# Question 11

## How can a forest-based bioeconomy support biodiversity and climate neutrality?

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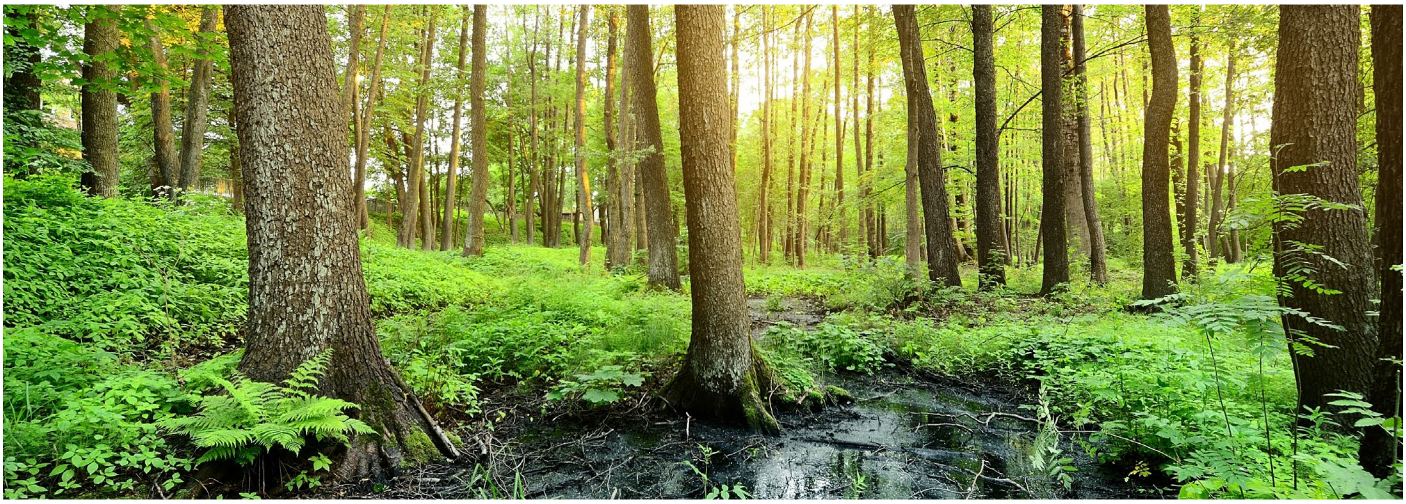
The Paris Agreement requires major societal and economic reforms to ensure that the global average temperature remains below 2˚C pre-industrial levels. Achieving this target requires a significant reduction in gross anthropogenic carbon dioxide ($CO_2$) emissions and an increase in human and biosphere carbon sinks. Forests are natural systems that remove carbon dioxide from the atmosphere via photosynthesis, and store carbon in biomass. Part of this carbon is transferred into soils through litterfall and tree mortality. In managed forests, part of the carbon (mainly in tree stems and major branches) may be extracted from the forest during harvest for material or energy use. If the wood is used for energy purposes, the carbon stored will be released when the wood is burned. If the wood is used for material use, the carbon is stored in wood products. In addition to carbon storage in forest ecosystems and in wood products, using wood can provide climate benefits by reducing fossil GHG emissions if they replace more greenhouse gas (GHG) intensive materials and fossil fuels.

Forests and forestry therefore play a key role in climate change mitigation; reducing deforestation and forest degradation lowers greenhouse emissions, forest management and afforestation can maintain or enhance forest carbon stocks and sinks; wood products can store carbon over the long-term; and wood products can substitute for emissions-intensive materials. Whereas it is difficult to exactly estimate the role of forests and forestry in achieving climate neutrality, the potential is generally considered to be significant (Roe et al., 2019).

For climate change mitigation and climate neutrality objectives, forest-based bioeconomy can bring climate substitution benefits (e.g. Leskinen et al., 2018), in addition to forest carbon sinks, and carbon stored in harvested wood products such as wooden buildings. For example, when using wood instead of concrete and steel as construction material, emission reductions can be achieved by less energy intensive construction processes and materials. For example, according to Leskinen et al. (2018), using 1 ton of wood for structural construction instead of concrete and steel, it is, on average, possible to avoid 2.4 tons of $CO_2$ emissions. However, it is also important to analyze holistically the overall climate impacts of forest-based bioeconomy and take all components of mitigation into account simultaneously. In the future, it is also important to pay attention to the development of product portfolios and aim to use forest biomass for the most climate-beneficial product categories.



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The impact of the bioeconomy on biodiversity depends to a large extent on the way we manage our forests. With quite high confidence we can say that a more intense use of forests will have negative consequences for biodiversity. However, bioeconomy development also spans many different sectors and there are also opportunities for the bioeconomy to be developed in such a way that it supports biodiversity. After all, there won't be a bioeconomy without biodiversity.

One key issue in forest-based bioeconomy development is the prevention of deforestation. The reforestation of abandoned agricultural landscapes and degraded landscapes also plays an important role in bioeconomy development. The restoration of traditional and establishment of new silvopastoral systems (cultural landscapes such as traditional wood pastures and grazed forest) are also part of bioeconomy development. Increasing forest cover and the creation of diverse landscapes, with structural diversity (diverse natural elements and a mosaic of semi-open and closed canopy forest) will have a positive impact on biodiversity. More ecological forest management practices such as continuous forest cover management, leaving dead and living retention trees (Gustafsson et al. 2012), and an increase in course woody debris (Stokland et al. 2012) will benefit many forest species as well.

Many generalist forest species thrive quite well in managed forest. But there are also rarer and specialized forest dwellers that would need old-growth forest conditions or large undisturbed forest areas, e.g. the three-toed woodpecker, white-backed woodpecker, flying squirrel, capercaillie, Ural owl etc. For these species, large protected forest areas or relatively undisturbed wilderness areas would be beneficial. However, the area of protected forest areas in Europe is rather small (12% are protected with the main objective of conserving biodiversity, 1.5% are strictly protected with no management interventions (Bauhus et al., 2017)) and even though it is obvious that there is a need to expand protected areas this takes time and has to be balanced with other forest functions and users. Because protected areas alone are not enough to safeguard biodiversity, it is important that managed forests also focus on conservation by adapting ecological forest management principles and mimicking more close-to-nature forest conditions.

Using forest biomass for wood-based products as well as utilizing forests for non-wood forest products brings a long-term economic interest to forest owners and other stakeholders for sustainable forest management, in order to maintain and develop the capacity of natural resources in long run. In addition, different market mechanisms developed for supporting various ecosystem services can serve the same purpose. Economic interest can therefore create the motivation and financial possibilities for acting against forest disturbances, and maintaining biodiversity and ecosystem services. The development of the forest bioeconomy and related technologies may also diversify the need for different tree species for various purposes, which, in turn, encourages the diversification of forests. In addition, ensuring the continuation of forest management can help biodiversity by avoiding large-scale closed forest canopies, and lead to an underrepresentation of early development stages and open patches that also contribute in particular ways to biodiversity.

To combine objectives related to biodiversity and climate, e.g. Verkerk et al. (2020) argue for the concept of Climate Smart Forestry (CSF). According to Verkerk et al. (2020), CSF is a missing component in national strategies for implementing actions under the Paris Agreement and is needed to (a) increase the total forest area and avoid deforestation, (b) connect mitigation with adaption measures to enhance the resilience of global forest resources, and (c) use wood for products that store carbon and substitute emission-intensive fossil and non-renewable products and materials. It is critical to find the right balance between short and long-term goals, as well as between the need for wood production, the protection of biodiversity and the provision of other important ecosystem services (Verkerk et al., 2020).

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