

Climate Threats to Agriculture, Food Security and Nutrition

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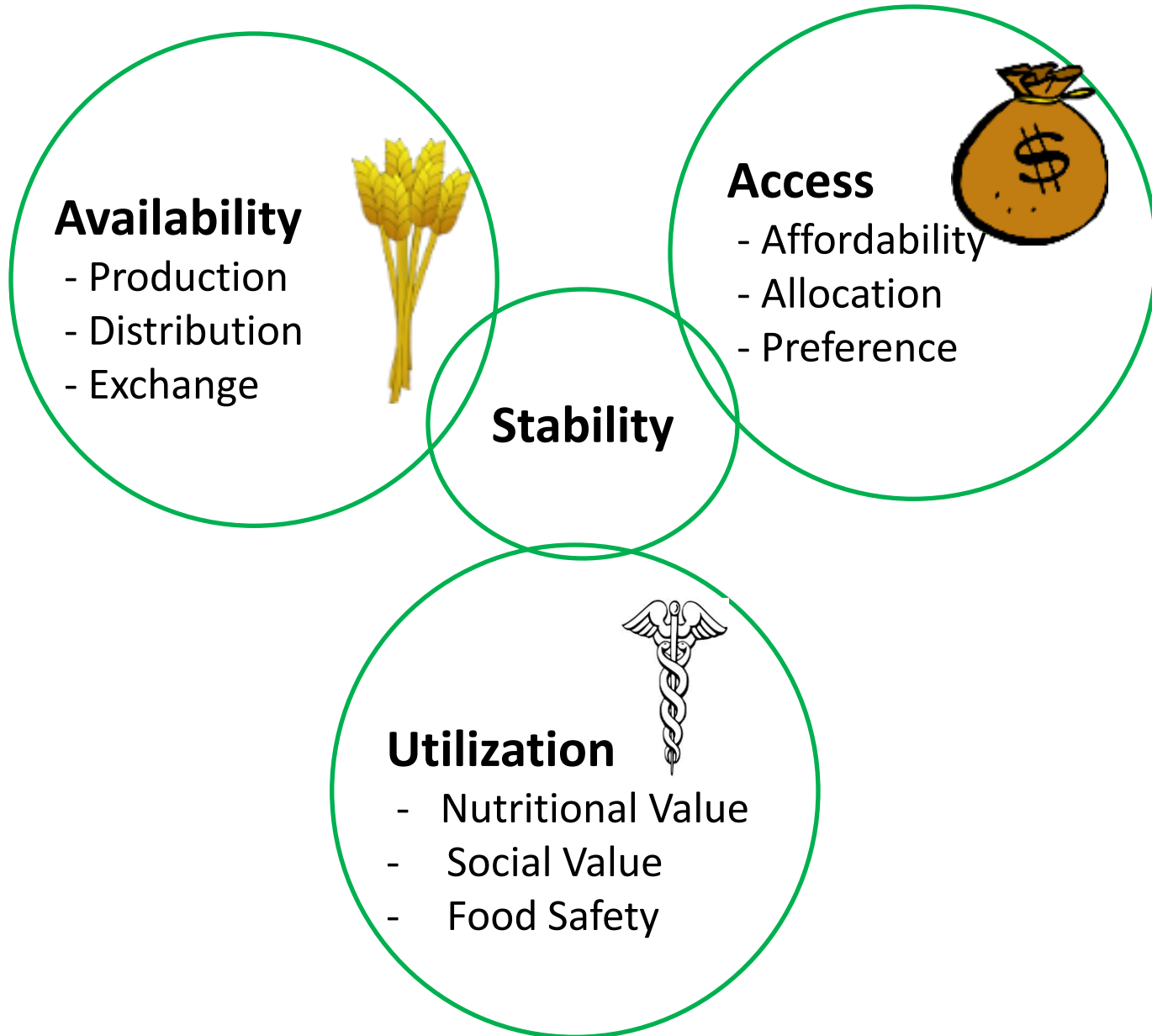
Food Security – What Is It?



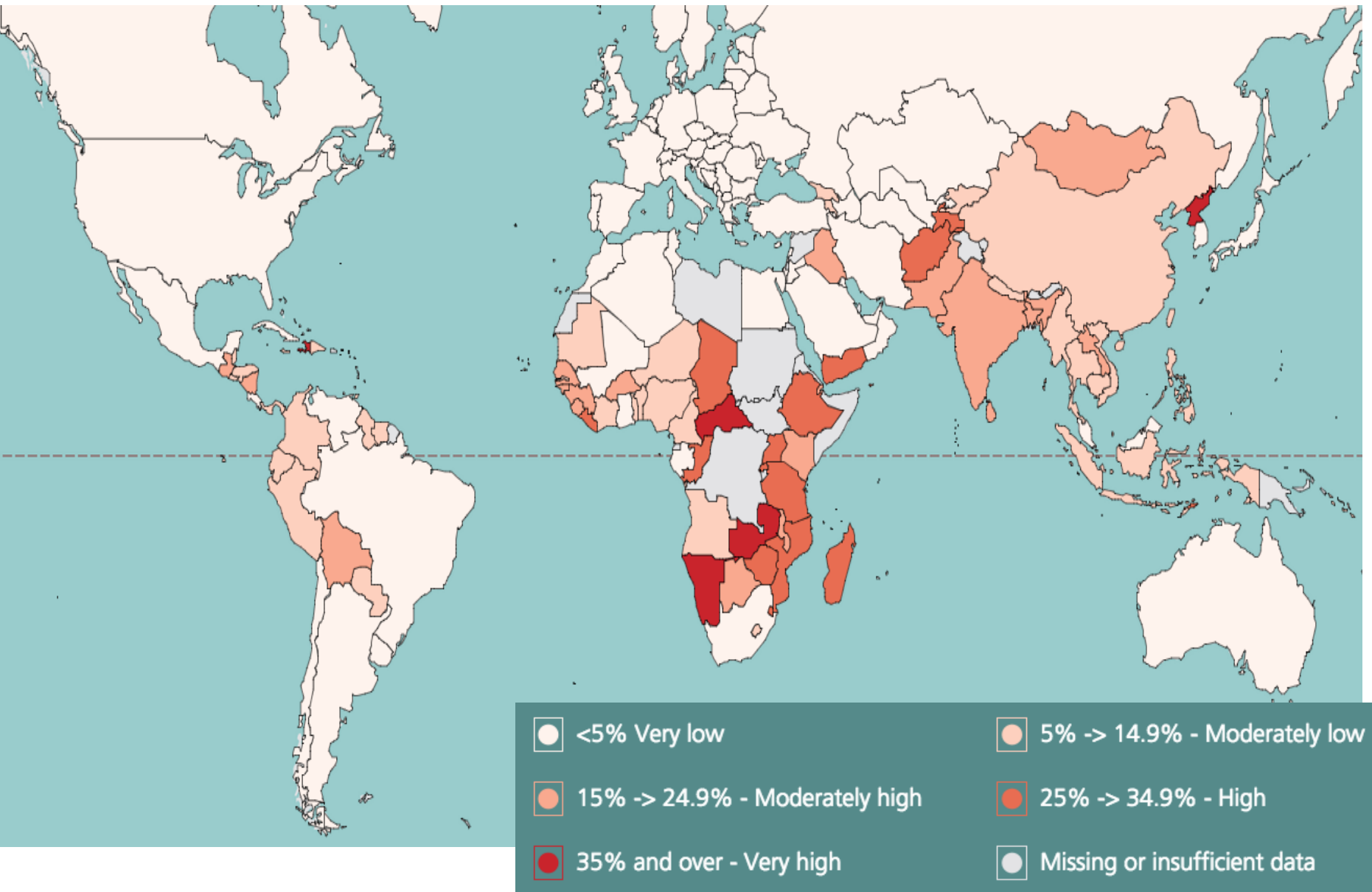
Food security exists when all people, at all times, have physical, social, and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

-1996 World Food Summit
(definition updated in 2012)

Linked concepts of Food Security

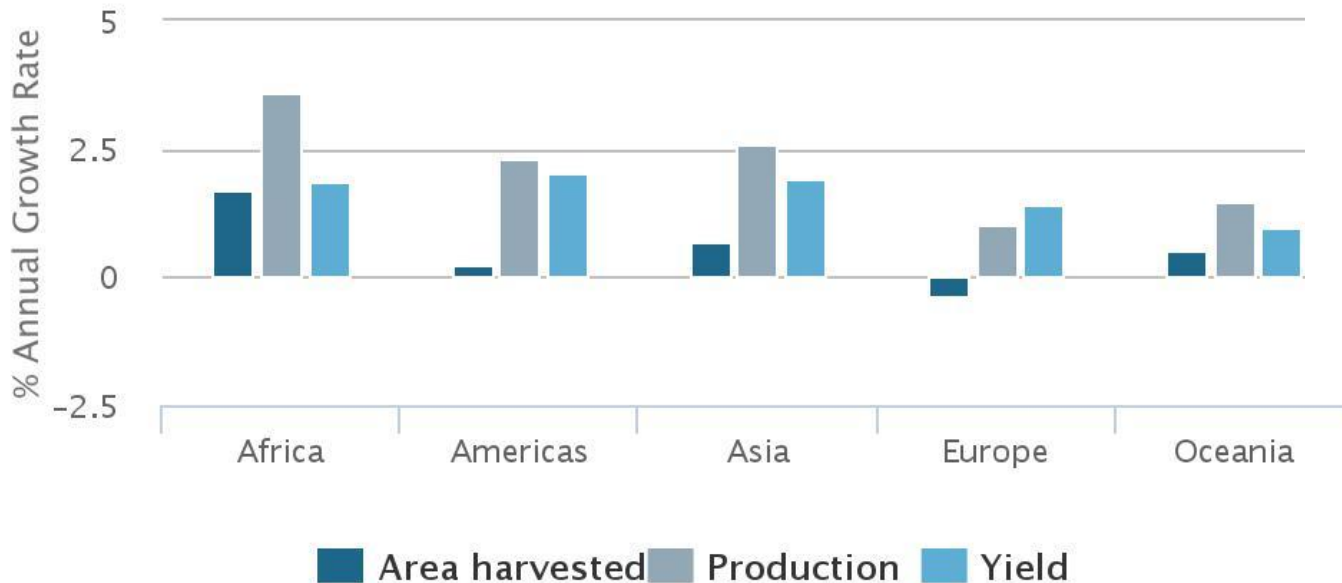


FAO Hunger Map for 2015



Agricultural production growing fastest in developing countries

Africa's expansion of cropped area is matched by yield gains

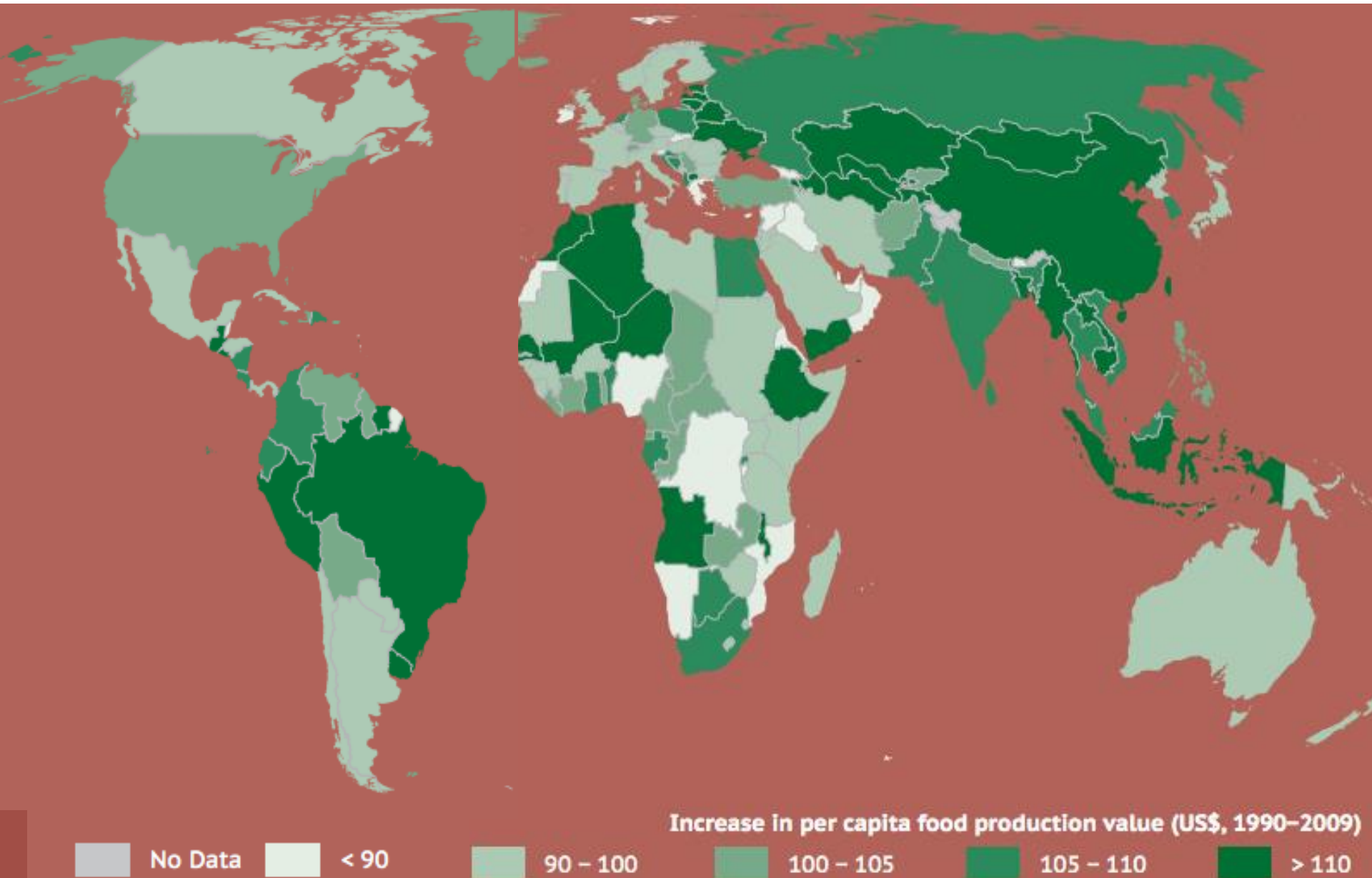


Production growth rates by region 2000 - 2013

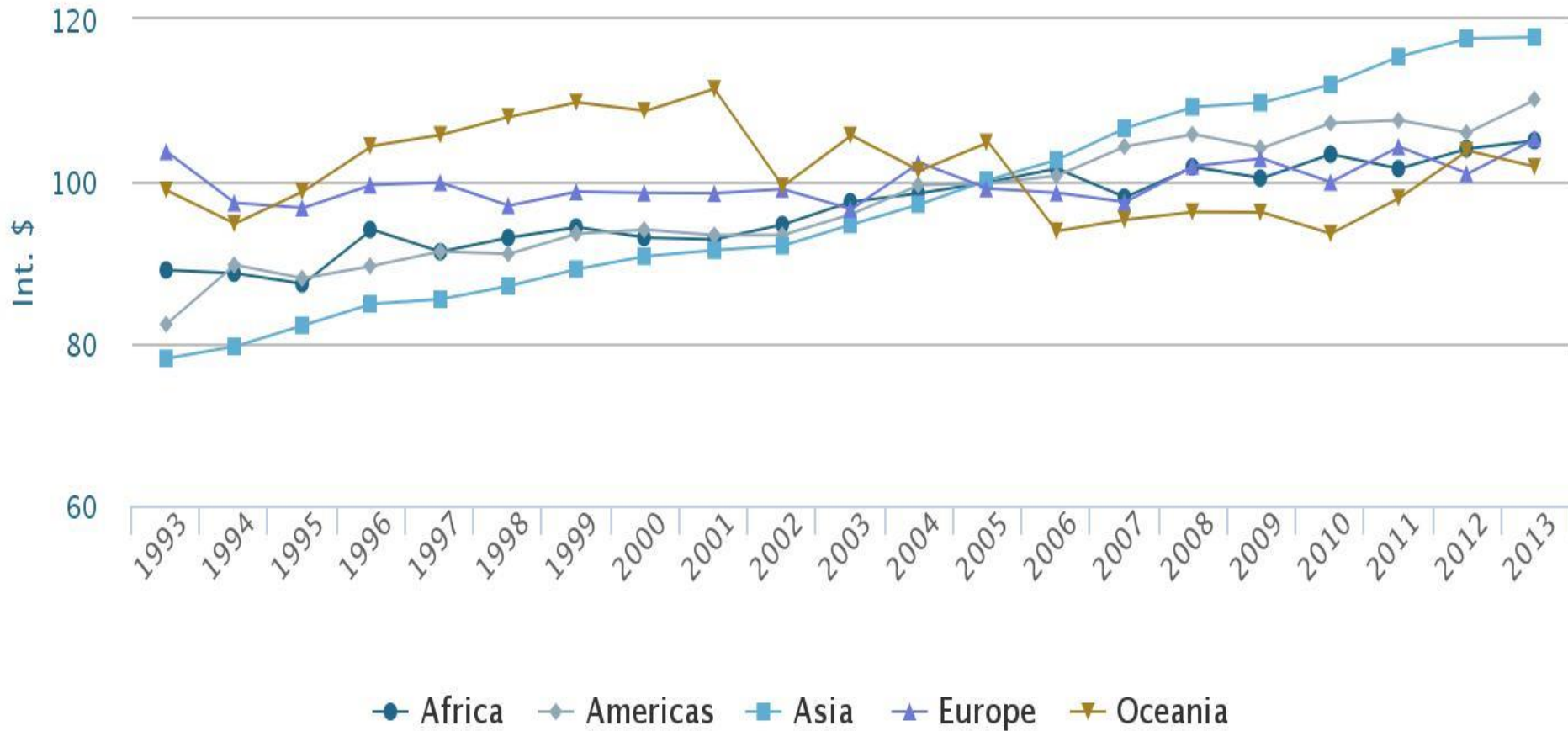
Africa	3.585%
Americas	2.286%
Asia	2.621%
Europe	1.024%
Oceania	1.469%

Growth rate calculated based on the Least-Squares method

Increase in per capita food production value over 20 years

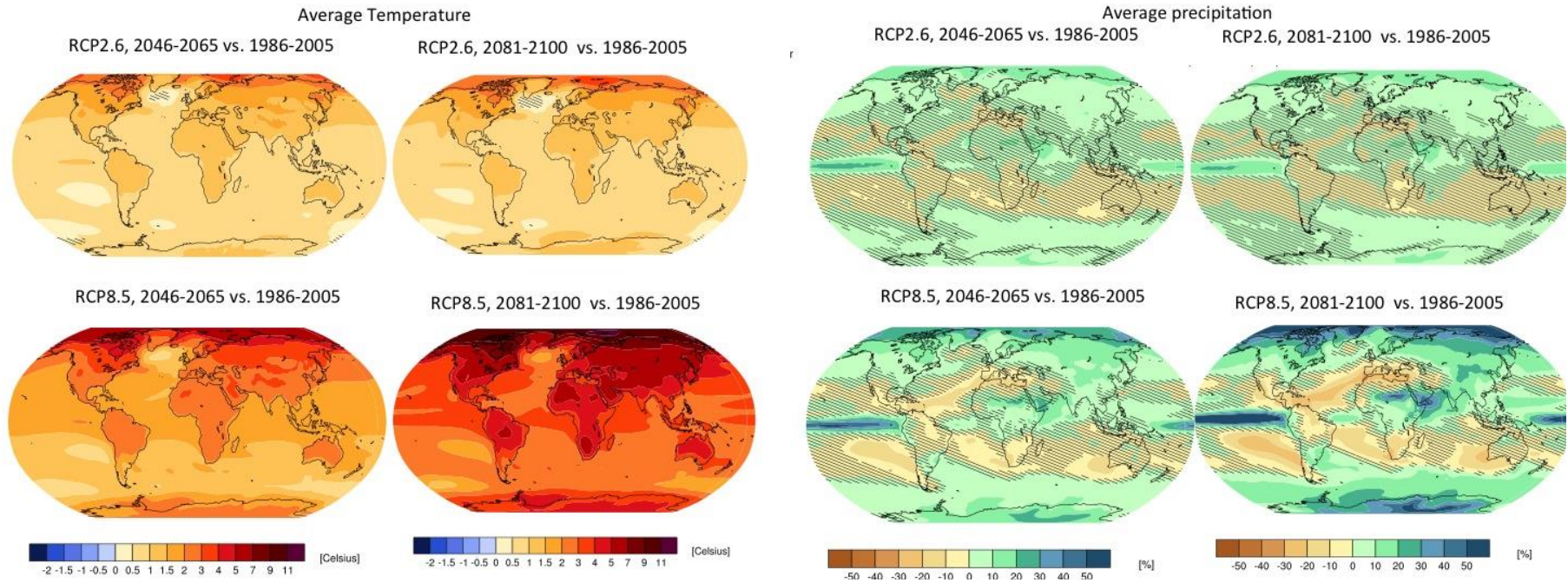


Increases in per capita production



M = Million, k = Thousand

Climate Change impacts on Agriculture Depend on GHG Emissions...



Low emissions warming is about 1–2°C for most areas by mid-century, persisting through 2100. High emissions result in 2–3°C by mid-century, 4–5°C by 2100 (>7°C in parts of north)

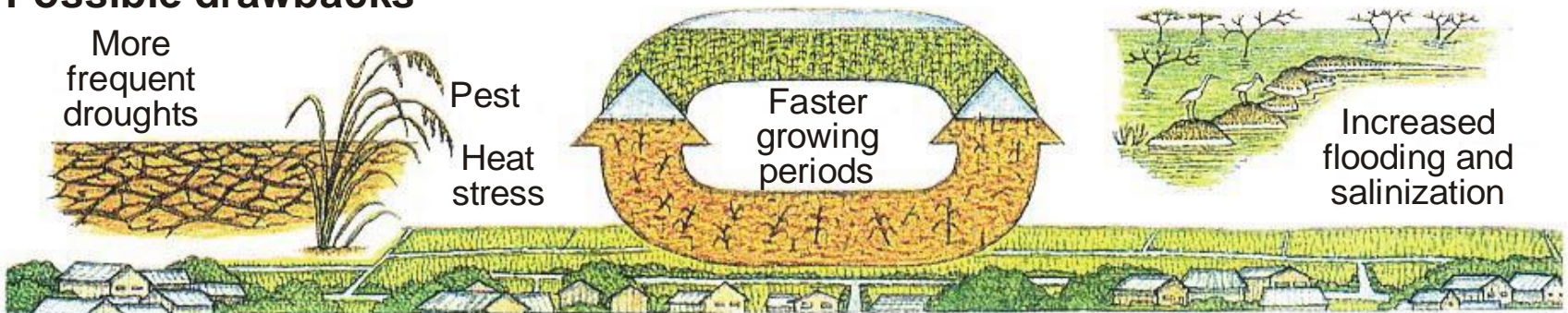
Both low and high emissions make wet areas wetter and semiarid drier. Annual precipitation increases 10-20% in many northern areas and decreases 10-20% in many southern areas.

Impacts on Agriculture are Complex

Possible benefits



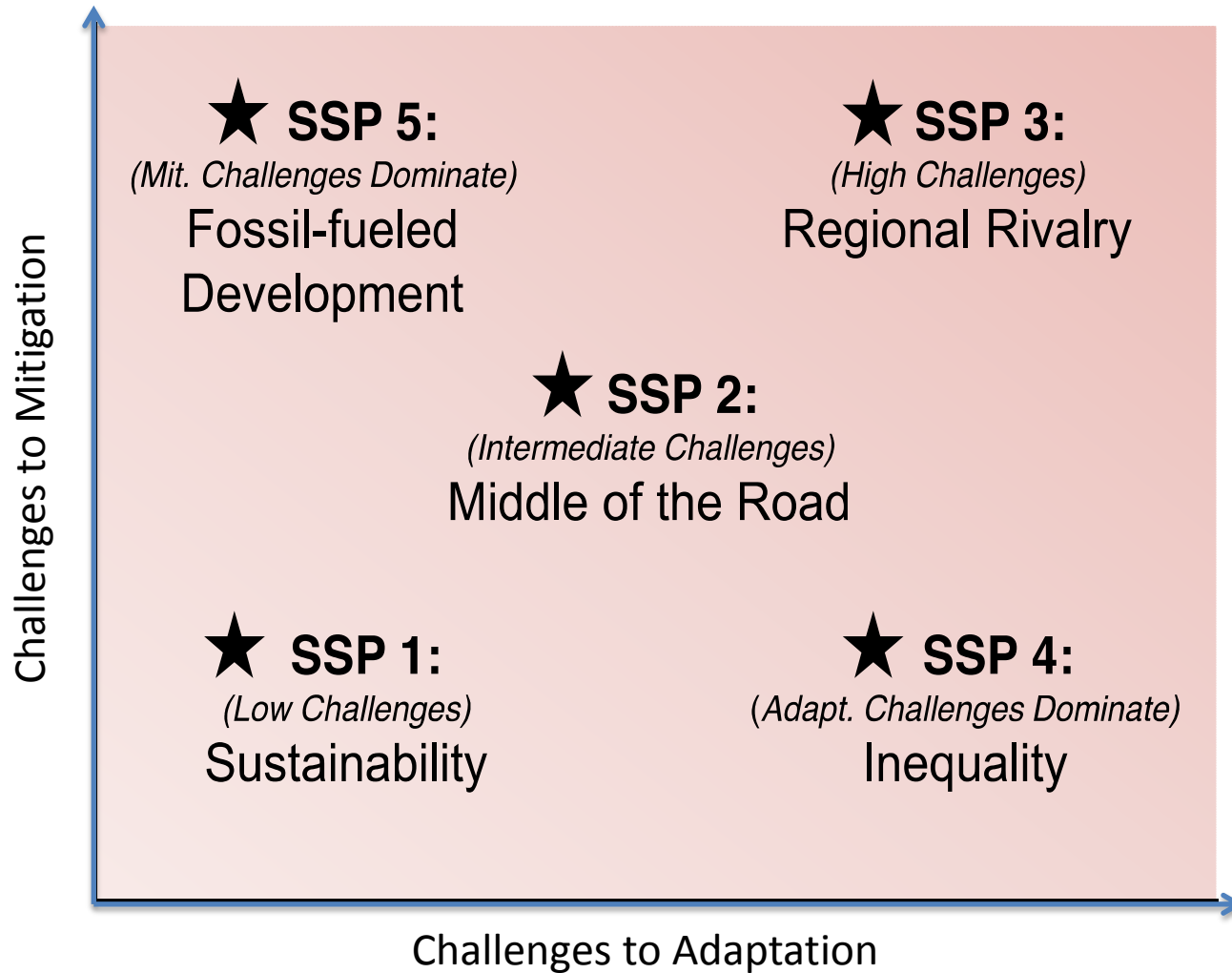
Possible drawbacks



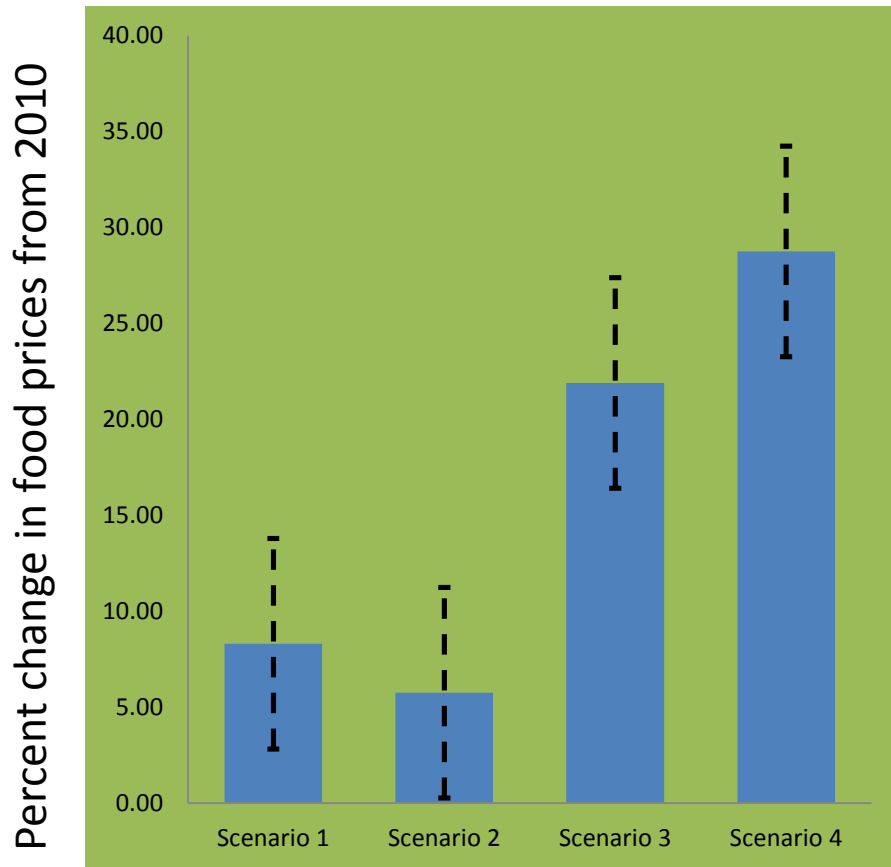
Climate Change impacts on food security depend on Socioeconomic Context

- Changing socioeconomic context matters to food security.
- Therefore must assess climate change in context of plausible future conditions or “pathways” of how society will be in 2050 or 2100
- Shared Socioeconomic Pathways (SSPs)
 - SSPs are assumptions about the state of global and regional society and ecosystems as they evolve over the 21st century, defined in terms of their reference scenario values

Reference Scenarios and Mitigative/Adaptation challenges



Projected Agricultural Commodity Prices in 2050: a measure of scarcity



Nelson et al (2014) PNAS

Scenario 1: Sustainability (SSP1)
(low emissions, *restricted trade*)

Scenario 2: Sustainability (SSP1)
(low emissions, *freer trade*)

Scenario 3: Regional Rivalry (SSP3)
(high emissions, *freer trade*)

Scenario 4: Regional Rivalry (SSP3)
(high emissions, *restricted trade*)

Bars = average projected change (%)

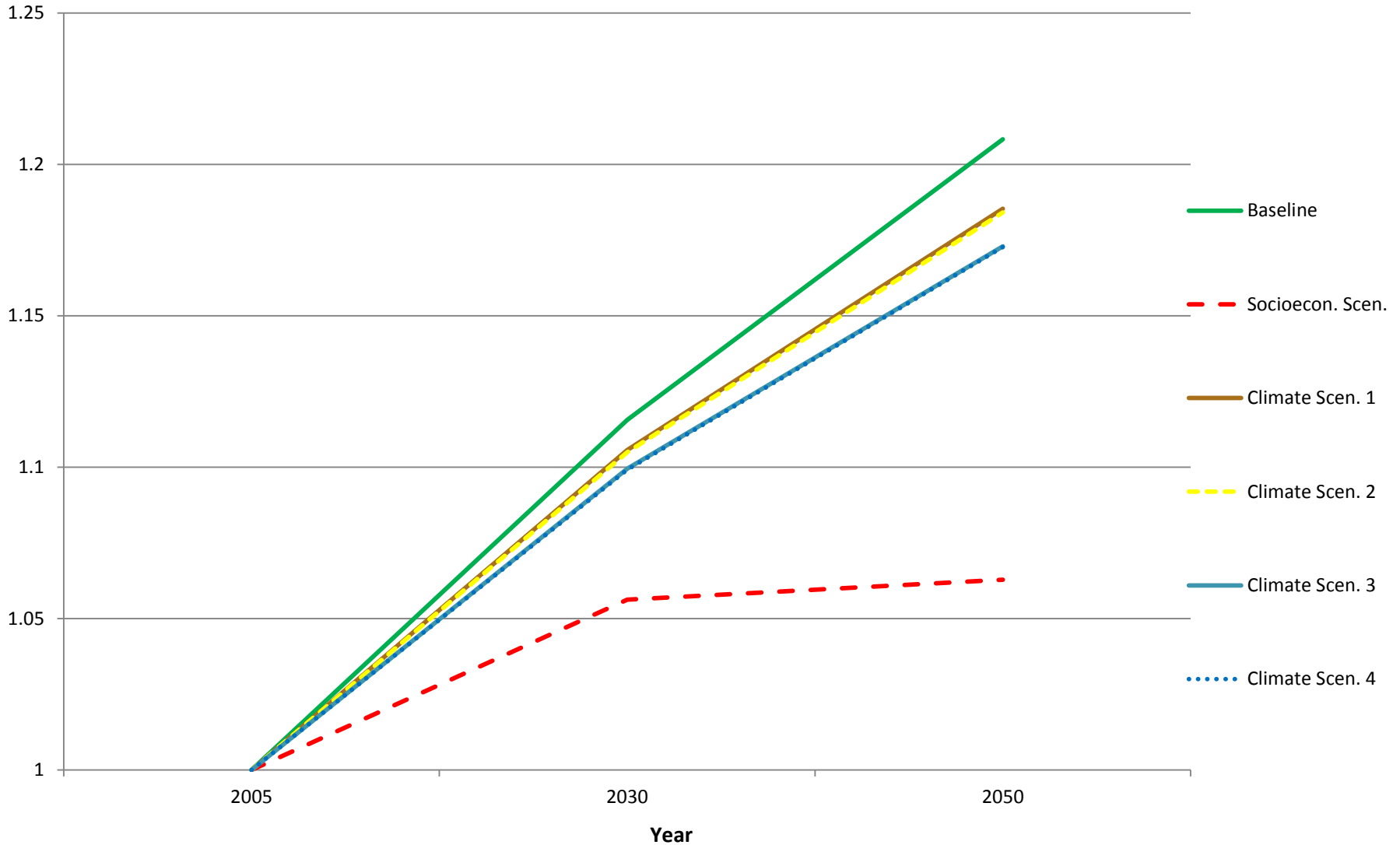
Dashed = range

Based on five global agricultural economic models.
Range represents economic model uncertainty only.

Daily Per Capita Caloric Intake

Global Average

2005-2050



From the 2015 USDA report *Climate Change, Global Food Security and the US Food System*

Integrated Assessment

Methodological Limitations

- Modeling systems do not represent the entire food system; generally include only production, demand, and trade
 - For example, omits threats to production such as pests, diseases and extreme events
 - Cannot capture regional diversity, issues of food access, food utilization through increased
- Uncertainty can amplify.

Climate change and the US Food System

- Climate change will have a significant impact on the global food system
- The changes experienced in the US Food System will have significance for the rest of the world
 - US is a major food exporter and importer
 - US provides humanitarian assistance in many forms
 - US is an important source of technological advancement across many elements of the food system
- How US agriculture responds to these challenges makes a difference for global food security