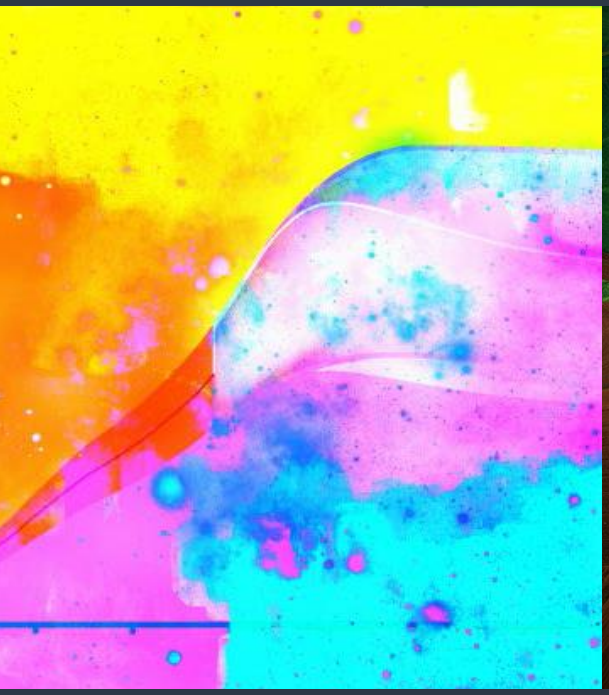
IPCC Special Reports on 1.5°C, Land, and Oceans



Cynthia Rosenzweig
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Columbia University
GRA Council Meeting
October 7, 2019

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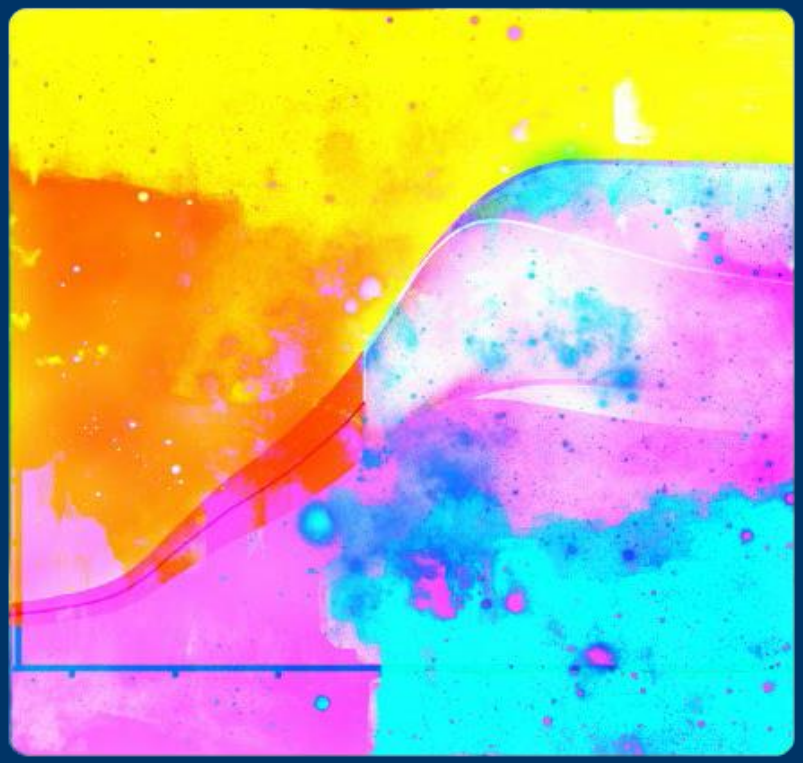


IPCC Special Report on Global Warming of 1.5°C

Impacts of global warming 1.5°C

At 1.5°C compared to 2°C:

- Lower impact on biodiversity and species
- **Smaller reductions in yields of maize, rice, wheat**
- Global population exposed to increased water shortages is up to 50% less

Andre Seale / Aurora Photos

Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO_2 emissions fall by about 45% by 2030 (from 2010 levels)
  - ↳ Compared to 25% for 2°C
- **To limit warming to 1.5°C, CO_2 emissions would need to reach 'net zero' around 2050**
  - ↳ Compared to around 2070 for 2°C
- Reducing non-CO_2 emissions would have direct and immediate health benefits

Robert van Waarden / Aurora Photos

Greenhouse gas emissions pathways

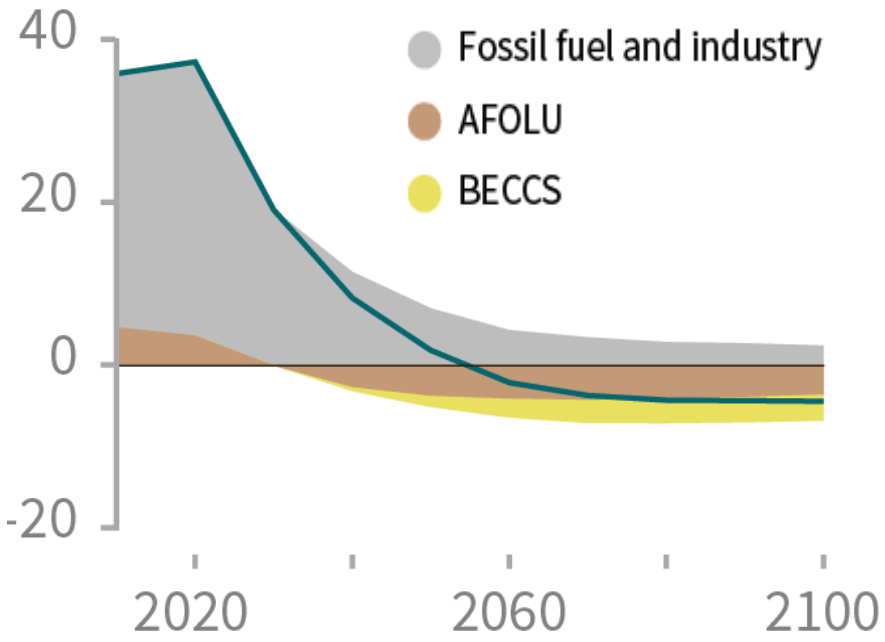
- Progress in renewables would need to be mirrored in other sectors
- We would need to start taking carbon dioxide out of the atmosphere
- **Implications for food security, ecosystems and biodiversity**

Peter Essick / Aurora Photos

SPM3b | Characteristics of illustrative model pathways

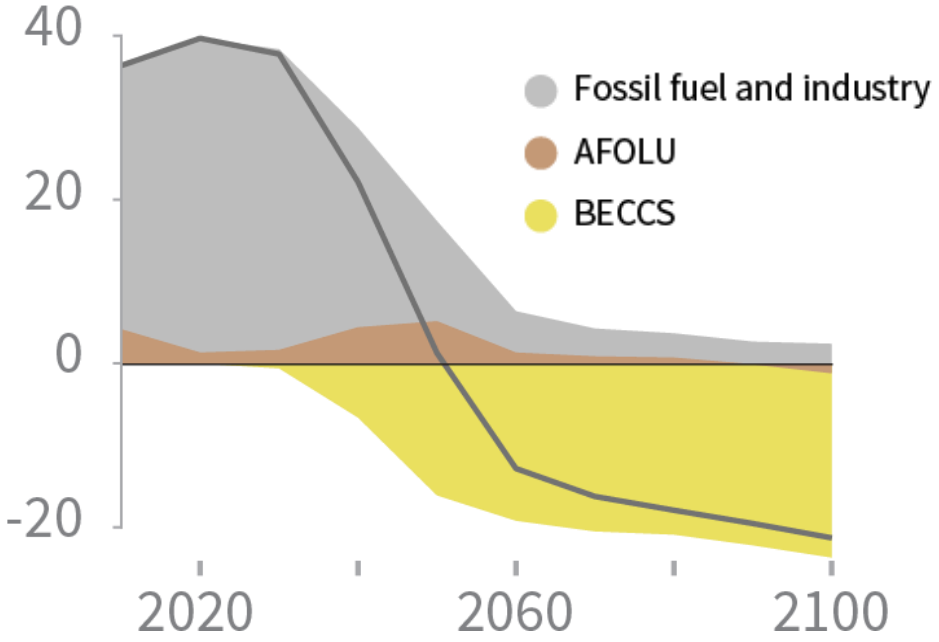
P2

Billion tonnes CO_2 per year (GtCO2/yr)



P4

Billion tonnes CO_2 per year (GtCO2/yr)



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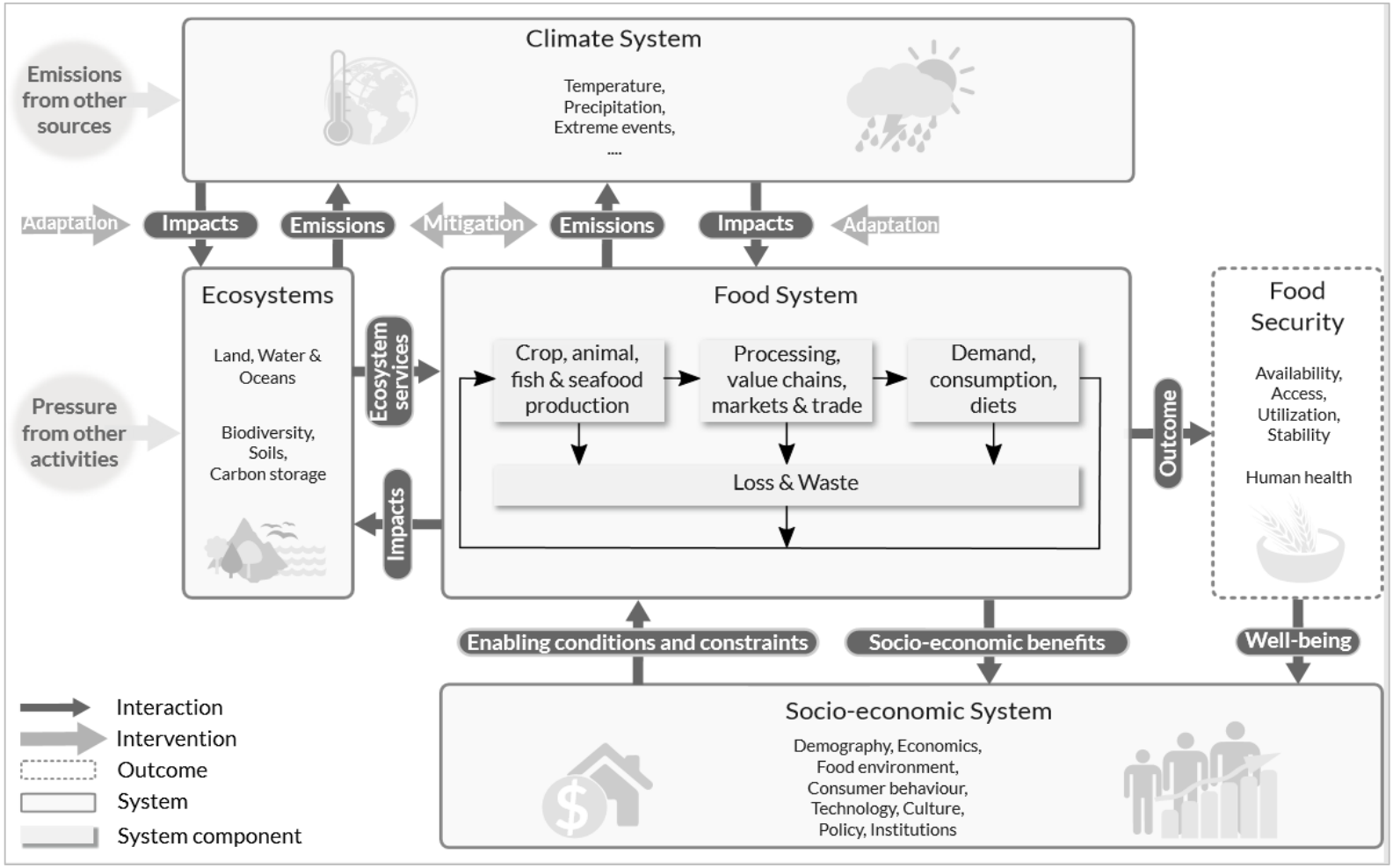
IPCC Special Report on Climate Change and Land

The Food System



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Why the Food System?

21-37% of all anthropogenic emissions from food systems *(medium confidence)* **[A3]**

Projected to increase *(high confidence)* **driven by population and income growth [A3]**

Climate change creates additional stresses on the food systems *(high confidence)* **[A5]**

At 2°C the risk of food system instability is very high *(medium confidence)* **[A5]**

Integrated supply- and demand-side options can be scaled up in all segments of the food system to advance adaptation and mitigation climate responses *(high confidence)* **[B6]**

Diversification in the food system can reduce risks from climate change *(medium confidence)* **[B6]**

Dietary changes can provide significant health cobenefits through improving nutrition *(medium confidence)* **[D2]**

Importance of integrated policies operating across the food system [C2]

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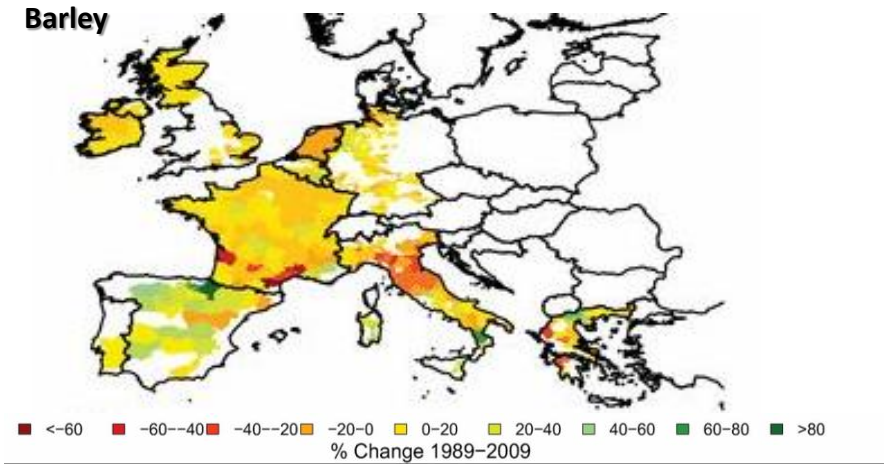
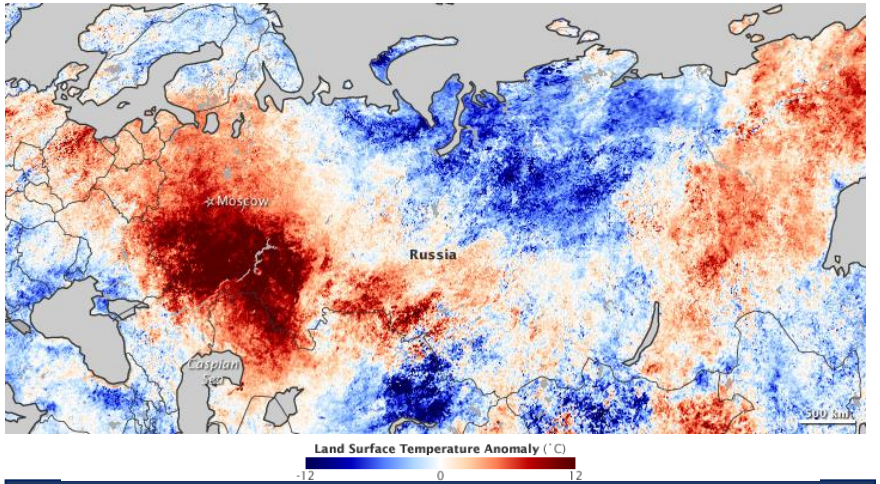
Food System Vulnerabilities - Observed



Availability – Decreases in wheat and barley yields in Southern Europe.
Moore and Lobell, 2015

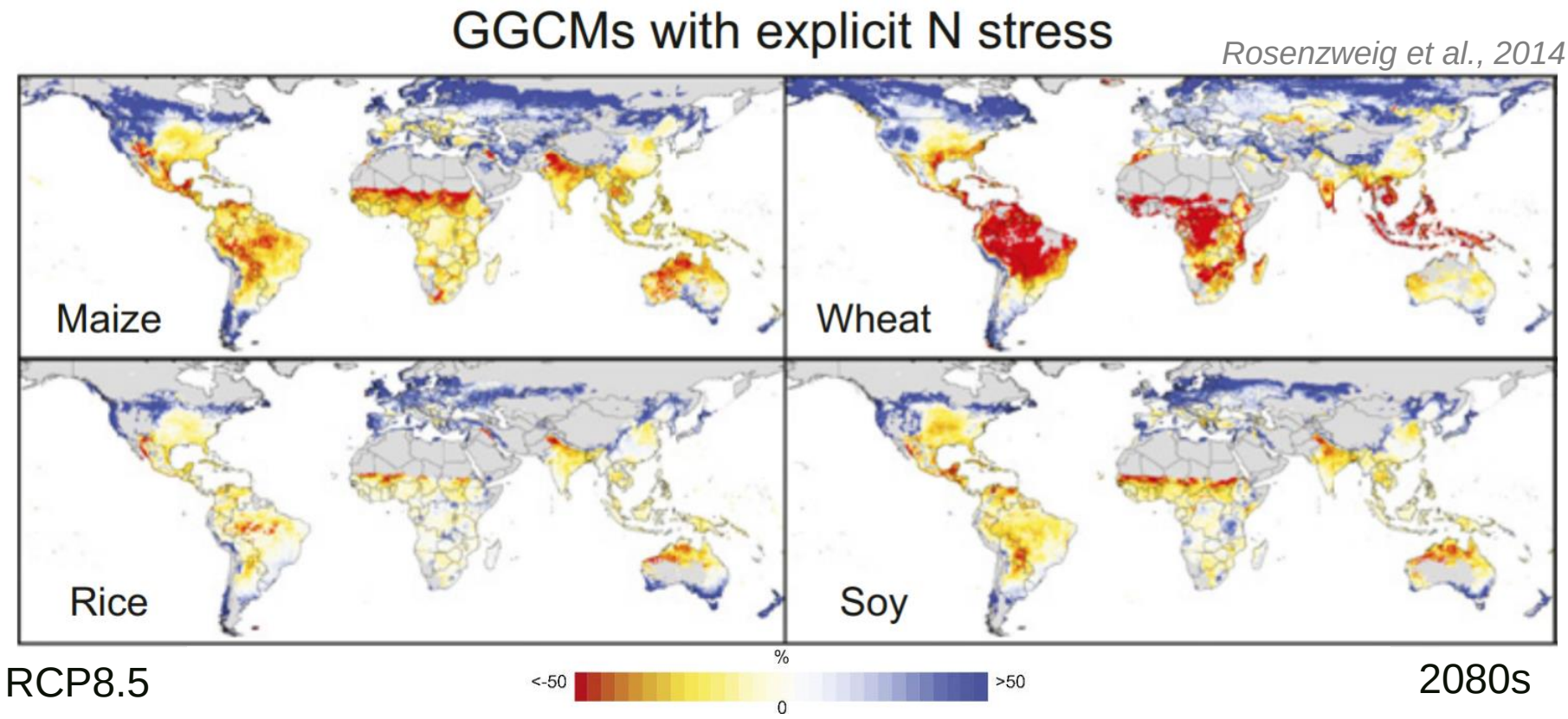


Access – 2010-2011 global food price spike, triggered by heatwave in Eastern Europe/Russia
Hoag 2014,Watanabe et al 2013,Barriopedro et al 2011. Image: NASA

Utilization – Reduced quality of apples in Japan due to exposure to higher temperatures.
Sugiura et al 2013. Image: LA Times

Stability – 2010 extreme rainfall/flooding in Pakistan led to massive loss of food reserves
Kirsch et al 2012, WFP 2010. Image: Kevin Frayer/AP

Food System Vulnerabilities - Projected



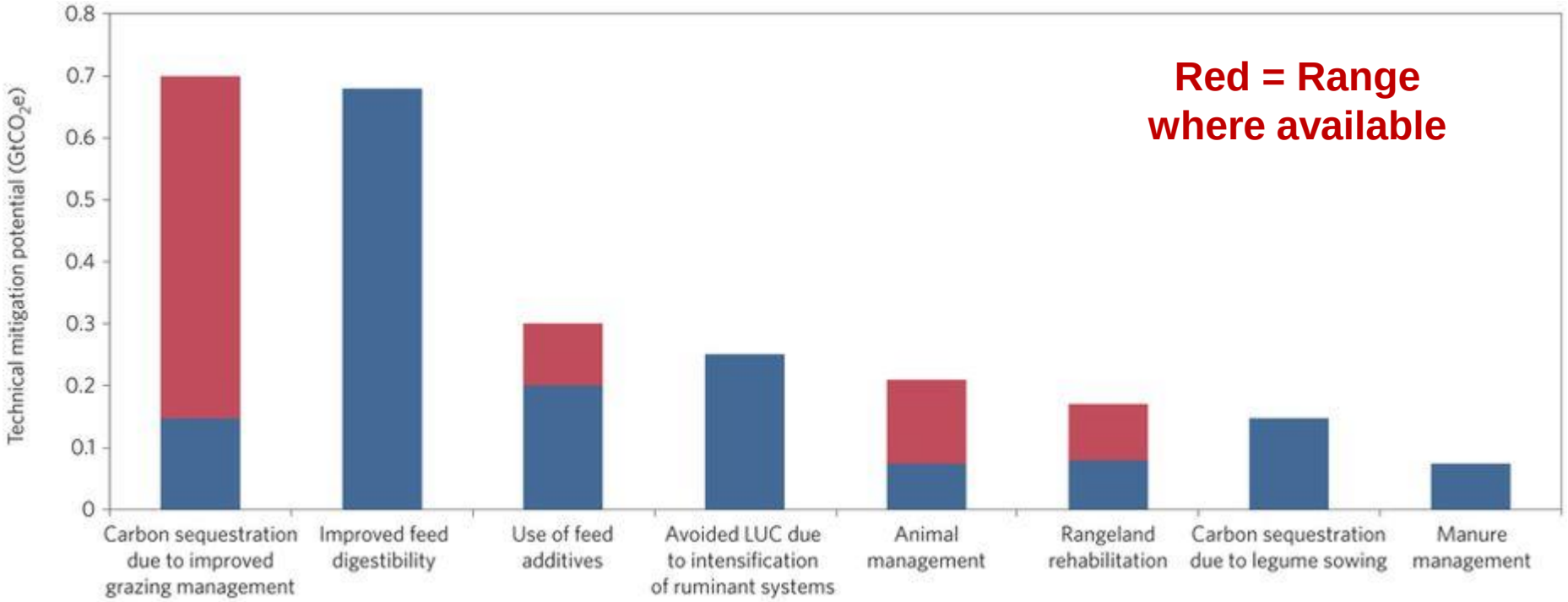
Median of 4 GGCMs and 5 GCMs/AgMIP led agricultural contribution to ISIMIP

Lower latitudes: more vulnerable to climate change, especially under N stress

Mid- and high-latitudes: small benefits at moderate-to-medium Temp increase (1-3 C)

Nutritional content of plants is affected negatively by higher CO_2 concentrations

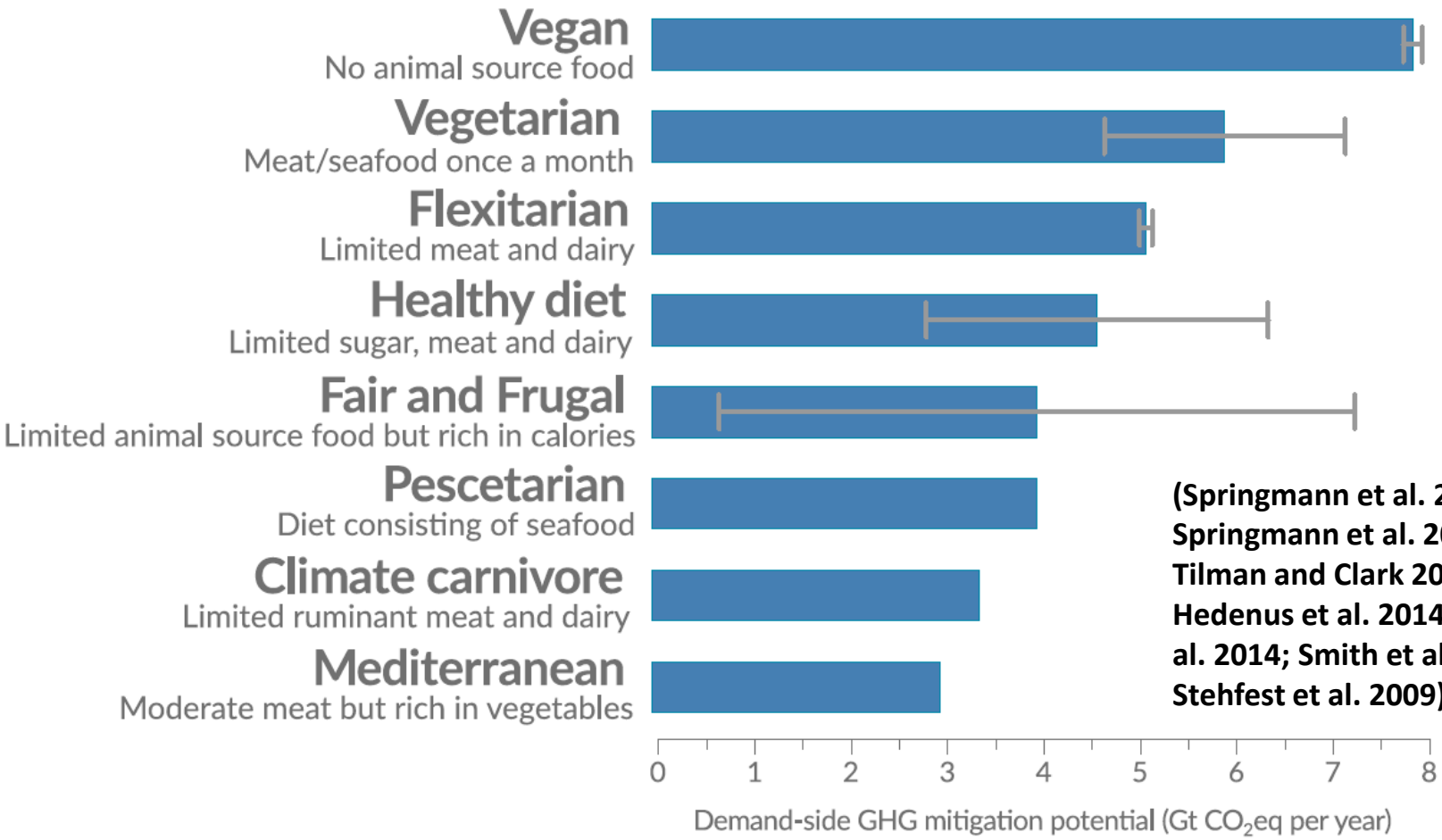
Supply-side Mitigation



Herrero et al., 2016

Supply-side mitigation practices in the food system can contribute to climate change solutions by sustainably and efficiently intensifying the use of land and sequestering carbon in soils and biomass.

Demand-side Mitigation



(Springmann et al. 2018; Springmann et al. 2016; Tilman and Clark 2014; Hedenus et al. 2014; Bajželj et al. 2014; Smith et al. 2013; Stehfest et al. 2009)

Technical mitigation potential of changing diets by 2050 according to a range of scenarios examined in the literature. Estimates are technical potential only, and include additional effects of carbon sequestration from land-sparing. Data without error bars are from one study only.

Economic mitigation potential is estimated as 1.8-3.4 $GtCO_2eq\ yr^{-1}$ by 2050 at prices ranging from 20-100 USD/tCO_2

Role of Food Loss and Waste

Definition: The decrease in quantity or quality of food. Food waste is part of food loss and refers to discarding or alternative (non-food) use of food that is safe and nutritious for human consumption along the entire food supply chain, from primary production to end household consumer level. Food waste is recognised as a distinct part of food loss because the drivers that generate it and the solutions to it are different from those of food losses

An estimated 25-30% of all food produced is lost or wasted. Contributing about 8-10% of all anthropogenic GHGs

Reducing food loss and waste is directly relevant to food security

Reduction of loss and waste can support both adaptation and mitigation

Different contexts in different countries must be considered

Food Systems and Bioenergy/Carbon Capture and Storage

Figure SPM3

If applied on a limited share of total land and integrated into sustainably managed landscapes [B2]

There will be fewer adverse side-effects and some positive co-benefits (e.g., salinity control, biodiversity, reduced eutrophication, increased soil carbon) can be realised *(high confidence)*. **[B2, 5.5]**

Some BECCS can increase demand for land conversion at a scale of several millions of km² globally *(high confidence)* **[B3]**

Could lead to ***adverse side effects for adaptation, desertification, land degradation and food security*** *(high confidence)*. **[B3, 5.5]**

Compromise sustainable development with increased risks for desertification, land degradation and food security *(medium confidence)*. **[B3]**

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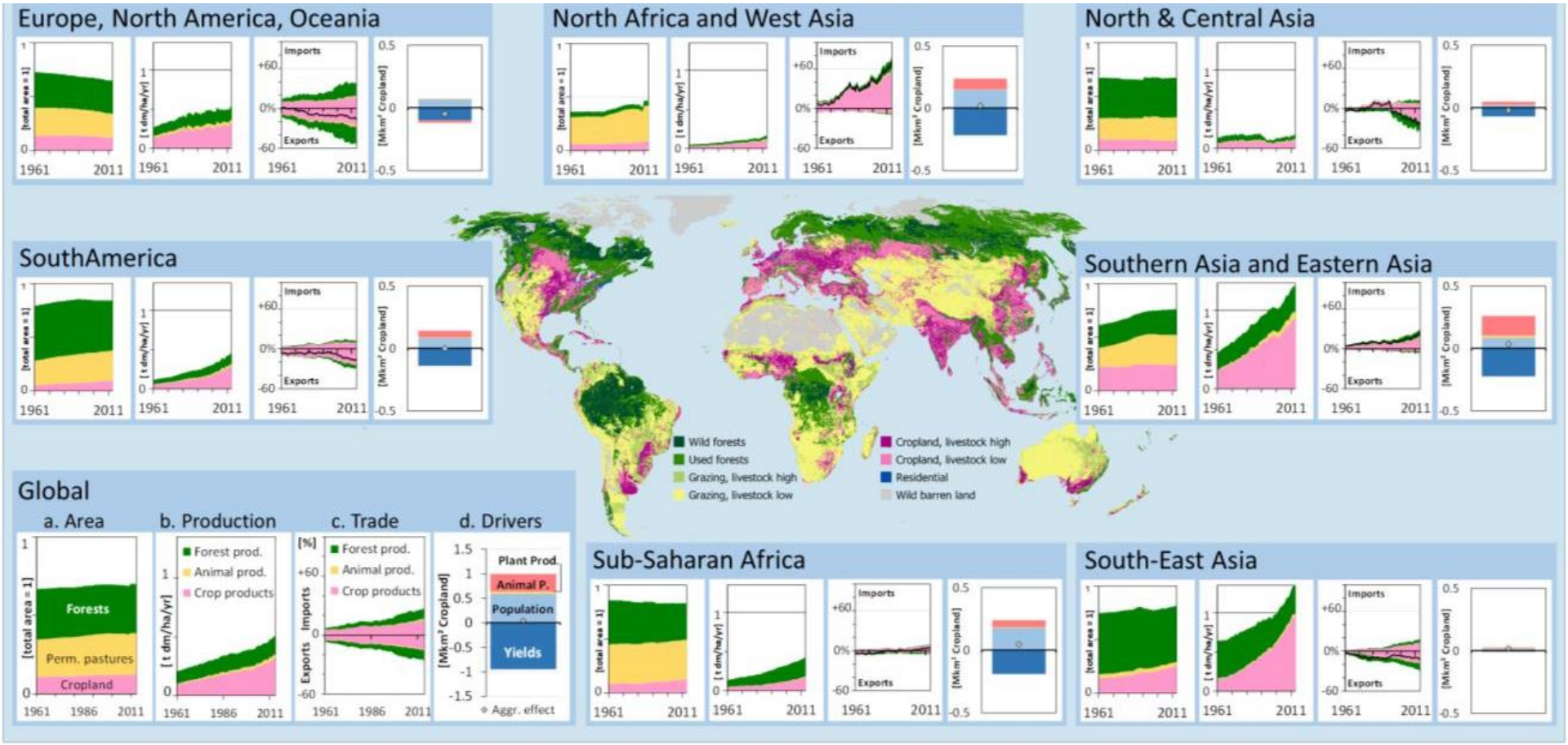
Regional Aspects

Figure 1.3



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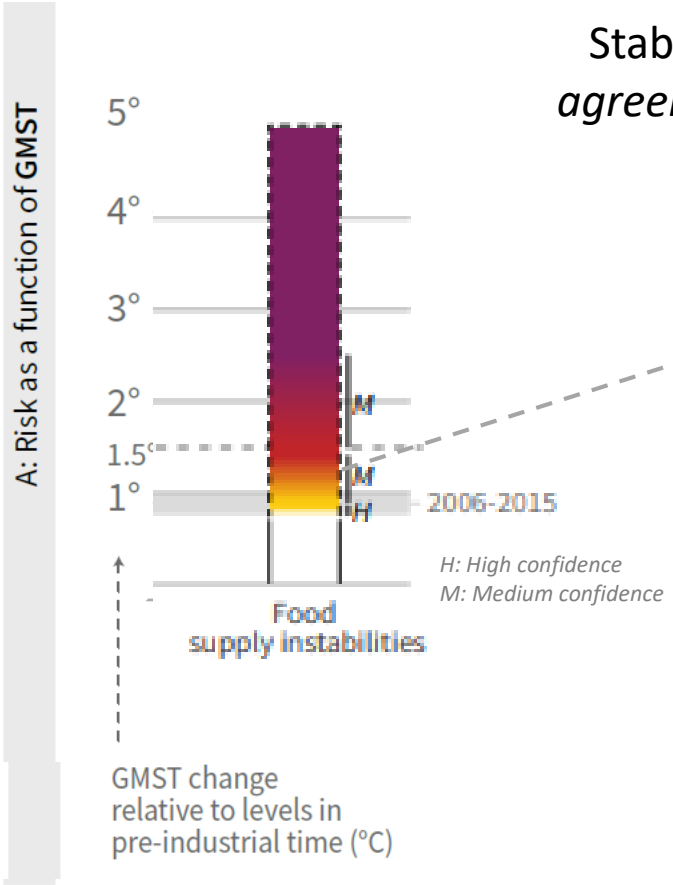
Food System Instability



Stability of food supply is expected to decrease (*high agreement, medium evidence)* → Extreme events, trade

Articles assessed: 22

Transition to high risk: particularly for food import reliant countries and regions

Linkages: GDP, price spikes, social tension, poverty, migration

Threshold Guidelines:
Moderate (yellow): up to 1 million people
High (red): up to 100 million people
Very High (purple): more than 100 million people

AR5 2014 MOD -> HIGH 2.5-3.5C SRCCL 2019 1.4C

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The Ocean and Cryosphere in a Changing Climate

This Summary for Policymakers was formally approved at the Second Joint Session of Working Groups I and II of the IPCC and accepted by the 51th Session of the IPCC, Principality of Monaco, 24th September 2019

Summary for Policymakers

WG I × WG II

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Changes in the mountain cryosphere

- Hazards for people, for example through **landslides, snow avalanches or floods** will increase as glaciers and permafrost decline.
- **Changing water availability and quality affects households, agriculture, energy systems, and people both in the region and beyond.**
- Limiting warming to 1.5°C would help people to adjust to changes in **water supplies** and **limit risks related to mountain hazards**.
- **Integrated water management and transboundary cooperation** provide opportunities to reduce the impacts of climate-related cryosphere changes on water resources.

Sea level rise and coastal extremes

- During the 20th century, the global mean sea level rose by about **15cm**.
- Sea level is currently rising **more than twice as fast** and will further **accelerate** reaching up to 1.10m in 2100 if emissions are not sharply reduced.
- Extreme sea level events which now occur rarely during high tides and intense storms will become more common.
- **Many low-lying coastal cities and small islands will be exposed to risks of flooding and land loss annually by 2050, especially without strong adaptation.**

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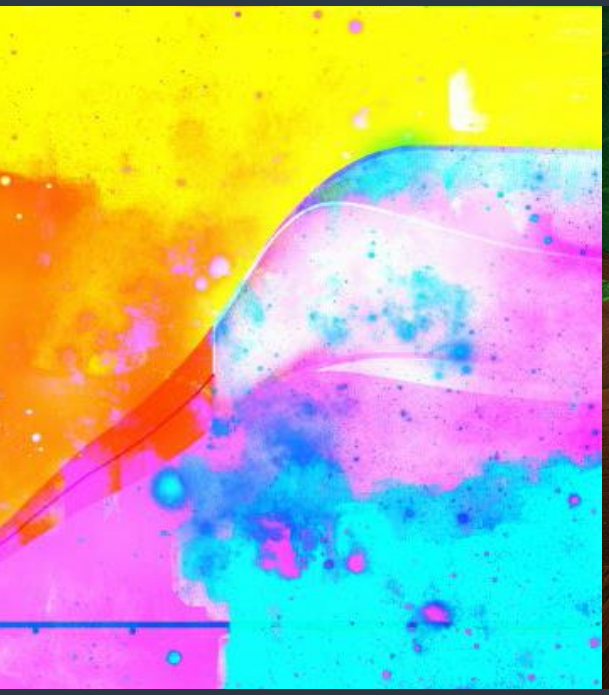
Changes in marine life

- Changes in the ocean cause **shifts in fish populations**. This has reduced the global catch potential. In the future some regions will see further decreases but there will be increases in others.
- **Communities that depend highly on seafood may face risks to nutritional health and food security.**
- Reducing other pressures such as **pollution** will further help marine life deal with changes in their environment.
- Policy frameworks for **fisheries management** and **marine protected areas** offer opportunities for people to adapt.

Thank You



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