TIMBER PRODUCTS IN THE BUILT ENVIRONMENT

It is well established that deforestation and land-use change play a significant role in contributing to increased levels of atmospheric carbon dioxide (CO_2). However, forestry can also contribute to reversing this trend, because atmospheric carbon can be sequestered in

Photo: Lone Ross Gobakken

The process of tree growth utilises atmospheric carbon in the production of wood biomass. When timber is harvested, this sequestered carbon can continue to be held in products that are derived from trees. The growing of trees is good, but so is harvesting them, provided it is done sustainably.

European forests have increased in area by approximately 2% in the past decade. The net annual increment (NAI) of European forests (the amount of wood that is created by trees every year minus natural losses) is in the region of 770 million m^3, while annual fellings are around 480 million m^3 [1], meaning that European forests act as a sink for atmospheric carbon dioxide. The benefits of atmospheric carbon storage can continue if timber is used in long-life products, such as the built environment. These benefits are even greater if timber is used as a substitute for building materials with a higher associated embodied energy for any given functional unit [2]. Although forests can be used to produce timber, they can also be managed for other additional benefits such as biodiversity, recreation, landscape, prevention of soil erosion or flooding.

Although forest biomass can be used as a sink for atmospheric CO_2, as the trees reach maturity the carbon inventory approaches a plateau [3]. Thus, in order to ensure continued sequestration of atmospheric carbon, it is necessary to harvest the biomass (and replant) and utilise this material in long life products, thereby storing the atmospheric carbon for longer periods [4]. Providing markets for timber ensures the survival of the forestry industry and provides an incentive for further planting. The felling of trees in well managed forests never exceeds the NAI, and the trees that are removed are replaced by manual restocking, of natural regeneration. If the felled timber is used immediately for energy production, then the carbon that is released by combustion is not immediately replaced by the re-growth of the forest; resulting in what is called a 'carbon pay-back time' [5]. Although there are benefits if the burning of fossil fuel is avoided through the use of biomass, much greater benefits arise if the harvested timber is used in long-life products.

Furthermore, when the end of life of a timber product is reached, the wood it contains can continue to be used as a carbon store by being cascaded down through lower value products (e.g. a timber beam can be chipped to make par-

ticleboard), keeping the atmospheric carbon in the materials carbon pool for longer [6]. Once the maximum physical use has been made of the wood, it can finally be burnt with energy recovery, returning the stored carbon dioxide to the atmosphere and also reducing the amount of fossil carbon released through substitution.

Timber is one of very few structural materials that is derived from atmospheric carbon dioxide. It can be used to replace alternative construction materials which have much higher associated embodied energies, providing additional benefit [7]. The use of timber provides additional benefits by supporting the economic health of the forestry sector, such a rural employment, providing incentives for replanting and for forest management for a variety of other benefits. The forestry industry uses certification and chain of custody schemes, linked to forest management plans to ensure that the timber is produced and harvested in an environmentally responsible and sustainable manner.

When determining the benefits of using timber compared to other construction products, the arguments can become complex because rival industries see timber as a threat to their market share. The production of all construction materials involves emissions of carbon dioxide associated with the processing, transport and maintenance during the functional lifetime. Analysis of the benefits of using different materials requires that a common functional unit is considered and that performance in service is known and that final disposal is considered. Such analyses often rely heavily on assumptions and this can (and does) confuse the comparisons. Many studies clearly show the benefits of substitution by using timber products, but other studies have been produced that can show the opposite.

However, there is no significant material in use in the construction sector that is made from atmospheric carbon dioxide and only a few that can be cascaded down through several life cycles. There are no other significant construction materials that can be incinerated at the end of life-cycle without release of fossil carbon. Timber is the ideal material for the circular economies of the future.

References

[1] EUROSTAT
[2] Lippke, B., Wilson, J., Meil, J., Taylor, A. (2010) Characterizing the importance of carbon stored in wood products. Wood and Fiber Science, **42**(CORRIM Special Issue), 5-14.
[3] Perez-Garcia, J., Lippke, B., Comnick, J., Manriquez, C. (2005) An assessment of carbon pools, storage, and wood products market substitution using life-cycle analysis results. Wood and Fiber Science, **37**(CORRIM Special Issue), 140-148.
[4] Storaunet, K.O., Rolstad, J. (2002) Time since death and fall of Norway spruce logs in old-growth and selectively cut boreal forests. *Canadian Journal of Forest Research*, **32**(10), 1801-1812.
[5] Holtsmark, B. (2012) Harvesting in boreal forests and the biofuel carbon debt. *Climatic Change*, **112**, 415-428.
[6] Skog, K.E., Nicholson, G.A. (1998) Carbon cycling through wood products: the role of wood and paper products in carbon sequestration. *Forest Products Journal*, **48**(7/8), 75-83.
[7] Gustavsson, L., Pingoud, K., Sathre, R. (2006) Carbon dioxide balance of wood substitution: Comparing concrete- and wood-framed buildings. *Mitigation and Adaptation Strategies for Global Change*, **11**(3), 667-691.

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