

Analysis of carbon flows for hemp fiber-based composites in different scenarios

M.Sc. Sarah Barth

Initial Situation

- Climate change is one of the central threats to life on Earth as we know it today.
- To stop climate change, the European Union (EU) wants to become carbon neutral in 2045
- In order to become carbon neutral, the EU must create a sink volume of around 850 million tons of CO₂ equivalents. [1]
- Industrial hemp absorbs more CO₂ equivalents than most commercial crops, making the plant a very potent carbon sink. [2]

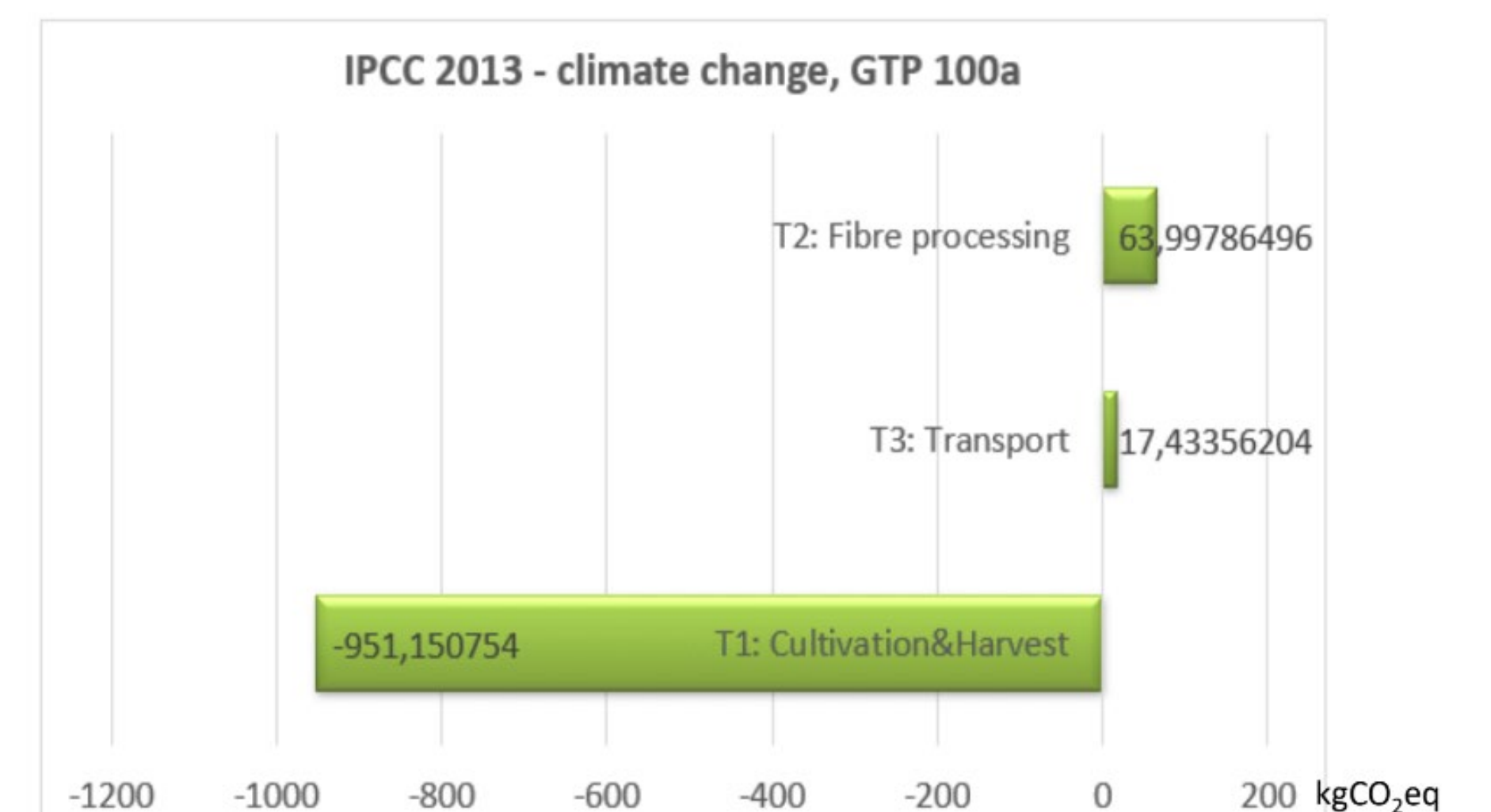
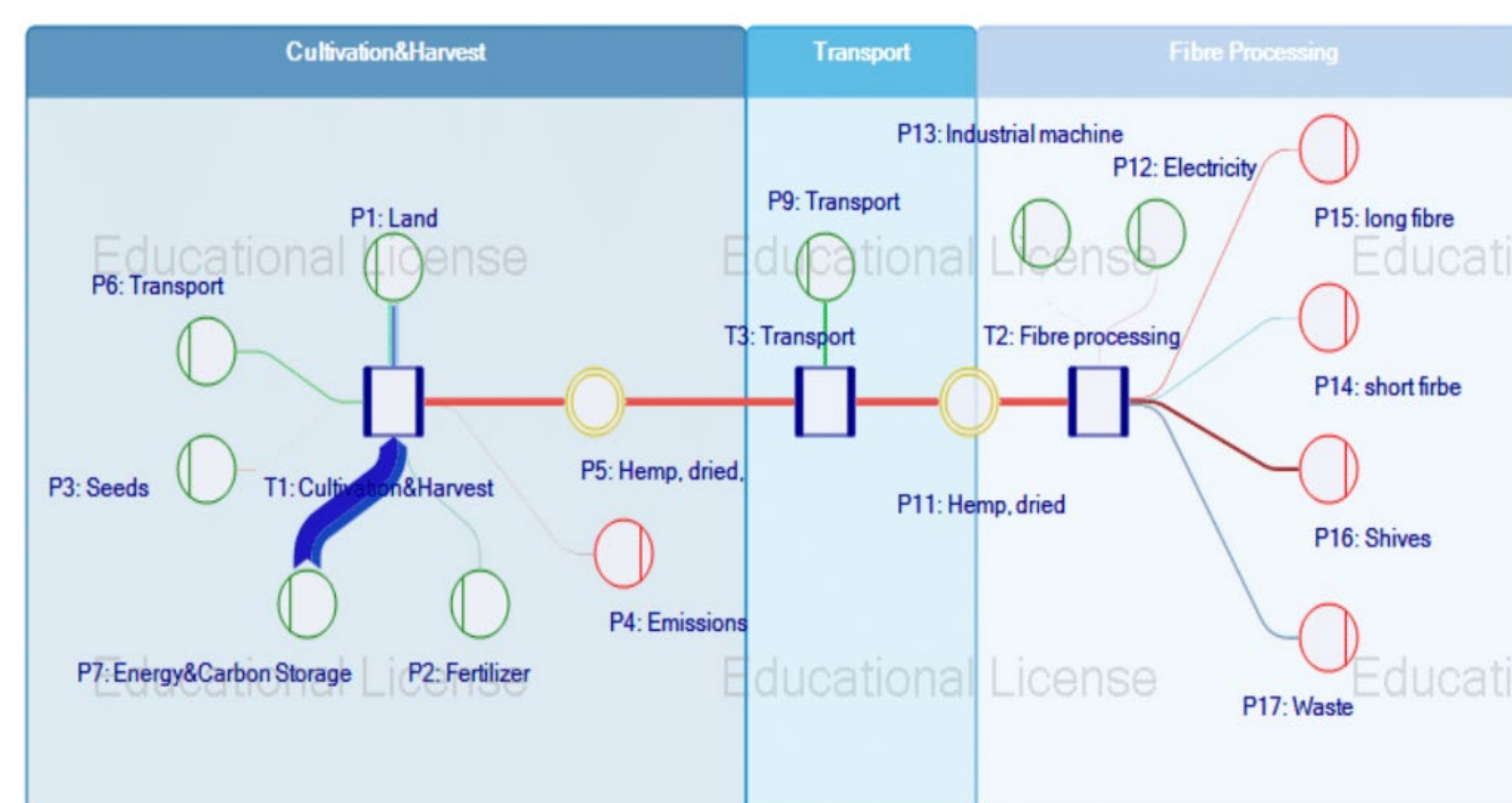
Aim of the study

- Analysis of the potential of hemp, in cultivation and processing. Evaluation of the potential in terms of industrial use.
- Analysis of the carbon flows of the multi-output product system of hemp crop utilization, based on the product system of the Hemp fiber production and the resulting by-products.
- Modeling the carbon flows of two key hemp composites to assess environmental performance.

Material and Methods

Within the scope of the analysis, the following value chain was analyzed:

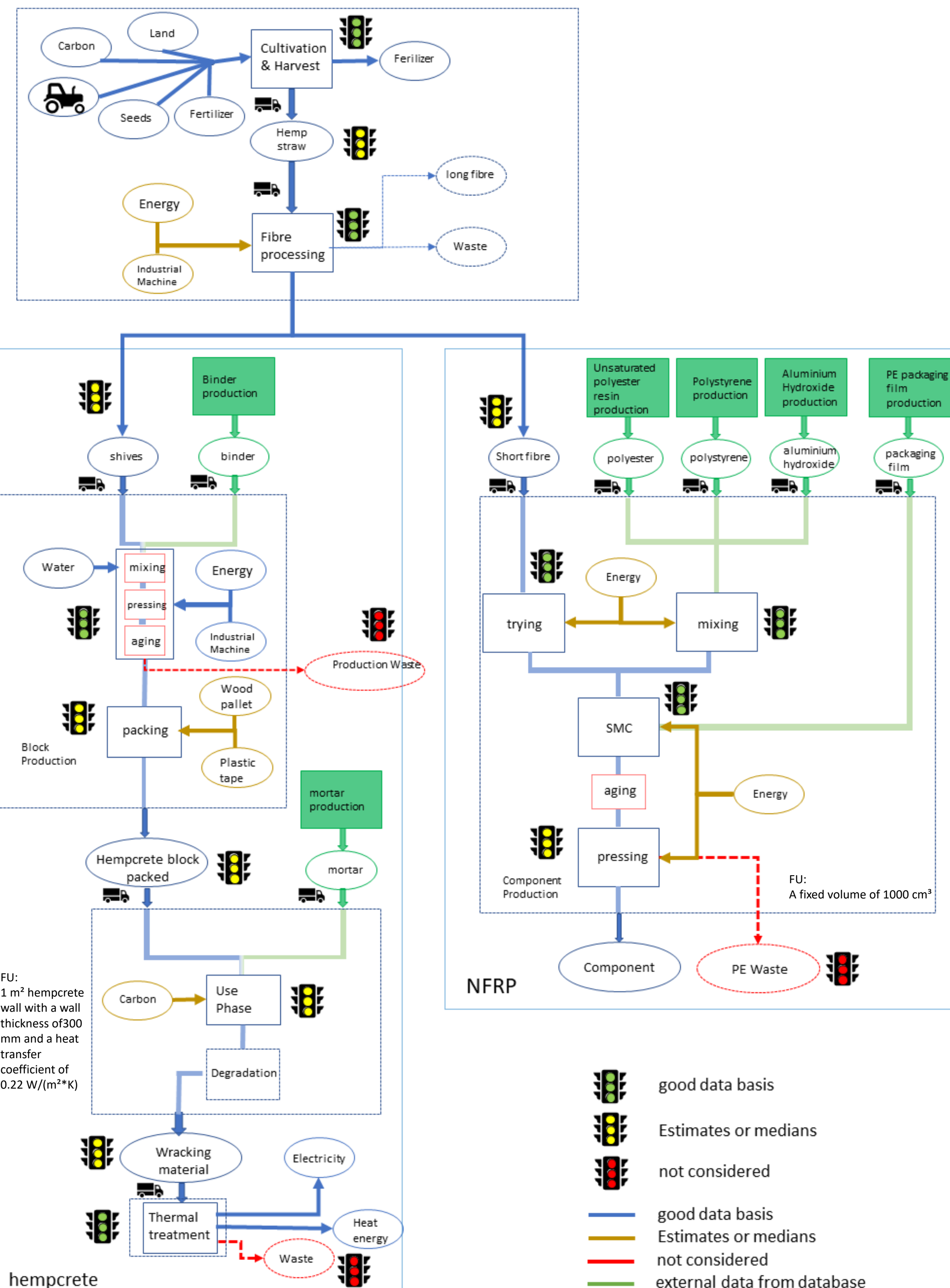
- The agricultural cultivation of hemp for the production of hemp straw.
- The processing of hemp straw into fibers and shives.
- Industrial processing into building materials and natural fiber-reinforced plastics.



Upstream chain of hemp fibre production

Results

Models and data quality



LCA natural fiber-reinforced plastic



The study, showed that the fossil-based component strongly contributes to the GHG emissions of the entire composite. This proves that the reduction of fossil components improve the environmental performance of the materials.

LCA Hempcrete



The study has a negative carbon footprint overall. This proves that hempcrete acts as a carbon sink and can thus make an important contribution to climate protection.

General problems on the hemp market

- The current Markets Considered underdeveloped. [3]
- There is a lack of demand from the industry for stronger development in the field, but at the same time the limited supply of hemp fibers is seen as a restriction for fast development. [3]
- The technical and economic usability of industrial hemp as a pure energy crop is still unclear.

Conclusion

- Hemp has significant carbon sink potential.
- Further processed in products like hempcrete, the carbon can be stored for a long time.
- In other products such as NFK, hemp can be used to substitute fossil components.

[1] Bier H. et al., „EBI Withepaper: Mit Pflanzenkohle basierten Kohlenstoffsinken dem Klimawandel entgegenwirken.“ 2020.

[2] J. Vosper, „The Role of Industrial Hemp in Carbon Farming.“ Good Earth Resources PYT Ltd., 2011.

[3] J. Rupp, J. H. K. Böhmer, H. Blum, J. Becker, E. Dunkelberg, B. Hirschl, B. Wagner und P. Heck, Potenzialfelder einer ländlichen Bioökonomie - Analyse und Bewertung von Wertschöpfungsketten einer nachhaltigen Koppel- und Kaskadennutzung von nachwachsenden Rohstoffen, Berlin: Schriftenreihe des IÖW 217/20, 2020