

# Reducing ozone pollution alleviates the adverse impact of climate change mitigation efforts on global hunger

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## 1 Introduction

- Global warming and surface ozone air pollution have been identified in many studies as important factors affecting crop yield<sup>1</sup>.
- Climate change mitigation policies help mitigate ozone pollution everywhere while slowing global warming<sup>2</sup>.
- Although earlier studies<sup>3</sup> have raised food security concerns in relation to climate change mitigation efforts, they have not considered the concurrent impacts of ozone mitigation that could increase crop yield and improve food security.

**Question:** (1) how ozone pollution affects future agricultural markets through changes in crop yields under climate change and mitigation pathways, and (2) how much additional benefit the reduction of ozone concentration through climate mitigation provide in reducing global hunger?

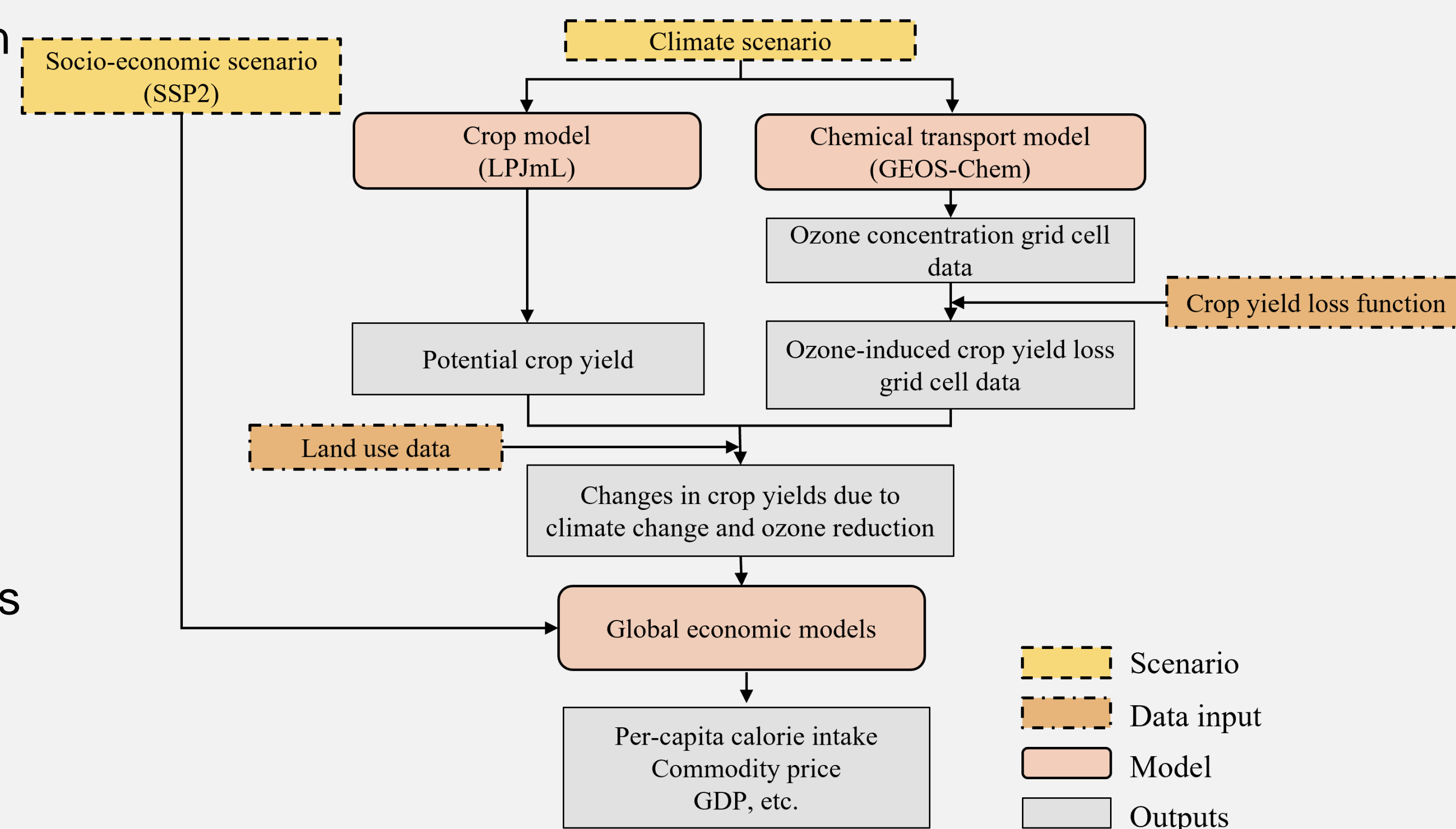
## 2 Method

Project ozone concentration and yield loss rate due to ozone and climate change

Aggregated into country-wise crop yield change information by using land use data

Input this yield change data into global economic models

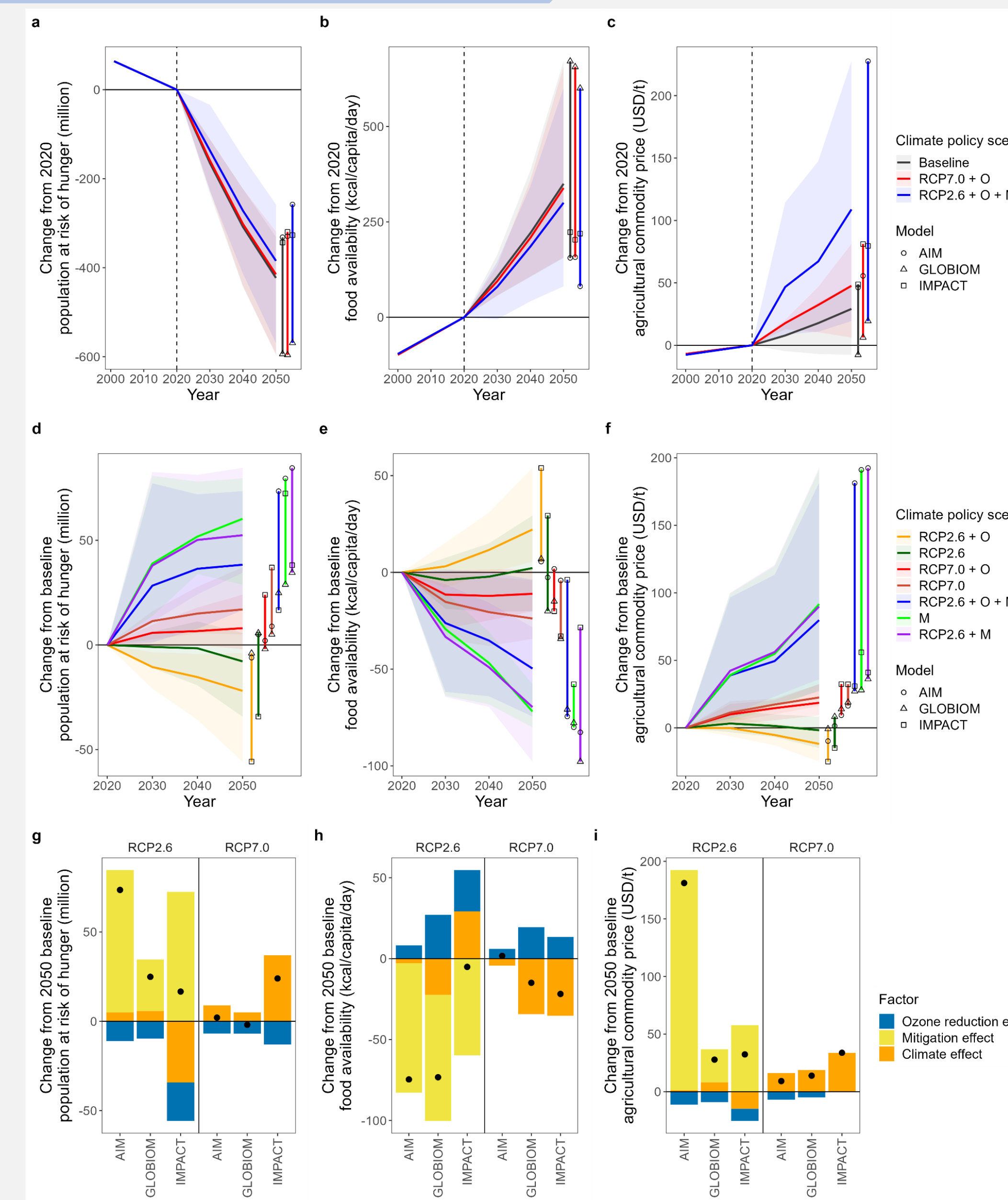
Analyzed final outputs for the population at risk of hunger, in each scenario



**Fig. 1.** A modelling framework for the scenario analysis in this study.

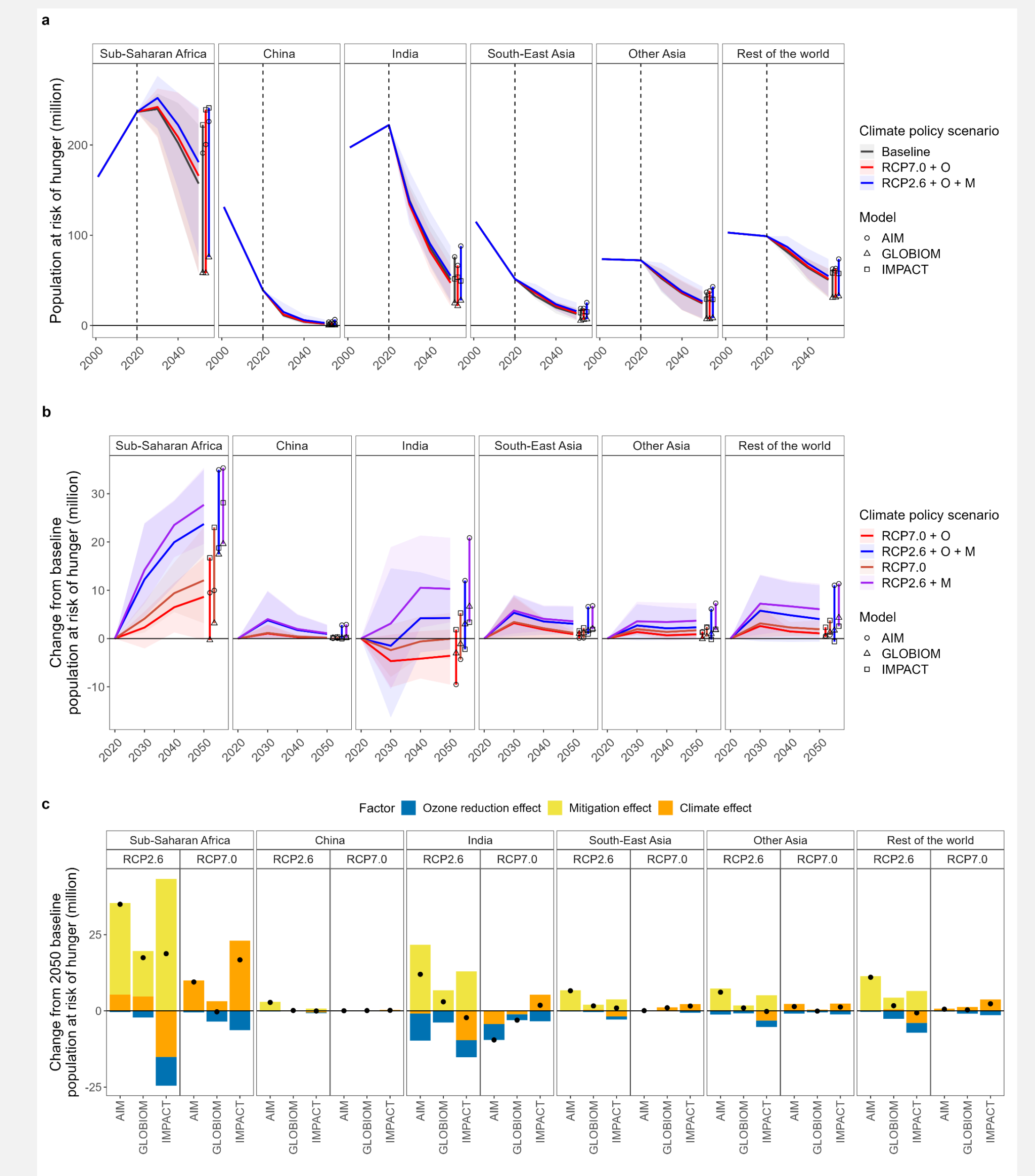
Scenario	Description
Baseline	Assume no climate change and no implementation of air pollution (ozone pollution level) control measures
RCP2.6	Only the effects of climate change in RCP2.6
M	Only the effects of mitigation in RCP2.6
RCP2.6 + M	Combined effects of climate change and mitigation in RCP2.6
RCP2.6 + O	Combined effects of climate change and ozone reductions in RCP2.6
RCP2.6 + O + M	Combined effects of climate change, ozone reductions, and mitigation in RCP2.6
RCP7.0	Only the effects of climate change under RCP7.0
RCP7.0 + O	Combined effects of climate change and ozone reductions in RCP7.0

## 3 Results



**Fig. 2.** Global implications.

In RCP2.6, an additional 50 million people could face hunger by 2050 without ozone reductions. While ozone reductions would still leave 38 million people at higher risk than the baseline trend, exceeding the risk level in RCP7.0, these reductions could mitigate the risk for 12 million people.



**Fig. 3.** Regional implications.

As with global trends, while ozone reductions have a limited effect on mitigating hunger caused by mitigation efforts, they can still significantly reduce hunger risk across all regions. Sub-Saharan Africa and India, where hunger is prevalent, show the largest absolute changes in response to each factor.

## 4 Discussion and conclusion

- Ozone reductions can boost crop yields, reduce food prices, increase calorie intake, and alleviate hunger. Specifically, in a low emissions scenario, they could reduce global hunger risk by 4% compared to the baseline scenario.
- Our findings underscore that even when accounting for ozone concentration changes, mitigation policies pose a significant threat to global hunger, outweighing the impacts of climate change.
- Strategies such as selecting more heat-tolerant rice and wheat in India and shifting to less resource-intensive diets in Sub-Saharan Africa have the potential to reduce the adverse effects of warming and mitigation efforts.

## Reference

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2. West, J., Smith, S., Silva, R. et al. Co-benefits of mitigating global greenhouse gas emissions for future air quality and human health. *Nat. Clim Change* (2013).
3. Hasegawa, T. et al. Risk of increased food insecurity under stringent global climate change mitigation policy. *Nat. Clim. Change* (2018).