

Submitted to Section: Remote Sensing in Agriculture and Vegetation

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Title: Cropland Mapping using Fusion of Multi-sensor Data in a Complex Urban/Peri-urban Area

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Dear Editor (s),

We want to thank the reviewers for the additional insightful and constructive comments. We have revised the manuscript in compliance with the recommendations and provided clarity as requested. We sincerely hope that the revised version of the manuscript can be considered for publication in your esteemed journal. Below are the responses to the comments. Reviewer's comments are in black italics, and our response is in green.

In addition, we added a co-author who was gracious enough to assist in the revision of the manuscript during the first round. Below, her contact information. Please also note the change in the order of names of co-author five. Thank you for your understanding.

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Kind regards,

(On behalf of co-authors)

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Reviewer 2:

I would like to thank the authors for their effort in addressing the review suggestions. However, if possible, please clarify how the authors addressed Response 14. I could not see the section 2.6 in the manuscript as mentioned. Please include it in the next version.

"Response 14: We added Section 2.6: Accuracy assessment to describe the accuracy evaluation metrics used in this study."

Response 1: Thank you very much for the review and for noting this omission. We sincerely apologize for the oversight. Section 2.6 can now be found at lines 274 – 283.

Reviewer 3:

There are still some minor issues with language clarity. For instance, in several tables and figures, DOY appears without DOY (Day of Year) being defined anywhere. A reader new to imagery may not be familiar with that term. On Line 315, Land Use Land Cover doesn't need to be capitalized. Also, later in the paragraph the author uses "land use / land cover" and later in the Discussion section they use "Land-use / land cover". Same with "producer"" and "user's" accuracy. In the Results section it's capitalized and in the Discussion it is lower case. Be consistent.

Response 2: Thank you for this observation. We have made amendments throughout the manuscript for consistency of terms and also the definition of the DOY acronym for the imagery novice reader. We have used 'land use/ land cover' and provided the full phrase 'Day of Year' along with the acronym in the tables.

Line 210: Seeing as you are using this land cover map for validation, a small bit of attention should be provided to the reader on how it was produced instead of "Details on its production are available at..." Just enough so the reader can determine its value as a reference source. The only time real issues found in various versions of this land cover database are discussed is in the Discussion section. This makes me wonder if this is the best dataset to use as a reference dataset.

Response 3: Thank you for pointing this out. We have added information on the production of the Japan Aerospace Exploration Agency's (JAXA) Japan High Resolution Land Use Land Cover (Version 18.03) including the input data, the classification method, land use/ land cover categories and the reported accuracy for the cropland (upland cropland) class. The JHRLULC map series is important as it is freely available, has regular updates and distinguishes between upland cropland and paddy field classes.

Please see lines 203 – 215.

Line 225: What does "cleaned-up" mean? I assume that involved an edit to polygon boundaries to more accurately represent the extent of each mask? To correct for data loss due to the conversion process?

Response 4: Thank you for the question. “Cleaned-up” does indeed refer to polygon editing of the vectorized masks. The generation of the land cover masks involved the use of raster math based on the temporal evolution of NDVI to estimate the land cover class. As such, some polygons were incorrectly labeled. For instance, since there are croplands whose phenology for the year closely matched that of paddy rice fields, we deleted these polygons. The loss of these polygons was compensated for by generating the dense point cloud thus ensuring that we had enough reference data points.

Figure 4. The imagery (c) is not necessary.

Response 5: This is well noted, thank you. We have left out Figure 4(c) as recommended. Please see

Line 241-250: Super interesting. Filing that away for future image classification projects.

Response 6: We greatly appreciate that you found this to be interesting. We believe that to enhance crop mapping and monitoring using remote sensing data, there is a compelling case for the creation of a database on tillage and post-harvest practices or other crop identifying features. Such a database would include, for various crops in different parts of the world, characteristics or features identifiable from the high-resolution satellite imagery availed by platforms such as Google Earth and Microsoft’s Bing Aerial. As an example, we provide a google maps link that shows post-harvest practice on maize/ corn fields in Kenya, which results in distinct clumps on the ground, visible from Google Earth (<https://goo.gl/maps/CrtcyyuHKjv>). With investment in, and exploitation of technology such as UAV mapping, such information can be used by governments and food agencies to map crops within the season and predict yields, thus allowing for planning especially in the event that harvests are impacted by drought or pests and diseases.

Line 252-260: A more detailed description of how this classifier works would be useful.

Response 7: Thank you for this suggestion. We have added information about the RF

classifier as implemented in RStoolbox package. Please see lines 263 – 273.

Line 353-357: "The overall accuracy was 67.1%, and the PA and UA for the peanuts class were 63.2% and 71.2% respectively. Given the limited amount of reference data, we found this classification accuracy to be sufficient. However, further research is necessary for the determination of the spectral-spatial-temporal characteristics of peanuts as they are an important crop in this area." What do you think this could be attributed to? the classification method? A short discussion on this would be helpful.

Response 8: Thank you for this recommendation. We have highlighted that RF requires numerous training datasets to train the model and that phenological similarity between peanuts and other crops cultivated at the same time such as carrots (Please see table 5) could have an effect on the classification accuracy. Please see lines 377 – 383.

Reviewer 4:

(1): In line 19, still it is not clear how the commodity price fluctuation can affect the regional food security.

Response 9: Thank you for the vital question, we hope that the explanation below provides some clarity.

According to Brown and Funk (2008) [Reference 1 in this manuscript], *"Since the 1990s, rising commodity prices and declining per capita cultivated area have led to decreases in food production, eroding food security in many communities. Many regions that lack food security rely on local agricultural production to meet their food needs. Primarily tropical and subtropical, these regions are substantially affected by both global climate variations and global commodity price fluctuations."*

Kalkuhl, Von Braun and Torero (2016) is an excellent treatise on the complex and sensitive subject of food prices and their implications for food security and policy. In this book, they state that:

"Food markets cannot be considered in isolation: Spatially separated markets are linked through trade; food markets are influenced by commodity, asset, and financial markets; and these, in turn, influence trading and allocation decisions of actors that also engage in food markets. Because of the complex interlinkages and interactions between several actors and economic sectors, food prices are not the mere result of farmers supply and consumers demand, and price volatility is not solely determined by harvest and income

shocks.”

The diagram below summarises the above statement.

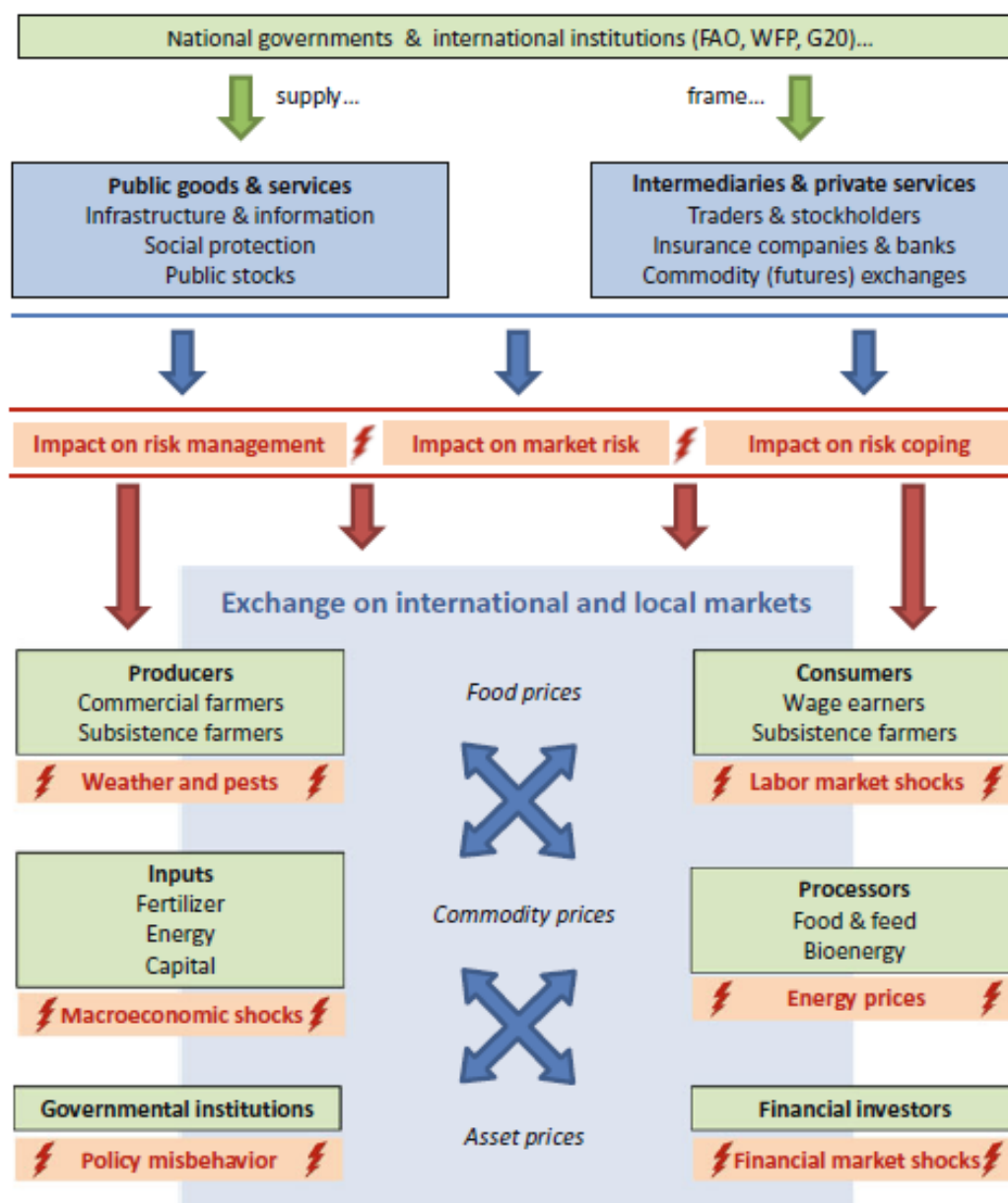


Figure 1: Conceptual framework of the casual impacts of price volatility. Source: Kalkuhl, M., Von Braun, J., & Torero, M. (2016)

References:

1. Brown, M. E., & Funk, C. C. (2008). Food security under climate change.
2. Kalkuhl, M., Von Braun, J., & Torero, M. (Eds.). (2016). Food price volatility and its implications for food security and policy.

(2): The legend of figure 2 is too small.

Response 10: Thank you for noting this. We have increased the font size of Figure 2 items.

(3): The scale of figure 7 must be checked. It seems they are stretched.

Response 11: Thank you very much, this is well noted. We have rectified the diagram to eliminate the height stretch.