innovative Biomaterials and Solutions for Wooden Construction]*. Poznan: Łukasiewicz Research Network – Wood Technology Institute.

- lack of governmental and non-governmental programs promoting and supporting wooden construction
- lack of national standards / technical conditions for wooden construction (which creates real difficulties in the implementation, supervision and acceptance of construction works)
- technical regulations hindering the use of wood in construction, in particular fire safety regulations
- lack of knowledge about modern solutions in the field of material engineering of contractors building wooden houses
- lack of a system of statistics on wooden construction in the official CSO reporting (lack of reliable, credible and comprehensive information on this industry, necessary for decision-making bodies creating the socio-economic and housing policy of the country),
- lack of educational programs on wooden construction (both at the level of vocational education, as well as secondary and higher education)
- low production potential and poor technical facilities of Polish companies producing and building wooden houses
- unfinished process of preparing standards enabling the use of construction wood
- lack of large sawmills specializing in the production of construction sawn timber
- bad habits and practices in the field of preparation of wood materials for wooden construction (e.g., impregnation with non-ecological agents)
- insufficient R&D funding, poor cooperation between industry and science in the field of wooden construction
- low level of knowledge of potential investors about the latest technologies and materials that can be used in wooden construction
- low level of cooperation and coordination of activities of various entities related to wooden construction (chambers, associations with decision-making bodies)
- still little implementation of modern, innovative material solutions, which means not using the potential of the latest technologies in wooden construction
- poor construction supervision, especially in the case of individual investments
- shortage of employees, especially those with appropriate qualifications.

In turn, stimulators may have a positive effect on the development of wooden construction, be an impulse for this development, contribute to the growth of innovation and competitiveness of this sub-segment of construction in the West Pomerania construction market. The most common are:

- expanding groups of investors / buyers of wooden houses
- abundant domestic wood raw material base
- good condition of the wood sector, generating modern wood materials for wooden construction
- European Union aid programs and funds, especially for "green construction"
- technologies that improve the energy efficiency of wooden houses
- promotion of wood and modern / innovative wood materials for construction
- promotion of construction in wooden technology
- knowledge of a part of society about wooden construction as reducing environmental pollution and counteracting climate change, including mainly CO<sub>2</sub> lowering
- activity of local governments in the field of housing and construction
- proximity to European markets generating demand for Polish wooden houses
- identifying wooden construction with the idea of sustainable development, bioeconomy and circular economy

- ecological character of construction in wooden technology, fashion for ecological behaviour, transferring pro-environmental attitudes to the purchasing preferences of buyers of wooden houses
- large recycling possibilities for wooden houses
- personalization, the ability to influence the form and layout of the house / apartment, the ability to take into account your vision, the needs of future residents, control the construction process
- strong competition motivating to constant improvement of production processes in wooden construction
- new markets for wooden houses
- new sources of supplies for raw materials and materials for the construction of wooden houses
- cooperation with scientific and research units favouring the creation of modern technical and technological solutions in wooden construction
- flexibility and the ability of companies building wooden houses to react to changes in the external environment, both at the regional, national and global levels.

The further development of wood construction in the West Pomerania Voivodeship, as well as in Poland, depends on a number of circumstances / conditions that should be met for this development to be possible. These conditions can be external (exogenous - resulting from the external environment of the wood construction sector) and internal (endogenous, originating in the sector itself) and have a diverse nature, e.g., legal, organizational, economic or technological. However, they are to a large extent a derivative of barriers slowing down the currently possible / potential dynamics of the sector's development (and result from the need to overcome / eliminate these barriers).

Final remarks on the most important conditions for the development of wooden construction in the West Pomerania Voivodeship:

The development of wooden construction in the West Pomerania Voivodeship is mainly determined by the development and implementation in practice of a wide, permanent and effective promotion of it in society, as well as the constant and effective transfer of knowledge in the field of wooden construction and modern technologies of wooden houses construction from countries that are important on the international market in this respect.

The current activities and further development of wooden construction determine the expectations of investors. Therefore, companies in this industry should know the preferences of their clients, and in their development strategies, take into account the current determinants of social behaviour and create instruments / tools for shaping them in the direction desired for the development of wooden construction, using stimulators and overcoming barriers to this development.

Wooden construction in the voivodship has a great development potential, which, however, has not been fully used so far. Therefore, it is necessary to develop faster and more stable than before in the coming years - to create a wooden construction market in the voivodship and stimulate demand for wooden houses, and as a result to increase its share in the structure of the entire construction and housing construction.

It is required to quickly take a number of strategic actions at the national level, mainly of a legal nature (e.g., unification of construction standards, introduction of new standards in the field of thermal requirements or standards for the construction and design of wooden houses) and economic (financial support, such as preferential loans, subsidies, tax exemptions, surcharges).



There is also a need to redefine the housing and construction policy in Poland and to develop tools and instruments that effectively implement its assumptions into business practice.

Despite the currently unfavourable situation in wooden construction, mainly due to the still low awareness of the advantages of this construction in the society and the lack of state support for its development, in the coming years, under a number of conditions, it may develop dynamically. In addition, multi-storey wooden construction, including residential buildings, may have great potential and a chance for rapid development in the future.

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## 6. Outlook: A European open innovation platform

This chapter gives a short overview of progress and next steps regarding the WP7.

### 6.1. Wood4Bauhaus – Wood Sector Alliance for the New European Bauhaus

The European Commission's *New European Bauhaus* (NEB)<sup>153</sup> calls for a creative, interdisciplinary, novel movement embedded in society to imagine a sustainable future together and to engage on a transformative path towards affordable and beautiful living spaces in urban and rural environments. A key step is the transformation of the building sector into a circular model that can also counteract the escalating climate crisis. This transformation requires prioritised research in the use of organic materials in buildings.

Launched in March 2021, the *Wood4Bauhaus Alliance* (W4B)<sup>154</sup> is a coalition of the main EU wood sector umbrella organisations, connecting research, industry and trade unions. The W4B Alliance is a full NEB partner and creates an open platform that bring together researchers, industry, architects, creatives and authorities to raise awareness, strengthen policy dialogue and launch joint actions fostering innovation in long-lived engineered wood products and hybrid, circular-by-design building solutions. W4B engages an open dialogue with all interested stakeholders to help sharing good practices about the Circular Economy and Green Buildings which maximise the use of nature-based materials, innovative building systems and smart solutions for the benefit of European citizens.

The W4B founding partners include:

- InnovaWood is the European network for wood science, innovation and education with 60+ member organisations in 28 countries, including RTOs, universities, VET centres and clusters.
- The European Confederation of Woodworking Industries (CEI-Bois) is an umbrella organisation of 21 European and national organisations from 15 countries backing the interests of the wood sector.
- The European Panel Federation (EPF) represents 100,000 direct jobs and counts more than 5,000 wood-based panel manufacturing and furniture companies in 25 countries.
- The European Organisation of the Sawmill Industry (EOS) represents 35,000 sawmills in 12 countries.
- The European Federation of Building and Woodworkers (EFBWW) is the European Trade Union Federation grouping 76 national free trade unions from 34 countries with members in the building, building materials, woodworking, forestry and allied industries and trades.
- The InnoRenew CoE is a new research centre in Slovenia focused on sustainable construction with renewable materials.

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<sup>153</sup> New European Bauhaus main website: [https://europa.eu/new-european-bauhaus/index\\_en](https://europa.eu/new-european-bauhaus/index_en)

<sup>154</sup> Wood4Bauhaus and alliance member websites: [wood4bauhaus.eu](http://wood4bauhaus.eu) [innovawood.com](http://innovawood.com) [cei-bois.org](http://cei-bois.org) [euro-panels.org](http://euro-panels.org) [eos-oes.eu](http://eos-oes.eu) [efbww.eu](http://efbww.eu) [innorenew.eu](http://innorenew.eu)

- BASAJAUN and WoodCircus<sup>155</sup>, two R&D project consortia fostering sustainable wood supply chains from forest harvesting to final buildings and Circular Economy solutions in the sector, have been instrumental to set up the W4B Alliance. They are represented by BASAJAUN partners Tecnalia, VTT and InnovaWood.

The goal is to inspire as many actors as possible to co-create and develop contributions to the NEB from European to regional and local level, all in the common interest to advance and exploit as much as possible nature-based materials and innovative building systems. The W4B Alliance will therefore:

- Encourage research and innovation for novel and innovative use of wood in the built environment.
- Foster new collaborations and cocreation of different stakeholders across disciplines, sectors, and society.
- Facilitate knowledge sharing and skills development especially also towards future generations.

The W4B Alliance has initiated already various activities including various meetings, workshops, recommendations and proposals to initiate the open innovation platform with various actors in the sector. Two policy documents have already been developed jointly with European wood industry umbrella organisations and submitted to the NEB High Level group:

- i) Research Needs & Priorities supporting Sustainable Construction with Nature-based Materials under the European Green Deal (26 May 2021)
- ii) Policy recommendations to encourage nature-based materials like wood in construction and renovation of the built environment (22 June 2021)

The W4B Alliance is proactive in reaching out to other i) NEB partners and to ii) major construction companies that have interest in innovative wood solutions, to increase the visibility of the European woodworking sector. The Alliance will be a key partner of the platform and become one main channel for the communication of BASAJAUN results.

## 6.2. Regional roadmaps for transformation

Based on this report, the regional roadmaps are elaborated in close exchange between the project partners who identify common directions of EU regions for the development of wood construction. A series of regional meetings is hosted by the project partners that explore and validate the roadmaps together with stakeholders in their innovation ecosystem. This leads to a coordinated vision and strategy for the OIP and enhances options and synergies for cross-fertilization between the regions. The BASAJAUN innovations, demonstrators and regional profiles are used as first showcases to engage the dialogue and explore ways to adopt solutions also in other regions. This also includes recommendations to address specific regional barriers and to improve the regulatory framework. Collecting and sharing best practices from other countries, both in wood construction and other sectors, for example on Green Public Procurement or on open innovation, are of high interest for all regions.

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<sup>155</sup> WoodCircus, Horizon 2020 project no. 820892, 2019-2021. <http://www.woodcircus.eu/>

The main next steps are:

1. Regional stakeholder meetings to obtain priorities and feedback for roadmaps.
2. Collect best practices for wood construction innovation and demonstration projects using national and regional funding (from whole Europe).
3. Outreach to other interesting initiatives.
4. Draft of OIP concept and business plan.
5. Initiate launch with BASAJAUN demos, innovations and other results



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