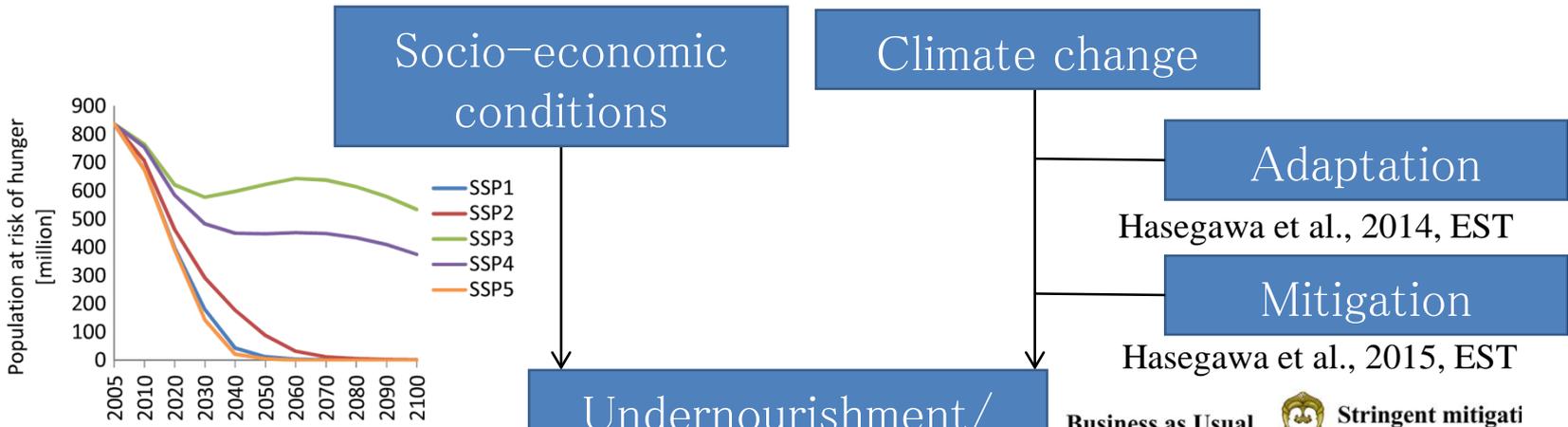


Economic implications of climate change on human health through undernourishment

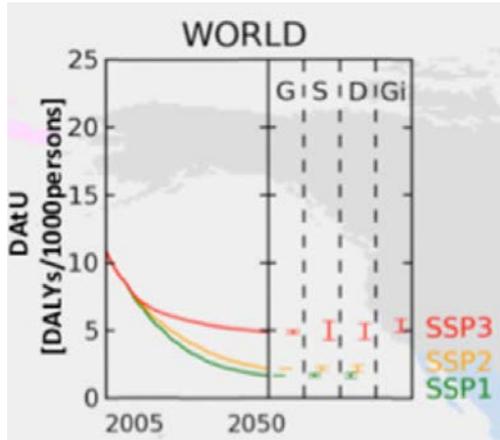
Tomoko HASEGAWA

The 21st AIM international workshop, 15/11/2015

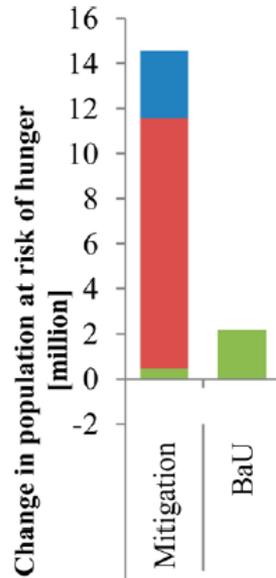
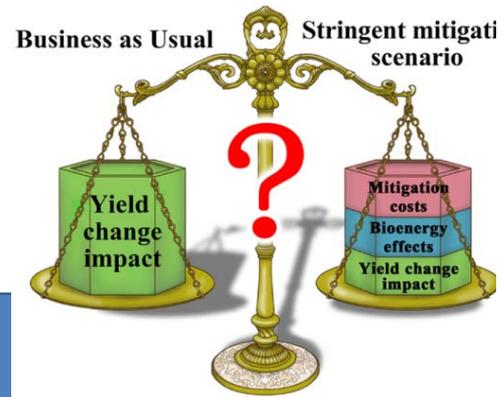
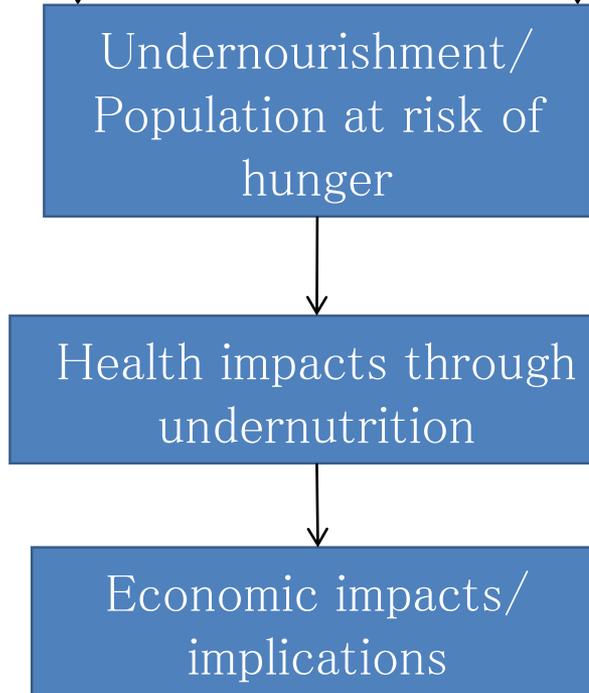
Our earlier studies



Hasegawa et al., 2015, ERL



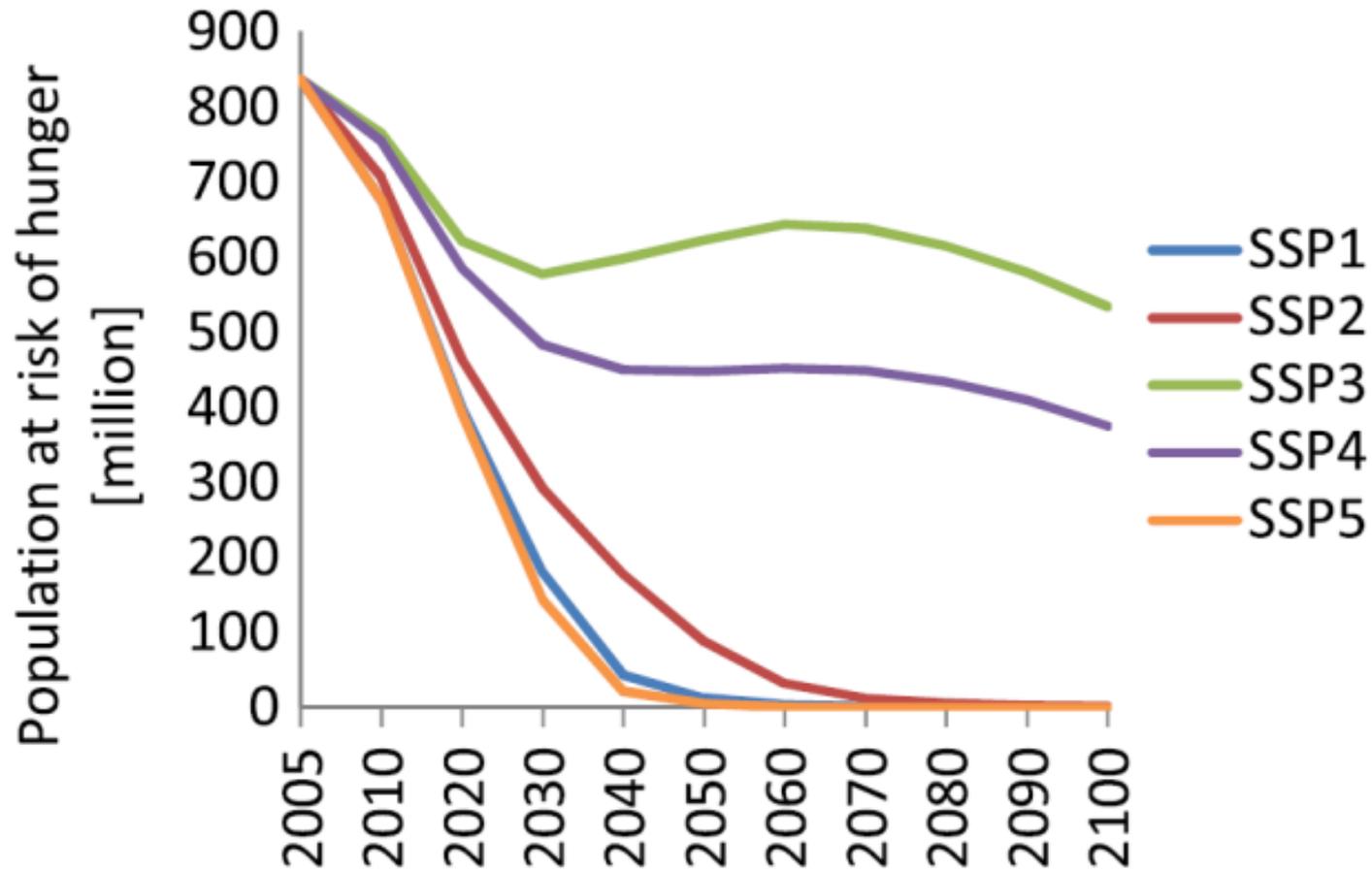
Ishida et al., 2014



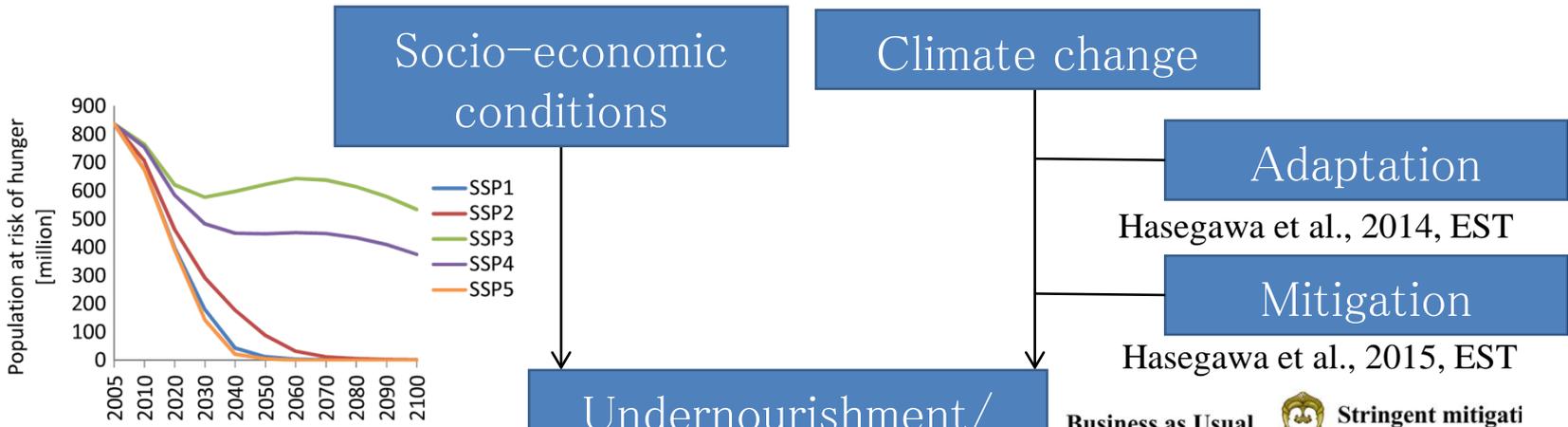
← Now we are here!

Hasegawa et al.,
under review

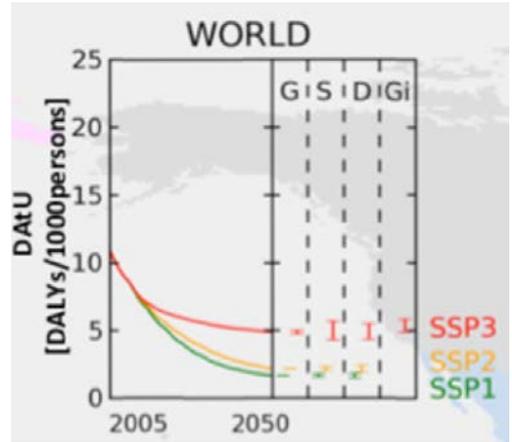
Future hunger risk in this century



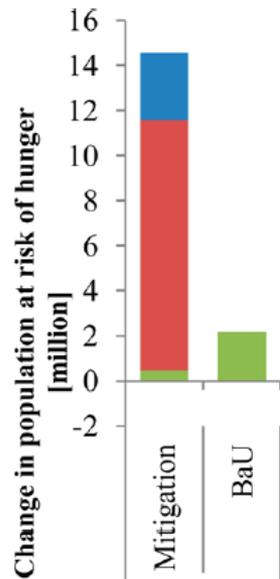
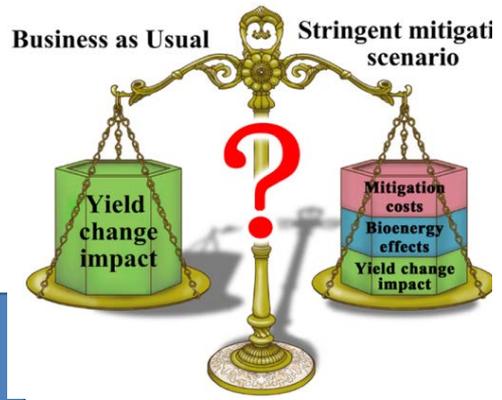
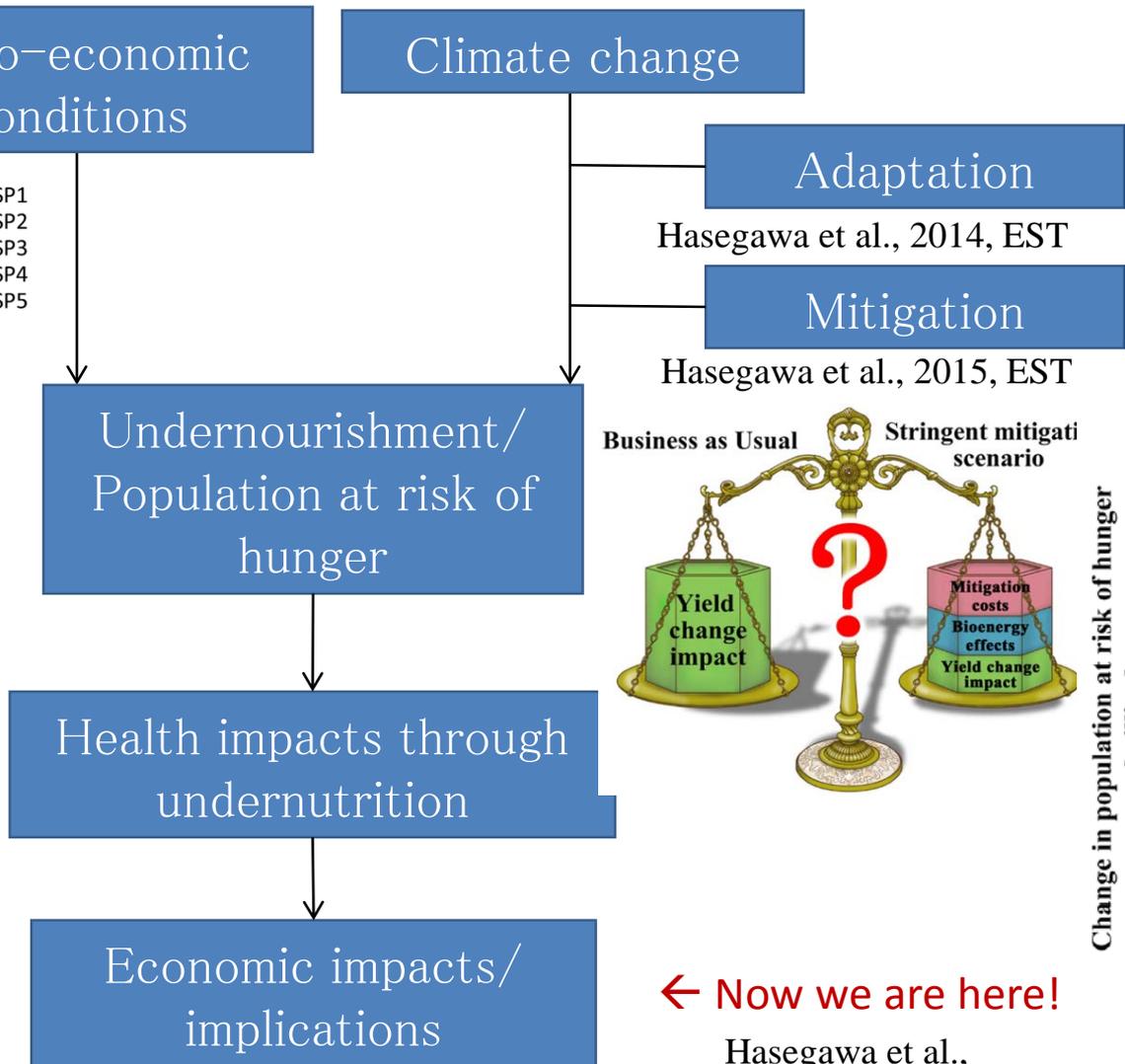
Our earlier studies



Hasegawa et al., 2015, ERL



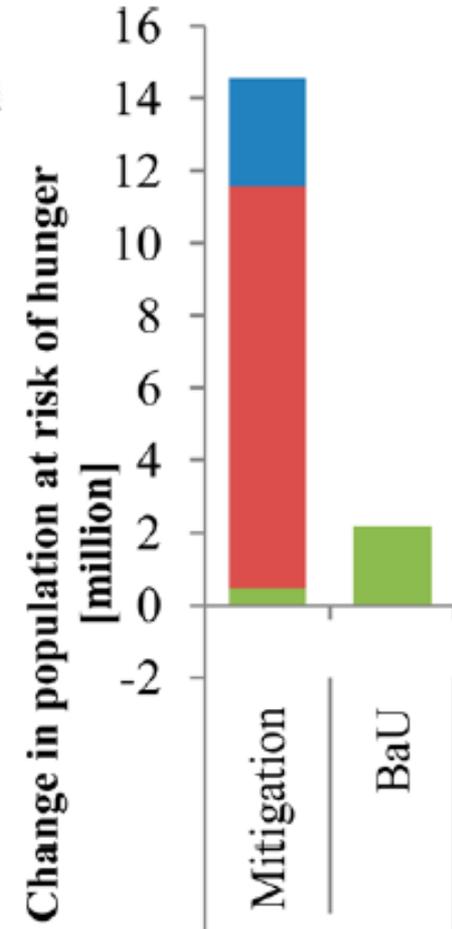
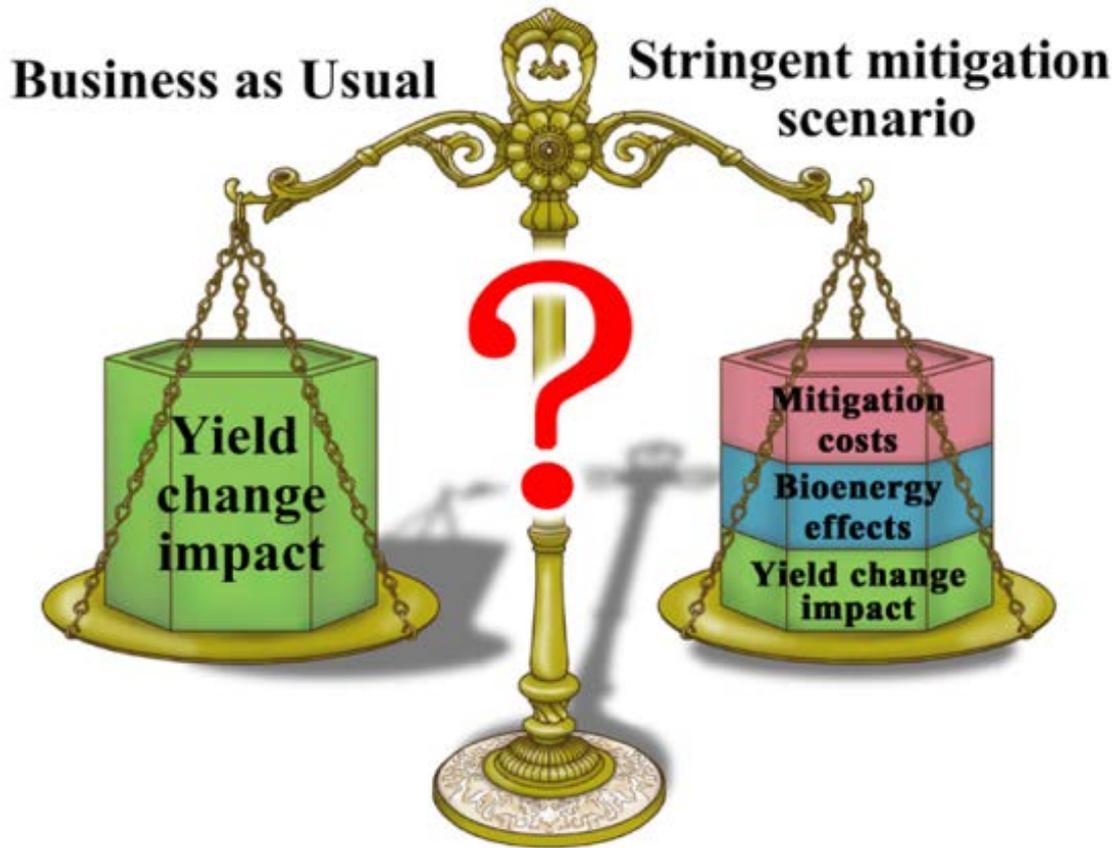
Ishida et al., 2014



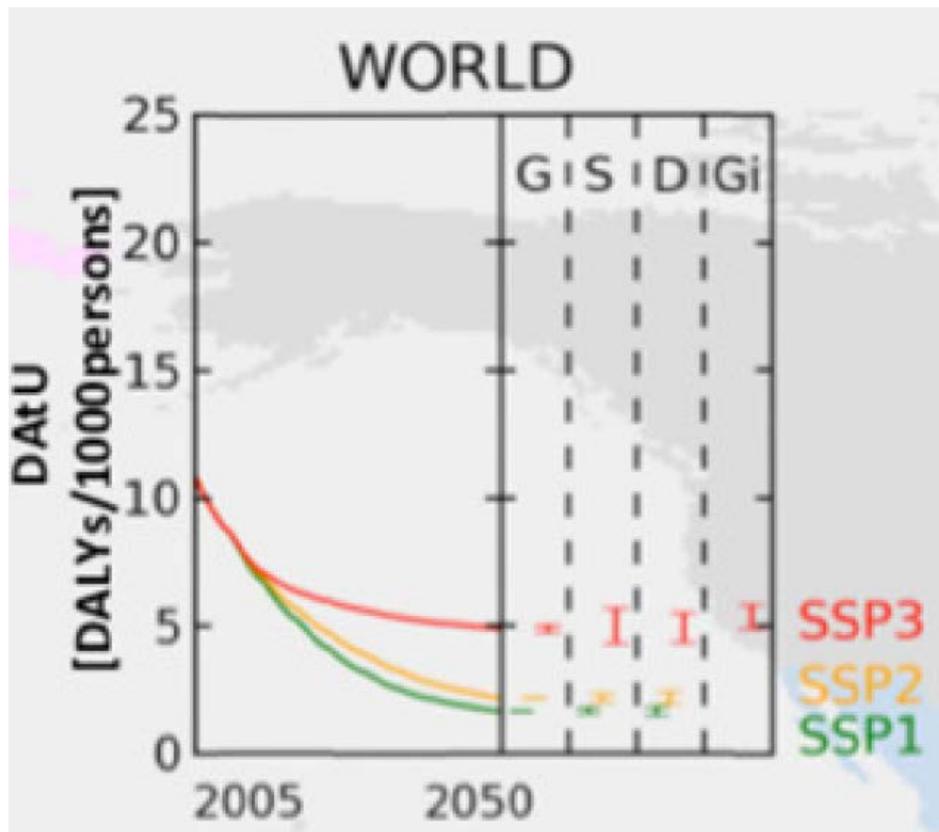
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Hasegawa et al.,
under review

Consequences of mitigation on undernourishment

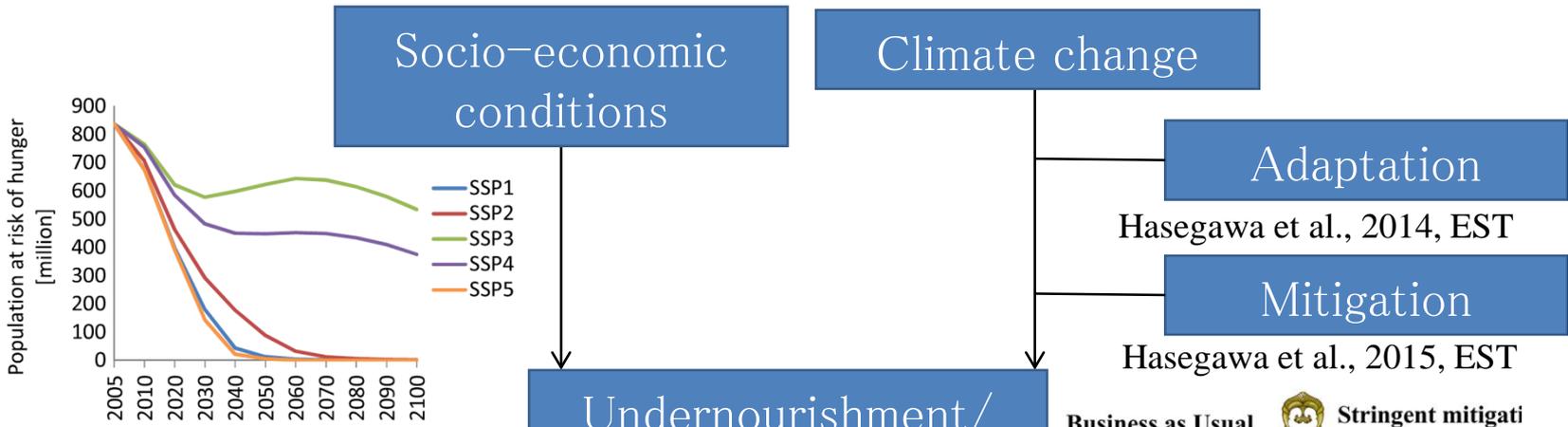


Health burden due to childhood undernutrition

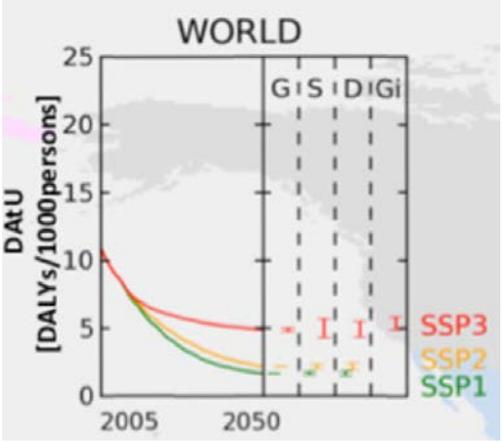


	RCP2.6	RCP4.5	RCP8.5
SSP1	SSP1 Policy	SSP1 BAU	
SSP2		SSP2 policy	SSP2 BAU
SSP3		SSP3 policy	SSP3 BAU

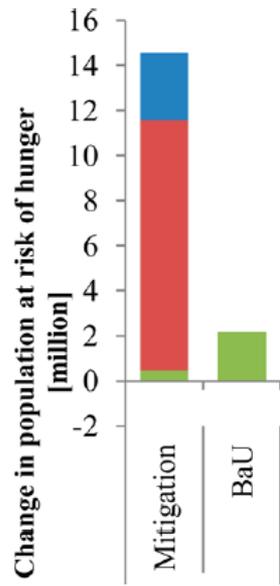
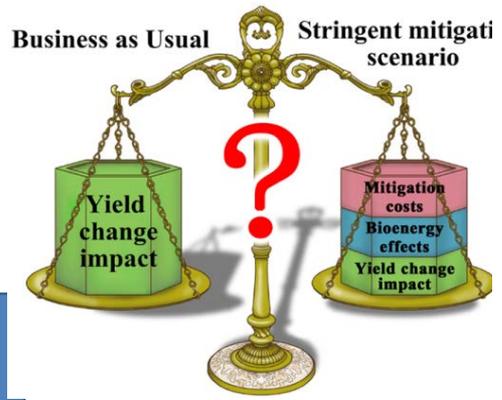
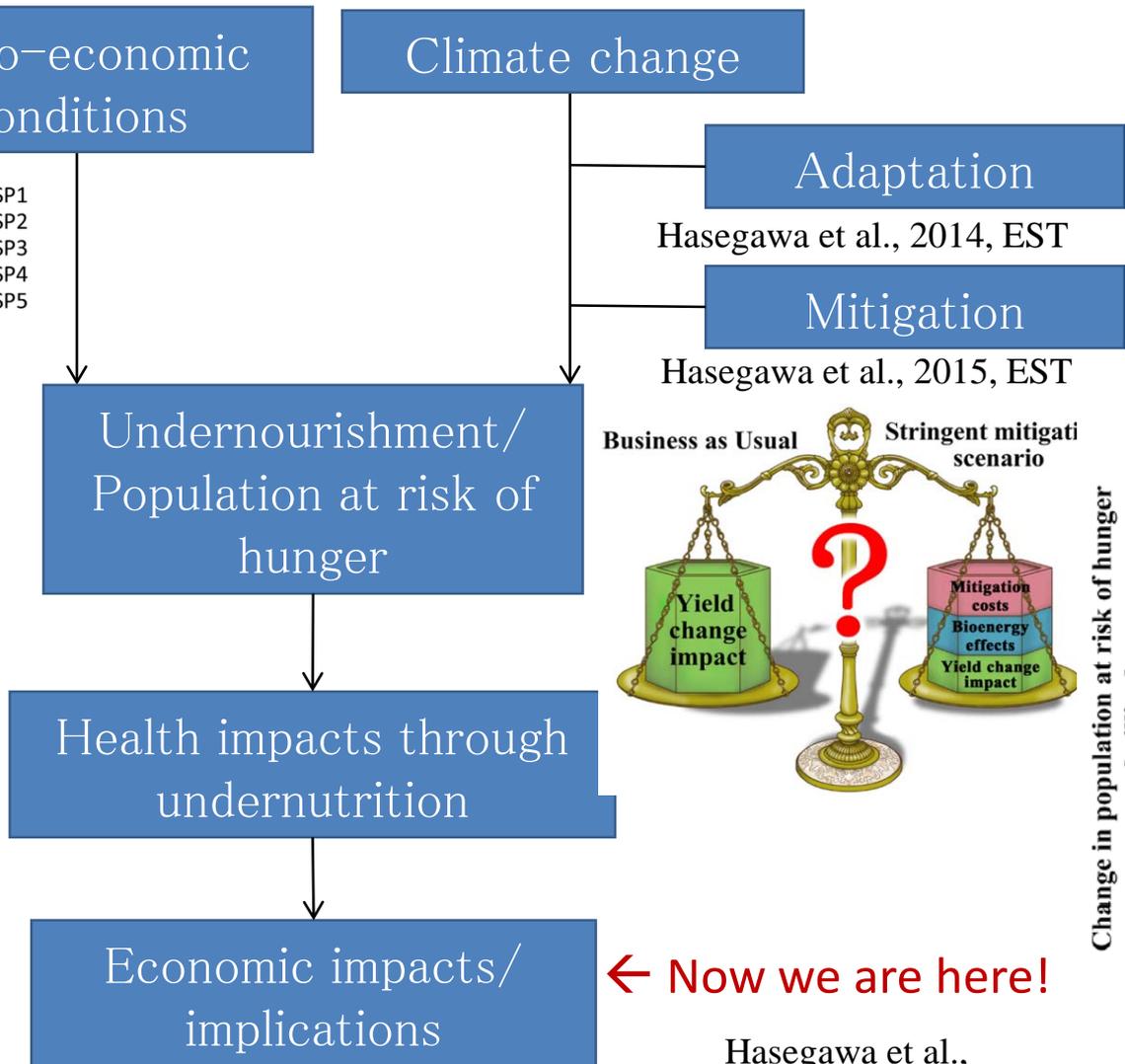
Our earlier studies



Hasegawa et al., 2015, ERL



Ishida et al., 2014



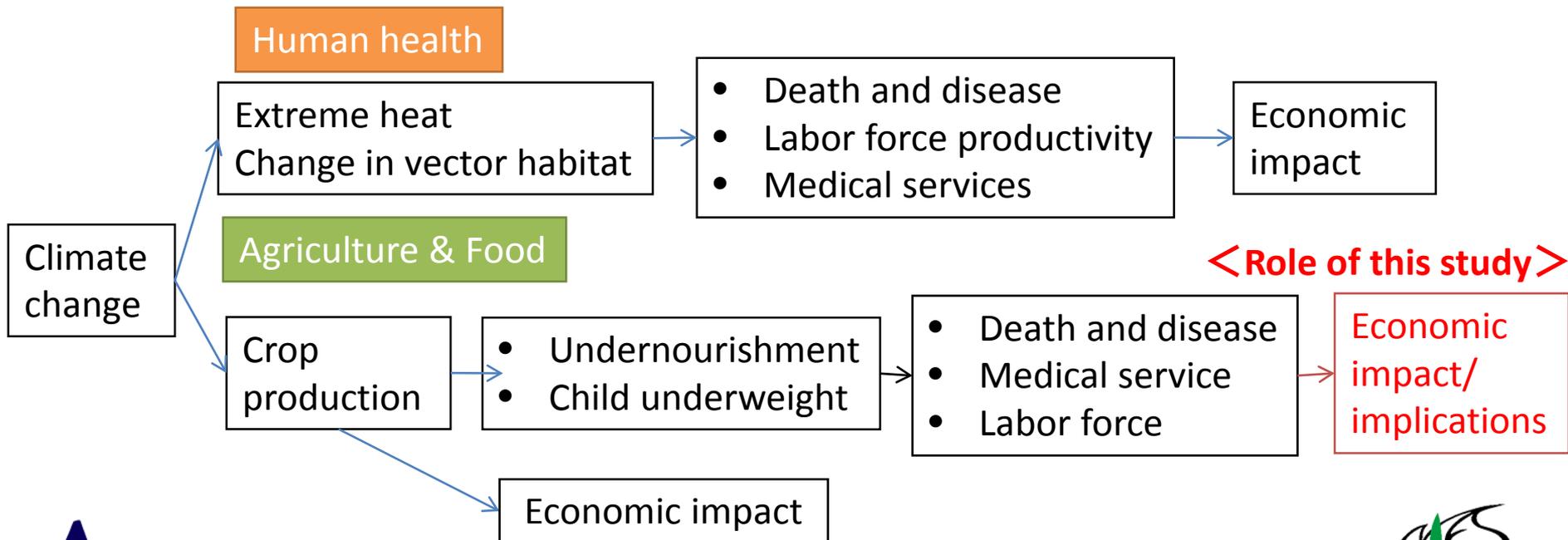
← Now we are here!

Hasegawa et al.,
under review

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

DALY

Disability Adjusted Life Year is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

$$= \text{YLD} \quad + \quad \text{YLL}$$

Years Lived with Disability Years of Life Lost

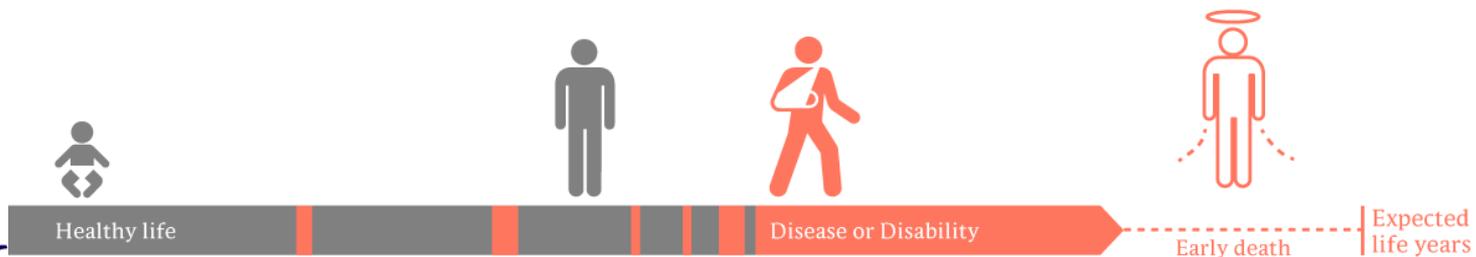
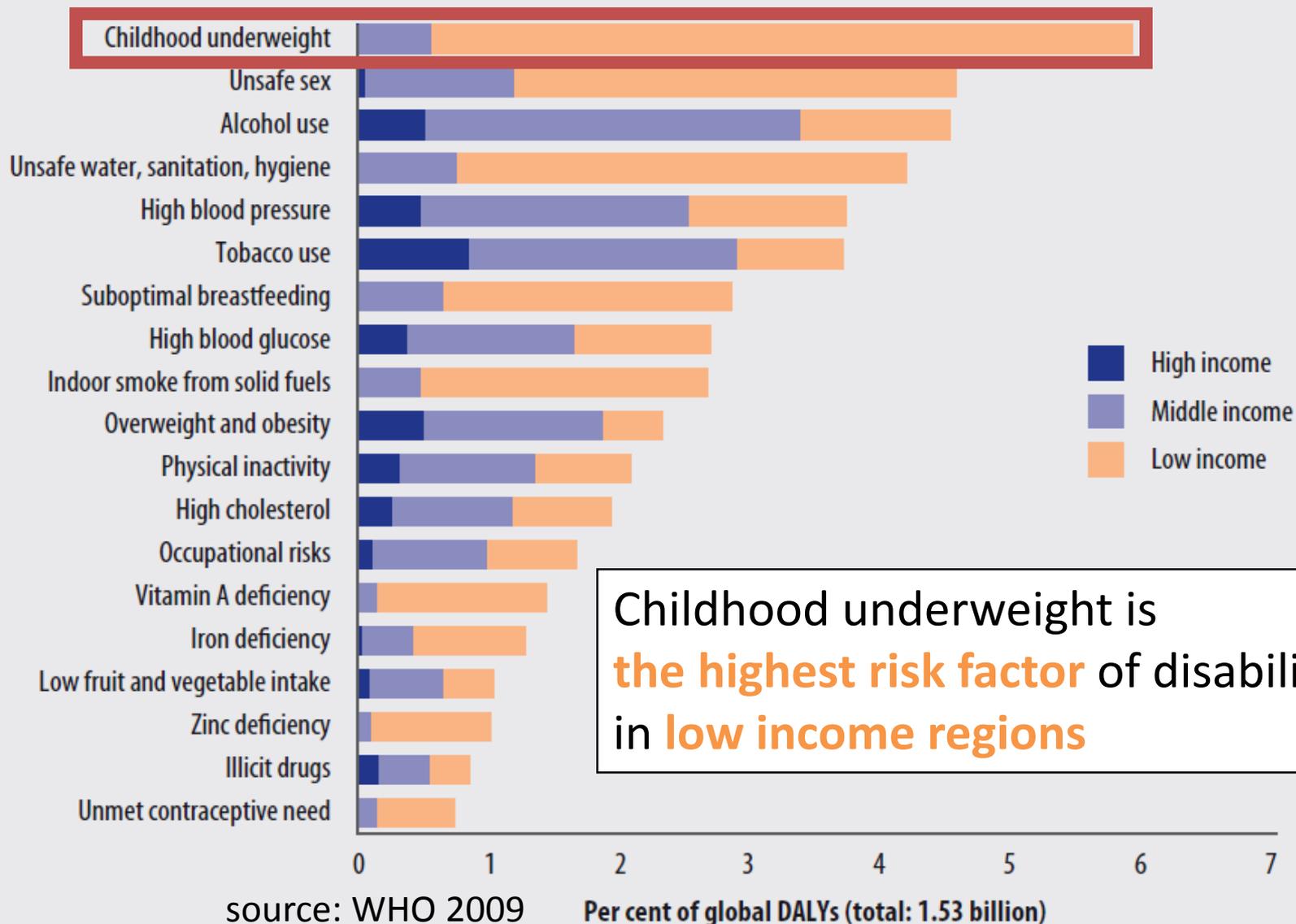
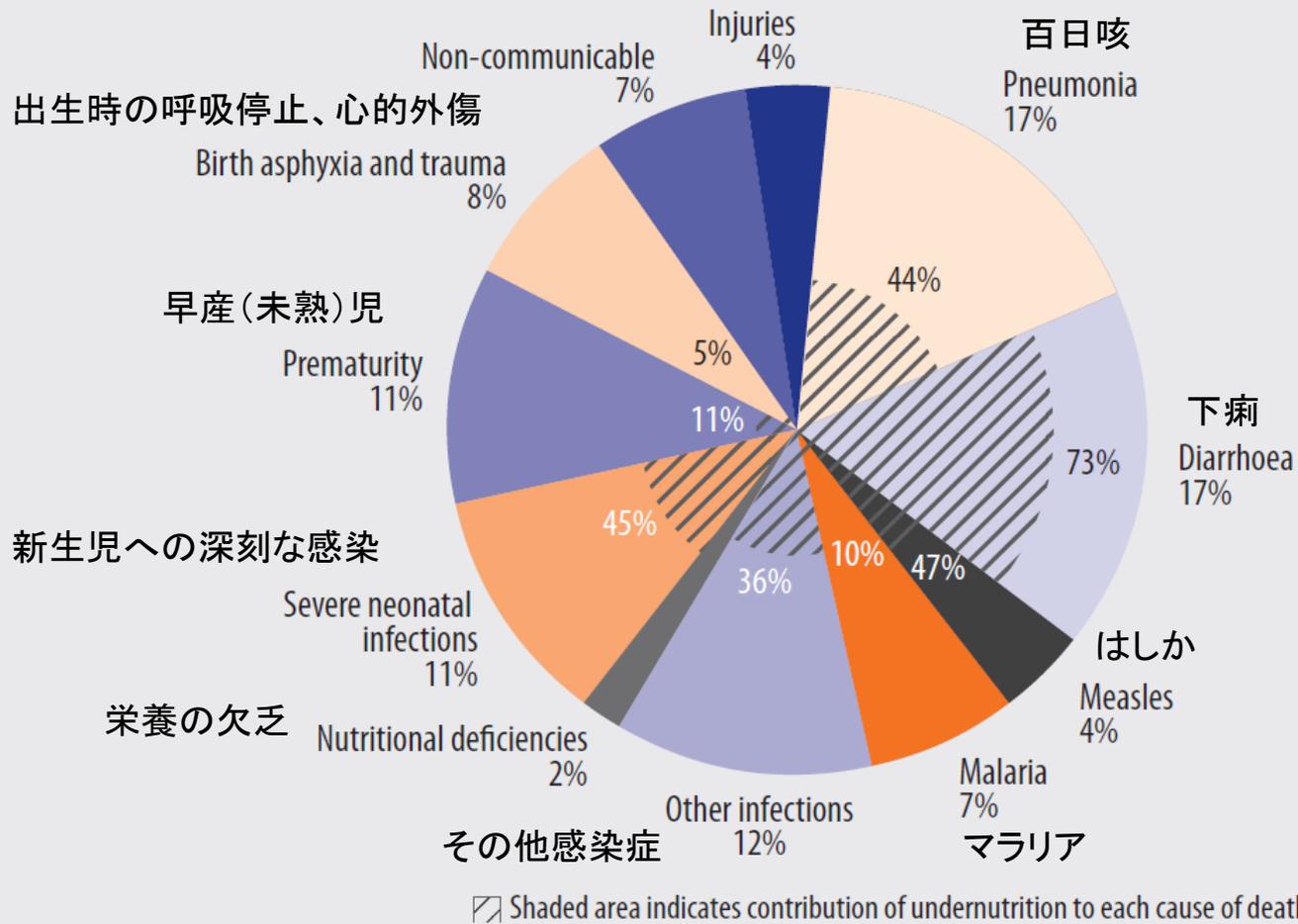


Figure 7: Percentage of disability-adjusted life years (DALYs) attributed to 19 leading risk factors, by country income level, 2004.

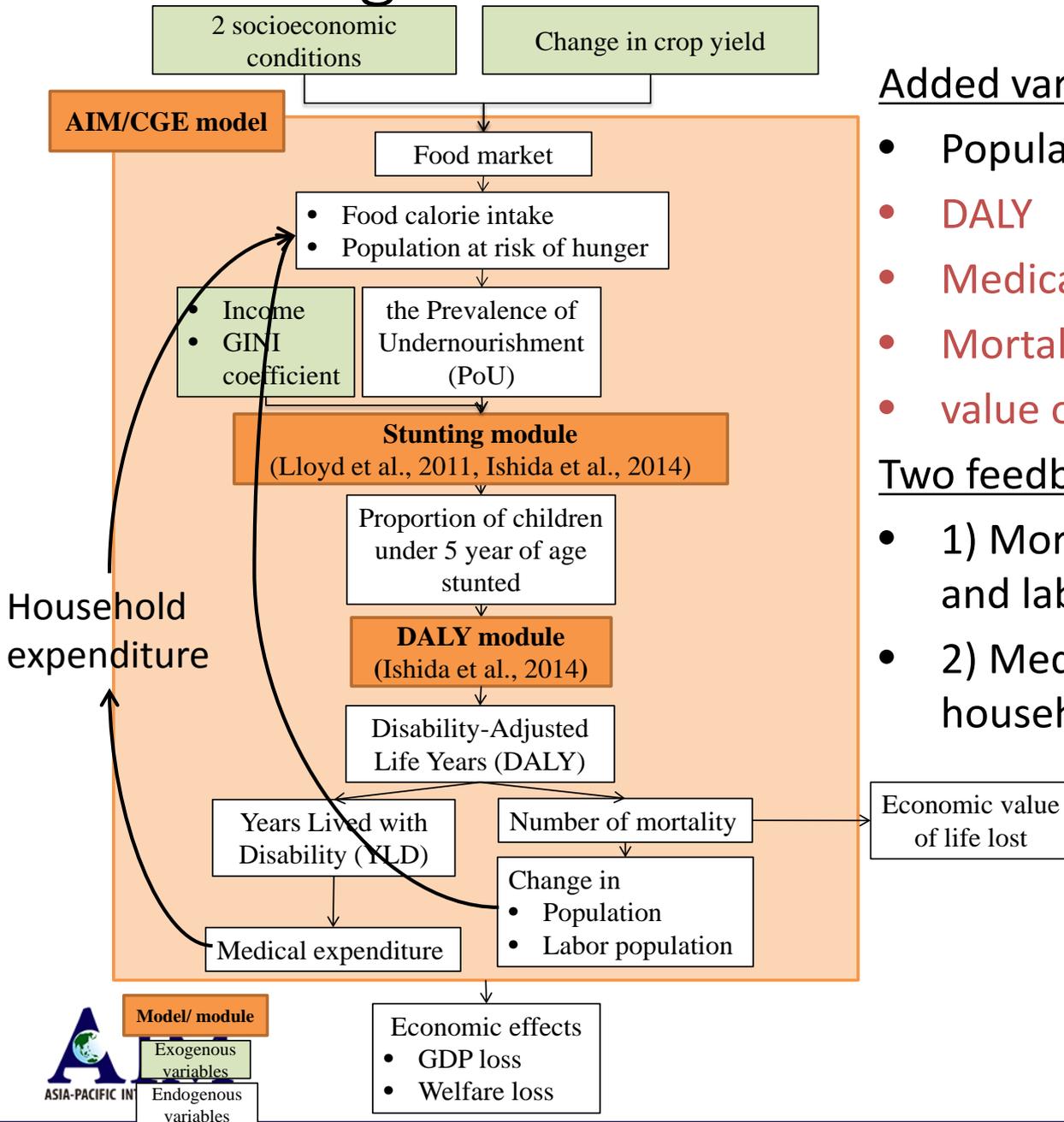


Childhood underweight is the highest risk factor of disability in low income regions

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



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)

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

- 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 derived using an income adjustment.
- The value of the health risk observed in China, 2005 was 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

- 4 crop models
- 5 climate models
- 3 climate conditions

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