

Climate, Drought, Water, and Food Security

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dam

2 km



Photo Courtesy of NASA Earth Observatory

Food Security & Climate Change

<u>World</u>	<u>Today</u>	<u>United States</u>
795M	Undernourished / Food Insecure	15.8M Households
>2B	Micronutrient Deficient	≥10.5%
2.5B	Overweight/Obese	68.8%
25 - 50%	Food Waste	30 - 40%

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
(updated in 2012)

Key Concept:
Food Security

Does food
exist?

Availability

- Production
- Distribution
- Exchange



Can you
get it?

Access

- Affordability
- Allocation
- Preference



Stability

Are these things
stable over time?

Can you
use it?

Utilization

- Nutritional Value
- Social Value
- Food Safety



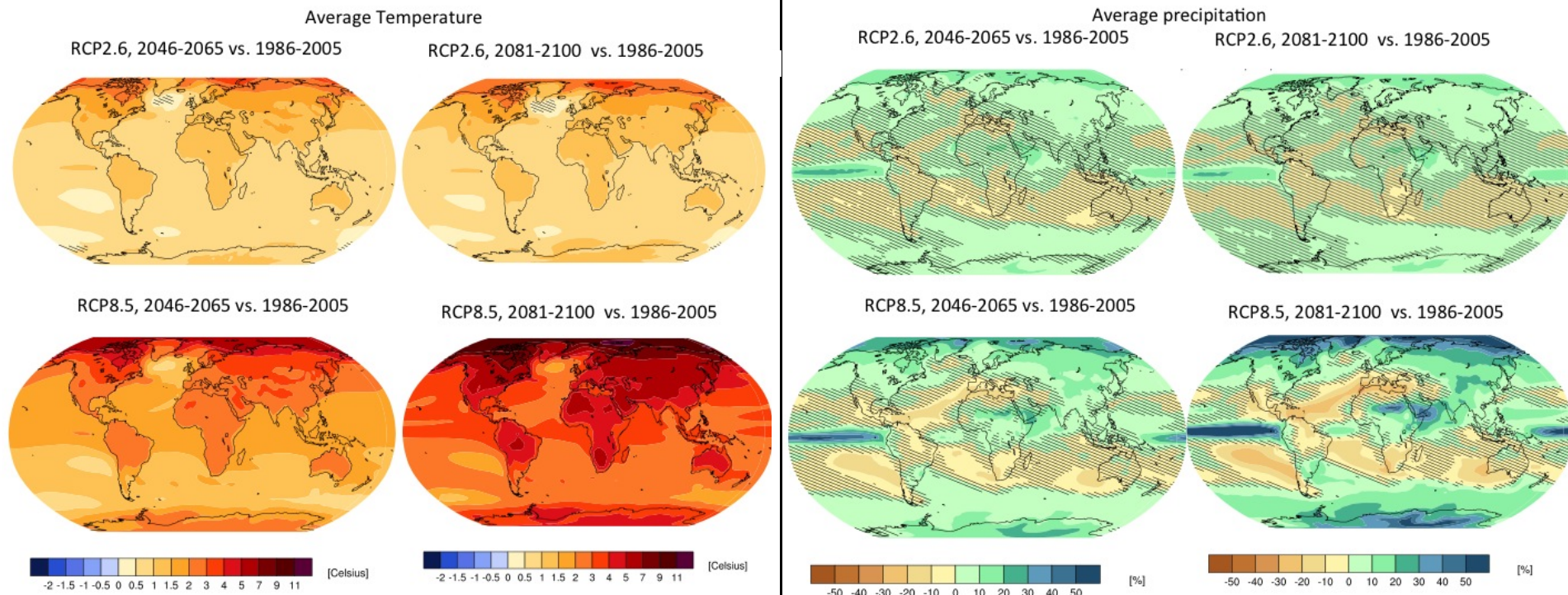
All must occur simultaneously for food security to exist.

Key Concept: Food System



An individual food system may have few, many, or all of these elements.

Effects 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)

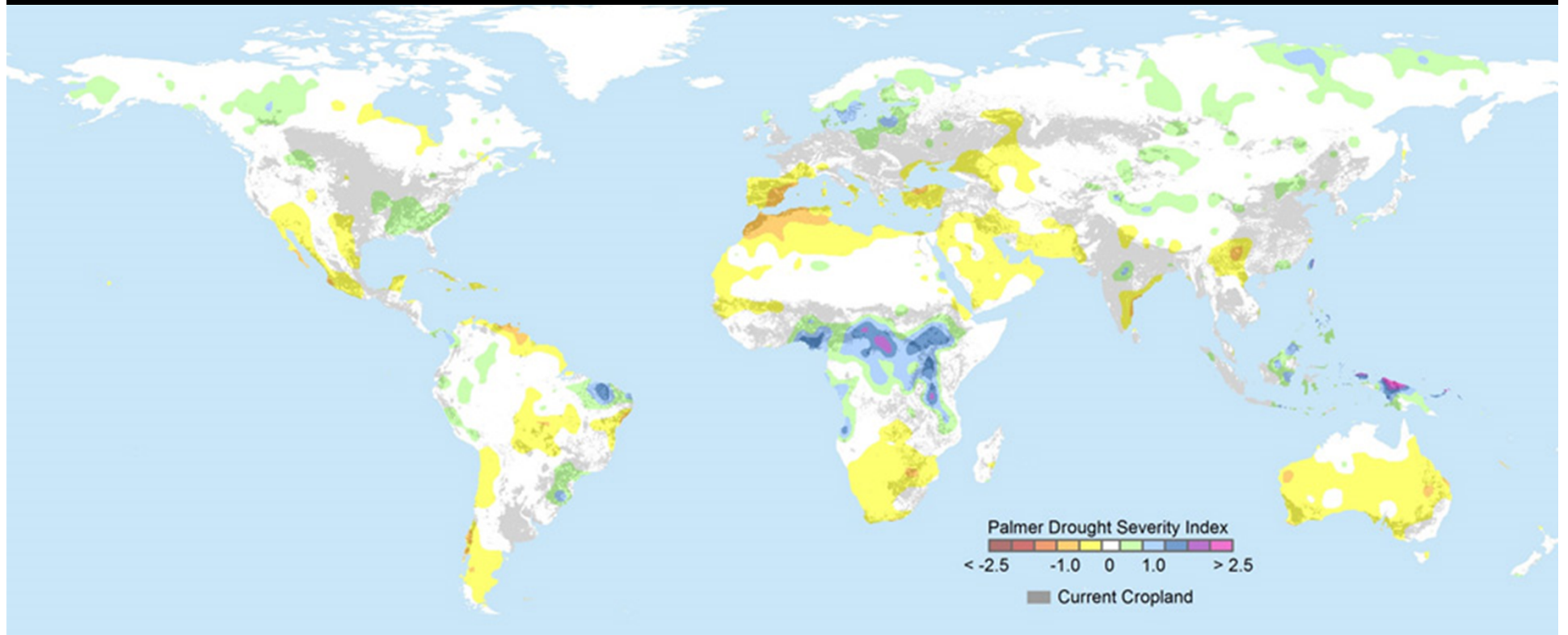
Both low and high emissions make wet areas wetter and semiarid regions drier. Annual precipitation increases 10-20% in many northern areas and decreases 10-20% in many southern areas.

Climate Effects on Agricultural Production

- Crops - High nighttime temperatures, high temperatures during pollination, water stress/drought, extreme events, frost during flowering, chilling requirements not met, high temperatures during fruit development
- Animals — High temps lead to lower production of meat, dairy, eggs and lower reproduction rates, increased production costs, altered forage availability & quantity
- Insects, Pests & Disease — Changing distribution, higher overwinter survival rates, higher populations, increased vigor, reduced efficacy of controls, increased risk from imports

Palmer Drought Severity Index (PDSI)

2013 – 2015
(annual average)

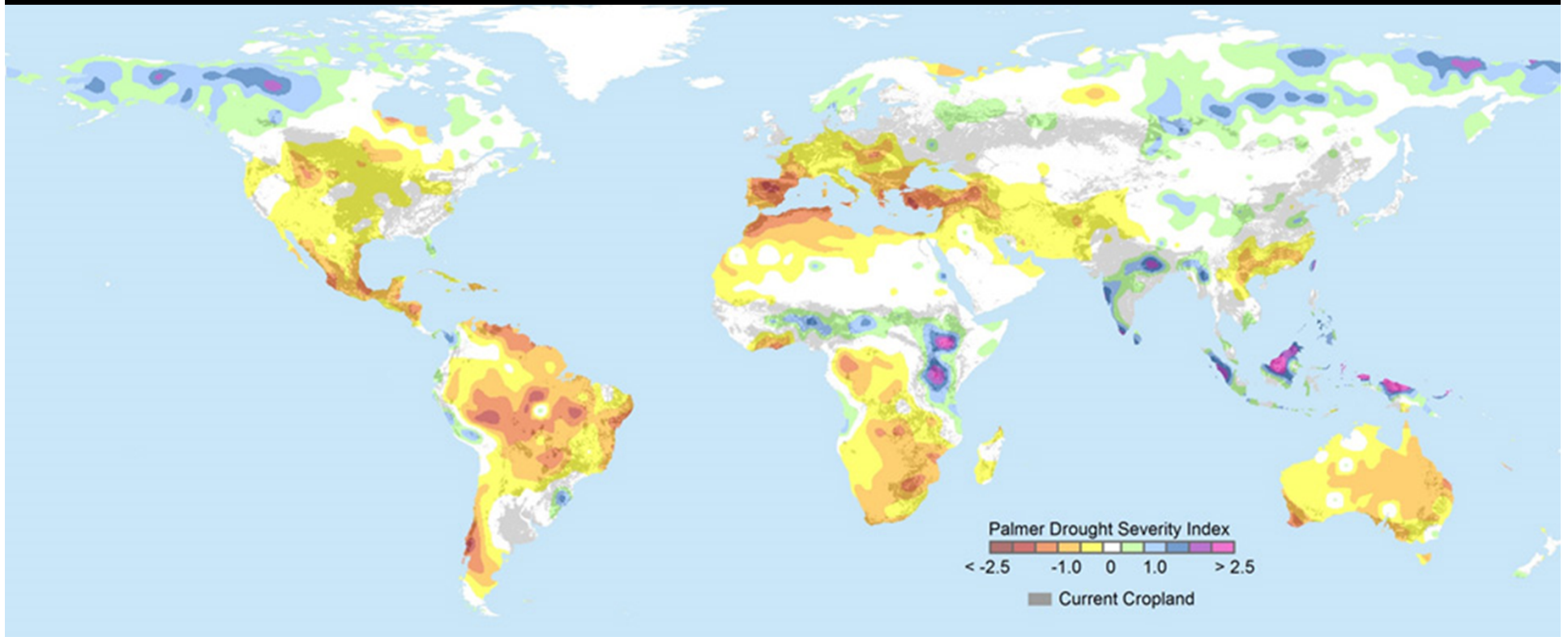


Total Global Cropland Area in Drought: ~ 4%

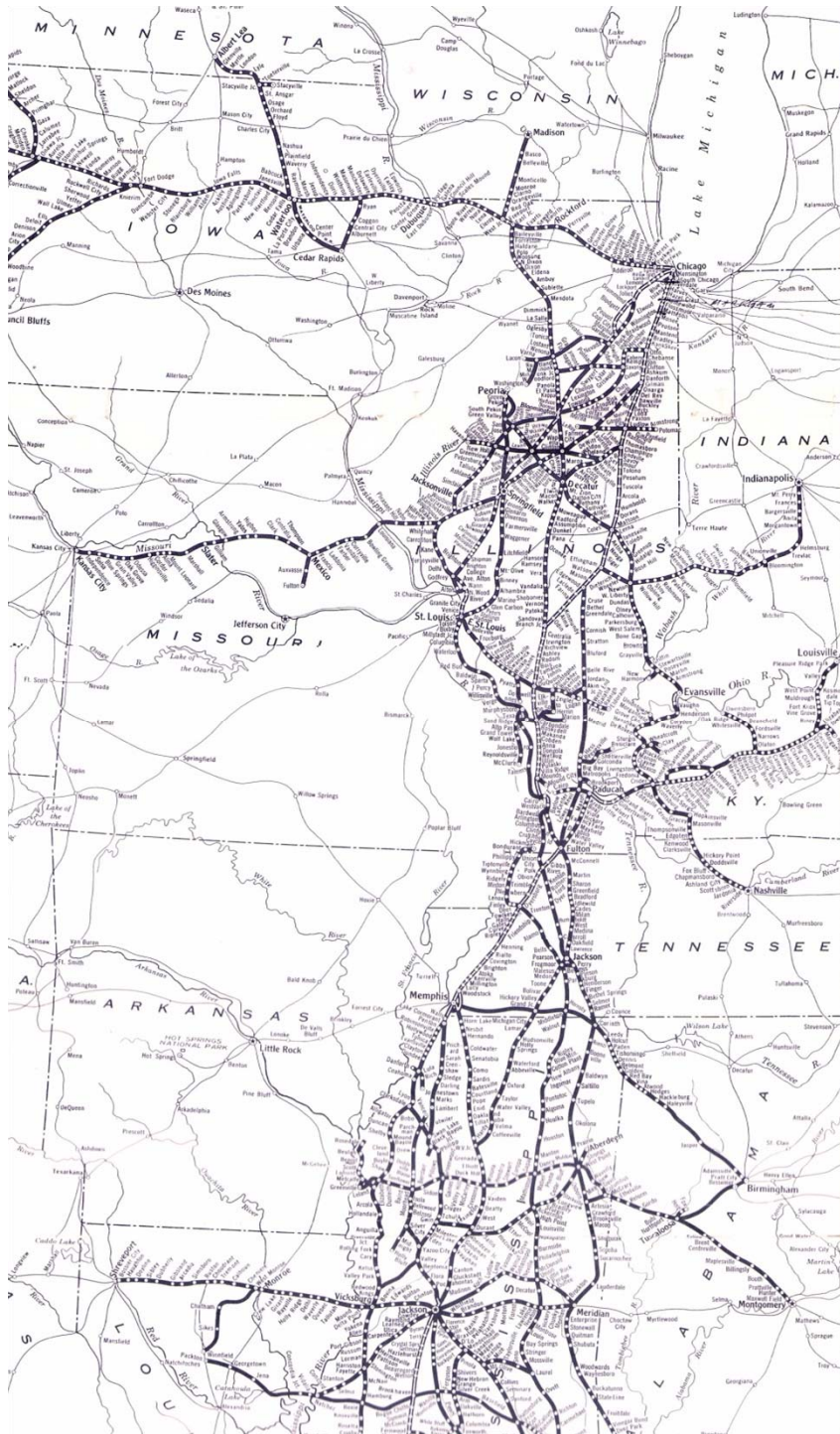
Palmer Drought Severity Index (PDSI)

2097 – 2099 (annual average)

RCP 4.5



Total Global Cropland Area in Drought: ~ **18%**
CMIP5 projected



Transportation, Drought & Food

1988

- Mississippi River
 - Dredging
 - Reduced Loads
 - Higher Barge Shipping Costs
 - Delivery Failure
- Illinois Central Railroad
 - Seasonal Climate Forecast
 - Leased additional cars
 - Increased shipments



barges
tow boat

Mississippi River

sandbar

dike

2012
Mississippi River

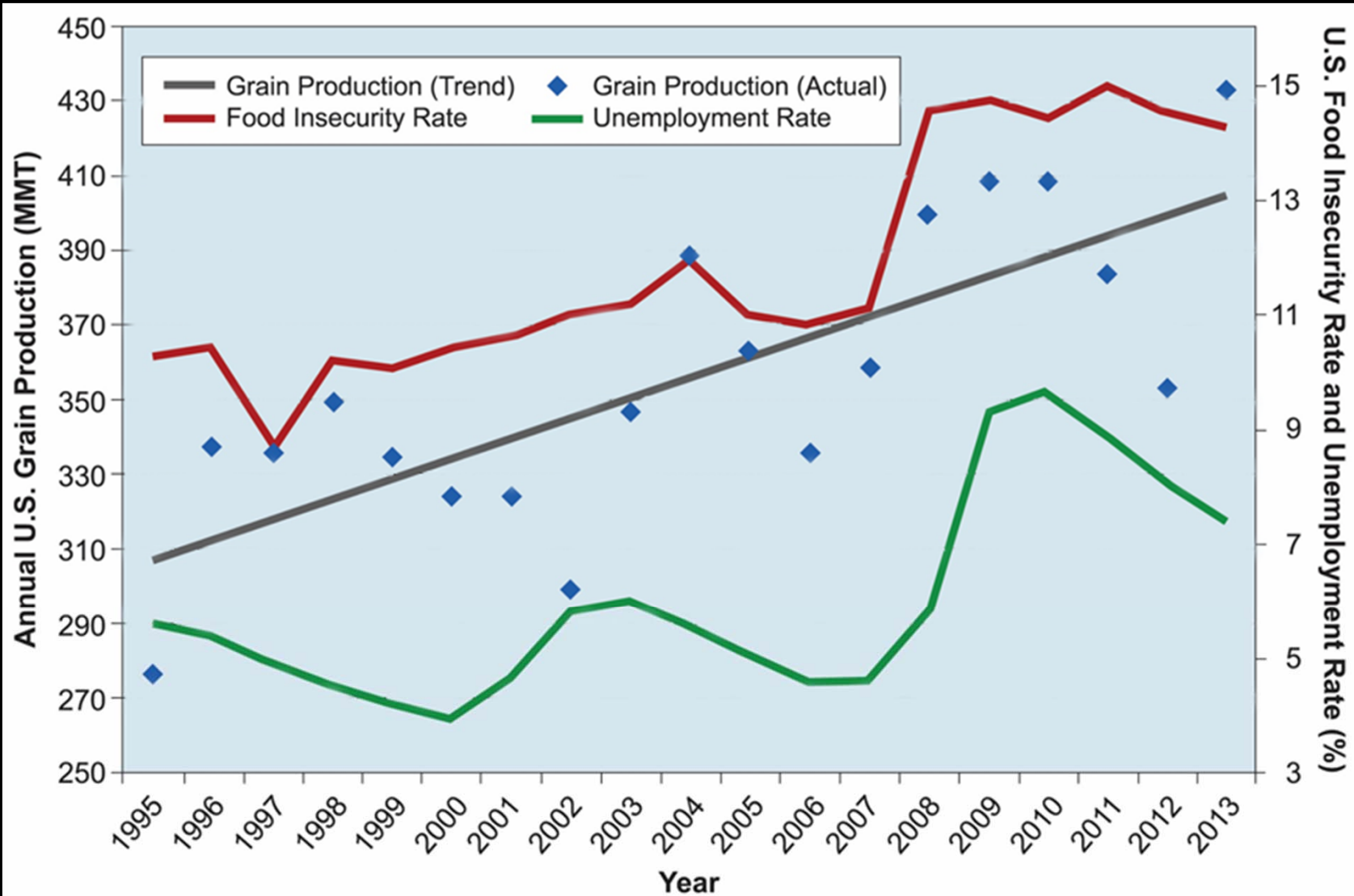
500 m

...and on Socioeconomic Context

- Changing socioeconomic context matters to food security.
- Assessed climate change in context of plausible future conditions or “pathways.”

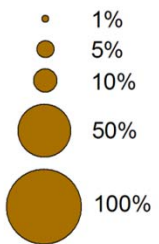


Grain Production, Food Insecurity Rate, and Unemployment in the U.S. 1995-2013

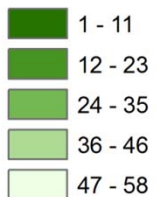


Food Deserts in California

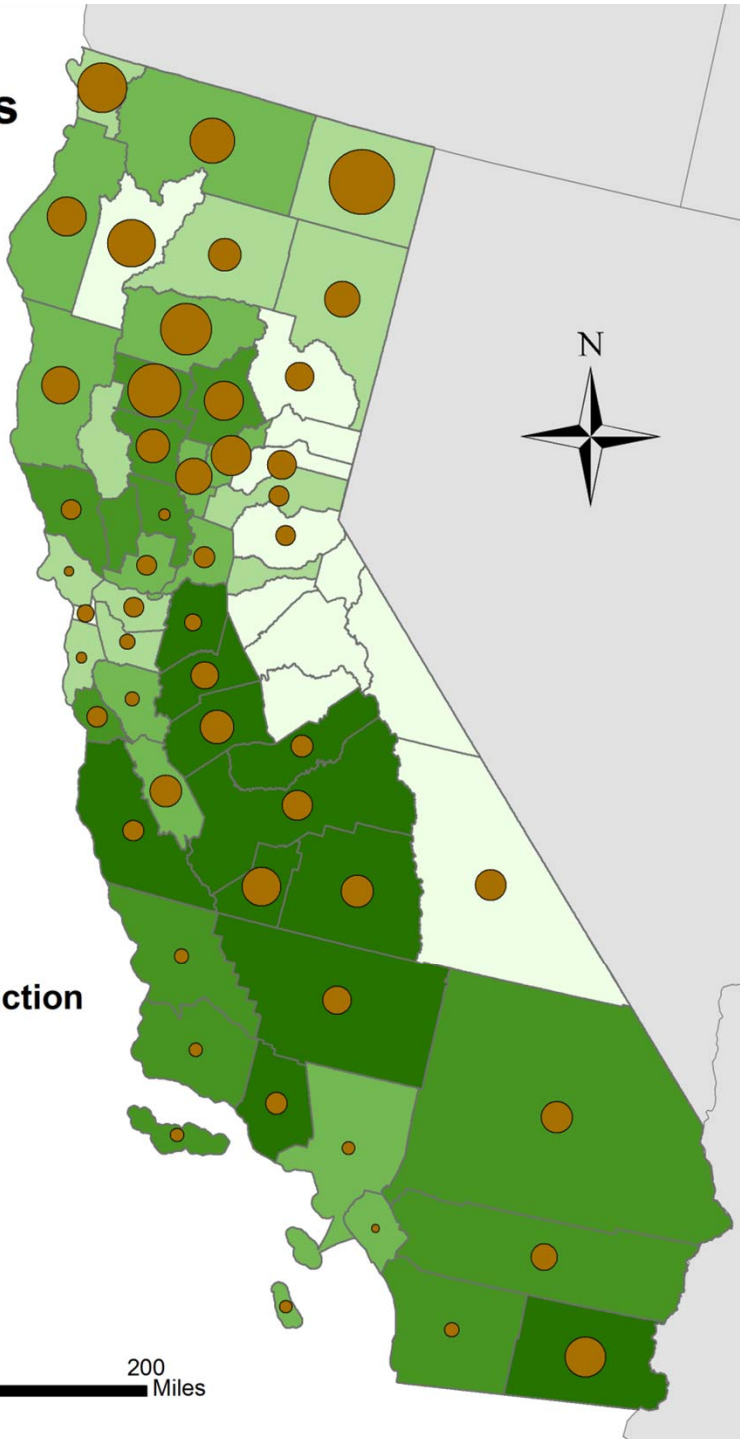
Food Deserts Per Census Tract



Agricultural Production By County Ranking



0 100 200
Miles



California

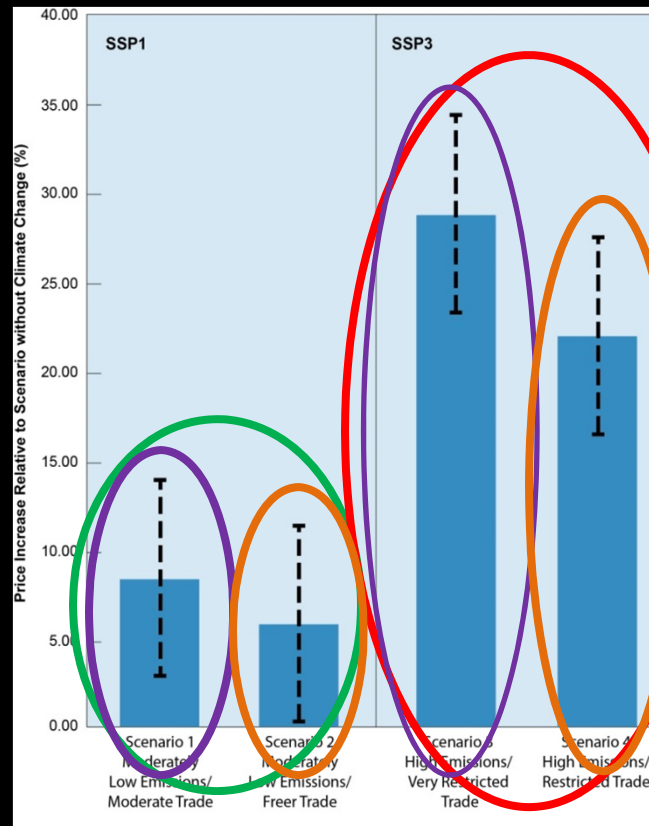
- Highest state GSP in the U.S.
- >76,000 farms and ranches (CDFA)
- \$54 billion in agricultural production (CDFA)

4.42 Million
SNAP Recipients

(as of April 2016, USDA FNS)

Food Prices in 2050 under Different Emissions and Trade Futures

Low GHG Emissions —
High GHG Emissions —

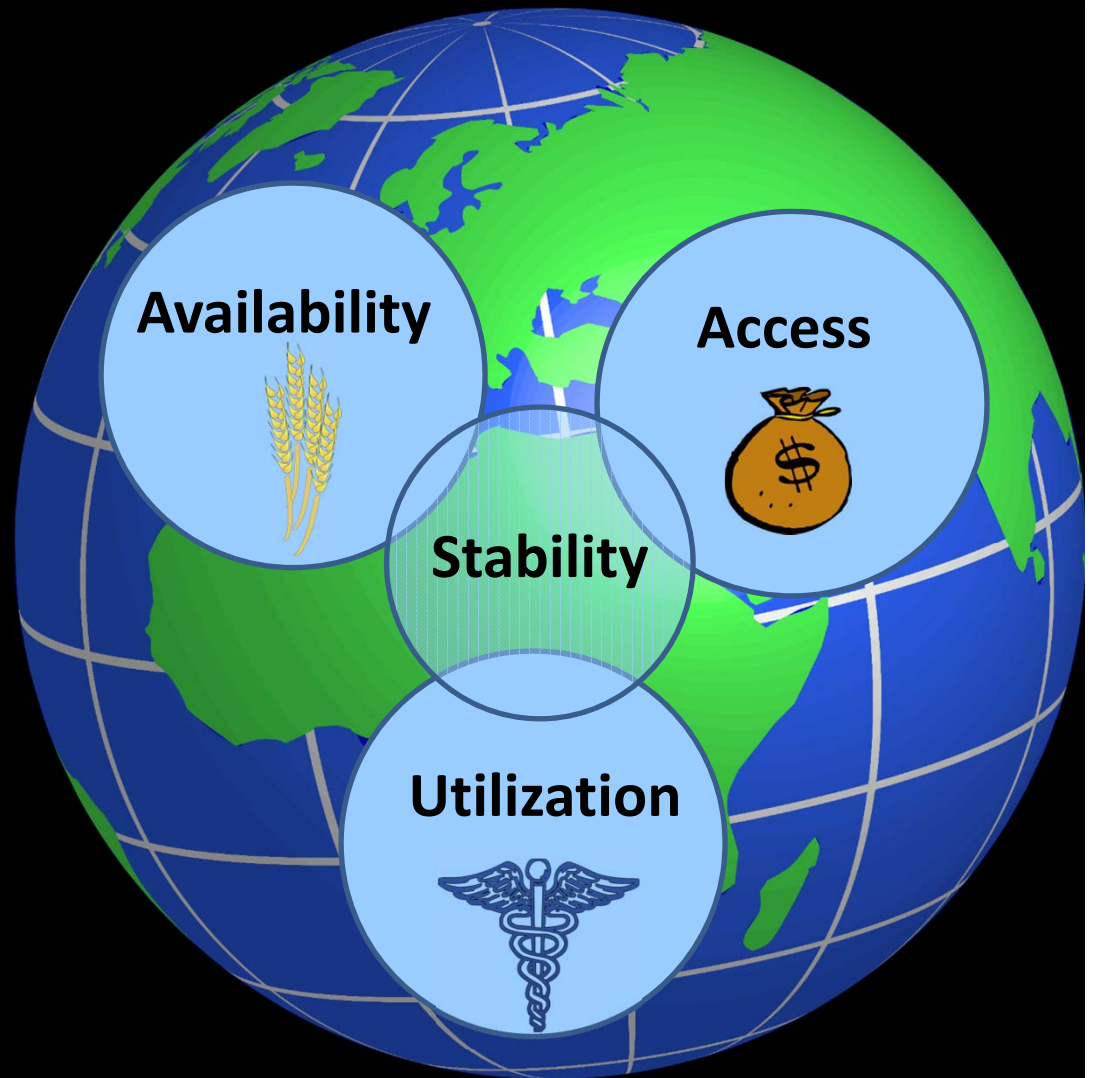


Lower Trade —
Higher Trade —

Climate change is very likely to affect food security.

Risks are greatest for the poor and in the tropics.

Risks are magnified as the rate and magnitude of climate change increase.





U.S. Consumers and Producers are Likely to be Affected

- **Types, cost, and seasonality of imported foods**
- **Export demands and infrastructure requirements**
- **International Assistance**
- **Research and Information**

Adaptation



The complexity of the food system allows for multiple intervention points for managing food security



Food Express

