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Carbon balance of harvesting technologies in short rotation energy plantations in Hungary

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Forest management is the only economic activity, which allows the sustained removal of a significant amount of carbon from the atmosphere. Carbon neutrality of wood as raw material must be justified also nowadays, considering several factors forestry is a supplier of traditional, renewable raw materials as products for different industrial and household processes. The „raw wood product" is usually the base of other different final products, and its ecological impacts in the forest production system are recognised as only the part of the total impacts. The application of Life-Cycle Assessment (LCA) in forestry remained a challenge for the LCA community.
In our research project by the method of LCA, we have carried out the environmental impact assessment of harvesting technologies. Calculated on a common functional unit (1 ha), we have performed the comparative environmental LCA for working systems of short rotation energy plantations (poplar, willow). On the basis of their carbon footprint, we have compared the typical technologies (different harvesting technologies per ha of 3 ha poplar technology, 5-10 ha willow technology, 20 ha willow stands technology).
System boundaries and processes involved: felling; chipping with chipper/mobile chipper; forwarding, uploading + transport + unloading with crane truck; firing of sternwood and branchwood (absolute dry, energy goal); burning (semi-humid) and biodegradation of slash. The transport distance was considered uniformly 40 tkm (crane truck).
On the basis of absolute carbon footprint (considered fossile and biotic origin together), the ranking of stands is the following for the whole technological life cycle: „20 ha willow (33%) – 3 ha poplar (33 %) – 5-10 ha willow (34%)" (between the values of GWP 100 years: 60581,03 - 61735,45 [kg CO_2-Equiv.]). The CO_2 emission of biotic origin resulting from wood firing has a major influence on the carbon footprint of total life cycle (97-99%). We found that 30-40% of fossil CO_2 emission is due to the works in felling area, while 60-70% is due to the uploading, transport and unloading of wood.
In order to illustrate the extent of carbon footprint (GWP 100 years, [kg CO_2-Equiv.]), we used the estimated carbon sequestration of the cut wood in the plantations. We demonstrated the carbon sequestration capacity by a ratio, which values (1,37-1,46) are good indicators of the positive carbon balance.
In the case of raw wood products, „carbon neutral" is an often used attribute, which is proposed by the authors to be refined to „low emission raw material" on the basis of the observed values of GWP. The results of the study (GWP) highlight the carbon footprint of forest utilization processes, the knowledge of which has a strong influence on the consideration of raw wood products as low-emission raw materials, and on the more exact definition of carbon sequestration capacity. The knowledge of these information helps the more accurate identification of climate risks and the role in climate changes.

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