Reduced air pollution from climate mitigation could boost crop yields and lower hunger risk

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An international research team used multiple global agroeconomic models and found that climate mitigation consistent with the 1.5 °C target could raise global hunger risk in 2050 by 17% (56 million people) compared with a baseline scenario that assumes today's climate and air pollution conditions persist. However, the concurrent reduction in ozone offsets approximately 15% (8.4 million people) of this increase, with Sub-Saharan Africa and India accounting for 56% of the offset.

Climate change threatens global food security; however, climate mitigation policies may increase hunger risk by driving competition for land through bioenergy production and afforestation. Based on simulations from six global agroeconomic models, researchers from The University of Tokyo, Ritsumeikan University, Kyoto University, National Institute for Environmental Studies, and E-Konzal Co. Ltd., together with collaborators from other countries, report that the ozone reduction benefits of climate mitigation could partially offset this increase in hunger risk.

1. Baseline changes in global hunger risk

The baseline scenario assumes that today's climate and air pollution conditions persist and follow SSP2 socioeconomic settings, a "middle-of-the-road" development pathway with moderate population growth and social, economic, and technological trends that broadly follow historical patterns within each region. According to the multi-model median of the six global agroeconomic models, food availability will increase by 2050 in the baseline scenario, decreasing the global hunger risk. Compared with 2020, the number of people at risk of hunger will fall by approximately 390 million by 2050, reaching approximately 330 million by 2050 (Fig. 1a–c).

2. Climate mitigation increases hunger risk

Compared with the baseline scenario, the 1.5 °C climate target scenario (SSP2-2.6) introduces carbon pricing and other climate mitigation measures that substantially raise production and agricultural commodity prices (Fig. 1f), to a greater extent than in the warming scenario (SSP2-7.0). Consequently, food availability will decline (Fig. 1e), and the global population at risk of hunger by 2050 is projected to be approximately 56 million higher than the baseline (Fig. 1d).

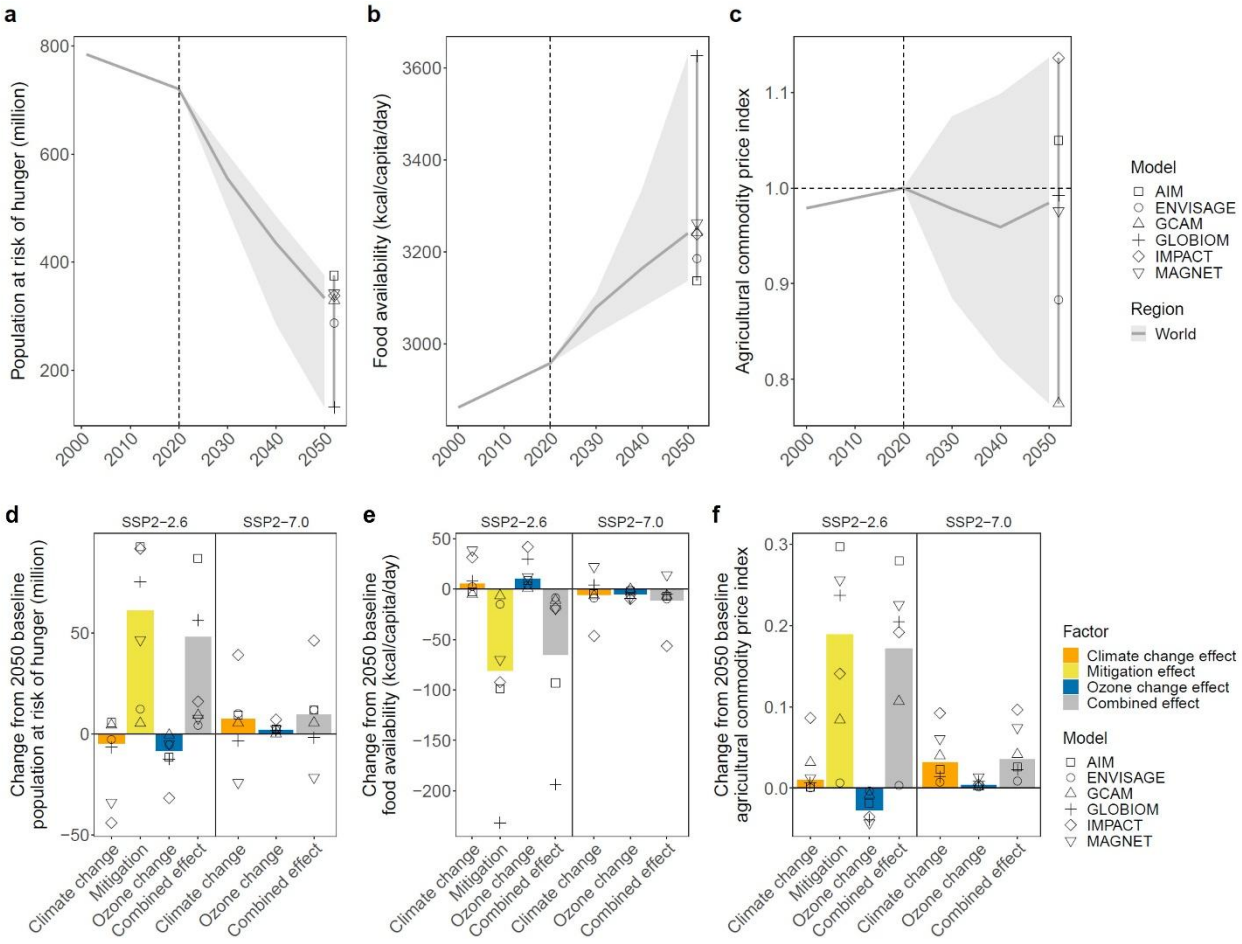

Fig. 1. Reduced air pollution from climate mitigation could boost crop yields and lower hunger risk.
Global population at risk of hunger (a), global mean food availability (b), and food prices (c) in the baseline scenario, and, as differences from the 2050 baseline estimate, the effects of climate change alone, climate mitigation policies, and the associated ozone reduction on the global population at risk of hunger (d), global mean food availability (e), and food prices (f). The combined effect represents the sum of the effects of these three drivers. Shaded areas in (a–c) indicate inter-model uncertainty, whereas bars in (d–f) show the median across the six models. Markers denote individual model results.

3. Ozone reduction partially offsets the negative effects of mitigation

The same mitigation policies reduce the emissions of ozone precursors, leading to lower ozone concentrations and higher crop yields. These ozone-driven yield gains reduce food prices and increase food availability. Consequently, approximately 8.4 million of the additional people at risk of hunger (approximately 15% of the mitigation-induced increase) will be offset by ozone reduction in 2050.

4. Benefits are concentrated in regions with severe hunger today

Regionally, approximately 56% of the hunger-reducing effect of ozone decline occurs in Sub-Saharan Africa and India, where hunger is currently the most severe.

These findings show that jointly assessing climate change, climate mitigation policies, and changes in tropospheric ozone from mitigation allows for a more accurate understanding of the tradeoffs and offsetting effects embedded in climate mitigation. Although previous studies may have overestimated the negative impacts of climate mitigation on food security by neglecting the benefit of ozone reduction, this study confirms that stringent mitigation can still increase hunger risks if land use and price effects are not

appropriately managed.

To implement climate policies that limit future increases in hunger risk, it is essential to look beyond greenhouse gas emissions and carbon balances alone and to explicitly incorporate food security impacts at the design stage of mitigation strategies.

5. Publication

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Ozone pollution reduction partially offsets the negative impact of climate mitigation efforts on global hunger

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