Climate Change and the Food System: Emerging Synergies and Trade-Offs

IPCC Special Report on Climate Change and Land

Agricultural landscape between Ankara and Hattusha, Anatolia, Turkey (40°00' N – 33°35' E)
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Climate Crisis and the Future of Food
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www.ipcc.ch/report/SRCCL
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]
Food System Vulnerabilities - Observed

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

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

Access – 2010-2011 global food price spike, triggered by heatwave in Eastern Europe/Russia

Stability – 2010 extreme rainfall/flooding in Pakistan led to massive loss of food reserves
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
Role of Diets

**Diets for a healthy life**
Grains, legumes, fruits and vegetables, nuts and seeds, and animal-sourced food produced in low-GHG emission systems [B6, 5.5]

**Opportunities for adaptation and mitigation**
while generating co-benefits in terms of human health (*high confidence*) [D2, 5.6]

**Mitigation potential**

**Technical**: 0.7-8.0 GtCO\(_2\)eq/yr by 2050

**Economic**: 1.8-3.4 GtCO\(_2\)eq/yr by 2050 at prices ranging from 20-100 USD/tCO\(_2\) [B6, 5.5]

**Dietary changes** can ease the economic burdens of ill health caused by malnutrition and allow redirection of revenues to sustainable intensification and sustainable land management practices (*medium confidence*) [C2, D.2, 5.5]

**Co-benefits**
Human health, such as reduced risks of coronary heart disease, some forms of cancer and Type II diabetes (*medium confidence*) [C2, D2, 5.7]

Food security requires diets for a healthy life - ensuring healthy diets has both adaptation and mitigation benefits
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 GtCO₂eq yr⁻¹ by 2050 at prices ranging from 20-100 USD/tCO₂.
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.
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.

Herrero et al., 2016
Some BECCS can increase demand for land conversion at a scale of several millions of km² globally (high confidence) [B3]

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]

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]
Regional Aspects

Figure 1.3
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 2.5-3.5°C SRCCL 2019 1.4C**
Thank You

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