

## Science, Management and Innovation research project - 2024 -

<b>Title</b>	Estimating the GHG emission of international maritime shipping of the Netherlands' imported Crude Palm Oil (CPO)
<b>Project start date</b>	January / February 2024 (for a period of 6 month)
<b>Host organization and location</b>	Environmental Sciences Department, Radboud University
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**Problem description:** The world is highly connected by the trade chain of agricultural commodities (i.e.: palm oil). Every traded commodity inherently carries environmental impacts (GHG emissions). Emissions result from several processes, including land use change, crop production, industrial processes (mill and refineries), domestic transportation, and international shipping transportation. Among those emissions sources, the domestic and international shipping transportation emission is often overlooked in emission calculation and not even included in the main report in national GHG emission inventory to UNFCCC (only as supplementary information). However, it's important to note that maritime shipping generated 1 billion CO<sub>2</sub>-eq during period 2007-2012 (IMO 2014) and is expected to increase up to 210% by 2050 (Lee 2017). Currently the international maritime shipping emission of commodities are calculated using the LCA approach, which employs average fuel consumption and distance of the voyage. Consequently, this method results in the same emissions per ton of traded commodity (Schim Van Der Loeff et al. 2018). Hence, it is essential to explore a more detailed emissions calculation for each commodity's specific origin-destination voyage (Escobar et al. 2020).

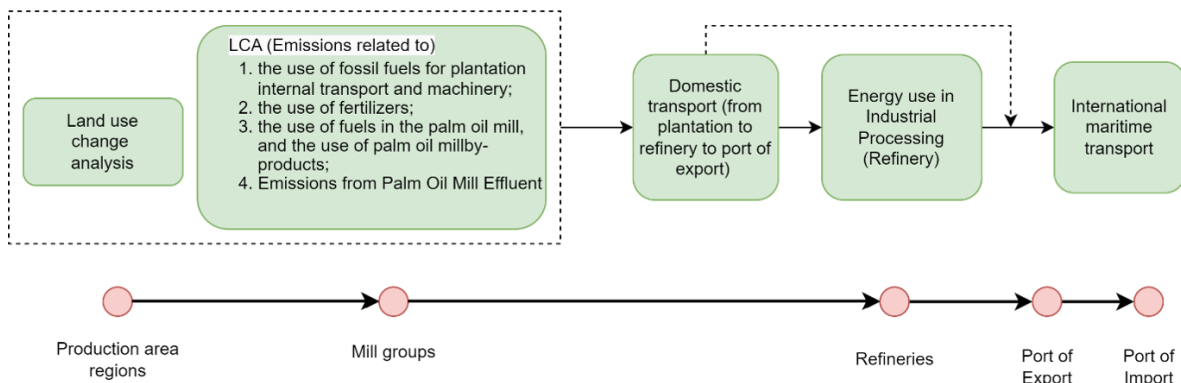


Figure 1. Palm Oil Supply Chain

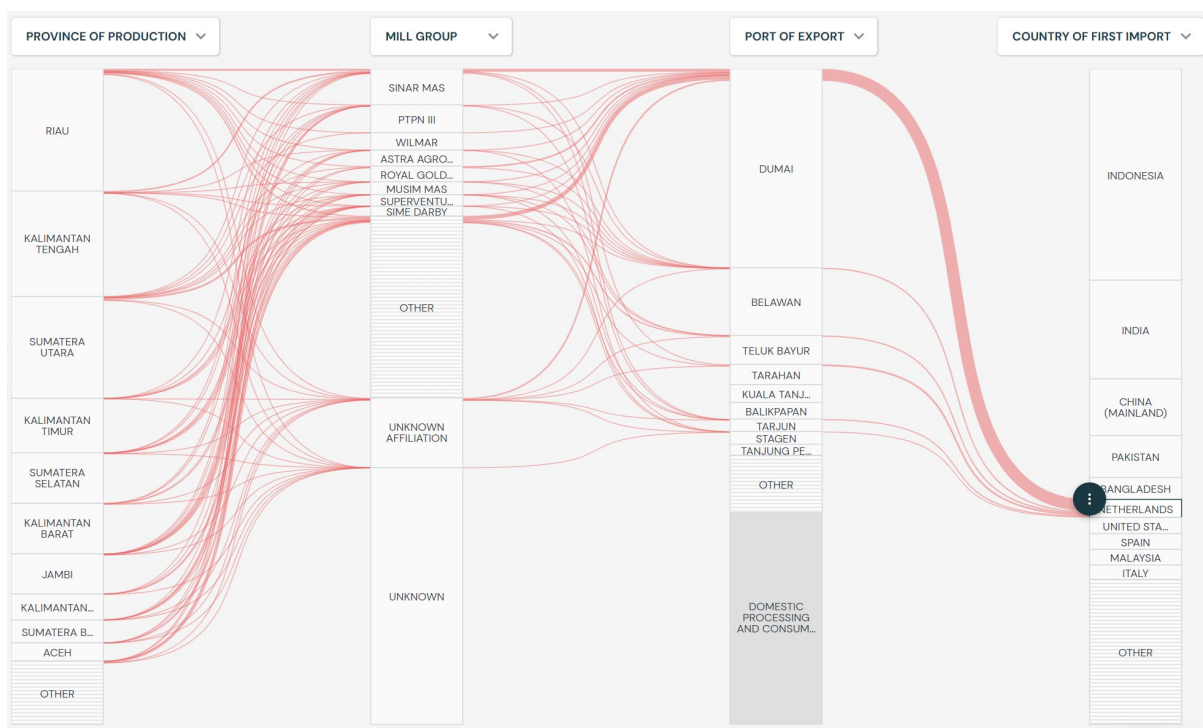
**Goal of research project:** In this project we will use palm oil as use case, and you will look at how much the total emission from domestic transport (land and sea) and international maritime shipping of exported palm oil from Indonesia to the Netherlands. The main steps are: 1) Design data analysis flow to extract vessel and voyage manifest document and align it with the trade (export-import) information; 2) Calculate the emission of voyages from port of departure (Indonesia) to port of arrival (Rotterdam) during period 2018-2020; 3) Allocate the total emissions to Crude Palm Oil (CPO) commodity using Harmonised Commodity Description and Coding System. You will use global datasets such as TRASE EARTH commodity supply chain, Automatic identification systems (AIS) from

International Maritime Organization, World Fleet Register, and Harmonised Commodity Description export database.

**Note for SMI students:** The research project boundary is still flexible. You can propose new ideas or different directions (perhaps on social, management, policy dimensions), but still must address the main goal of the project. Interested students can discuss this arrangement further with the supervisors.

### Requirements:

- You have experience in large dataset analysis.
- You are interested in the agriculture commodities supply chain.
- Proactive and able to work in a team.



### References:

- Escobar, Neus, E. Jorge Tizado, Erasmus K.H.J. zu Ermgassen, Pernilla Löfgren, Jan Börner, and Javier Godar. 2020. "Spatially-Explicit Footprints of Agricultural Commodities: Mapping Carbon Emissions Embodied in Brazil's Soy Exports." *Global Environmental Change* 62 (May): 102067. <https://doi.org/10.1016/j.gloenvcha.2020.102067>.
- IMO. 2014. "3rd International Maritime Organization GHG Study 2014: Reduction of GHG Emission from Ships." IMO. [https://cedelft.eu/wp-content/uploads/sites/2/2021/04/MEPC-67-6-INF3-2014-Final-Report-complete\\_1438780969.pdf](https://cedelft.eu/wp-content/uploads/sites/2/2021/04/MEPC-67-6-INF3-2014-Final-Report-complete_1438780969.pdf).
- Lee, David. 2017. "Update of Maritime Greenhouse Gas Emission Projections." CE Delft. [https://cedelft.eu/wp-content/uploads/sites/2/2021/03/CE\\_Delft\\_7169\\_Update\\_of\\_Maritime\\_Greenhouse\\_Gas\\_Emission\\_Projections\\_DEF.pdf](https://cedelft.eu/wp-content/uploads/sites/2/2021/03/CE_Delft_7169_Update_of_Maritime_Greenhouse_Gas_Emission_Projections_DEF.pdf).

Schim Van Der Loeff, Wendela, Javier Godar, and Vishnu Prakash. 2018. "A Spatially Explicit Data-Driven Approach to Calculating Commodity-Specific Shipping Emissions per Vessel." *Journal of Cleaner Production* 205 (December): 895–908. <https://doi.org/10.1016/j.jclepro.2018.09.053>.