Dynamic Material flow analysis (MFA) as a tool for efficient forest management policies

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Résumé

The conception of an efficient forest management policy first needs a good understanding of the initial situation and the current forest dynamics. This preliminary work leads to the production of large amounts of data, usually presented through spreadsheets that are barely readable. The use of material flow analysis (MFA) herein allows to visualise the results in the form of a Sankey diagram, which highlights the main material flows of the forest and helps to identify the key points of the studied territory.
Most of the MFA studies conducted so far are static, which means that they are "pictures" of the system, representing only the flows for one time step. Dynamic MFA extends this framework by taking into account the temporal dimension and allowing for the tracking of the evolution of flows and stocks over years. The development of such a method is still in the field of research and needs further development to be commercially available. The advantages of dynamic MFA over static MFA allow researchers to build prospective scenarios by modelling the historic dynamics of the studied system and the effects of future policies on an industry.

The use of MFA in the French forest has been gaining interest for less than 10 years; hence, it is still pretty new. The first Sankey diagram was built by INRIA for the AF Filières project (2017), whose main objective was to validate on a case study the MFA method developed by INRIA over more than 10 years. The development led to the foundation of Terriflux in 2021 to publish a software called OpenSankey, integrating the method. One of the key specific features of OpenSankey is the data reconciliation process, which makes data coherent. Since then, five projects have been conducted (or are being conducted), four utilising OpenSankey, which has become the reference tool for MFA in the forest and timber industry (as well as in other sectors). All of them are static MFA, but the last and most ambitious one, BACCFIRE, will be using dynamic MFA as well to build prospective views.

Funded by ADEME and led by ONF, the ongoing BACCFIRE project aims to build generic value chains for the mainland French forest, in order to address carbon questions. The first objective is to model the evolution of flows and stocks of carbon in the French forest, the second is to compare the mitigation potential of different management decisions, taking into account sequestered and avoided carbon in forests and wood products. This project relies heavily on the construction of a Sankey diagram of material flows in the French forestry and timber industry, assigned to Terriflux. This task led to the most detailed Sankey diagram of the industry.
OpenSankey and its methodology will be presented. The first results of its application to the

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most advanced project so far, BACCFIRE, especially its dynamic MFA. The specific issues of the forest and timber industry, which are data collection and uncertainty quantification, will also be addressed.

Mots-Clés: Material flow analysis, dynamic, prospective, forest management, data visualisation