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The contribution of forests and forest products to a circular bioeconomy

Circularity concepts in wood construction

Note by the Secretariat

Summary

This document was prepared by the secretariat to facilitate discussion among member States on the work of the joint Economic Commission for Europe/Food and Agriculture Organization (ECE/FAO) Forestry and Timber Section (joint Section) on the contribution of forests and forest products to a circular bioeconomy. This work is in line with the mandate given by the ECE Committee on Forests and the Forest Industry (COFFI) and the European Forestry Commission of FAO (EFC) during their Joint Session in 2021 (ECE/TIM/2021/2 FO:EFC/2021/2).

During the discussion of this agenda item, the secretariat will inform COFFI of the ongoing work on the publication on circularity concepts in wood construction and will ask member States for comments.

I. Background

1. The ongoing Joint Section's work on circularity concepts in forest-based industries results from a mandate given by the Economic Commission for Europe Committee on Forests and the Forest Industry (COFFI) and the FAO European Forestry Commission (EFC) during their joint Session in 2021 (ECE/TIM/2021/2 FO:EFC/2021/2) to:

(a) "Prepare a series of studies further reviewing the application of circular models in specific forest-based industries, including through identification of case studies and best practice

(b) Take into consideration the whole forest-based value chain and bring attention to the circular nature of wood as a renewable resource and the role of sustainable forest management".

2. In line with this mandate, the Joint Section is pursuing the work on "Circularity concepts in wood construction" as part of the planned series, including the following studies:

(a) "Universal preconditions of circularity in forest-based industries" planned for 2023. The study will cover different aspects of forest management such as forest health and regeneration, provision of ecosystem services and the optimal use of forest resources, which have an impact on the circularity of forest-based production processes. The study also aims to link the questions of circularity with the natural carbon cycle. To that end, the study will look at the circularity potential and challenges in the end-of-life management of forest-based products.

(b) "Circularity concepts in wood construction" as an example of long-lived products value chain planned for 2022. The study will analyse how circularity concepts can be applied in the construction industry at different stages of the value chain and in different construction methods. It will also look at the circularity aspects of the retrofitting and demolition of existing buildings. The study will present the industry context as of today and will point out opportunities and challenges in transition towards more circular practices. The analysis will be supported by examples of good practice (reuse, repurpose, recycle, urban mining, modularity, etc.).

(c) Circularity concepts in pulp and paper industry" as an example of a group of commodities with short lifespan planned for 2023. The study will analyse how circularity concepts can be applied in the pulp and paper industry at different stages of the value chain and in different industries using pulp and paper, such as printing or packaging. The study will present the industry context as of today and will point out opportunities and challenges in transition towards a more circular practice. The analysis will be supported by examples of good practice (reuse, repurpose, recycle, urban mining, etc.).

3. The following Executive Summary provides an overview of the scope of the upcoming publication on circularity concepts in wood construction. During the session the secretariat will provide further updates and will ask member States for to comments.

II. Executive Summary

4. When it comes to sustainability and circularity, wood as a natural raw material has a number of advantages over other building materials. The natural cycle of wood begins in the forest as trees grow, with solar energy and carbon dioxide as key inputs to wood formation. The cycle continues with conservative harvesting from sustainably managed forests and use of wood in producing a broad range of products. When used in the industry in a cascaded way, wood circulates in the technical cycle where it can be recovered either at the end of its first useful life, or in the form of residues or by-products from production processes. Wood used in construction can be applied in diverse functions, as parts of buildings (e.g., for structural frames, decking, flooring, wall and roof sheathing, window frames, doors, and more) or at different stages of construction processes (e.g., for foundation framework supports and scaffolding).

5. Whether or not a practice is sustainable rests on three pillars: environmental protection, economic viability and social equity. Wood fares well in all these categories. The fact that wood is renewable, is produced using solar energy, is composed of captured and stored carbon as it is formed within growing trees, and can be converted to useful products using relatively little fossil energy all add up to define a material that is less environmentally impacting than such materials as steel, masonry and reinforced concrete. These things translate to environmental advantage only if wood is produced in a sustainably managed and responsively harvested forest or plantation. But here too, wood has an advantage in that third-party oversight of forest management is widely practiced via forest certification programmes that have been in place for almost three decades. Providing for rigorous evaluation of all aspects of forest management, including impacts on soil health, water quality, fish and wildlife habitats, rare and endangered flora and fauna, cultural and historical sites, and more, these programmes provide a means of ensuring attention to important issues while producing sustainable volumes of wood and other products and services. They also provide a social context for wood production, bringing to the fore common social concerns and allowing external overview of industry practices. No such supply chain assurances, consultation mechanisms or third-party oversight programmes are in place for concrete, steel or any other construction material.

6. In many parts of the UNECE region wood dwelling units account for approximately 10 per cent of new construction, or less. Limitations on building with wood, including limits on construction height also exist in many places.

7. The new types of wood products which have enabled wood to displace steel and reinforced concrete in tall buildings are all the result of extensive research over many years. They are also the result of focused attention to obtaining greater uniformity of properties than exhibited by solid wood. The cumulative result of many decades of research – and more than a century since the issuance of a German patent for glue laminated timber – mass timber buildings today contribute to circularity and environmental sustainability while also providing a highly engineered and high-performing material for construction. Mass timber allows for the beneficial use of renewable resources that can be fashioned into useful products with less manufacturing waste than previous forms of structural wood products, that provide low carbon-emission alternatives to reinforced concrete and steel, and that store massive quantities of carbon for as long as they remain in existence.

8. Modern wooden construction methods have been developed with economic pragmatism in mind, intuitively applying sustainability and circularity principles at the same time. New technologies incorporating a high degree of prefabrication are employed. This prefabrication speeds construction processes, provides for precision sizing of modules and connections and thereby promotes energy efficiency of completed buildings, greatly reduces waste and protects modules from the effects of weather.

9. Responsible wood use in construction is more circular and sustainable than use of other common building materials. Wood has inherent advantages and provides multiple benefits because it is a natural material, can be fashioned into useful building components with minimal climate impact, and can be incorporated into buildings which have lower lifecycle energy consumption and lower carbon emissions than non-wood structures. Substitution of wood for reinforced concrete or steel in construction results in reduced emissions. Significant additional carbon storage could occur within the built environment with the use of wood in construction. Wood use in the construction sector results in lower use of fossil fuel energy and lower embodied fossil energy in the built environment. The reduced greenhouse gas emissions and use of renewable bioenergy in wood produce manufacturing contribute to circularity and sustainability. In any kind of building a reasonable carbon strategy is to incorporate as much wood as possible.

10. Although wood use in construction offers substantial sustainability and circularity benefits, there is also additional innovation that is could be explored. Currently, waste from building deconstruction is not being recovered effectively. Designing for building disassembly and material recovery needs to be accomplished to improve the circularity of wood in the construction sector. The data suggests that there is considerable room for improvement in wood recycling at the end of life for buildings. The greatest opportunity for

improved circularity for wood is in the recovery and reuse or recycling of building demolition waste.