



Accounting for land use dynamics in the calculation of carbon substitution by wood products

Principle investigator: Anaïs CHARIS KANELLOS, UMR Bureau d'Economie Théorique et Appliquée (BETA)

LabEx partners: Miguel Rivière (CIRED, BETA), Sylvain Caurla (BETA)

Collaboration: Thierry Brunelle (CIRED)

Thematic action concerned: WP4

❖ *Context & objectives*

The principle of carbon substitution is based on the use of wood products as a substitute for other materials or fossil energy sources that emit more greenhouse gases. The difference in emissions between wood products and other energy sources is measured through the "carbon substitution" of wood products. However, the diversity of methods used does not allow the effectiveness of the "carbon substitution" of wood products to be objectively assessed. And for similar products and contexts, the values obtained vary greatly from one study to another; probably due to incomplete consideration of emissions throughout the life cycle of wood products.

In particular, the thesis co-financed by the LUCAS project and the CLIMAE metaprogramme focuses on the consideration of land use changes in the forestry sector.

The objective is to find out what are the determinants and consequences of land use change in the forestry sector, by studying the interactions between the agricultural and forestry sectors and also in situ the dynamics of forest exploitation according to harvesting levels.

❖ *Approaches* —

The first chapter is a literature review on land use changes in environmental impact assessments of wood products. This review identifies the different types of land-use changes that are relevant to the forestry sector and how they are integrated into the environmental assessments.

The literature review was conducted in three stages, the first aims at determine the query in order to capture studies that fall within the scope of the study: we determined a first block of keywords related to environmental assessment ("environmental assessment", "life cycle assessment"), a second block related to wood products ("wood products", "forest products"), and a last block related to land use changes ("land use", "deforestation"). We obtained 86 results. Second, we performed a screening of abstracts and, when necessary, full-texts to identify publications that did indeed fit the intent of our study. Then we defined exclusion criteria and carried out a second sorting based on the complete reading of the articles. The corpus is made up of 55 articles.

❖ *Key results* —

- There are two approaches to the definition of land-use change (LUC): LUCs in the strict sense, which only concern land-use change between the agricultural and forestry sector (deforestation, afforestation), and LUCs in the broad sense, which also concern changes within the forestry sector (crop intensification). Changes in the strict sense are assimilated to changes in the extensive margin (extension of areas) and in the broad sense to changes in the intensive margin (intensification of crops).
- Changes at the extensive margin are quantified using the ecological footprint assessment method, while changes at the intensive margin are mostly quantified using the life cycle assessment method. This is due to methodological constraints.
- The definition of land-use change in the strict sense is more commonly used in the literature because the environmental consequences of land-use change between agriculture and forest are very significant. The immediate consequences of afforestation and deforestation on the environment are carbon and nitrate losses and effects on biodiversity.
- Only 5 papers study indirect land use changes such as leakage or imported deforestation because it is more difficult to identify them.

❖ ***Main conclusions including key points of discussion —***

- ❖ The keywords of the query call for studies on the strict meaning of land use change, but half of the corpus is made up of studies considering the broad meaning, which reflects a lack of clarity between the two concepts in the literature.
- ❖ The environmental impact assessment methods found in the corpus (life cycle assessment, ecological footprint, material flow analysis, sustainability footprint) have numerous methodological limitations for taking land use into account.

❖ ***Perspectives —***

Some options to avoid land use changes are mentioned in the papers, such as the valorisation of forest residues, the cultivation of lignocellulosic plants on marginal lands, or the reinforcement of controls and sanctions to avoid the illegal exploitation of resources which is a recurrent phenomenon in developing countries. It would be interesting to reflect on the different public policies that could limit these land use change phenomena.

Chapter 2 (in progress) consists of identifying the determinants of production at the intensive and extensive margins. Starting from a small theoretical model, we will test different variables at the country level in order to find out which parameters have an effect on these two production modes. The analysis will focus on a group of countries with FAO data.

Valorization — DEEPSURF conference, nuit des chercheurs.