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This manuscript has been previously reviewed at another Nature Portfolio journal. This document only contains reviewer comments and rebuttal letters for versions considered at Communications Earth & Environment.

6th Nov 23

Dear Dr Meijl,

Your manuscript titled "The Russia-Ukraine war threatens food affordability and biodiversity, but higher energy prices could help reduce carbon emissions" has now been seen by our reviewers, whose comments appear below. In light of their advice we are delighted to say that we are happy, in principle, to publish a suitably revised version in Communications Earth & Environment under the open access CC BY license (Creative Commons Attribution v4.0 International License).

We therefore invite you to revise your paper one last time to address the remaining concerns of our reviewers. At the same time we ask that you edit your manuscript to comply with our format requirements and to maximise the accessibility and therefore the impact of your work.

Please note that it may still be possible for your paper to be published before the end of 2023, but in order to do this we will need you to address these points as quickly as possible so that we can move forward with your paper.

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Please outline your response to each request in the right hand column. Please upload the completed table with your manuscript files as a Related Manuscript file.

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We hope to hear from you within two weeks; please let us know if you need more time.

Best regards,

Martina Grecequet PhD
Associate Editor,
Communications Earth & Environment
@CommsEarth

REVIEWERS' COMMENTS:

Reviewer #1 (Remarks to the Author):

The authors have adequately addressed my concerns about the magnitude of the GHG emissions.

Reviewer #2 (Remarks to the Author):

The inclusion of GHG emissions related to agricultural land use change and labor force in the impact of the Russia-Ukraine war adds value to existing literature on this topic using the CGE model. The revised manuscript has also made significant improvement over the first draft. I am certain of the authors' extensive work. However, I also think this is not yet a publishable standard. Apart from Reviewer #2's concerns, the following points need to be reconsidered.

- 1.The title includes "biodiversity", but there are no results showing the negative impact on biodiversity loss except for a citation of other publications (lines 280-281);
- 2.The Introduction part is a mix of background and methodology which needs to be clearly and logically organized. For example, the authors describe more about what has been done (some descriptions are duplicated with those in the Methods) and very little about the core scientific issues of assessing the impact of the war on global food security and the environment, which makes it unclear about the purpose as well as importance of simulating medium-term impact of the conflict using the MAGNET CGE model. Moreover, Alexander et al. (2022) also quantified the impact on global agricultural land use year by year for 2020-2050 using a different model. Why is this not considered one of the studies providing global medium- to long-term economy-wide perspective of the war? (line 39). Other minor points that should be avoided, such as not spelling out the full terms of the N, P, and K fertilizers in line 60, GHG in line 62, MAGNET in line 71 at their first appears in the text.

The associate editor invited us to revise our paper one last time to address the remaining concerns of our reviewers.

Our reply is:

The inclusion of GHG emissions related to agricultural land use change and labor force in the impact of the Russia-Ukraine war adds value to existing literature on this topic using the CGE model. The revised manuscript has also made significant improvement over the first draft. I am certain of the authors' extensive work. However, I also think this is not yet a publishable standard. Apart from Reviewer #2's concerns, the following points need to be reconsidered.

1.The title includes "biodiversity", but there are no results showing the negative impact on biodiversity loss except for a citation of other publications (lines 280-281);

We dropped biodiversity from the title and based on the Editorial Summary:

"High food and energy prices due to the Russia-Ukraine war decrease food affordability but could reduce global greenhouse gas emissions according to a computable general equilibrium model simulating the medium-term impact of the conflict."

we changed the title to:

The Russia-Ukraine war decreases food affordability, but could reduce global greenhouse gas emissions.

2.The Introduction part is a mix of background and methodology which needs to be clearly and logically organized. For example, the authors describe more about what has been done (some descriptions are duplicated with those in the Methods) and very little about the core scientific issues of assessing the impact of the war on global food security and the environment, which makes it unclear about the purpose as well as importance of simulating medium-term impact of the conflict using the MAGNET CGE model.

We are not sure what is exactly meant by this remark as we explicitly have introduced the core scientific issues in this introductory part. The introductory part starts with some background info in the first paragraph which results in what is missing in all the current analyses. Paragraph two states a bit more on one of the core scientific issues on the importance of food access. What has been done, what is missing and what we address in this paper (e.g. importance of food access).

The third paragraph adds more core scientific issues and transmission channels: There is a need for:

- *integrated land-food-fertilizer-energy perspective*
- *importance trade relations*
- *importance fertilizers are energy intensive and a key input for agriculture. Given that Russia is an important exporter of N, P, and K fertilizers*
- *economy wide perspective to get overall GHG emission effect*
- *importance of land use for biodiversity*
- *importance of holistic picture*

In the fourth paragraph we say that most previous most previous studies are based on expert judgments, sector-specific or country models and we identify that our method is able to cover the core points mentioned above. By doing this we explain which mechanism are important to deal with the core issues. So in this introductory part we focus on some elements of our methodology that are

essential to deal with the core scientific issues identified before. In the methodology part we explain more the general features of the CGE approach.

We agree that the detailed discussion on how we measure food purchasing power can be better treated in the methodology section and therefore the paragraph below is moved from the introduction to the methodology part:

“The ‘food purchasing power’ indicator, is calculated by relating price developments of a specific food consumption basket to income developments of a particular income group. We define (%) changes in food purchasing power as % change in income of specific income group minus % change in the price of a food basket. For the food basket, consumption of cereals (including paddy rice, wheat and ‘other grains’) is used as a proxy for the diet of less wealthy people, as rice is an important food component for poor people in Asia, while grains are important in Africa (Van Meijl et al. 2021a). Changes in the wages of unskilled (production) workers in the agricultural sector are used as a proxy for the income component of poor people.”

Moreover, Alexander et al. (2022) also quantified the impact on global agricultural land use year by year for 2020-2050 using a different model. Why is this not considered one of the studies providing global medium- to long-term economy-wide perspective of the war? (line 39).

We studied Alexander et al (2022) again and this study provides no economywide perspective but is a partial equilibrium analyses. The key word is “economy wide” and this is not covered by Alexander et al.

However, to better reflect the long term perspective of the Alexander article we adjusted the sentence and now we explicitly mention it. See the changes in bold:

*While many analyzes of the impact of the conflict for food markets focus on short-term and net-import country specific effects (e.g., Balana et al., 2022; De Weerd and Duchoslav, 2022; Diao et al, 2022a; Diao et al., 2022b), on global effects of one commodity (Mottaleb et al. 2022), on various agricultural products (Carriquiry, et al. 2022) **or on longer term agricultural products** (Alexander et al. 2022), none of the studies until now provides global longer-term economy-wide perspective of the Russian invasion into Ukraine.*

Other minor points that should be avoided, such as not spelling out the full terms of the N, P, and K fertilizes in line 60, GHG in line 62, MAGNET in line 71 at their first appears in the text.

We spelled out all these terms in full at their first appears in said lines:

- Nitrogen (N), Phosphorus (P) and Potassium (K)
- GHG: Greenhous Gas
- Modular Applied GeNeral Equilibrium Tool (MAGNET) CGE model