LUCAS

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

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Collaborations : CIRED

Thematic action concerned: :　　　　　*WP4*

Context —
The principle of carbon substitution is based on the use of wood products to replace other materials or fossil energy sources that emit more greenhouse gases. The difference in emissions between wood products and other energy sources is measured using the "carbon substitution" of wood products. However, the diversity of methods used makes it impossible to objectively assess the effectiveness of the 'carbon substitution' of wood products. And for similar products and contexts, the values obtained vary greatly from one study to another, no doubt due to incomplete consideration of emissions over the entire life cycle of wood products.
In particular, the thesis co-financed by the LUCAS project and the CLIMAE metaprogramme focuses on taking into account changes in land use in the forestry sector.

Objectives —
The aim is to identify the determinants and consequences of changes in land use 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 (finalised) is a literature review on how changes in land use are included in environmental impact assessments of wood products. This review identifies the different types of land-use change that concern the forestry sector and how they are incorporated into analyses.
- The second chapter (in progress) is a theoretical model of land allocation (between agriculture, primary forest and secondary forest) and harvest intensity. Dynamic optimisation model and simulations are used to assess the trade-offs between extending or intensifying forest production under scenarios of climate change, wood demand and consideration of ecosystem services.
- The third chapter (in progress) is an empirical analysis of the determinants of wood production at the intensive and extensive margins at the country level, using FAO data.

Key results —
1.　　　*Literature review*:
- A majority of articles (30/53) consider land use changes at the extensive margin (e.g. deforestation, afforestation, etc.). 23/53 consider changes at the intensive margin.
- From a methodological aspect, life cycle analysis is the most widely used, followed by the ecological footprint. The most studied environmental impact is carbon emissions. Articles give less consideration to hydrological impacts, loss of biodiversity and soil degradation.
- Overall, land use changes are rarely included in environmental analyses of wood products. Existing methods and classifications are poorly adapted to include forest specificities in the analyses.

2. *Theoretical model*:
-Meeting wood demand can increase carbon benefits by developing tree plantations and secondary forests, despite primary forests. However, sustainable management requires limiting the exploitation of primary forest.
-Encouraging the protection of primary forest through taxes or subsidies and intensifying the exploitation of secondary forest makes it possible to safeguard primary forest while meeting the demand for wood.
-Tree mortality due to the effects of climate change can lead to the abandonment of forest resources and the conversion of land to agricultural use due to economic non-viability.

Main conclusions including key points of discussion —
-Methods and classifications need to be updated to take greater account of land use changes, which environmental impact is underestimated.
-The intensification of forest management practices makes it possible to protect the primary forest while sourcing wood demand. However, these forest management practices need to be supervised and the protection of primary forest can be achieved through financial incentives such as taxes and subsidies.

Perspectives —
-Existing methods can be improved by the harmonization of a harvest intensity indicator.
-The empirical application in Chapter 3 aims to introduce an intensity indicator and to test the assumptions made in the theoretical model.

Valorization —
   1. *Past :*
- DEEPSURF conference 2023
-ULVON Conference on Environmental Economics 2023
-Chaire RENEL 2023

   2. *Futures :*
-Submission of literature review to Ambio journal
-IPWSD 2024 PhD Workshop