General comment:
[Comment] I respect the authors' challenge in compiling farm-size- and crop-specific harvested area datasets like one presented in this study. Although there might be much room for further validation of the developed dataset, I would not request it since it is in realty difficult to objectively assess the uncertainties of the dataset when no similar dataset is available. My comments are mostly from editorial point of view, and to improve the manuscript further.

[Response] We would like to thank you for the time and effort spent on reviewing. We appreciate your comments which enable us to improve our manuscript. We provide our responses below.

Relatively major comments:
[Comment] 1. I did not find any list of the 56 countries covered in this dataset. Probably, Table S6 is close to the list, but it might be incomplete in the case that Meharabi's dataset and your dataset are not overlapped. Related to this, why don't you present your dataset as the map in main text for demonstration purpose? Showing a map of main variable of your dataset is help readers understand your dataset.

[Response] We agree that the complete list of the 56 countries, taken from Ricciardi's dataset, is missing in the manuscript, and will add it as supplementary materials. We will also add maps on the harvested area of rainfed maize belonging to two farm sizes (2-5 ha and 500-1000 ha) in the next revision to illustrate some of the multiple dimensions of the dataset in a limited number of maps.

The list of 56 countries:

Table. The list of 56 countries and country code

No.	Country code	Country	No.	Country code	Country
1	ALB	Albania	29	LUX	Luxembourg
2	AUT	Austria	30	LVA	Latvia
3	BEL	Belgium	31	MEX	Mexico
4	BFA	Burkina Faso	32	MLI	Mali
5	BGR	Bulgaria	33	MLT	Malta
6	BIH	Bosnia and Herzegovina	34	MNG	Mongolia
7	BRA	Brazil	35	MWI	Malawi
8	COL	Colombia	36	NER	Niger
9	COS	Costa Rica	37	NGA	Nigeria
10	CYP	Cyprus	38	NLD	Netherlands
11	CZE	Czechia	39	NOR	Norway
12	DEU	Germany	40	PAN	Panama
13	DNK	Denmark	41	PER	Peru
14	ESP	Spain	42	POL	Poland
15	EST	Estonia	43	PRT	Portugal
16	ETH	Ethiopia	44	PRY	Paraguay
17	FIN	Finland	45	ROM	Romania
18	FRA	France	46	RUS	Russian Federation
19	GBR	United Kingdom	47	SVK	Slovakia
20	GHA	Ghana	48	SVN	Slovenia

21	GRC	Greece	49	SWE	Sweden
22	HRV	Croatia	50	TJK	Tajikistan
23	HUN	Hungary	51	TLS	Timor-Leste
24	IND	India	52	TZA	United Republic of Tanzania
25	IRL	Ireland	53	UGA	Uganda
26	ITA	Italy	54	URY	Uruguay
27	KHM	Cambodia	55	USA	United States of America
28	LTU	Lithuania	56	ZAF	South Africa

The maps for demonstration purposes:

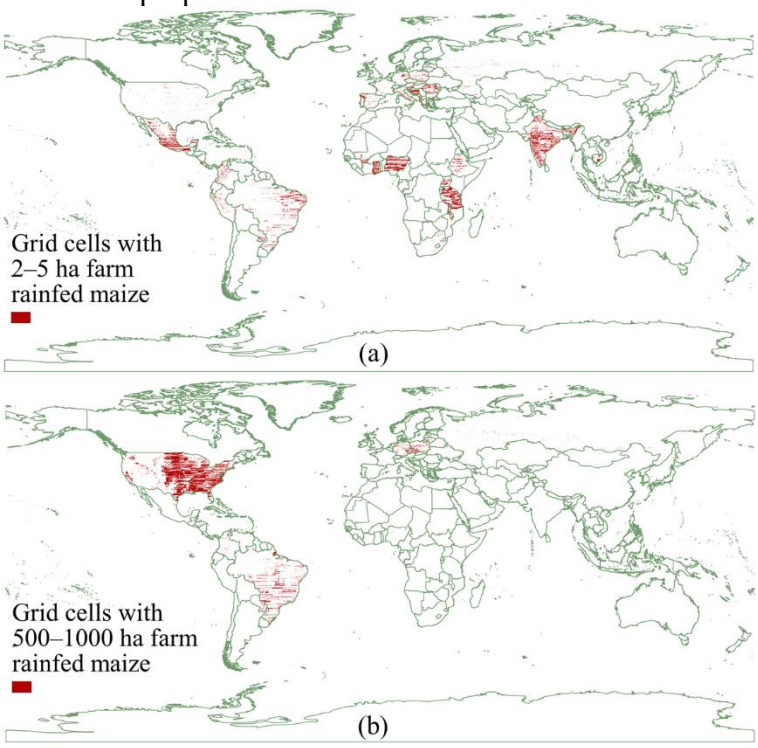

Fig. The gird cells with a harvested area of rainfed maize belonging to the farm size 2–5 ha (a) and farm size 500–1000 ha (b), according to the GAEZ based downscaled map.

[Comment] 2. Since some farming types (e.g., the rainfed subsistence in SPAM2010) are assumed to be an indicator of small-scale farmers in literature (e.g., Iizumi et al. (2021)), it would be great if you could show how the individual farming type considered here correlate with field size or not, using your dataset.

[Response] We agree that the combined data on farm size and farming type is valuable in providing insights into agriculture structure and is worthwhile to be illustrated in the paper. We will add the distribution of farming systems within each farm size in the next revision.

Our dataset indicates the subsistence and low-input rainfed farming system is mainly operated at smaller farms, but the smaller farms do not exclusively consist of subsistence and low-input rainfed farming system: they also operate a significant portion of the irrigated and high-input rainfed area. Similarly, the main type of farming system of larger farms is high-input rainfed, but the high-input rainfed is far from being limited to larger farms.

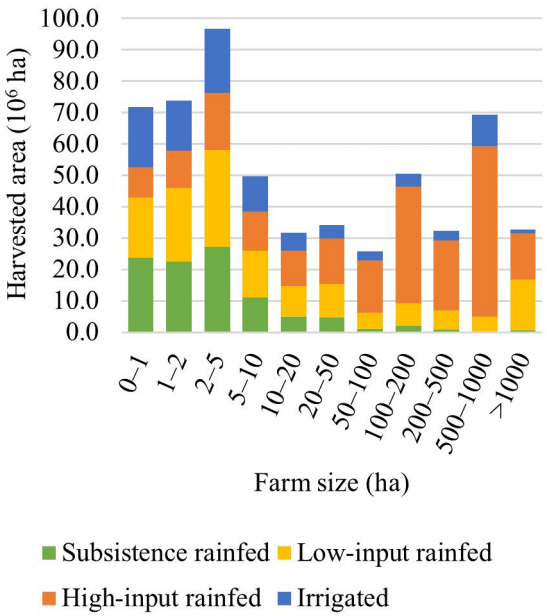

Fig. The distribution of irrigated, low- and high-input rainfed, and subsistence rainfed farming systems within each farm size according to the SPAM based downscaled map

[Comment] 3. I would encourage the authors to add a brief discussion towards next step – specifically, compiling a farm-size and crop-specific production or yield dataset. Increasing productivity of small-scale farmers is a main goal in SDG 2 (zero hanger). Once farm-size harvested area datasets like one presented hare become available, then people expect farm-size- and crop-specific yield dataset to calculate the production share of small-scale farmers. But it is elusive how yield differ by farm size (e.g., Muyanga and Jayne (2019) and Supplementary Text of Iizumi et al. (2021)). What is your though on the current feasibility and limitations to develop such dataset?

[Response] One of the underlying aims of constructing the current dataset is to compile the best-available empirical farm-size specific dataset. Compared to harvested area, an empirical farm-size specific dataset on yield or production is even more scarce. The data on yield or production of farm sizes is available for limited countries, but those countries are not always the most vulnerable in terms of food insecurity. Developing farm-size specific maps on yield or production may be the goal of further research and may be one of the applications of our dataset that directly benefit from the additional dimensionality achieved. Such datasets would require estimating the yield based on additional datasets or models.

As pointed out by the reviewer, correlations between farm size and yield are still under debate. Many factors contribute to this relationship, including but not limited to crop types, fertilizer input, climate, and soil conditions. The farm size itself does not directly affect yield, but farm size often correlates with factors that affect yield.

So, estimating crop yield for different farm sizes requires first unpacking the factors that directly impact yield and correlate with farm sizes. For environmental factors like soil conditions and climate, this could be achieved by overlapping our dataset with the soil and climate database. Agricultural management and input factors, like fertilizer input, could be inferred from the agricultural production system data. Specifying agricultural management and input factors according to farming systems could help to first evaluate crop yield for different farming systems, and then allocate the yield back to farm sizes according to their

proportion in each farming system. Such an approach would rely on the assumption that agricultural management practices of different farming systems do not depend on farm size. Reliable estimations of yield for different farming systems could be either derived from SPAM2010 and GAEZ v4 data or based on crop modeling when the data on the factors are available.

We will add the above discussion in the next revision.

Specific comments:

[Comment] 4. Table1. The units of spatial resolution are mixed (arcmin and km). Using a consistent unit or showing an indication for conversion (for instance, approximately 10 km for 5 arcmin) increase readability.

[Response] We agree with your suggestion. We will add indications for unit conversion.

[Comment] 5. L129. Can you add a brief definition of crop area, planted area, harvested area and cultivated area? Especially, are crop area and cultivated area used here crop-specific?

[Response] The crop area, planted area, harvested area, and cultivated area is crop-specific. These variables were identified by Ricciardi's dataset from the local agriculture census. There is no worldwide standard definition for these items (FAO, 2015). Local agriculture censuses have their preference to use one of them for specific crops. Generally speaking, planted area is used for temporary crops; cultivated area for temporary crops and permanent crops; crop area for temporary crops, permanent crops, fallow, meadows, and pastures; harvested area is the cultivated area excluding the area destroyed by natural disasters or other reasons (FAO, 2015, 2020). We will clarify them in the next revision.

[Comment] 6. L164. "the total harvested" -> "the total area harvested"

[Response] We agree with your suggestion. This phrase will be corrected.

[Comment] 7. L216. "access" -> "assess"

[Response] We agree with your suggestion. This word will be corrected.

[Comment] 8. Fig. 3. How did you associate farm size with the water scarcity levels of Hoekstra et al. (2012)? Since the water scarcity level data are on monthly resolution, did you calculate an average for cropping season?

[Response] We are sorry that there is a mistake in the reference here. We used the updated water scarcity map of Hoekstra et al. (2012), Mekonnen and Hoekstra (2016). In the updated dataset, there are monthly water scarcities and also an annual average of monthly blue water scarcity. We used the latter one. We will correct the reference and clarify the data source in the next revision.

[Comment] 9. L308-309. This is rather speculative. At least, relevant citations are needed to support this statement on change in farm size for ten-year period. And for your reference, in their Fig. 2, Yu et al. (2013) reports based on farmer interview that change in farmland area per household increase from 1.3 ha in the early 1980s to 2.6 he in the early 2010s for some villages in North China. Although you have talked here about Bulgaria, which could be largely different with China, it seems that the difference (78.5% and 5% of harvested area is under the farm size 50-100 ha in Lowder's dataset and your dataset, respectively) is too large to be explain by the difference in the reported time.

[Response] Thanks for pointing it out. Here, we want to emphasize both our results and other datasets indicate large farms are the major farm size in the country, but you are right, we also need to explain the difference better. How datasets process the farm size class may contribute to the differences besides the reported time. The farm size classes collected from the local agriculture census usually need to be harmonized into a classification system. Different datasets may have their own choice during this process. This may lead to the differences shown in the comparison, especially when the major farm sizes are similar but not the same.

We will add some explanations in the next revision.

[Comment] 10. L364. I think the social-ecological factors mentioned here indicate the use of GAEZ. Although this reasoning may be true, there is no result to show what social-ecological factors lead to the difference in the two crop maps.

[Response] Indeed, the social-ecological factors were considered in both GAEZ and SPAM. Quantifying how the use of different social-ecological factors may lead to differences in the two crop maps however is beyond the scope of this manuscript. Instead, we will weaken this statement in the next revision.

Reference

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