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covid-19 Brief

December 2020

Shift of Yield Dynamic during a time of Crisis: The Case of Millet in Senegal.

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The COVID-19 pandemic is causing disruption in several countries due to the burden of the disease and also to policies implemented to mitigate its propagation. The impacts in the agricultural sector are wide-ranging, including disruptions to market access for crops and inputs or farmers and farm workers' mobility restrictions, the disruption of logistics and transport systems, among others. The ability to assess and quantify early in the season, the combined effects on countries' agricultural production systems, allows various stakeholders to better plan ahead and respond more effectively. The sooner we can anticipate the impact on agricultural production and domestic supplies, the easier it will be to prevent the pandemic from morphing into a food and nutrition security crisis. More accurate and timely information on food crop yield, makes it possible for countries to design targeted policies to protect access to food among the most threatened communities. This brief uses remotely sensed data and applies machine learning techniques to forecast future millet yields in Senegal in the context of the evolving Covid-19 crisis.

The challenge of accessing and collecting data during the time of crisis makes it very difficult to obtain accurate and timely information on production systems and thus food supplies in local markets. This can be partly overcome by make use of remote sensing data. Nowadays, high temporal and spatial resolutions satellite images are publicly available and allow to remotely access a rich set of information related to vegetation and climate data. With the opportunities offered by artificial intelligence, it is possible to then use machine learning techniques as a framework to learn patterns embedded within datasets and generate information regarding future yield outcomes.

Figure 1.*2017 Spatially Disaggregated Millet yield in Senegal*

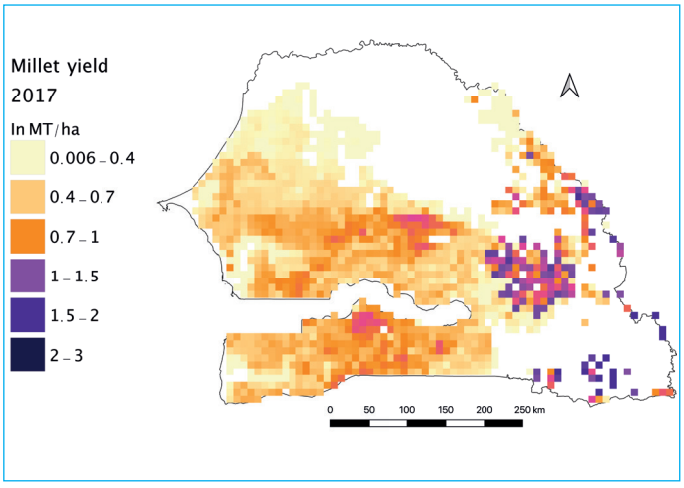
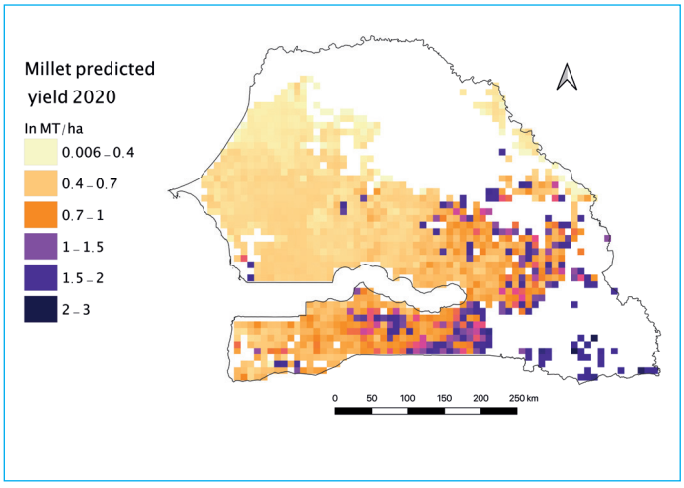


Figure 2. *2020 (predicted) of Millet yield in Senegal*



We used Artificial Neural Networks and biophysical remotely sensed data to predict millet yields in Senegal for 2020 at pixel level (Figure 2) and compared it with 2017 yield (Figure 1). Millet is one of the most cultivated cereal in Senegal, accounting for nearly a quarter of the areas sown to cereals for the 2017/18 season. It represents on average 42% of the total cereals produced but only 26% of cereals consumption by Senegalese households (ANSD, 2018).

Our model allows to examine the spatial distribution of yield changes between 2017 and 2020 at pixel level. The two maps Figures 1 and 2 respectively show a slight change in terms of agricultural productivity over the 2017-2020 period. The results indicate that 2020 millet yields are higher than in 2017 across most of the country, as shown in Figure 3, which presents the predicted 2020 millet yields as fractions of yields in 2017 pixel by pixel (10 km). According to our projection results, millet yields are expected to increase considerably compared to 2017 in areas in the East and the South, such as around Kolda. The areas in the center of the country, in particular around Kaffrine, Kaolack and Fatick also show higher yields but to a much lower extent.

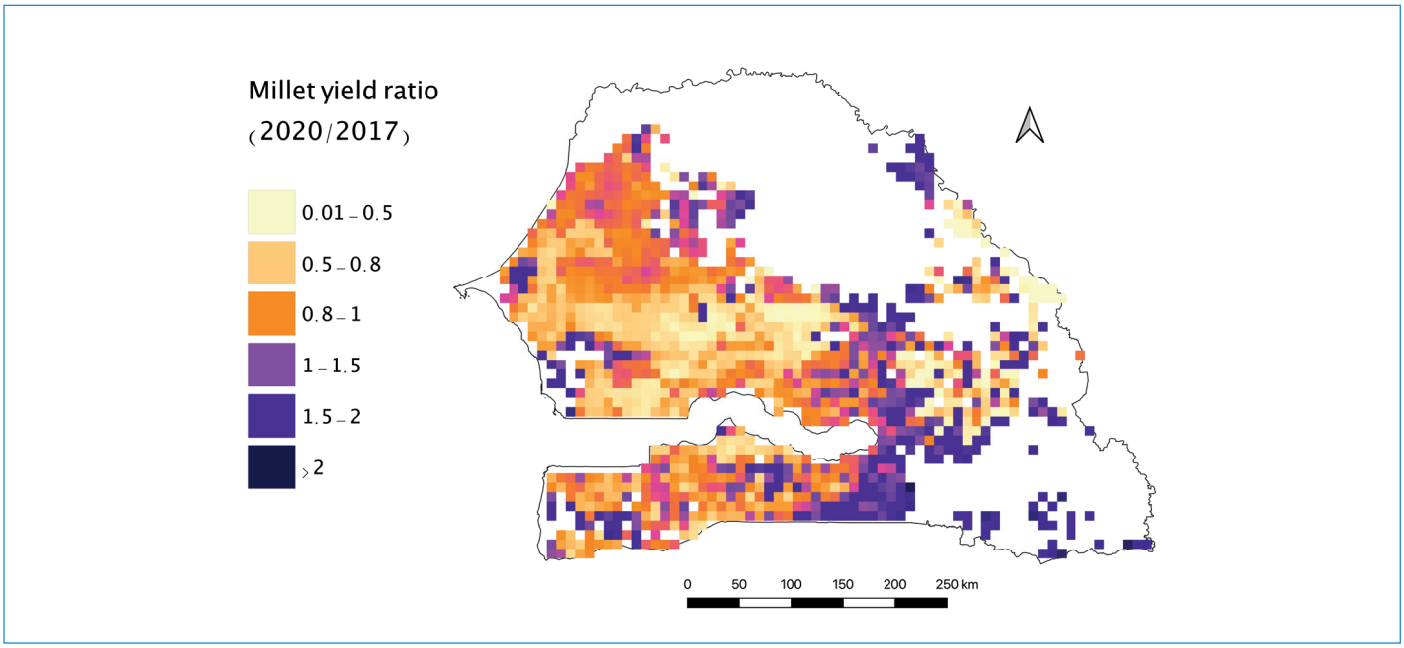
The greater spatial differentiation provided by our model makes it possible to devise more targeted policies for increased impact in terms of protecting the most vulnerable communities in areas where the sharpest decrease in yields may be expected. In addition, better forecasting of food crop yields in the context of possible widespread disruption of production systems is a good starting point to identify key priority areas for the assess and tracking of the impacts of COVID-19 and similar shocks on local food supplies.

Background documents

1. FAOSTAT Data (http://www.fao.org/faostat/en/#data/QC)
2. Ly, R. and Dia K. Forthcoming. "Application of Remote Sensing and Machine Learning for Crop Production Forecasting". COVID-19 Bulletin No. 4. Kigali. AKADEMIYA2063.
3. International Food Policy Research Institute. 2020. "Spatially-Disaggregated Crop Production Statistics Data in Africa South of the Saharan for 2017", https://doi.org/10.7910/DVN/FSSKBW, Harvard Dataverse, V1.
4. Agence nationale de la Statistique et la démographie (ANSD). « Bulletin mensuel sur les statistiques économiques Juin 2018

Note: *The boundaries and names shown, and the designations used on maps do not imply official endorsement or acceptance by AKADEMIYA2063.*

Figure 3. *2020 (predicted) and 2017 (FAOSTAT) ratio of Millet Yield in Senegal. Ratio below unity means agricultural yield reduction in 2020 compared to 2017*



AKADEMIYA2063 is grateful to USAID for funding for this work through a Feed the Future grant with Policy LINK. Any opinions stated here are those of the author(s) and are not necessarily representative of or endorsed by AKADEMIYA2063.

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