Economic implications of climate change on human health through undernourishment

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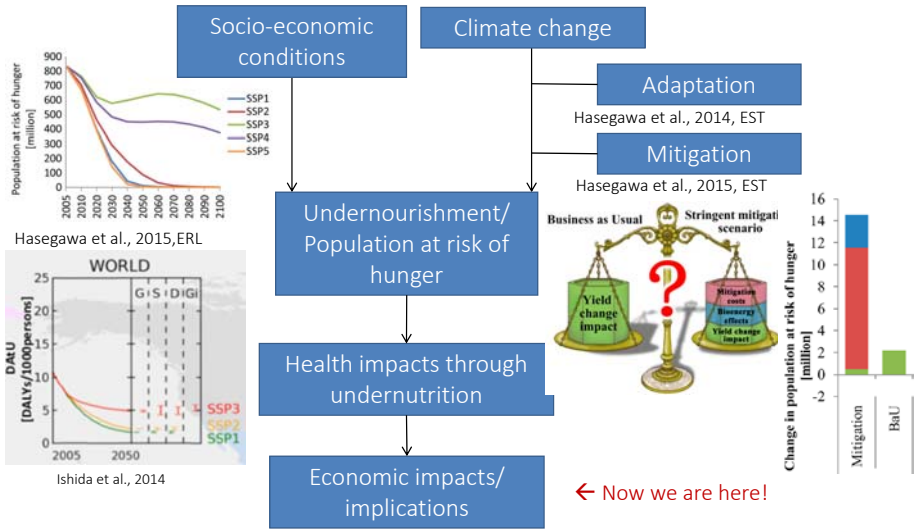
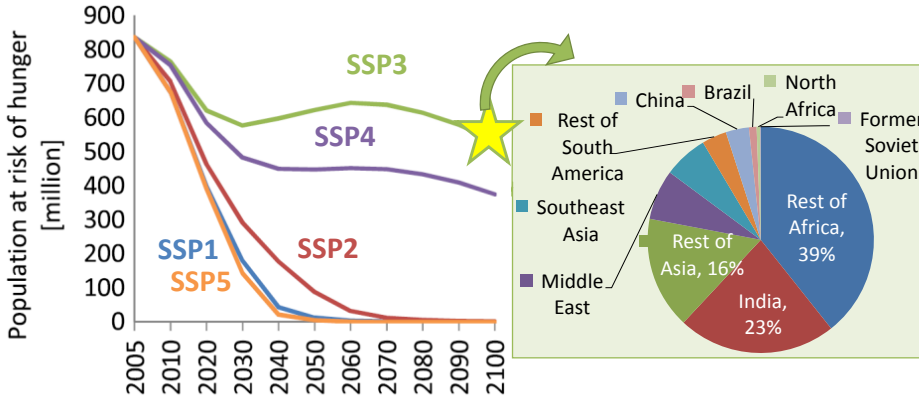
Our earlier studies



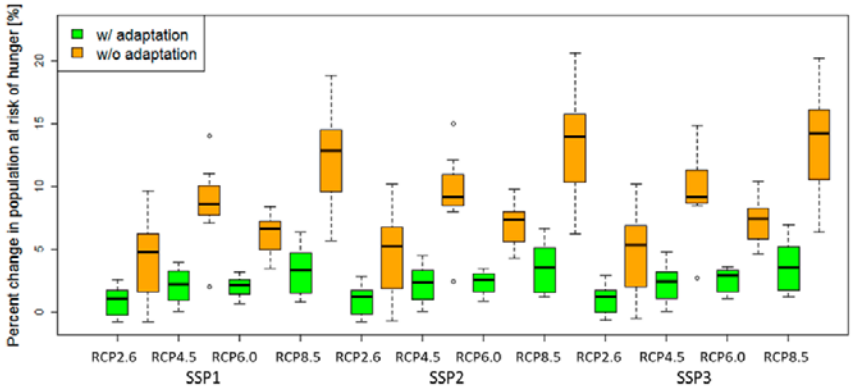
Risk of hunger in the 21st century

The 21st-century risk of hunger strongly differs among different socioeconomic conditions.



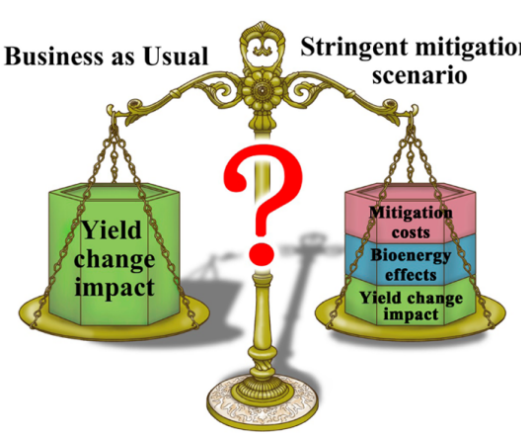
Hasegawa et al., 2015 ERL

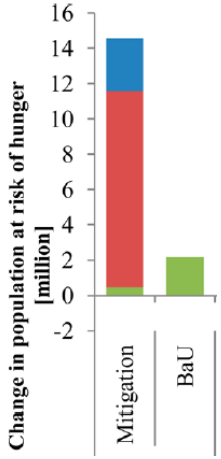
Adaptation effects on hunger risk



Hasegawa et al., 2014 EST

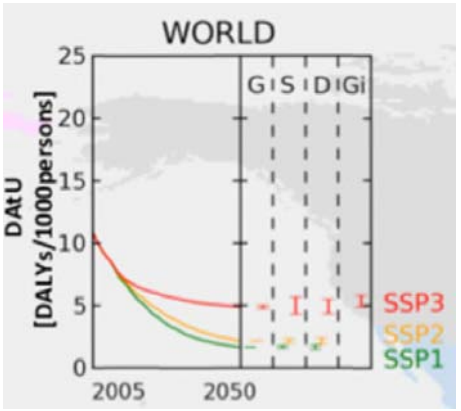
Consequences of mitigation on undernourishment





Hasegawa et al. 2015 EST

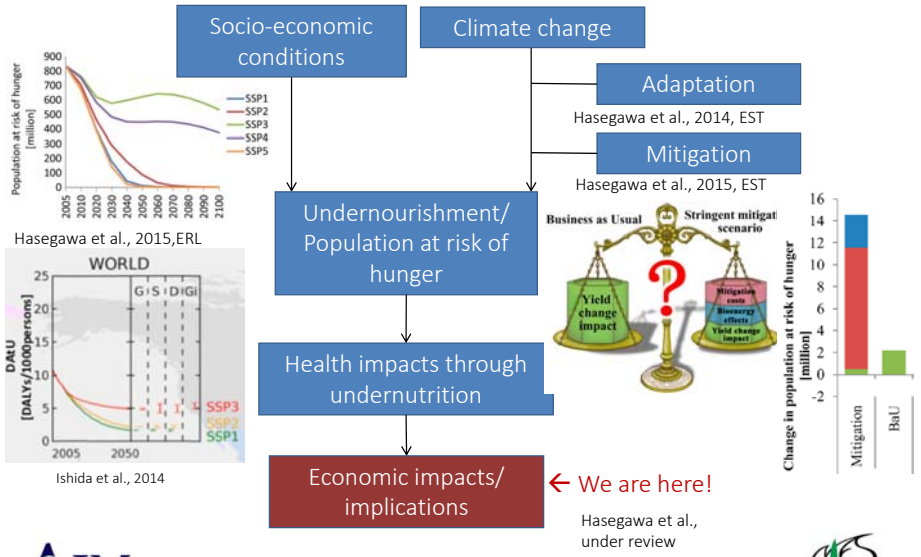
Health burden due to childhood undernutrition



	RCP2.6	RCP4.5	RCP8.5
SSP1	SSP1 Policy	SSP1 BAU	
SSP2		SSP2 policy	SSP2 BAU
SSP3		SSP3 policy	SSP3 BAU

Ishida et al. 2014

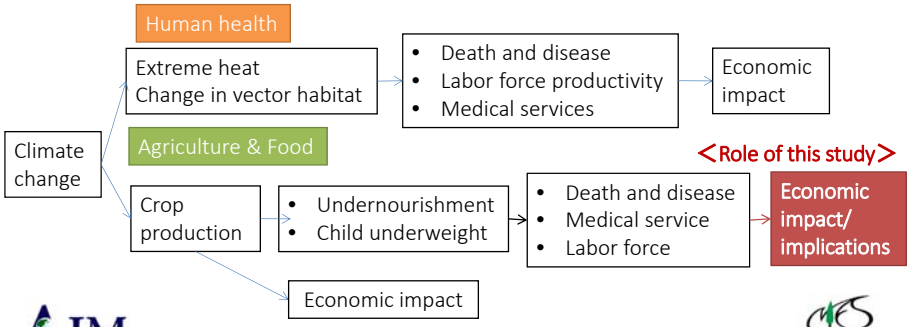
Our earlier studies



Research question

"How large is climate change impact on human health through undernourishment?"

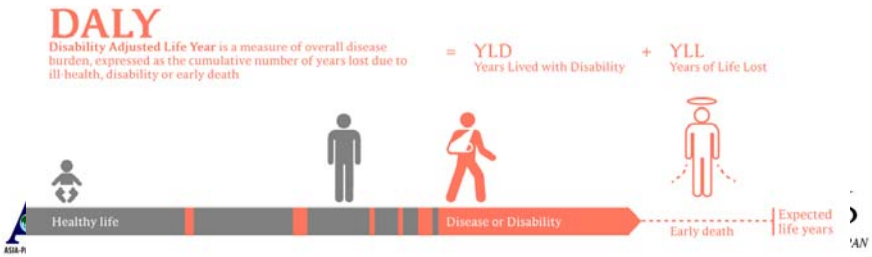
- Economic impacts of decreases in labor force and population, and additional healthcare cost
- Value of lives lost.

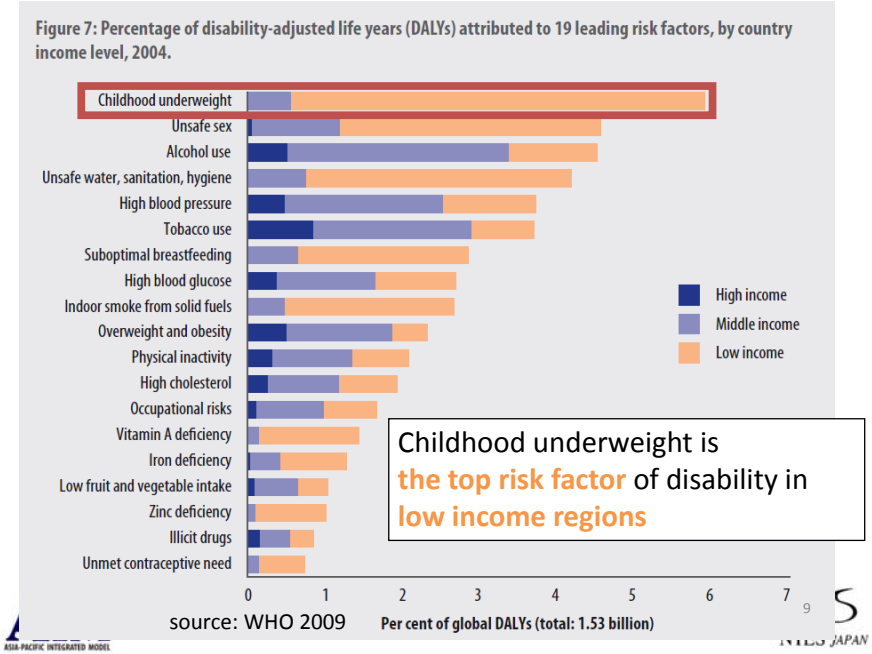


Disability-Adjusted Life Years (DALY)

- DALY is years of "healthy" life lost weighted by disability and mortality (Murray 1996).
- DALYs have been used by WHO as a measurement of disease burden.

- DALY have information of risk factor and disease or disability
- E.g. : risk factor → disease or disability
  - childhood underweight → malaria
  - tobacco → lung cancer

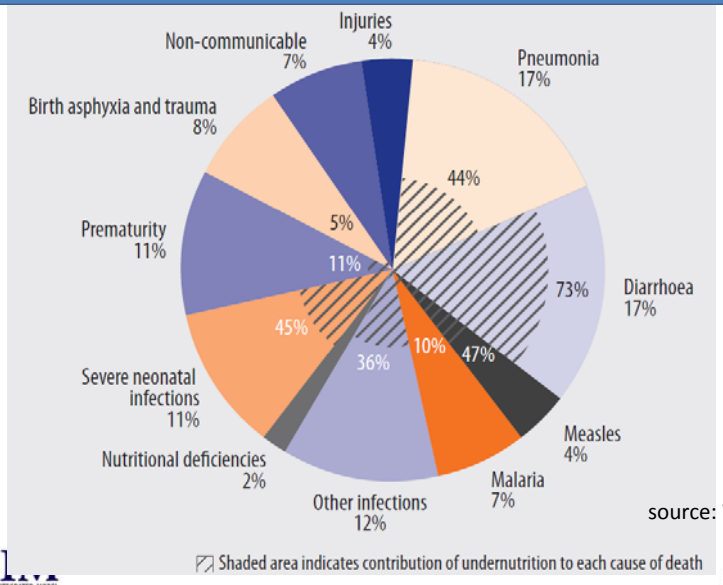




Childhood underweight is **the top risk factor** of disability in **low income regions**

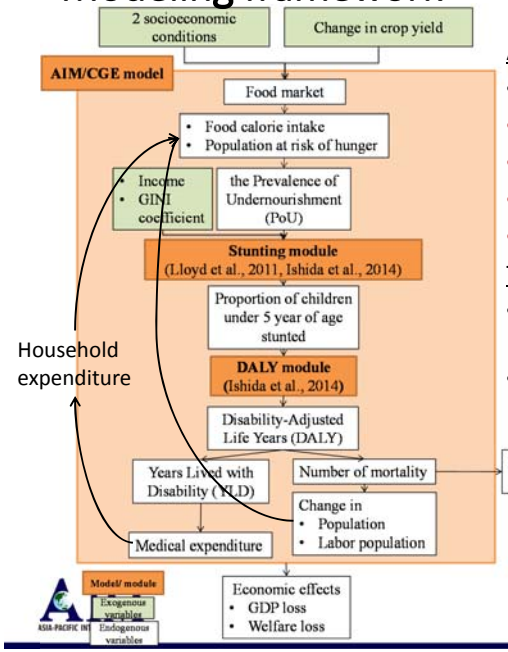
source: WHO 2009

Major causes of death in children under 5 years old (Shaded area: contribution of undernutrition to each cause of death)



source: WHO 2009

Modeling framework



Added variables
- Population at risk of hunger
- DALY
- Medical expenditure
- Mortality
- value of life lost

Two feedback
- 1) Mortality fed back to population and labor force
- 2) Medical cost fed back to household expenditure

DALY model

- Ishida et al. (2014)

$$\log\left(\frac{DALY_{t,c,d}}{POP_{t,c}}\right) = \varphi_d + \psi_d \cdot \log\left(Y_{t,c}\right)$$

- t: year, c: country, d: disease;
- $DALY_{t,c,d}$: DALY due to disease d (year)
- $POP_{t,c}$: population
- $Y_{t,c}$: Proportion of children stunted.

Economic value of Life lost as a result of Disability

- **Value of Statistical Life (VSL):** an evaluation based on the WTP to avoid the risk of death.
- Approach developed by OECD (2012), where the VSL is adjusted and different in different income levels.
- The value observed in China, 2005 applied to other mid- or low- income regions

Scenario settings

- 3 climate conditions: RCP2.6, RCP8.5, No climate change
- 2 socioeconomic conditions: SSP2, SSP3
- Year: 2005-2100

Uncertainty considered using ISIMIP results of crop yields

- 4 crop models
- 5 climate models
- RCP2.6, RCP8.5

Socioeconomic conditions

Climate conditions	SSP2	SSP3
No change		
RCP8.5		
RCP2.6		