AN ASSESSMENT OF THE TRADE IMPACT OF THE UKRAINE WAR ON THE ENVIRONMENT: THE CASE OF OILSEED RAPE

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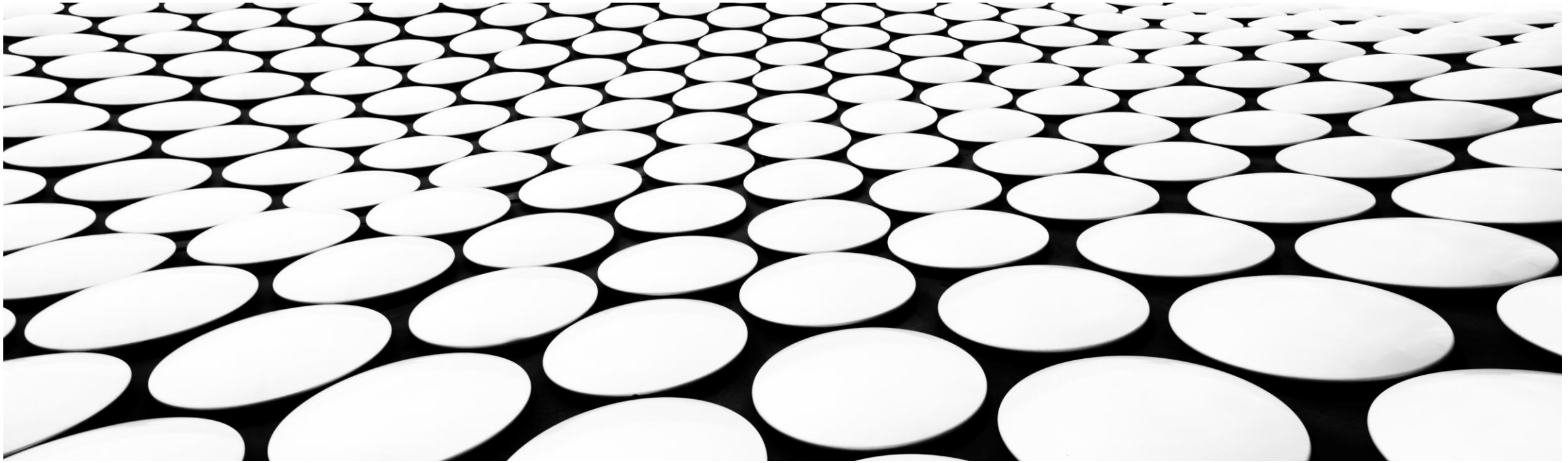


CONTENT

- Motivation and objective
- The International Agree-Food Trade Network Model
- The Life Cycle Assessment
- Simulation results
- Conclusions

I. MOTIVATION AND OBJECTIVE

- It is well known the fact that trade patterns can cause negative environmental effects on third countries (Peters et al., 2011; FAO, 2022).
- However, it is not well known how these effects are influenced by market imperfections (i.e. oligopolies/seller power and oligopsonies/buyer power).
- The objective of this research is to propose a framework that links an international trade model based on market imperfection that is refereed to as the International Agree-Food Trade Model (IAFTM), and the Life Cycle Assessment approach (LCA) to assess the environmental effects on the trade network system.
- We assess this development by considering the case of the Ukraine war.

I. MOTIVATION AND OBJECTIVE

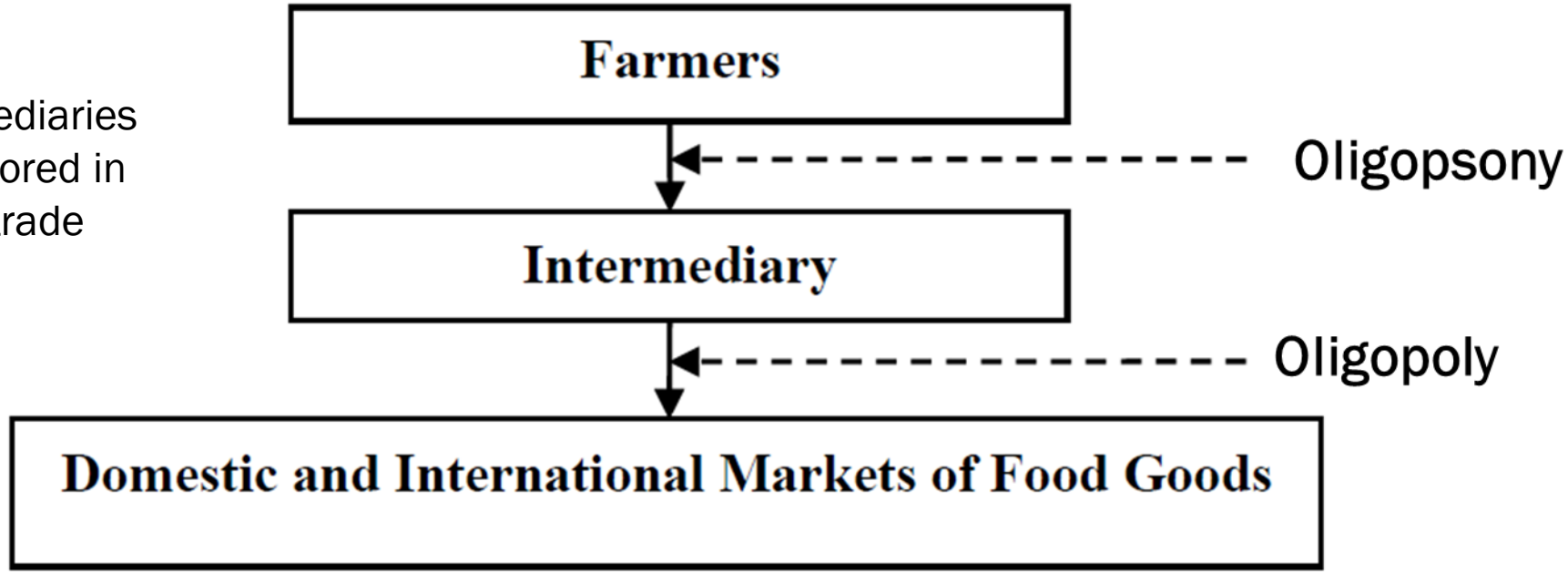
- Current investigations of the possible environmental effects of the Ukraine war have in common, is that they normally consider the environmental effect caused by physical destruction of the war in this country (Kireitseva et al., 2023; Pereira et al., 2022; Rawtani et al., 2022; Wenning and Tomasi, 2023).
- However, little is known about how this war may trigger environmental considerations in other countries.
- It is known that since late 2021, prices for commodities such as grains and vegetable oils have increased significantly as a result of the disruptions to exports from the Black Sea.
- Since Ukraine and Russia are major world producers of these commodities, this has caused global supply disruption of several agricultural goods (Chepeliev et al., 2023; Glauben et al., 2022).
- According to Steinbach (2023), this disruption has materialized as significant trade diversion benefiting several countries such as Australia, India the US and the EU, among others (Glauben et al., 2022; Steinbach, 2023).
- This change in trade patterns is what can cause negative environmental effects on third countries.
- It appears that this possible relationship between trade and the environment within the context of the war has not been explored yet, and the aim of this investigation is to contributing to filling this gap by means of the proposed methodological approach. .

II. THE INTERNATIONAL AGREE-FOOD TRADE MODEL

- We argue that the presence of powerful intermediaries in the supply chain is what causes market imperfection in the trade system.
- Reasons:
  - Highly concentrated and powerful companies
  - They cause oligopolies in retail markets
  - They cause oligopsonies in the interphase producers(farmers)-intermediaries.

II. THE INTERNATIONAL AGREE-FOOD TRADE MODEL

The role of intermediaries has largely be ignored in the debate on trade



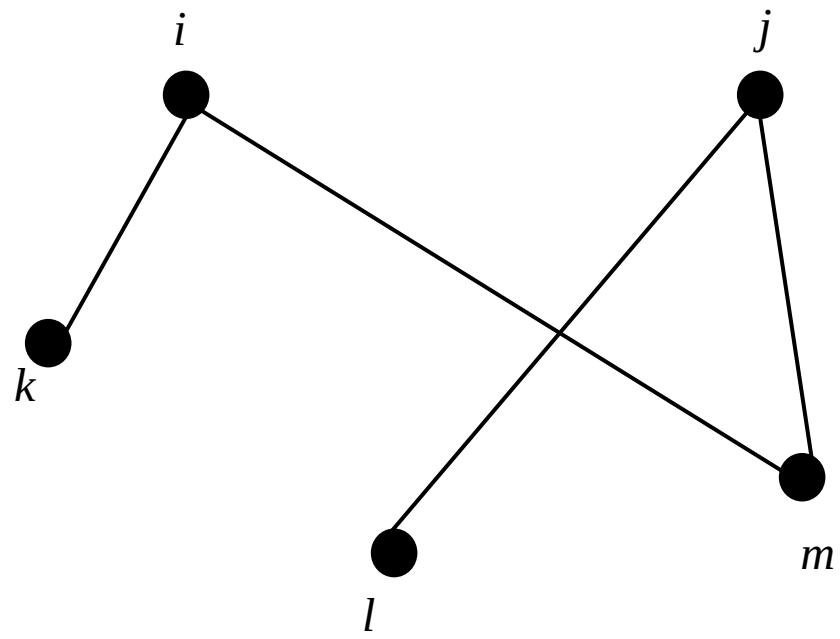
Vertically related food chain.

II. THE INTERNATIONAL AGREE-FOOD TRADE MODEL

- In order to model imperfection related to intermediaries, an extension of the International Trade Network developed by Goyal and Joshi (2006), and Furusawa and Konishi (2007) is proposed.
- The extended version formally considers the imperfections related to the existence of powerful intermediaries in agriculture.
- The model is currently being used by the AHDB in collaboration with Harper Adams University to simulate the possible impacts of the new trade deals being signed by the UK.
- Results from this collaboration has proved that the IAFTM produces reliable results of trade shocks, making it a suitable approach to assists with the assessment of the environmental impact when markets operate under imperfections.
- For technical aspects of the model, see May (2021).

II. THE INTERNATIONAL AGREE-FOOD TRADE MODEL

Node = Country
Link = bilateral agreement

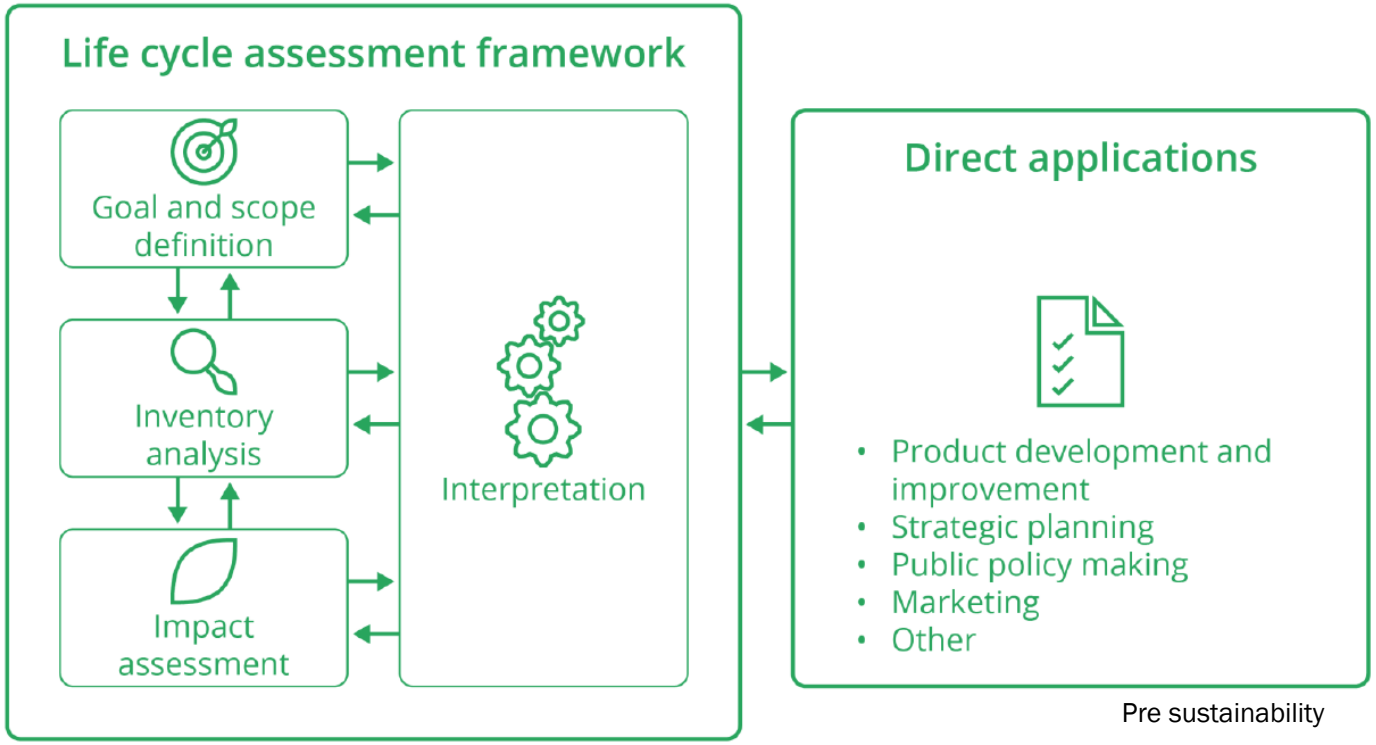


III. THE LIFE CYCLE ASSESSMENT

- Life cycle assessment (LCA) is a standardized methodology developed for analyzing environmental impacts of product and processes comprehensively through its life cycle from raw material acquisition through production, use, end-of-life treatment, recycling, and final disposal.

Pre sustainability

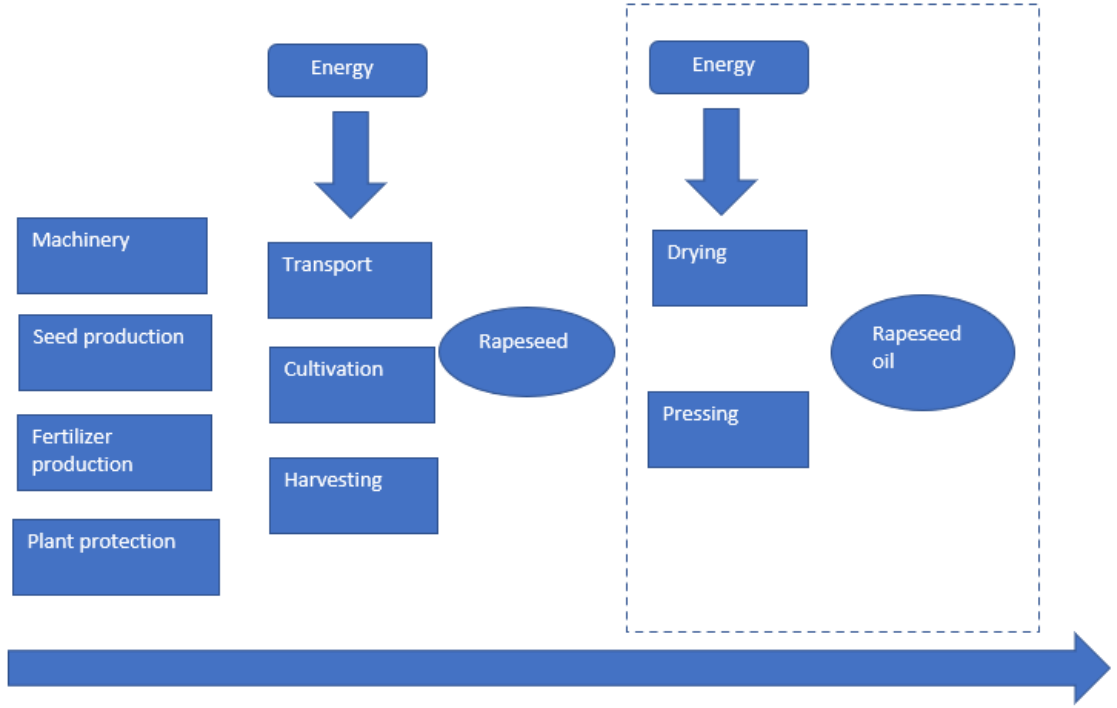
FOUR MAIN STAGES FOR A LCA



Pre sustainability

SYSTEM BOUNDARIES AND FUNCTIONAL UNIT

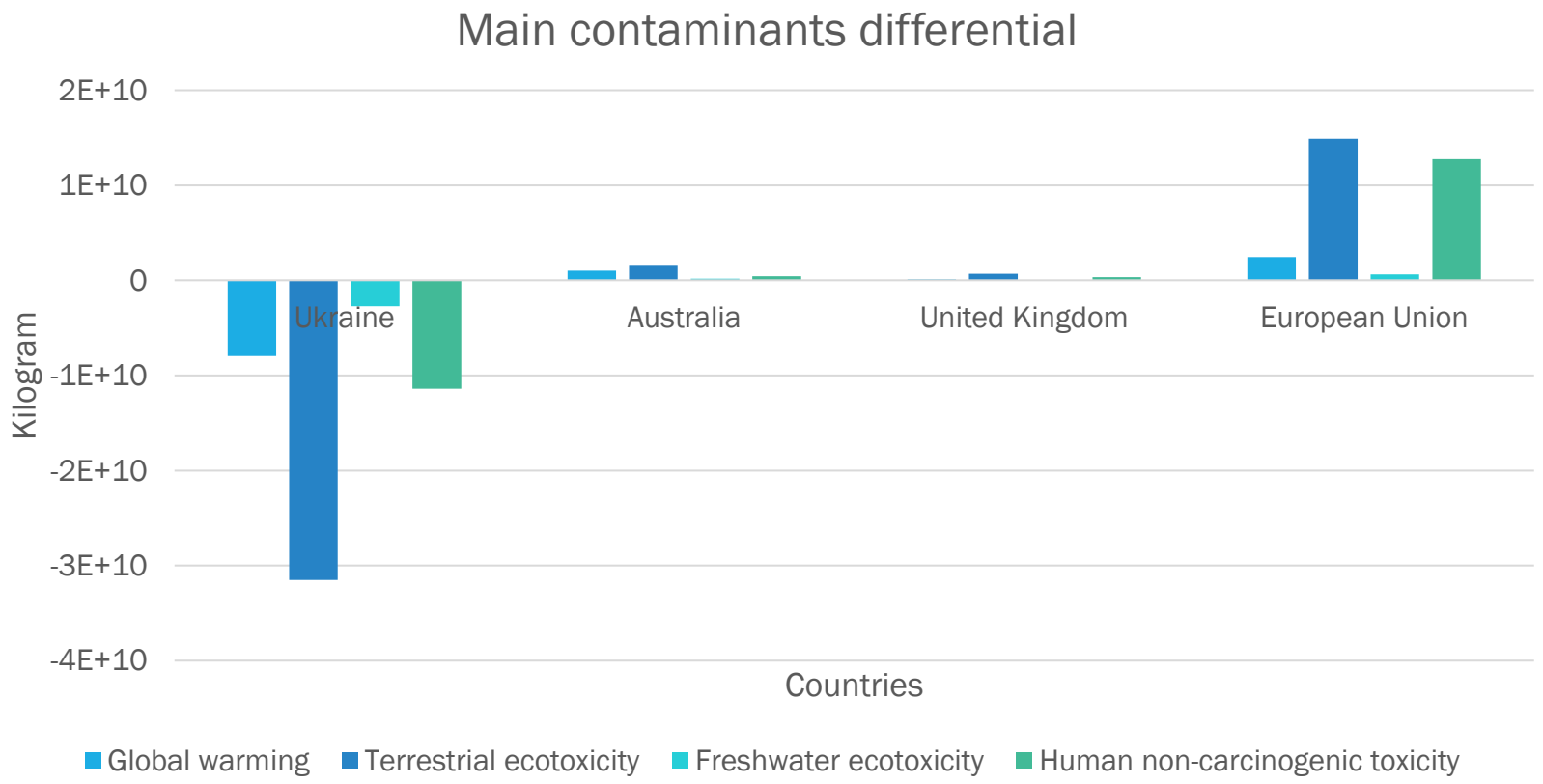
The functional unit for this project is 1 ton of oilseed rape. The transportation for final consumption will not be accounted.

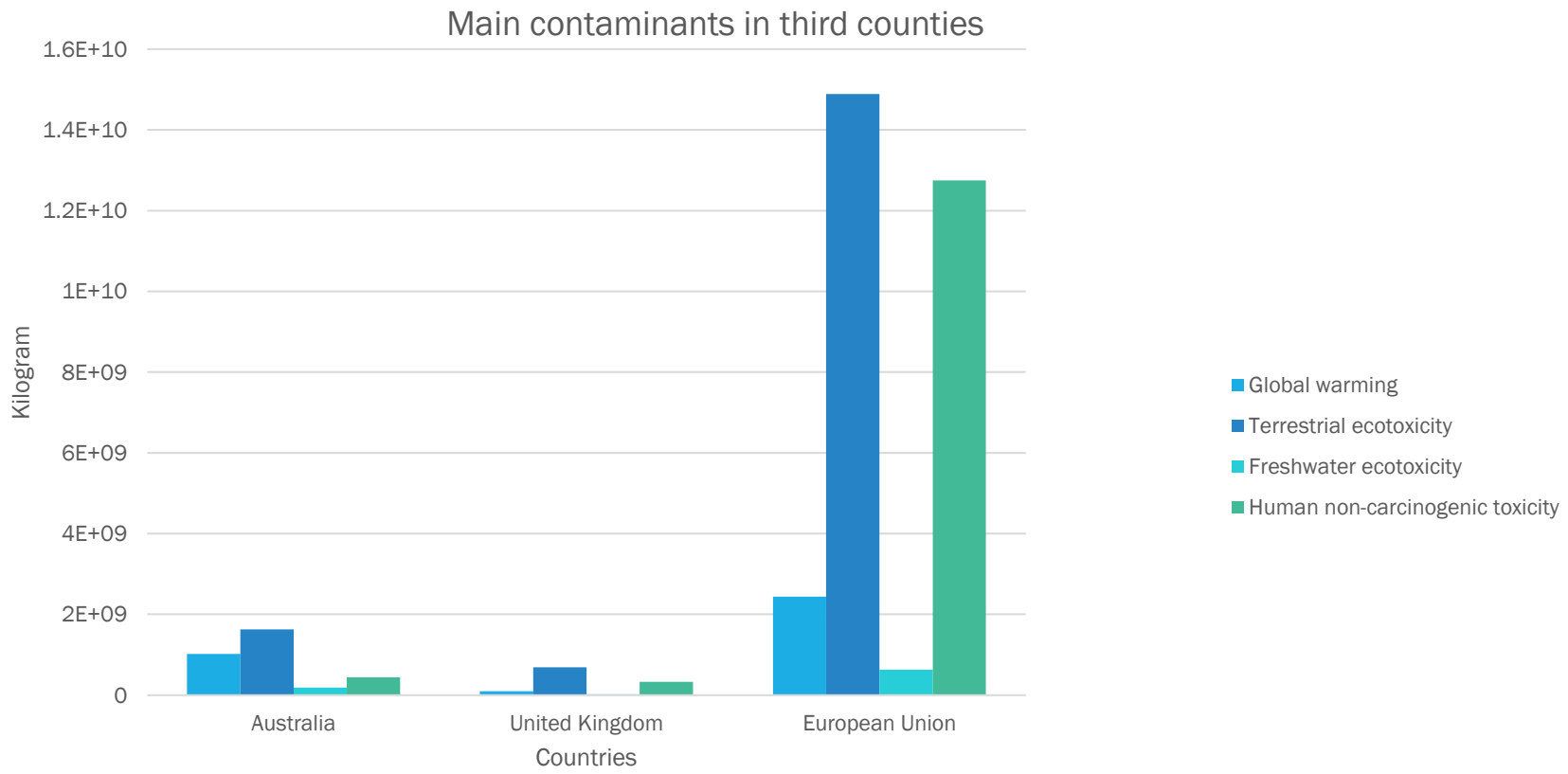


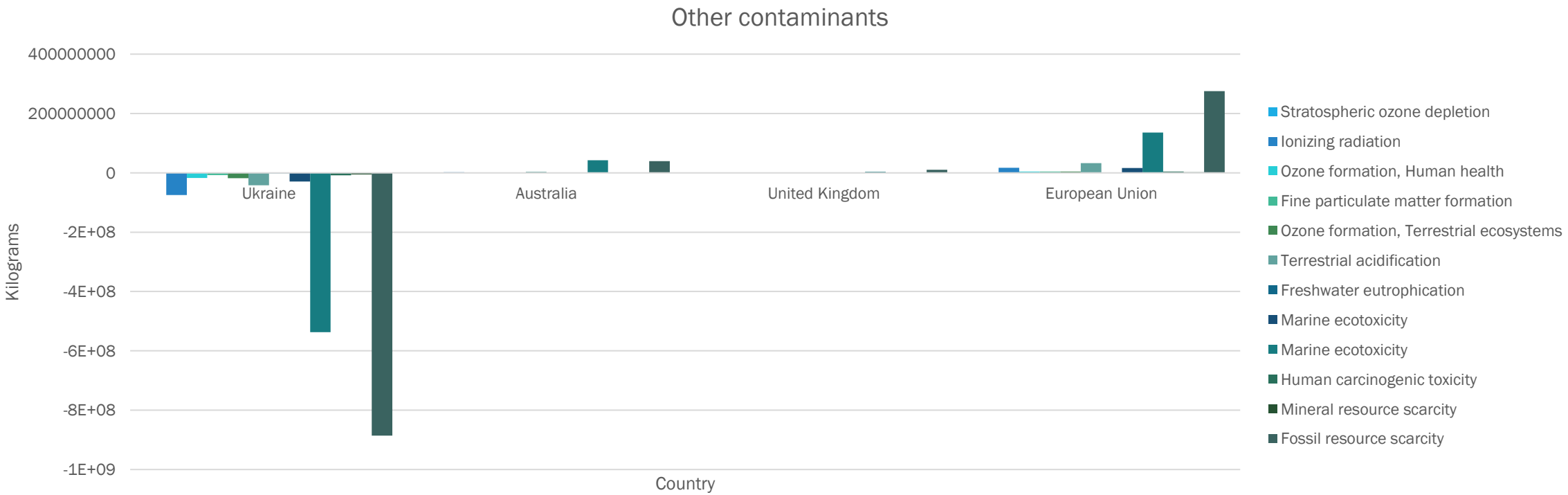
The environmental impact assessment was calculated with the ReCiPe 2016 Midpoint (H) V1.04 / World (2010) H an using the AGRI-footprint data base in SimaPro 9.0

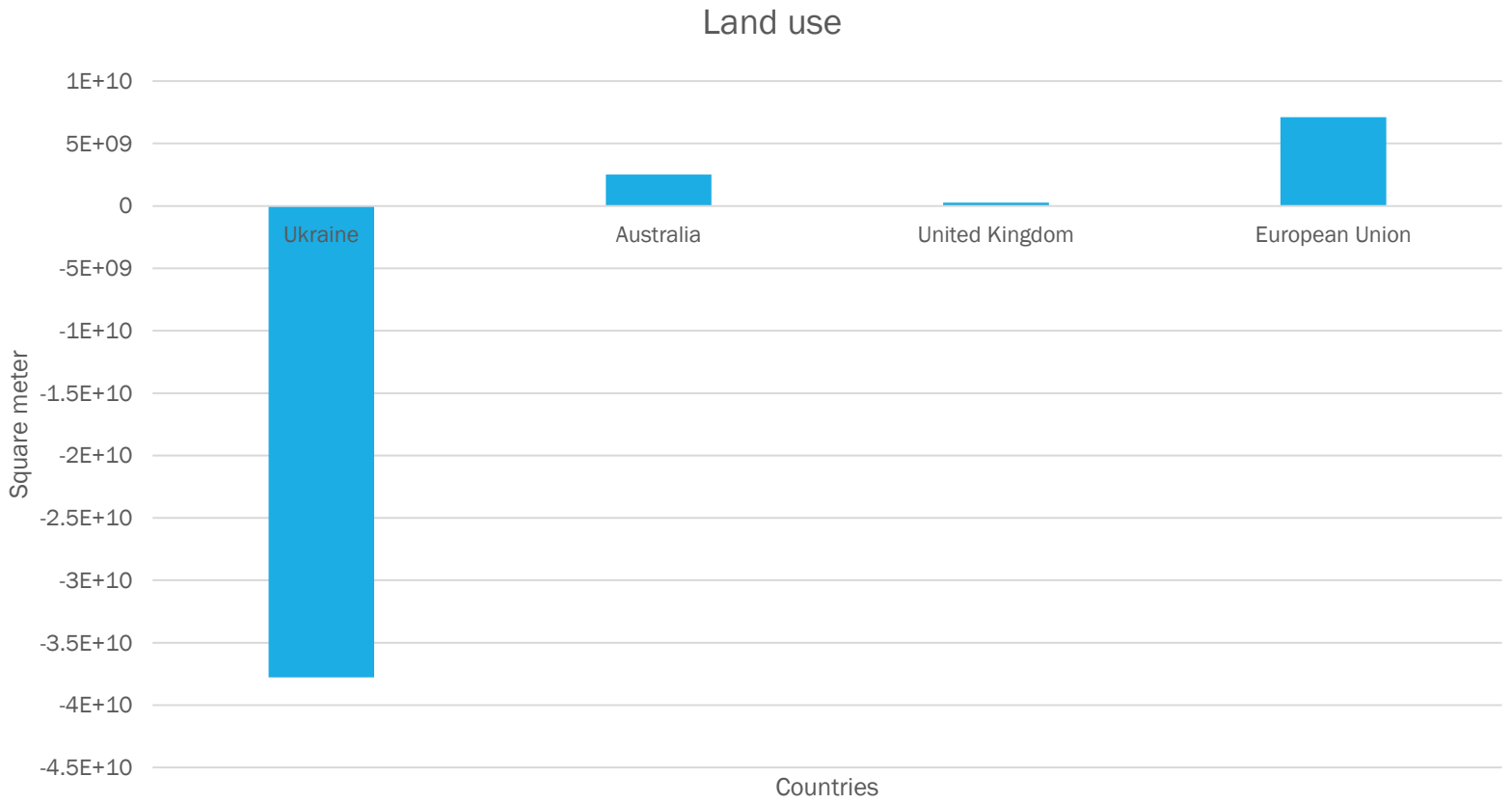
IV. SIMULATION RESULTS

- The simulations considered a network formed of four nodes: Ukraine, UK, Australia and the EU.
- It explores the environmental impact of the war in the Oilseed Rape sector.
- The simulation assumes an extreme case of a decrease in the production of OSR by 75%.
- The LCA was performed for the base output scenario and the post shock scenario.
- In this instance, the LCA was performed using available data in the AGRI-Footprint data base and simulating the decrease in production of OSR in Ukraine.


Main contaminants differential
2E+10
1E+10
0
-1E+10
-2E+10
-3E+10
-4E+10
Kilogram
Ukraine
Australia
United Kingdom
European Union
Countries
Global warming
Terrestrial ecotoxicity
Freshwater ecotoxicity
Human non-carcinogenic toxicity


Main contaminants in third counties
1.6E+10
1.4E+10
1.2E+10
1E+10
8E+09
6E+09
4E+09
2E+09
0
Kilogram
Australia
United Kingdom
European Union
Countries
Global warming
Terrestrial ecotoxicity
Freshwater ecotoxicity
Human non-carcinogenic toxicity


Other contaminants
400000000
200000000
0
-2E+08
-4E+08
-6E+08
-8E+08
-1E+09
Kilograms
Ukraine
Australia
United Kingdom
European Union
Country
Stratospheric ozone depletion
Ionizing radiation
Ozone formation, Human health
Fine particulate matter formation
Ozone formation, Terrestrial ecosystems
Terrestrial acidification
Freshwater eutrophication
Marine ecotoxicity
Marine ecotoxicity
Human carcinogenic toxicity
Mineral resource scarcity
Fossil resource scarcity


Land use
1E+10
5E+09
0
-5E+09
-1E+10
-1.5E+10
-2E+10
-2.5E+10
-3E+10
-3.5E+10
-4E+10
-4.5E+10
Square meter
Ukraine
Australia
United Kingdom
European Union
Countries

IV. SIMULATION RESULTS

Results from the IAFTN analysis

- The results of the simulations revealed that a decrease in the production and exports of OSR in Ukraine is compensated to some extent by additional production by the other countries.
- This happens because the decrease in the export output by Ukraine reduces competition in their target foreign markets. This, in turn, makes these markets more profitable which is what motivates the other countries to increase exports to these countries.
- Particularly, a decrease in the production of OSR by 75% (i.e. a decrease by 1,900,529 tons) in Ukraine triggers an increase the production of this good in UK, Australia and EU by 1% (i.e. 18,558 tons), 2.9% (66,903 tons) and 3.2% (569,719 tons), respectively.

Results from the LCA

- The LCA shows how the environmental impacts shift from Ukraine to the other countries due to the compensation in production.
- The increase in production of the good in other countries translates in an increase of CO2eq, with the EU being most affected.
- Global warming, Terrestrial ecotoxicity, Freshwater ecotoxicity, Human non-carcinogenic toxicity are the four main impact categories affected by the shock.

V. CONCLUSIONS

- The main contribution of this research, is the integration of the IAFTM and the LCA to assess the impact of trade shocks on the environment.
- A study case consisting of the impact of Ukraine war on the environmental related to the production of OSR was considered to test the proposed approach.
- The results revealed that a significant decrease in the production of OSR in Ukraine will trigger additional production in third countries (trade diversion)
- This will also cause an increase in environmental damage in these countries, mainly in relation to Global Warming, Land Use, Terrestrial Ecotoxicity, Fresh Water Ecotoxicity and Human non-carcinogenic ecotoxicity.
- The most affected country in terms of environmental damage is the EU.
- In contrast, the less affected country is the UK.
- This differential impact on third countries not only reflect asymmetries between countries (e.g. market size), but also how integrated are countries in the trade network.
- Environmental mitigating strategies/policies should consider the side effects of trade shocks:
  - Some countries become exporters of environmental damage
  - Some countries become importers of environmental damage
- Specific policies to deal with this problem is left for future research.

REFERENCES

- Chepeliev, M., Maliszewska, M. and Seara e Pereira, M.F. 2023. “The War in Ukraine, Food Security and the Role for Europe.” EuroChoices 22(1): 4-13.
- FAO. 2022. The State of Agricultural Commodity Markets 2022. The geography of food and agricultural trade: Policy approaches for sustainable development. Rome, FAO.
- Furusawa, T. and Konishi, H. 2007. “Free Trade Networks”, Journal of International Economics 72,(2): 310-335
- Glauben et al. 2022. “The war in Ukraine exposes supply tensions on global agricultural markets: Openness to global trade is needed to cope with the crisis.” IAMO Policy Brief, No. 44e, ISBN 978-3-95992-136-7, Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle (Saale), https://nbn-resolving.de/urn:nbn:de:gbv:3:2-880459
- Goyal, S. and Joshi, S.. 2006. “Bilateralism and Free Trade”, International Economic Review 47(3): 749-778.
- Kireitseva et al. 2023. “Toxic impacts of the war on Ukraine.” International Journal of Environmental Studies 80(2): 267-276.
- May, D. 2021. The International Agri-Food Trade Network (IAFTN) Model: technical Report. AHDB (available at IAFTN_Technical Report_291021_WEB.pdf (windows.net)
- Pereira et al. 2022. “Russian-Ukrainian war impacts the total environment.” Science of The Total Environment 837(1): 155865. Peters et al. (2011). “Growth in emission transfers via international trade from 1990 to 2008.” PNAS 108(21): 8903-8908.
- Rawtani et al. 2022. “Environmental damages due to war in Ukraine: A perspective.” Science of The Total Environment 850(1): 157932.
- Steinbach, S. 2023. “The Russia–Ukraine war and global trade reallocations”.
- Wenning, R.J., and Tomasi, T.D. 2023. “Using US Natural Resource Damage Assessment to understand the environmental consequences of the war in Ukraine.” Integrated Environmental Assessment and Management 19(2): 366-375.

Thanks