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Applied Systems Analysis
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Food Security in an Uncertain World

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*Ecosystems Services &
Management Program*

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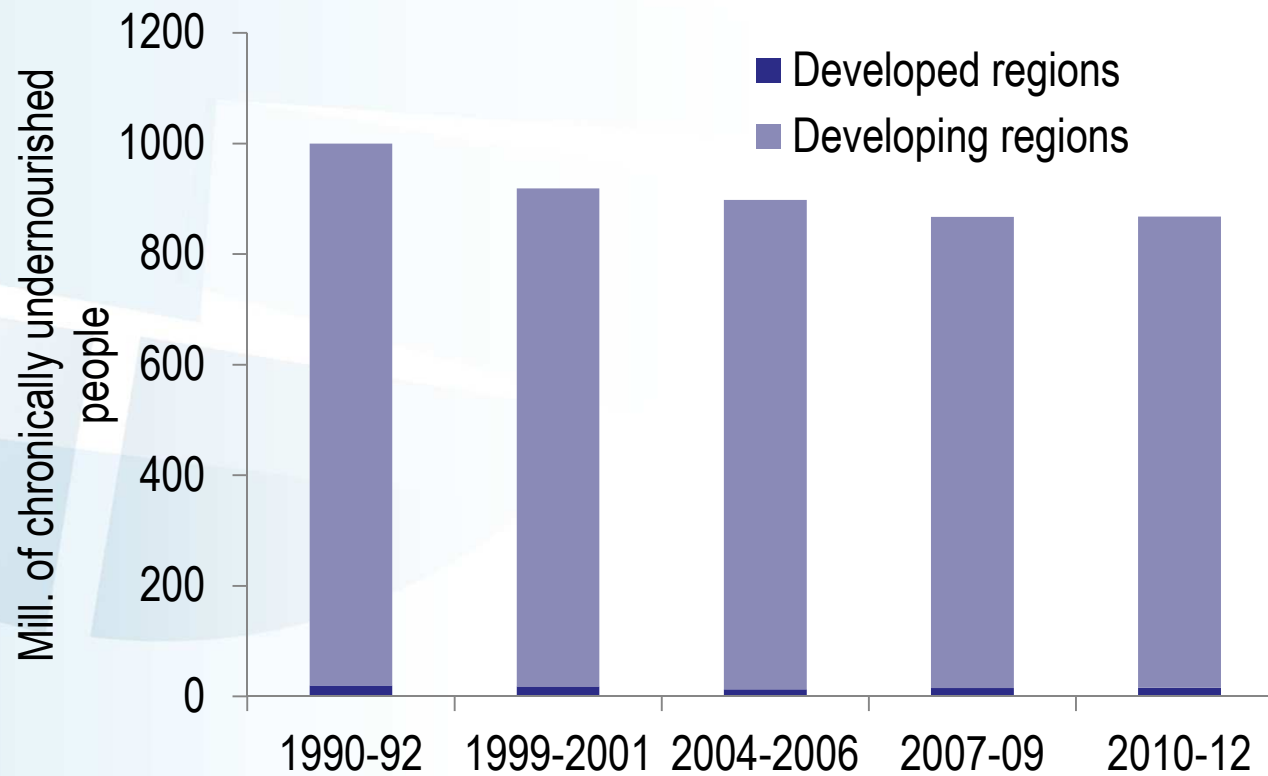
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Food security

Current FAO definition (1998):

“ Food security exists when all people, at all time, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. “

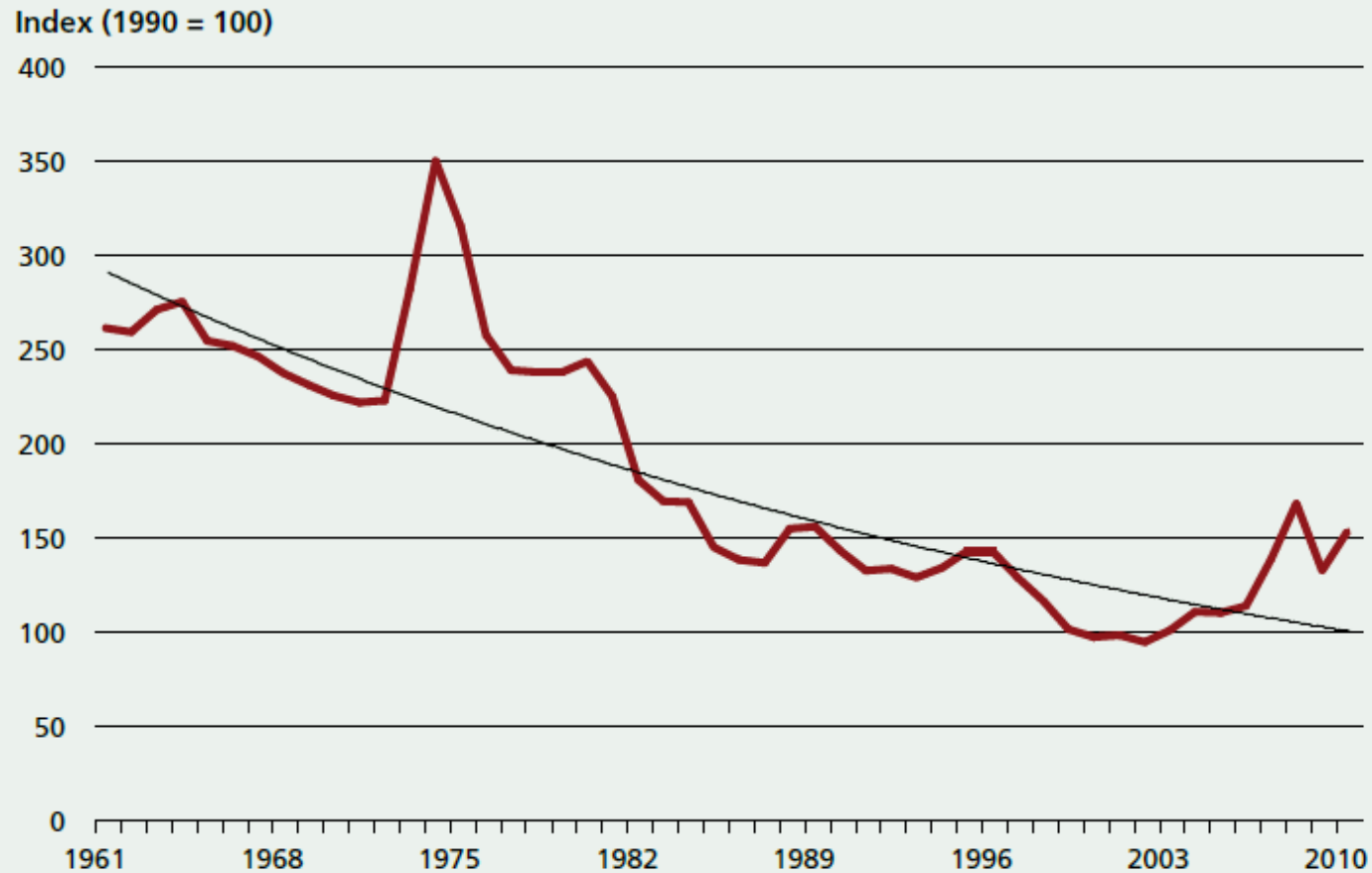
870 million remain hungry in 2010-2012



Source: FAO, SOFI 2012

Short-run dynamics vs. long-run trends

FAO Food Price Index in real terms, 1961–2010



Source: FAO, SOFA2011

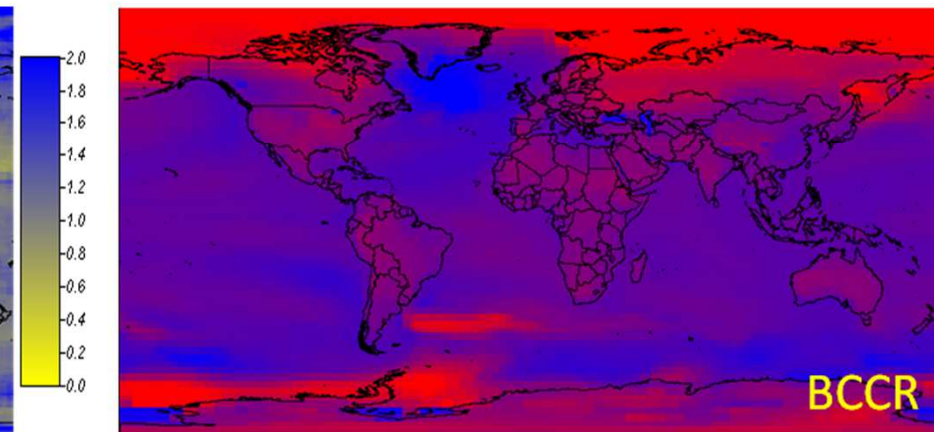
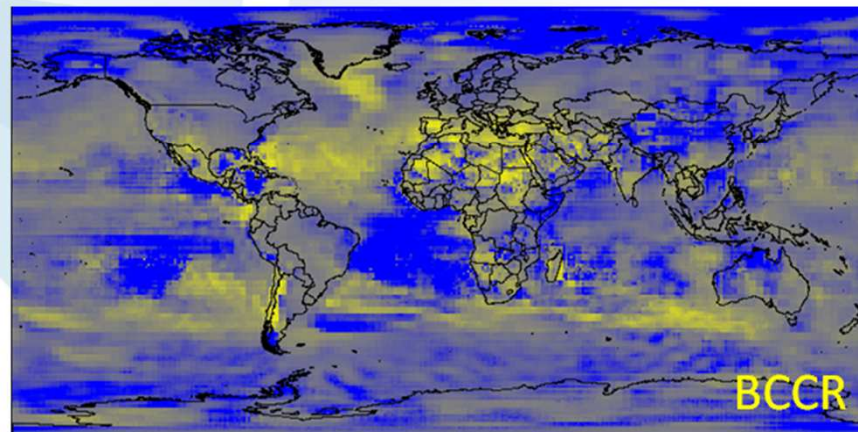
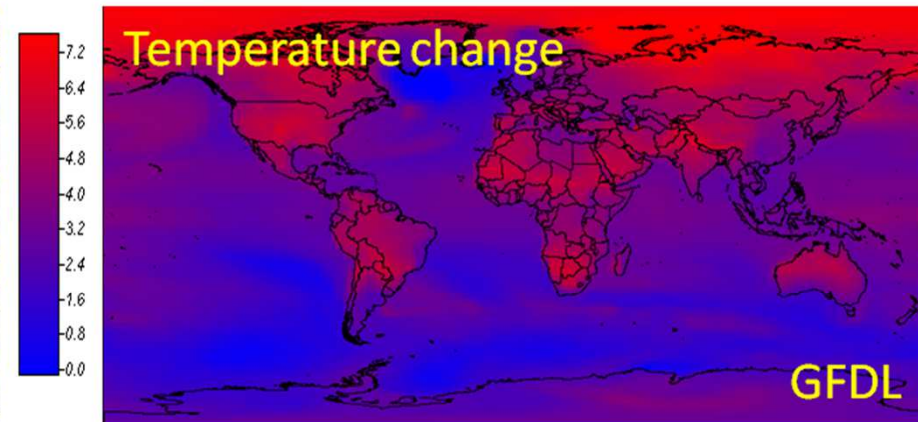
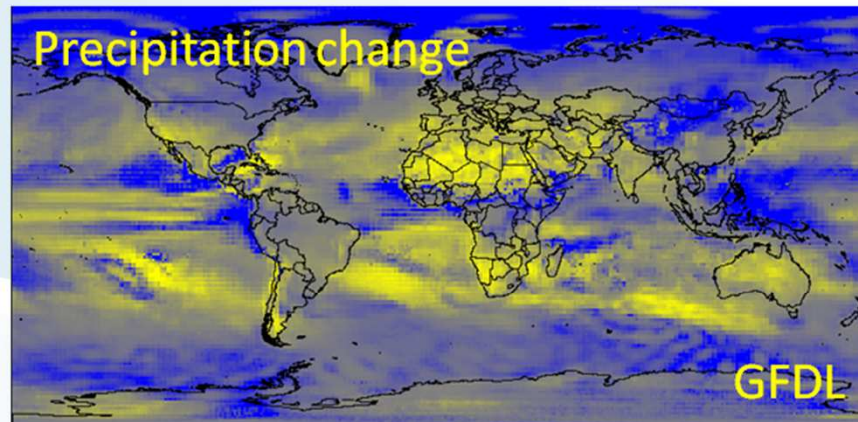
Food security within planetary boundaries

- Food prices and price volatility
 - Population & food demand growth, rapid diet transitions
 - Competition for land (e.g. bioenergy)
 - Declining investment in food system research
 - Pressure on water and other resources
 - Migration: international and from rural to urban areas
 - Political and economic instability
 - Climate change & uncertainty
- ⇒ We need an **integrated systems approach** to tackle these challenges comprehensively and sustainably.

Food security within planetary boundaries

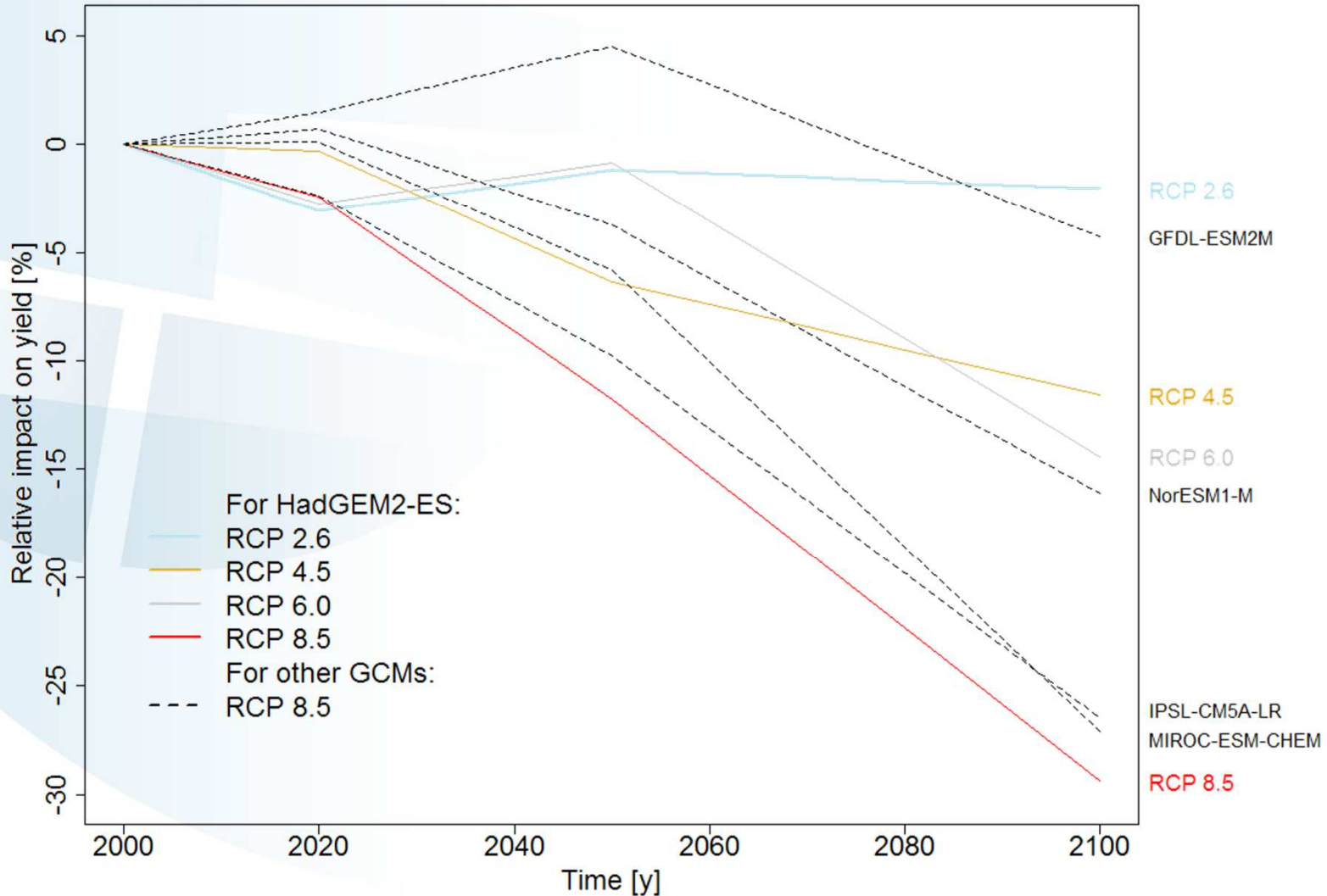
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 - **Climate change & uncertainty**
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A flavor of climate change uncertainty



Climate Change Impacts on Corn Yield

Corn (World agg.)



Robustness

- State-of-the-art: strategies optimal for each scenario.
- But this only outlines the scope of potential outcomes.
- Not ensured that strategies are robust across different futures.

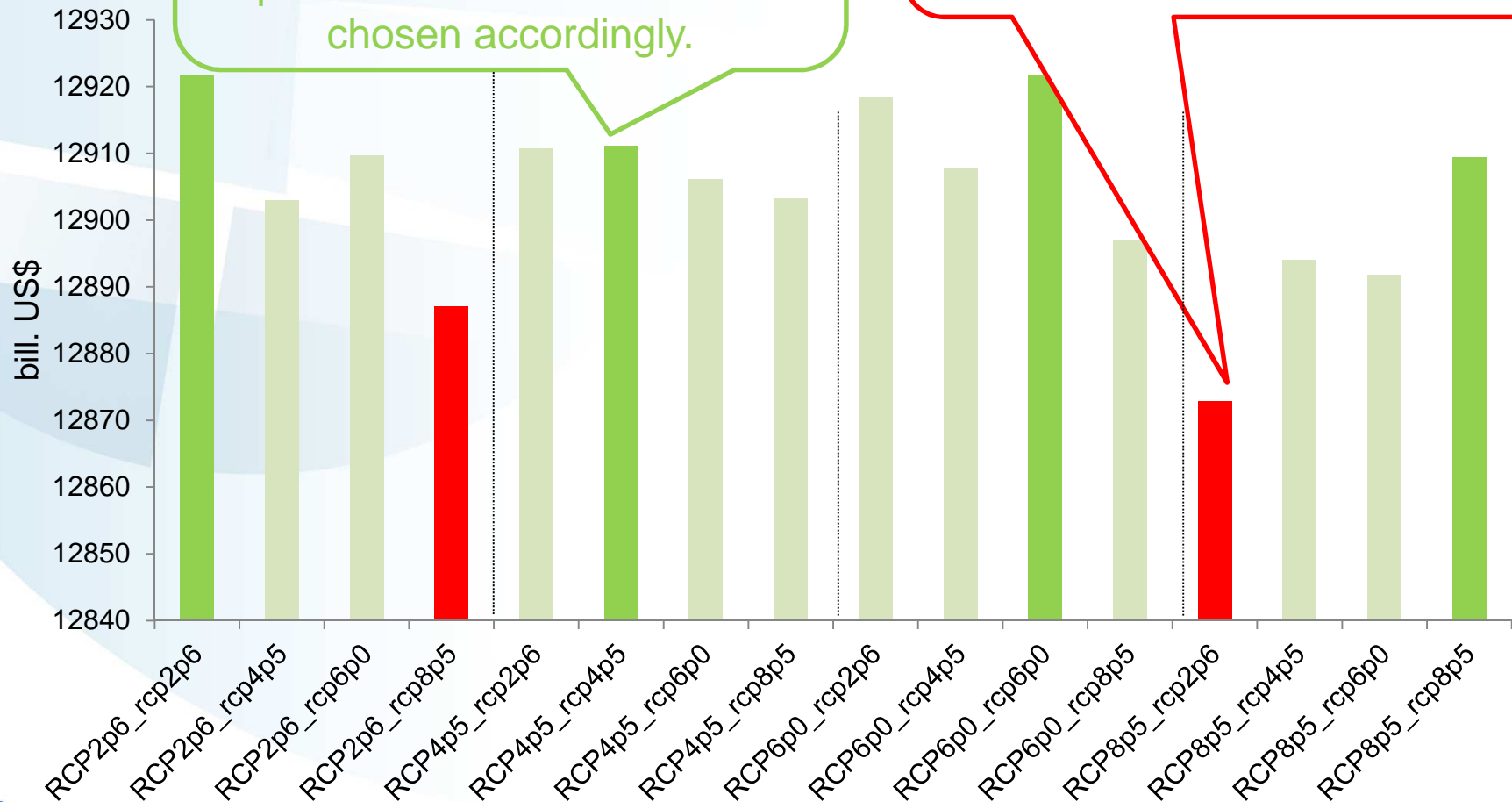
⇒ **Find the strategy ensures food security, no matter which scenario materializes!**

- Use ESM's Global Biosphere Management Model GLOBIOM to determine robust strategies across climate scenarios.

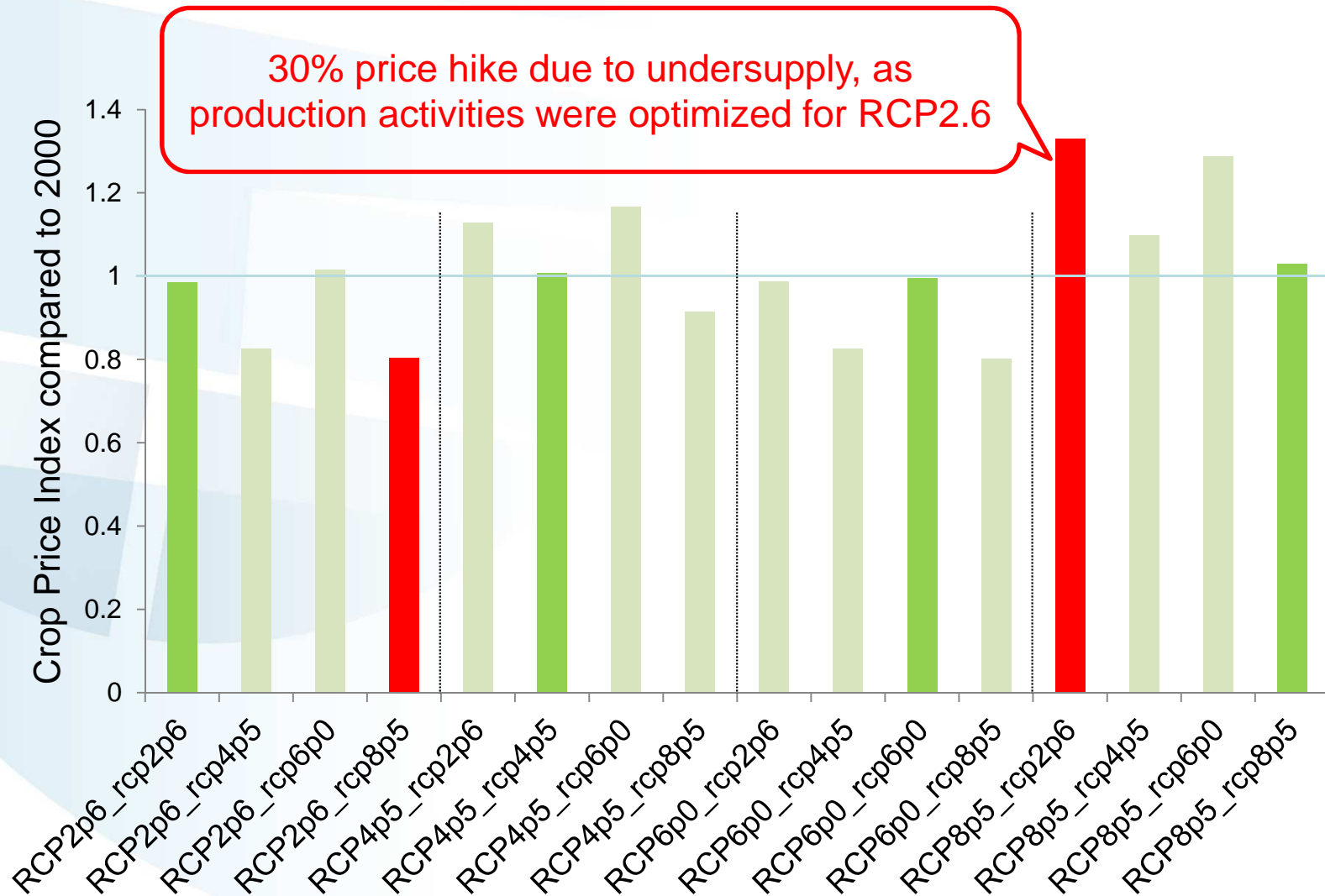
Welfare in 2050

Welfare is the highest if under each Representative Concentration Pathway (RCP) production activities can be chosen accordingly.

Substantial welfare decline if activities optimal under RCP2.6 are chosen and RCP8.5 materializes



Food prices in 2050



Lessons learnt

- No single adaptation policy superior across all climate scenarios.
 - Locking into a particular agricultural system superior under one climate scenario can imply substantial losses if a different climate scenario materializes.
- A robust strategy in an uncertain world:
 - Flexibility-enhancing measures: access to irrigation, seeds & fertilizers, market access.
- Resolving uncertainty and planning robustly can lead to substantial savings.
 - Reducing the extent of over- and underproduction and the accompanying environmental implications (land use change).

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More information on GLOBIOM model: www.globiom.org and www.iiasa.ac.at

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