Comment on JRC brief on the forest-based bioeconomy

15 May 2021
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General comments

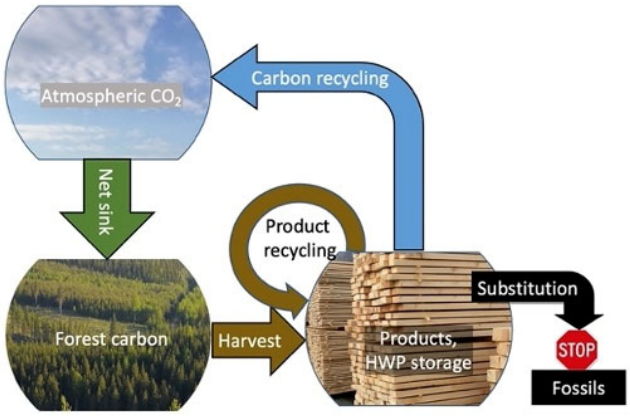
The EU Joint Research Centre (JRC) published a brief on 6 May 2021 titled: "Brief on the role of the forest-based bioeconomy in mitigating climate change through carbon storage and material substitution". This note reviews the brief and makes some suggestions for future enhancements.

Overall, the brief makes a good job in conceptualizing how the forest-based sector as a whole interacts with the global climate. JRC makes a fundamental point in that a holistic perspective is required to understand and develop the sector's contributions to climate solutions. With this it is understood that the forest shouldn't be analysed separately from the wood-based value chain and the mutual dependencies between these two systems should be made explicit. This is particularly true when aiming to leverage the full potential of the forest and forest-based sector for effective and large-scale climate change mitigation solutions.

Current focus in EU policy on forests is as a net sink and storage of carbon. This is reviewed and problematized. Following prevailing carbon accounting standards policies, such as LULUCF, tend to consider the forest as an isolated system, providing a high net sink that can be used in policy to offset fossil emissions in other sectors. In fact the EU Green Deal expects to increase this net sink to relieve pressure for reducing fossil emissions in other sectors. The brief makes a good review of issues with this expectation. More densely stocked forests would be prone to insect or fire damages, and growth would also gradually decrease. These risks are higher in set-aside areas where natural disturbances can be expected to be higher. Increasing the net sink in European forests, as projected in the Green Deal, would require extraordinary efforts and investments in forest management.

The brief thoroughly reviews the concept of carbon storage in Harvested Wood Products. While the net effect is much smaller that the net sink in forests, this is an established way to report and characterize climate benefits of wood-based products. However, the larger potential lies in displacement of fossil emissions. It is important to distinguish between these effects as they are fundamentally different. It is good that the brief has a separate section on displacement, although some improvements are suggested below.

Generally, the brief supports a holistic perspective of the circular forest-based bioeconomy, which should be strongly commended. The figure below seeks to illustrate the components that the brief considers.



Circular forest bioeconomy

Areas for improvements

It's the economy

For a brief on bioeconomy, the role of economics and markets could have been made more explicit. A major incentive for managing European forests is the demand for wood. While there are other regulatory and sometimes market-based arrangements for forest services and non-wood products, it is the income from wood that drives forest management towards high growth and less damages. In other words, we would not have had the current large net sink without a well-functioning forest-based sector that delivers wood-based products and bioenergy to society. And we will not be able to enhance the net sink in forests unless the forest-based sector grows. The road to a stable and increasing carbon stock in the forests goes through active management and harvesting of wood.

Similarly, there could have been a stronger focus on potential for innovation and efficiency in the wood-based value chain. It is clear that major climate benefits are to be found throughout the sector through more efficient use of raw material, new products, and more effective use of products. This potential is probably much larger than the potential of an

increased net sink in the forest, plus there is a positive feedback as investment in forest management could increase. Here, the system perspective would really become useful.

Conclusively, the fundamental point that economic performance and climate benefits go hand in hand in the forest-based bioeconomy should be made stronger.

Components that are left out

While strides towards a system perspective is taken, there are some components that are left out of the discussion:

- The sector still, in absolute terms, have considerable fossil emissions. Major reductions have been made in recent decades, particularly as own bioenergy is used in industrial processes, but work remains – particularly in transport of raw material and products;
- Similarly, if the forest-based bioeconomy is to be viewed as a circular system (see figure above), the full value chain should be considered, to consumer products, recycling of these and end-use, often as bioenergy.
- Rapidly evolving BECCS technology promises to add another level of climate benefit to the sector. As the business case also evolves, the European forest industry may be in a position to actively remove hundreds of million tons of CO_2 every year – in addition to the net sink in forest/HWP and the displacement of fossils;
- For a complete picture of displacement effects, all product categories must be included, and also consideration of the effects of recycling and end-use. In the brief (and in reference to this authors study from 2020) only solid wood products are included. Both fiber-based products and wood-based bioenergy delivers substantial displacement effects and should not be left out.

Displacement concept

The brief correctly note that the displacement (substitution) effect of wood-based products have historically received less attention as it is not part of regular GHG reporting. This is not to say that the effect has not been included, but that it was only indirectly accounted for as implicitly lower emissions in other sectors.

This also means that the concept as such and how to calculate the effect is still evolving.

In IPCCs Climate Change and Land Report, material substitution is included in their analysis of mitigation potentials. The potential is put at a relatively modest level (0.25-1 $GtCO_2e/yr$ globally) and refers only to solid wood products replacing cement and steel (IPCC, 2019, p.48). The mitigation potential of Bioenergy with Carbon Capture and Storage (BECCS) is considered much higher at 0.40-11.30 $GtCO_2e/yr$, out of which "up to several $GtCO_2e/yr$" (p.25) relates to the bioenergy as such leading to "avoiding combustion of fossil energy" (p.575), i.e. a substitution effect although not referred to with this wording in the Land report. It is also important to note that:

- These are estimated potentially <u>additional</u> mitigation through substitution by wood and bioenergy. That is, the level of substitution/prevention effects already in place

through delivery of forest products are taken for granted from a climate change mitigation perspective.

- Wood fibre products are not considered in the Climate Change and Land report.

Overall, it is notable that substitution effects derived from the land-based sector is given a prominent role in the IPCC projections, alongside enhancing carbon sinks and conserving storage in the biosphere.

In the brief, only substitution effects from solid wood is considered, and assumed to be valid only for a fraction of the total volume of solid-wood products. In other words, a marginal-effect concept is applied, as it is for solid-wood products in the IPCC analysis. Both fibre products and wood-based bioenergy are excluded in the brief. This leads to severe underestimation of the sector's contribution in displacing fossil/cement emissions.

A more appropriate approach is to turn the question around and ask "How much fossil/cement emissions would be needed to replace forest-based products?". This gives the true picture of the role of wood-based products in moving towards a fossil-free (or net-zero) society. The assumption (as implicitly is made in the brief) that some products would then not be demanded by the market would be a different analysis of consumption reduction. This is in itself an important topic but can't be applied to the forest-based sector in isolation. In fact, from a climate perspective, such consumption reduction should preferably focus first on fossil-dependent material and energy.

For above reasons, this commentary note defends the referred application of displacement effects made by Holmgren (2020) where the full volume of forest-based products contributes, on average, to a displacement of 0,5 tCO_2e per m^3 harvested. Of course, this varies a lot between products and product uses. A challenge ahead, which the brief also identifies, is to increase the displacement effect, which can be done through innovation, efficiency gains as well as increased harvest levels from the forest (under the condition that forest growth is simultaneously enhanced).