

Editorial

Wood Productions and Renewable Materials: The Future Is Now

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Abstract: The forest sector plays a key role in meeting the climate change challenge. Forest products and renewable materials are masterpieces in achieving this role. This editorial details the benefits of these forest products and celebrates the contributions of the authors who submitted their work to this special edition of Forests journal. This edition presents 11 papers, which include the characterization of a new fiber supply, the description of advanced materials and their environmental impact, and an examination of structural products, wood protection, and modifications.

Keywords: forest products; renewable materials; product development; wood protection; environmental impact; wood characterization; wood structures; advanced renewable materials

The forest sector plays a key role in meeting the climate change challenge. The Intergovernmental Panel on Climate Change recognizes forests as part of the solution, with their significant contribution to mitigation efforts and multiple environmental and social co-benefits [1]. Furthermore, the forest sector represents an important share of the economy in many countries. Wood and renewable materials are among the final links of the forest value chain. Under sustainable management, forest products transform forests into carbon sequestration tools, provide essential goods and services, and contribute to the gross domestic product.

To keep global warming below 2 °C in 2100 and to reach the goals set by the Paris Agreement, building construction must become carbon-neutral or carbon-negative before 2030 [2]. This objective will require substantial efforts to reduce both the embodied and operational impacts of buildings where most renewable materials are used. This could be achieved in terms of embodied energy (in MJ) and carbon, which is commonly used in the literature as a substitute for total greenhouse gas (GHG) emissions (in kg CO₂eq) [3].

As the 2030 deadline approaches, there is a limited window of opportunity for action. If efficient strategies are implemented quickly and adopted, the large mitigation potential of renewable building materials could be exploited at low to negative cost using available technologies, while providing other value-added benefits [4]. Otherwise, suboptimal practices could be locked in for several decades due to the long-life cycles of the non-renewable building materials, which would represent a threat to climate change mitigation [5].

To take advantage of the benefits of bio-based materials, a better understanding of these materials is needed. Product development and optimized processes are key actions to make these positive benefits happen in our societies. This requires a thorough knowledge of the products and their value chain. Plantation trees are part of the solution. Chien et al. [6] has proposed using beams and self-tapping screws as metal connectors and resorcinol formaldehyde resin as glue to assemble components, based on various assembly configurations of Japanese cedar (*Cryptomeria japonica* (L. f.)

D. Don) lumber obtained from a plantation in Taiwan. Typical flexural load-bearing capacity and bending failure modes were observed in their studies, paving the way for the use of this plantation stock to structural application. New products must find their way to the market. The industry's competitiveness is an asset and Vu et al. [7] has suggested an assessment for the international competitiveness of the Vietnamese wood processing industry.

Renewable materials require protection strategies. Before and after surface protection treatment, near-infrared red spectroscopy has been demonstrated as a technique to understand the wood surface workability [8] of *Cryptomeria japonica* (L. f.) D. Don) and *Chamaecyparis obtuse* ((Siebold and Zucc.) Endl.) after oil treatments. The technique has a promising potential to discriminate the type of oil present on these traditional construction species in Japan. Wood protection can be achieved through wood modification. Impregnation is a wood modification technique that has existed for many years, but the use of new impregnation products such as maleic anhydride can lead to significant reduction of wood's moisture sensitivity [9].

The appearance of wood products is part of the quality of this material. Architects and designers tend to value its appearance in the works. Reducing discoloration of wood due to photodegradation caused by ultraviolet (UV) and visible (VIS) radiation by means of hindered amine light stabilizers (HALS) and nanoparticle pretreatments has been studied [10] on Siberian (*Larix sibirica* Ledeb.) and European larch (*Larix decidua* Mill). Their most effective pretreatment was a combination of UVA and HALS in a synergistic effect without affecting the gloss of the product.

Understanding renewable materials also means characterizing their anatomy. The windmill palm (*Trachycarpus fortune* (Hook.) H.Wendl.) and its application potential have been characterized by its anatomy [11]. Techniques such as scanning electron microscopy (SEM), atomic force microscopy (AFM), and a nanoindenter allow for the development of a new use for this abundant raw material. AFM has also been used by Wu et al. [12], who characterized the microstructure and mechanical properties of Poplar catkin fibers. Their work is essential to have good information on the fiber material, which has the potential to be part of the advanced material of tomorrow.

The development of advanced renewable materials started about 10 years ago. This represents an interesting path to include more bio-based materials in our society and to offer new opportunities to value forest resources. An example of this is the formulation of a nanocellulose aerogel from Poplar (*Populus tomentosa*) Catkin fiber [13]. The use of cellulose nanofibrils modified polyurethane foam composite as structural insulated material is another example of the use of an additive for advanced materials from renewable materials [14].

The development of new materials involves knowledge of their in-service behavior, especially in airtight environment where VOCs can be released. It was the aim of Cao et al. [15] to characterize the VOCs from plywood under such conditions. Advanced materials from renewable raw materials should also be developed in respect with reducing energy consumption and limiting CO₂ emissions, which is more than a trivial approach. The life cycle analysis (LCA) and its variations (static, dynamic, consequential, input/output, etc.) are powerful tools to support the product development scientist. These are powerful tools but are too cumbersome to be useful for product developers. Streamlined approaches such as those proposed by Heidari et al. [16] have great potential to support the scientific community in the early stage of product development.

The future of wood products and renewable materials is promising. There is a tremendous potential for our environment and our economies, and there remains much work to be done. This special issue reflects some of the great advances in this research field and I would like to express my gratitude to all the authors for their timely and high-quality contributions. I would also like to thank all the anonymous reviewers for maintaining the quality standard of the special issue. A final thank you to the editorial team at MDPI forests.

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