

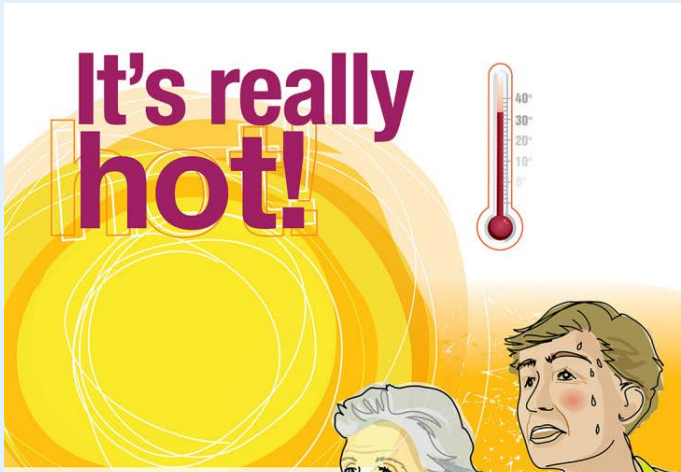
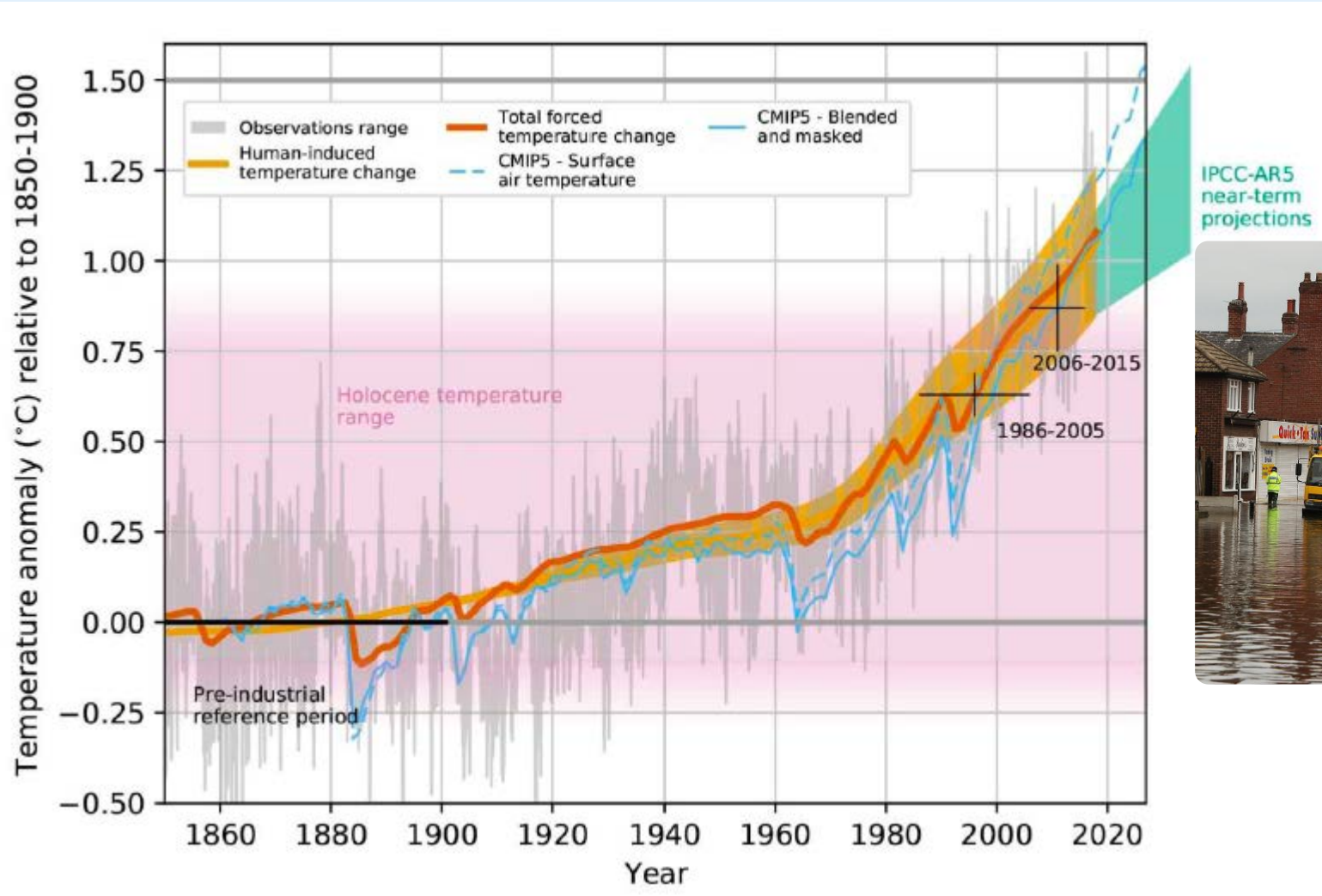
Population health risks of a changing climate

*The Health Emergency of Our Changing Climate
Part 2-Evolving Public Health Strategies in the 21st Century*

10 November 2020

Kristie L. Ebi, Ph.D., MPH
University of Washington

Global Mean Surface Temperature to 2020



WARMER AIR

↓
MORE EVAPORATION

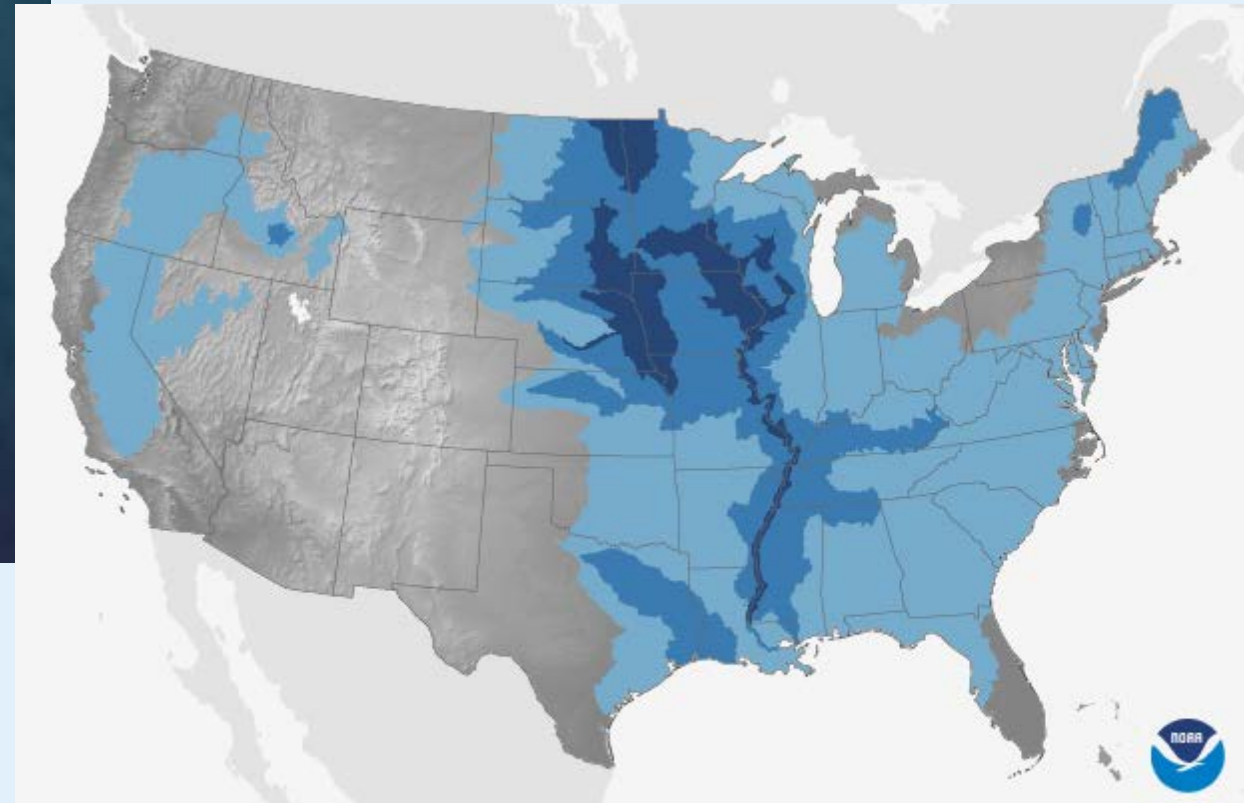
↓
MORE PRECIPITATION

Available
water

**1°F increase =
4% more water vapor**

- Temperature +

CLIMATE CENTRAL



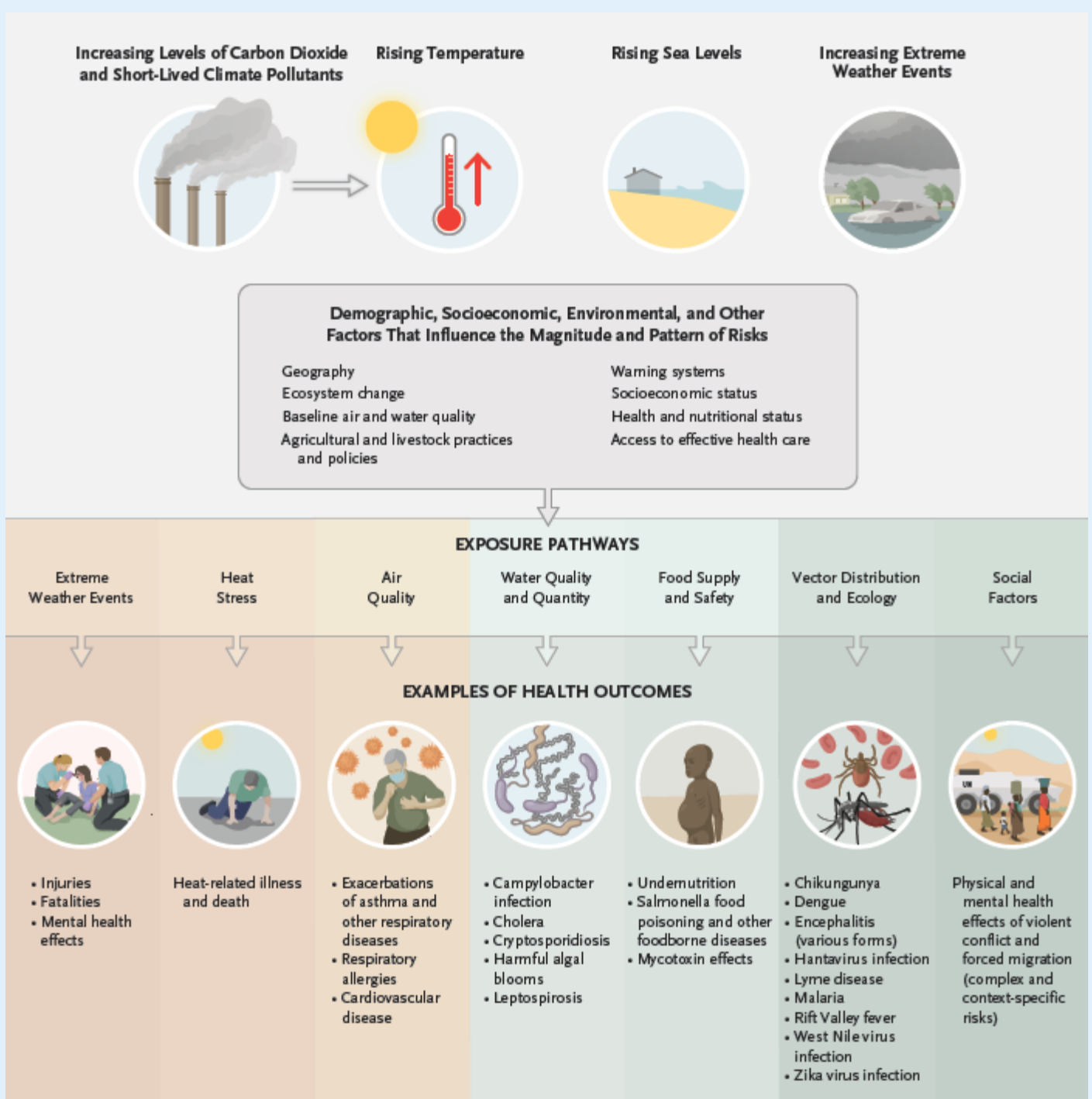
Flood Outlook
for March - May
Issued 2019 Mar 21

Spring flood risk potential



Climate.gov
Data: OWP







Mitigation




Climate-altering pollutants

Energy   

Transport 


Agriculture
Forestry
Other land use 

Industry 

Buildings 





Health co-benefits

- ↓ Air pollution 
- ↓ Noise
- ↑ Physical activity
- ↑ Nutrition 
- ↑ Water access and quality 

Adaptation




Direct environmental effects

Floods Drought Storms
Heatwaves Fire




Indirect environmental effects

Air pollution Reduction in crop productivity
Reduction in water quality Ecosystem damage

Socially mediated effects

Population migration Health infrastructure*
Conflict Age, gender, health†
Poverty



Health effects

- Heat illness
- Heart and lung diseases
- Infectious diseases 
- Undernutrition
- Mental illness 

Primary care actions



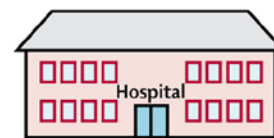
health care, promotion, and prevention



research and education



advocacy



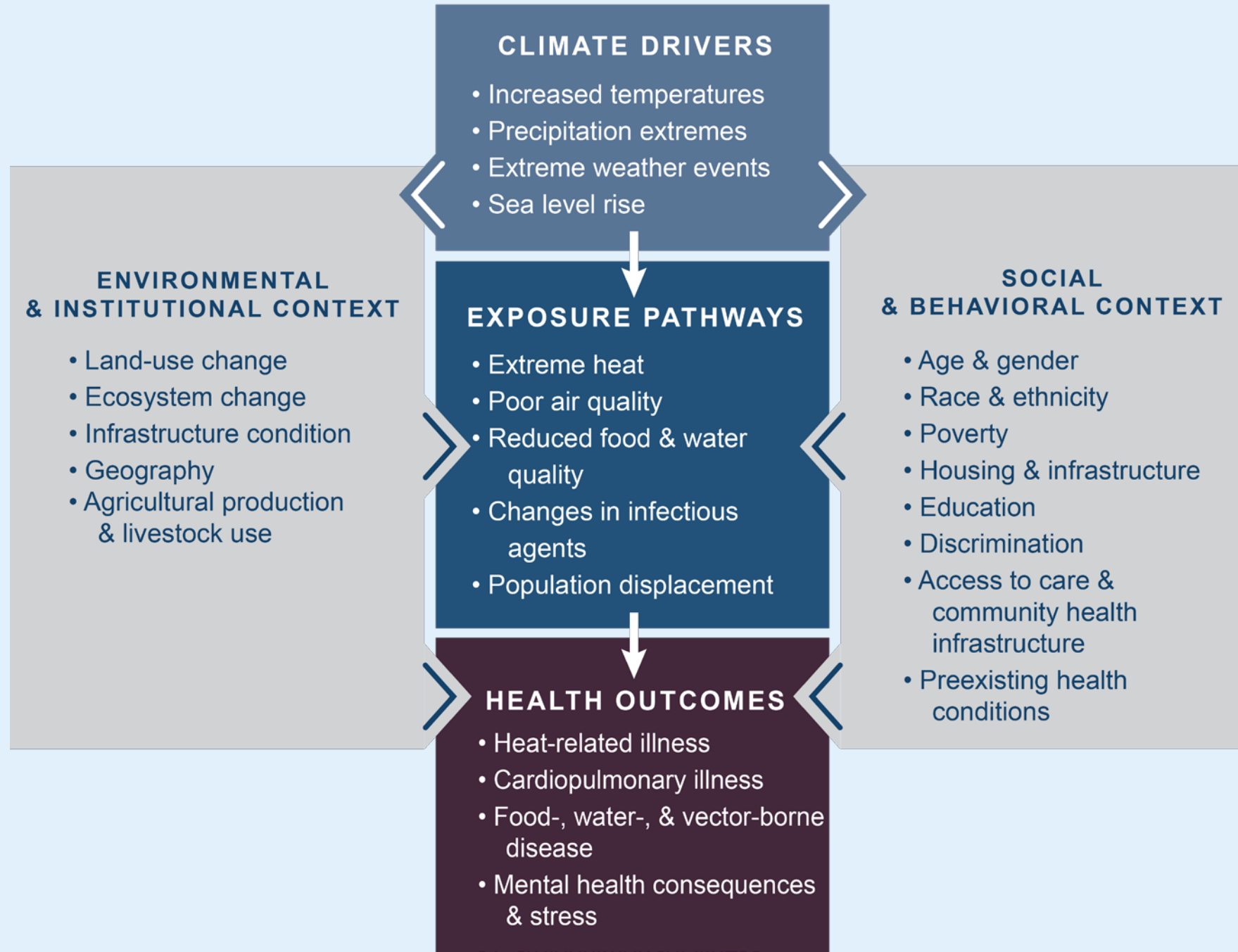
health system strengthening

Climate Change and Health

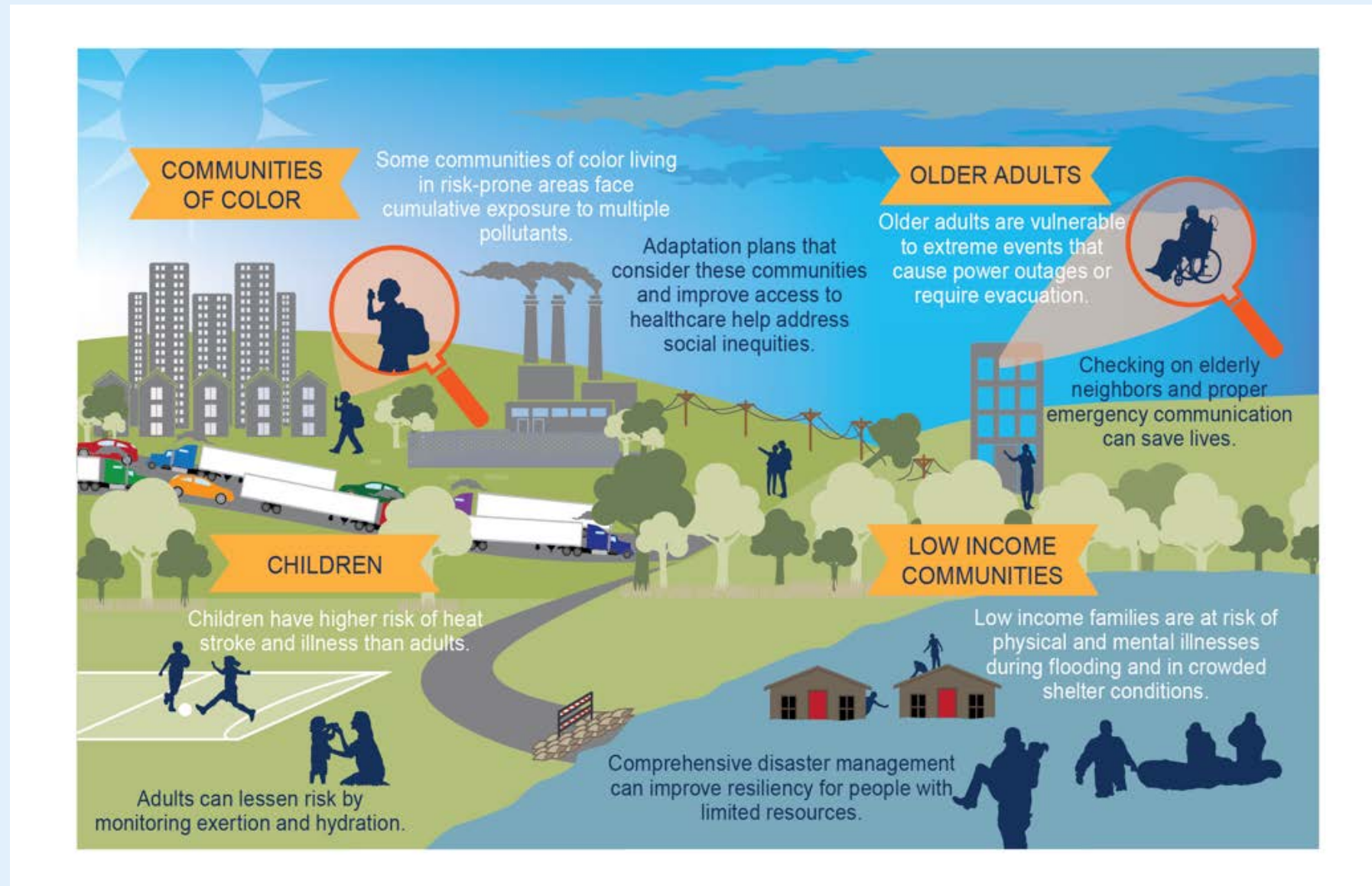
4th National Climate Assessment:

Climate change affects the health of all Americans

The health and well-being of Americans are already affected by climate change, with the adverse health consequences projected to worsen with additional climate change.



Exposure and resilience vary across populations & communities





In pictures: Hurricane Sally causes widespread flooding

Updated 3:30 PM ET, Fri September 18, 2020

A man checks on his truck as it rests on a tree in Perdido Key, Florida, on Thursday, September 17. Jake Crandall/The Montgomery



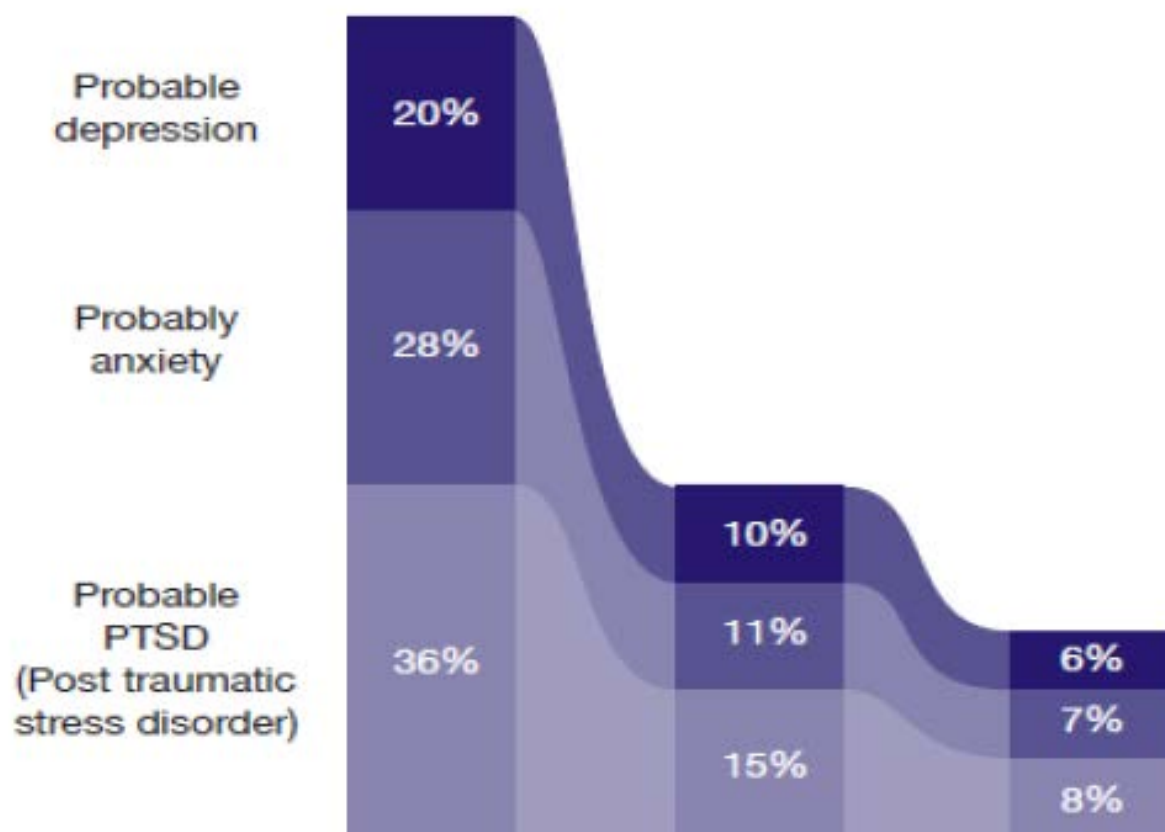
Flooded



Disrupted



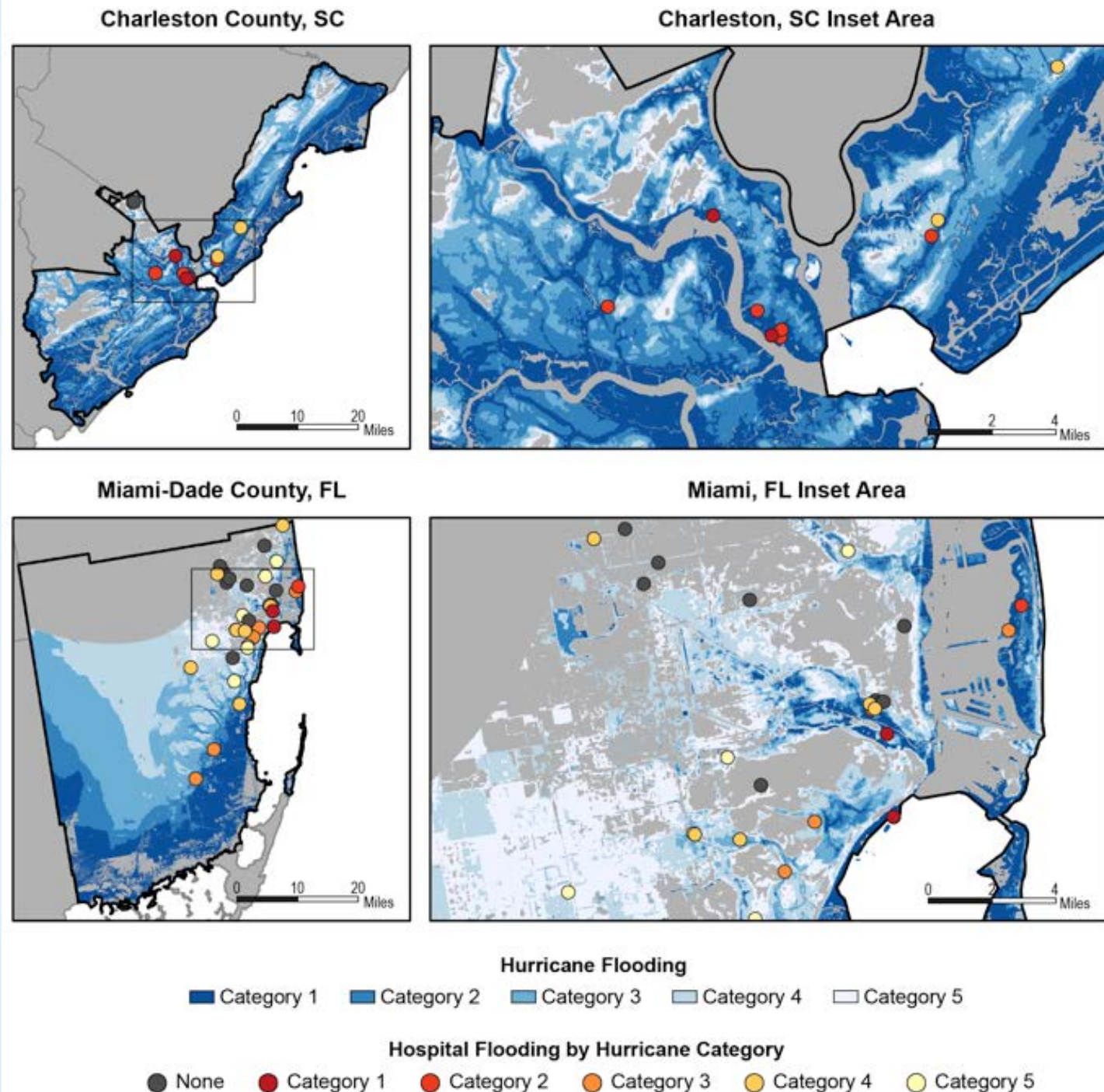
Not flooded



4th National Climate Assessment:

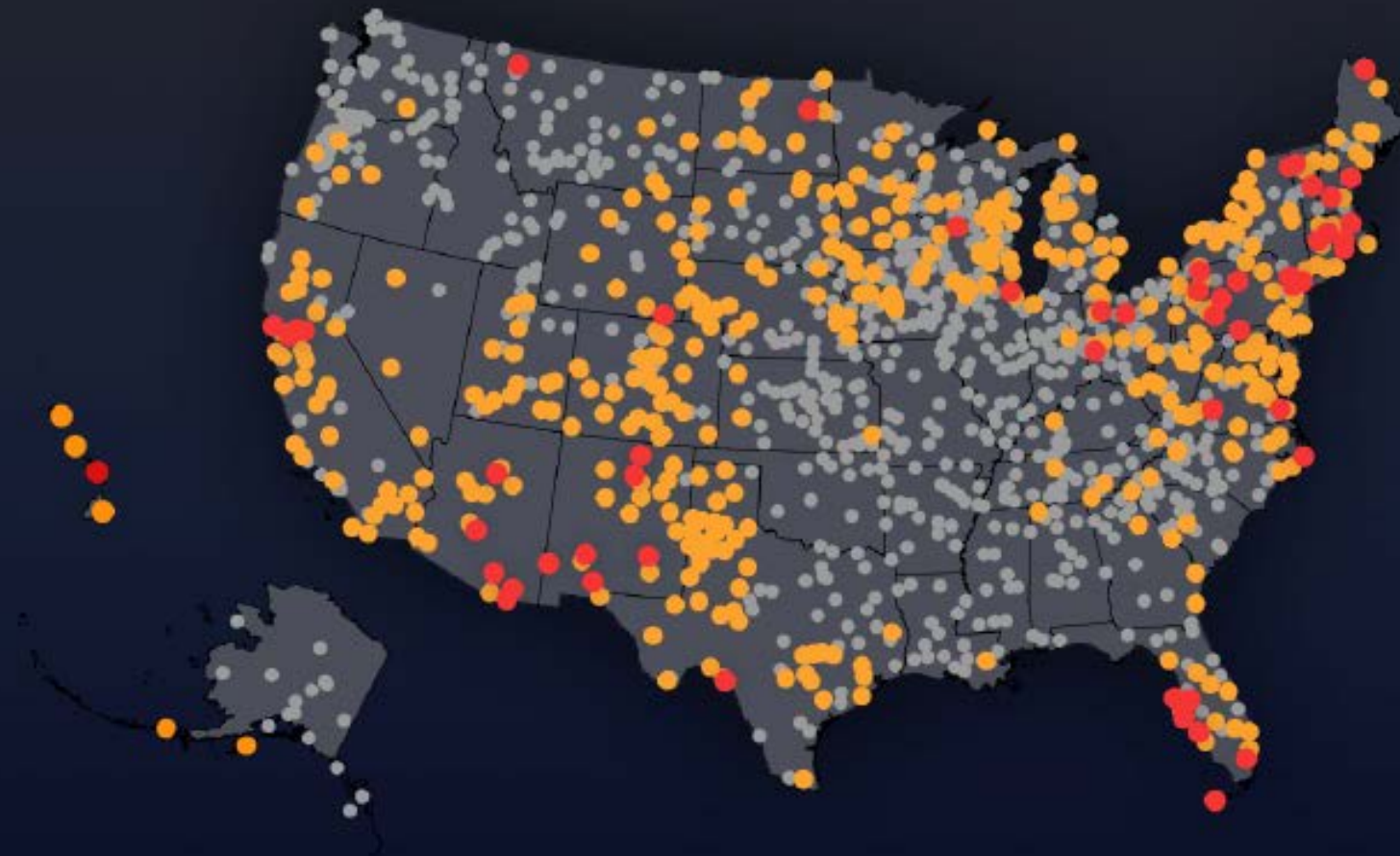
Adaptation reduces risks and improves health

Proactive adaptation policies and programs reduce the risks and impacts from climate-sensitive health outcomes and from disruptions in healthcare services. Additional benefits to health arise from explicitly accounting for climate change risks in infrastructure planning and urban design.



SUMMER 2020 RECORDS

● TOP 10 HOTTEST ● HOTTEST ON RECORD



Jun, Jul, Aug average temperature rankings. Data through August 2020
Source: RCC-ACIS.org

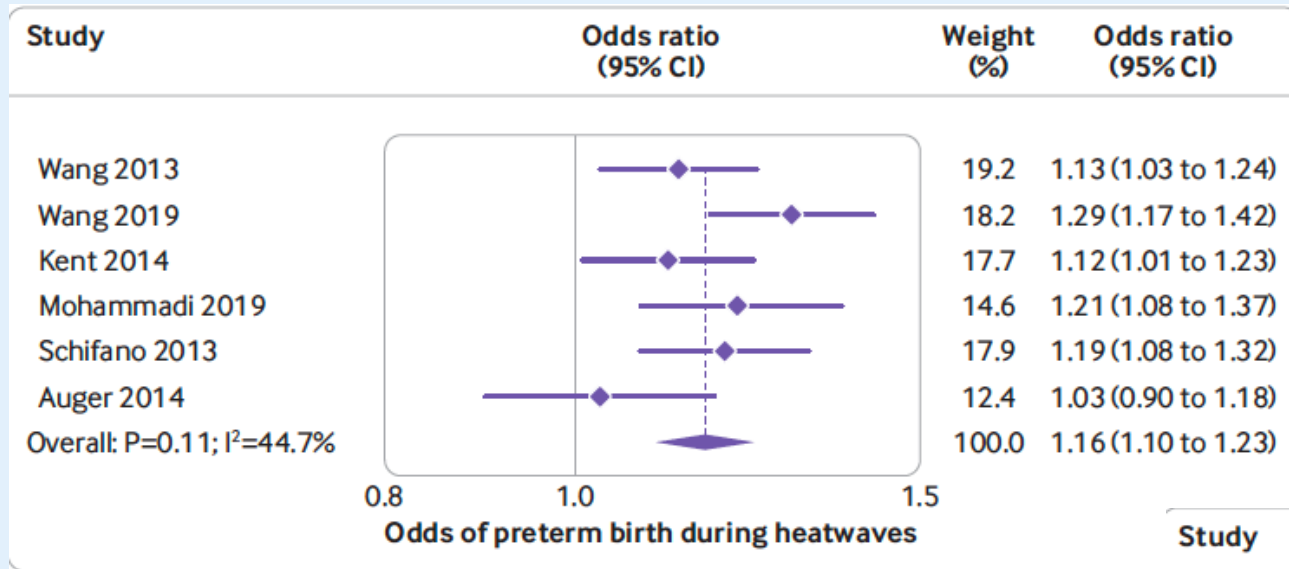
CLIMATE  CENTRAL



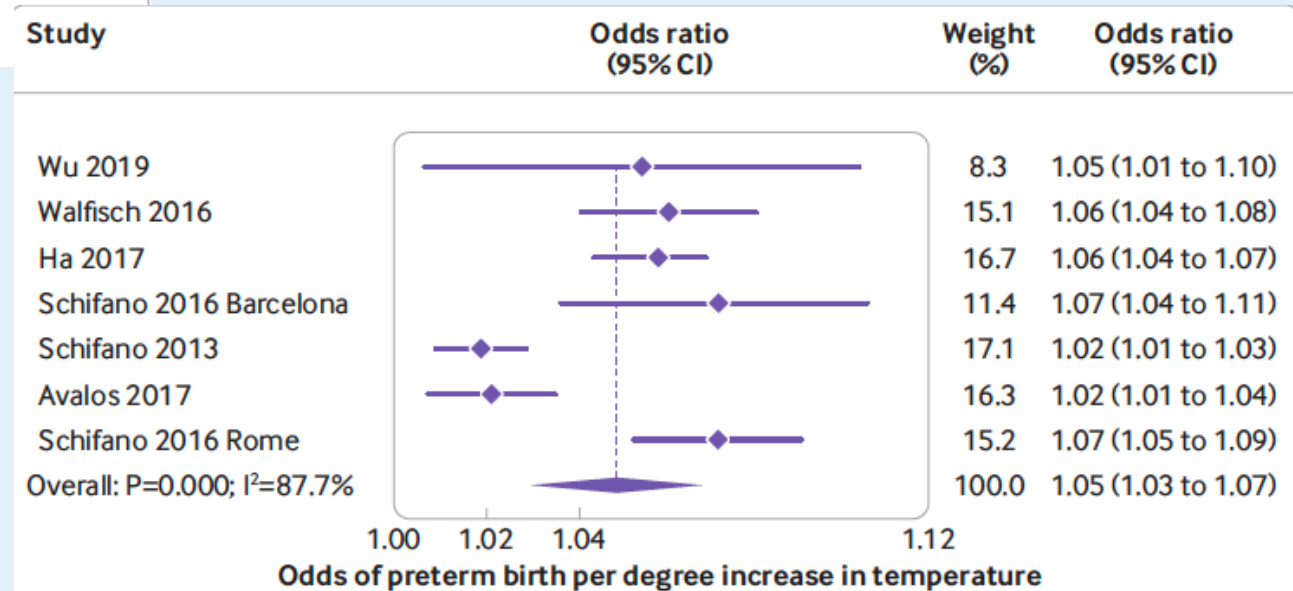


Exposure to heat and preterm births

Preterm birth during heatwaves



Preterm birth by temperature



Wednesday, June 13, 2018

Texas has reached the top of a list that is of grave concern, especially during the summer.

According to KidsAndCars.org, the Lone Star State is No. 1 for child hot car deaths in the United States.

From 1990 to 2017, there were 120 child vehicular heatstroke fatalities in Texas involving children ages 14 and under.

A total of 836 children died from heatstroke across the country after being left in hot cars over the last 17 years.

Playground equipment can get dangerously hot: Follow these tips to prevent kids from getting burned



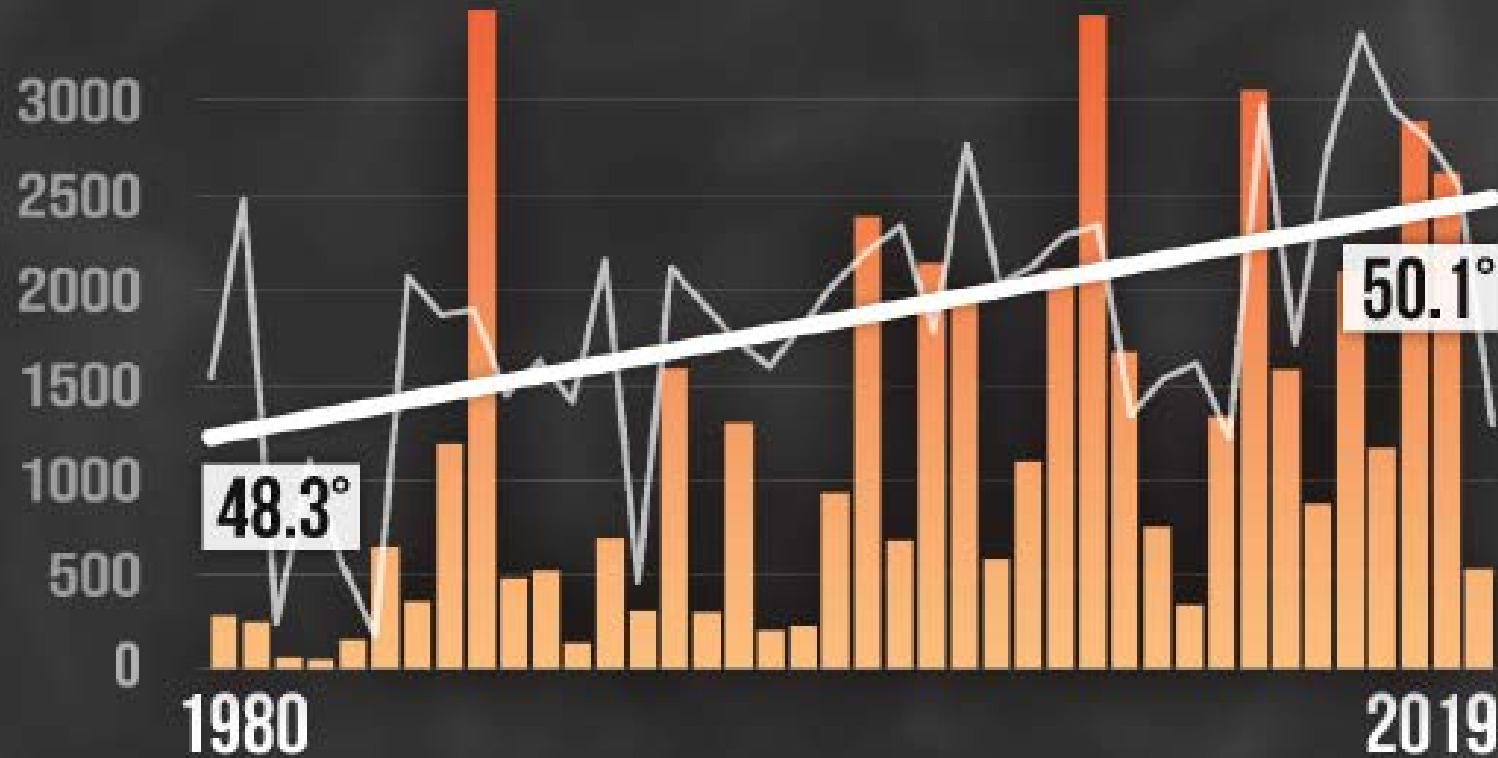
AHMEDABAD HEAT ACTION PLAN 2013

GUIDE TO EXTREME HEAT PLANNING IN AHMEDABAD, INDIA



HOTTER YEARS, HIGHER FIRE RISK ACRES BURNED ACROSS WESTERN STATES

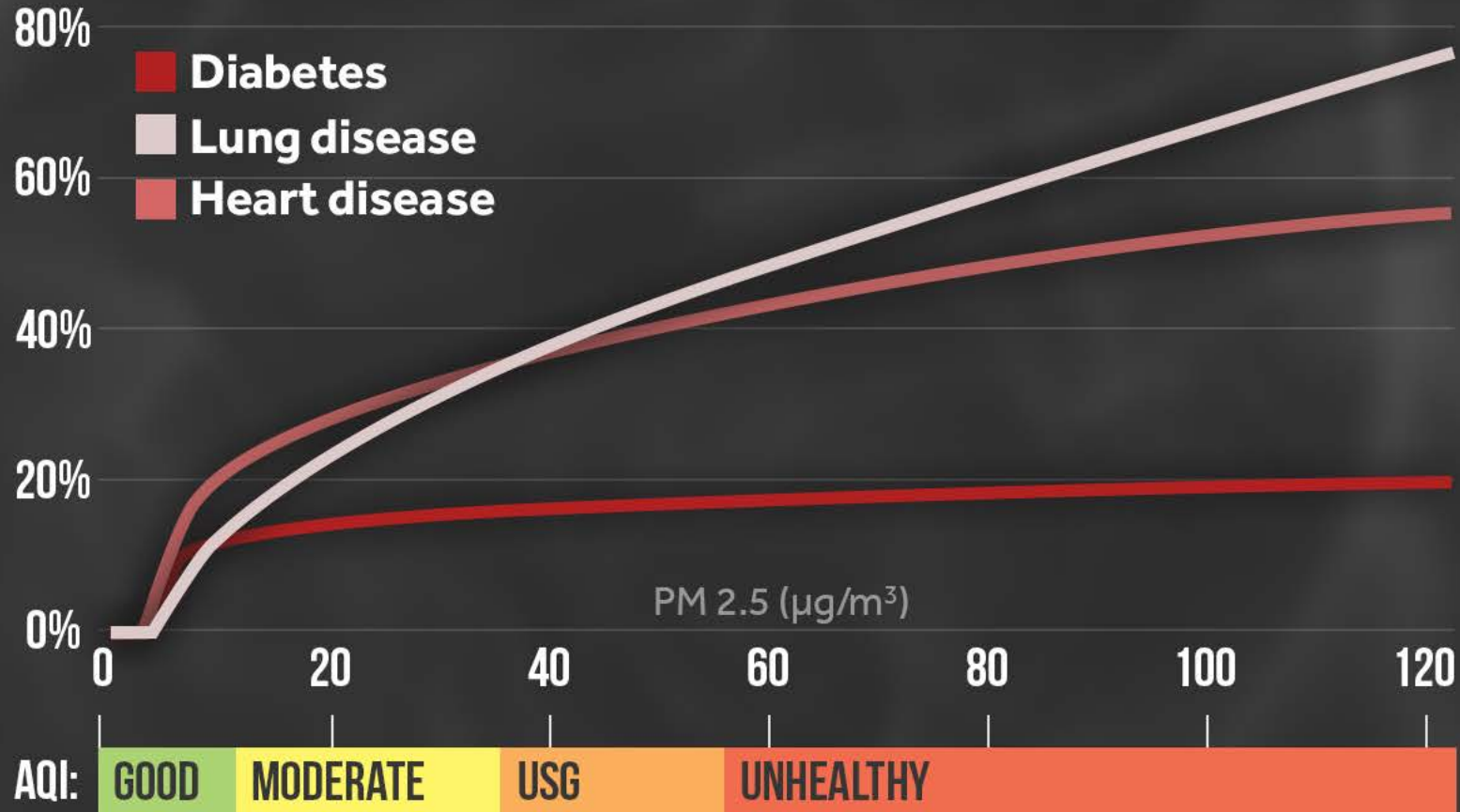
(THOUSANDS OF ACRES)



Total acres burned in the west, calculated by summing acres burned across 11 states: AZ, CA, CO, ID, MT, NV, NM, OR, UT, WA, & WY. Avg annual temps (1980-2019) calculated by averaging temps across same states. Sources: National Fire & Aviation Management FAMWEB Data Warehouse & NOAA/NCEP's Climate at a Glance

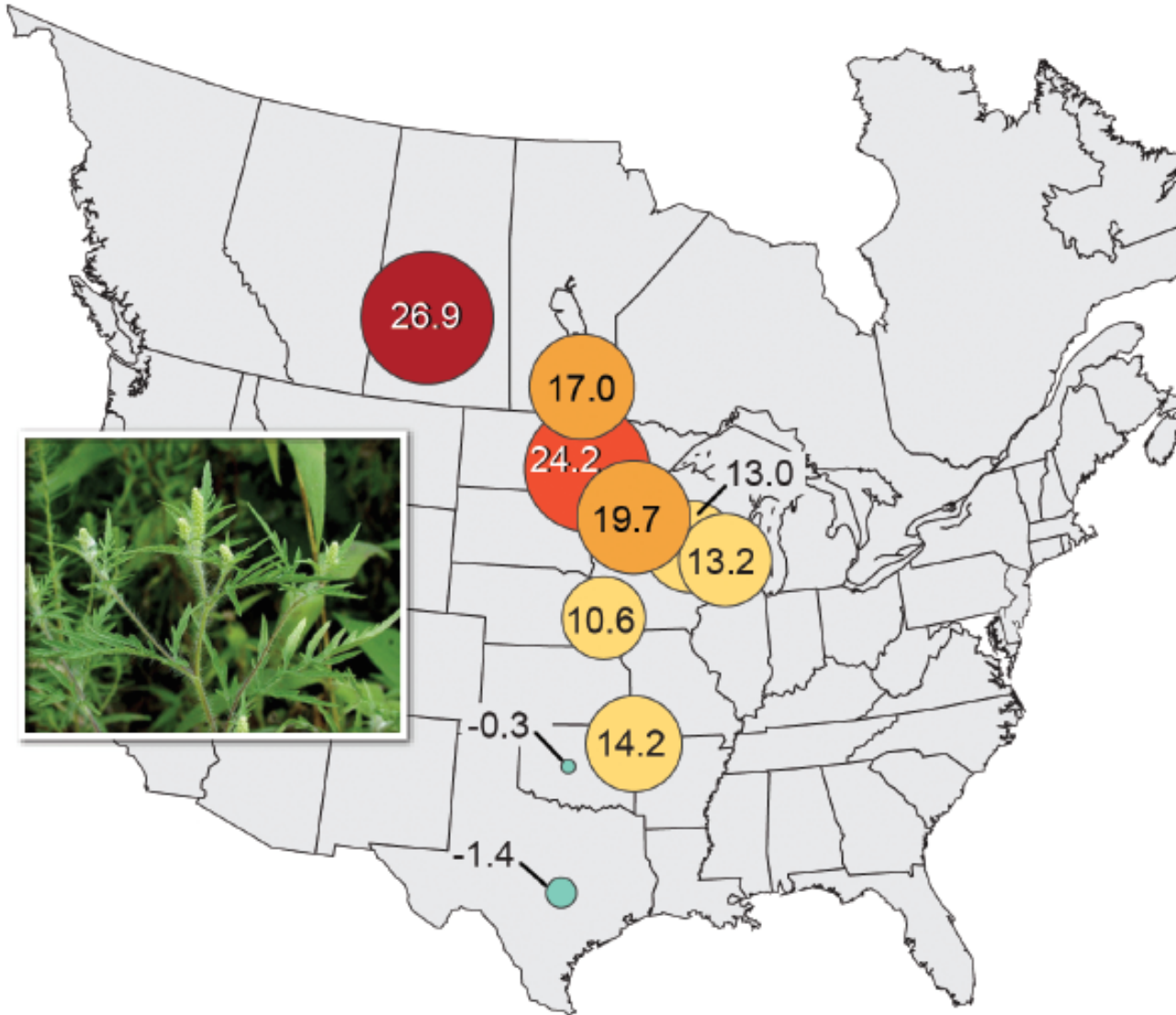
WILDFIRE SMOKE RISKS

Increased Risk

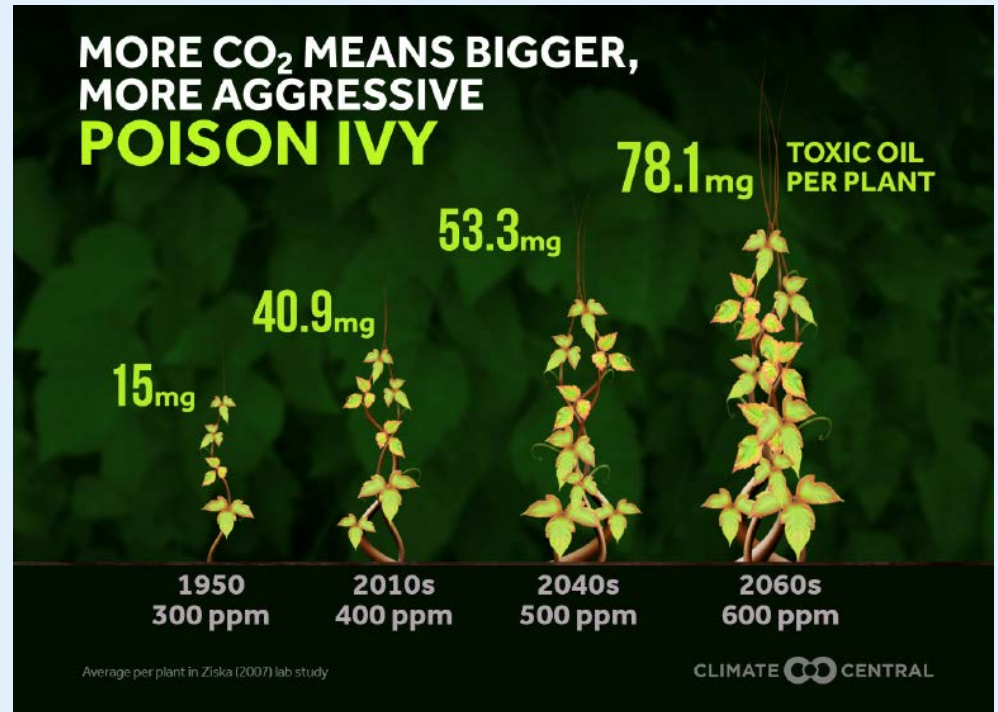
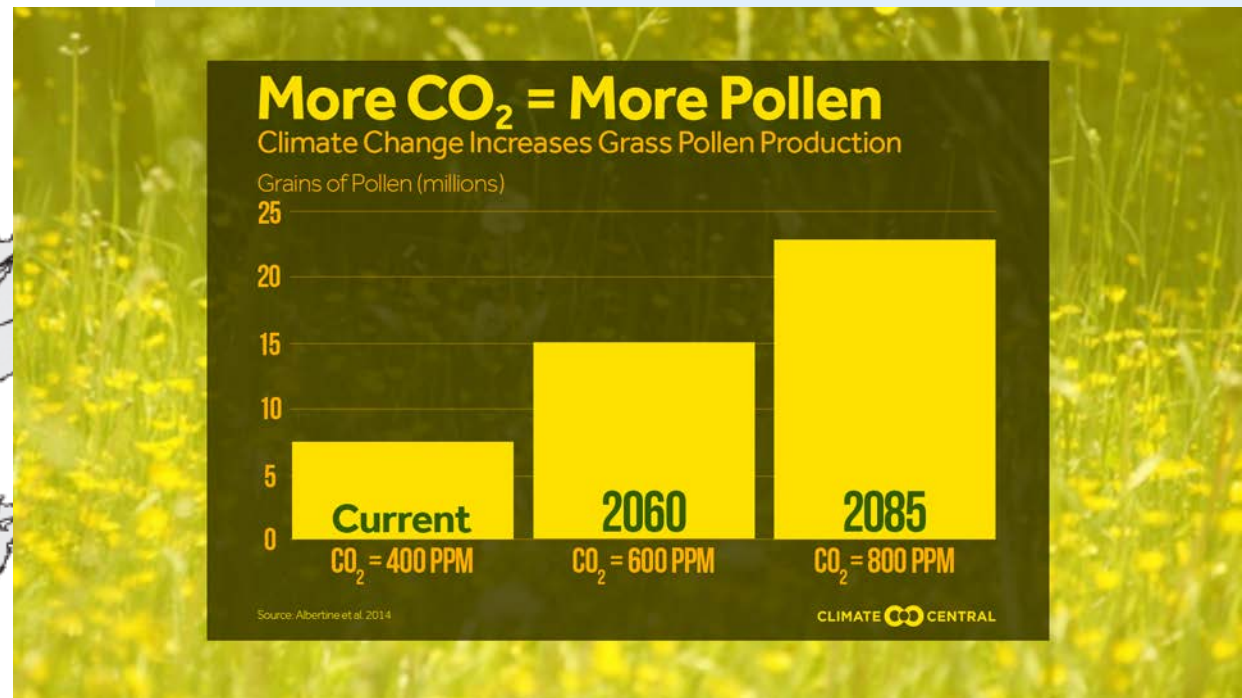


USG = Unhealthy for sensitive groups
Source: Bowe et al (2018), Cohen et al (2017)

Ragweed Pollen Season Lengthens

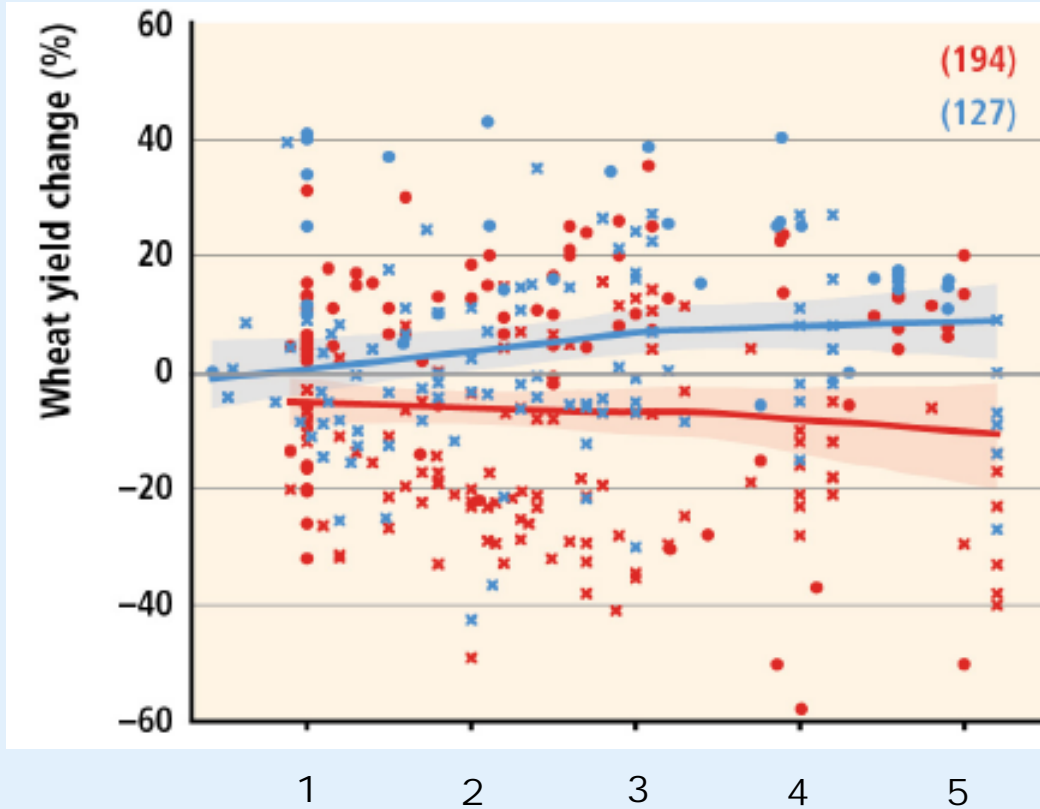


Change in Ragweed Season Length (Days)

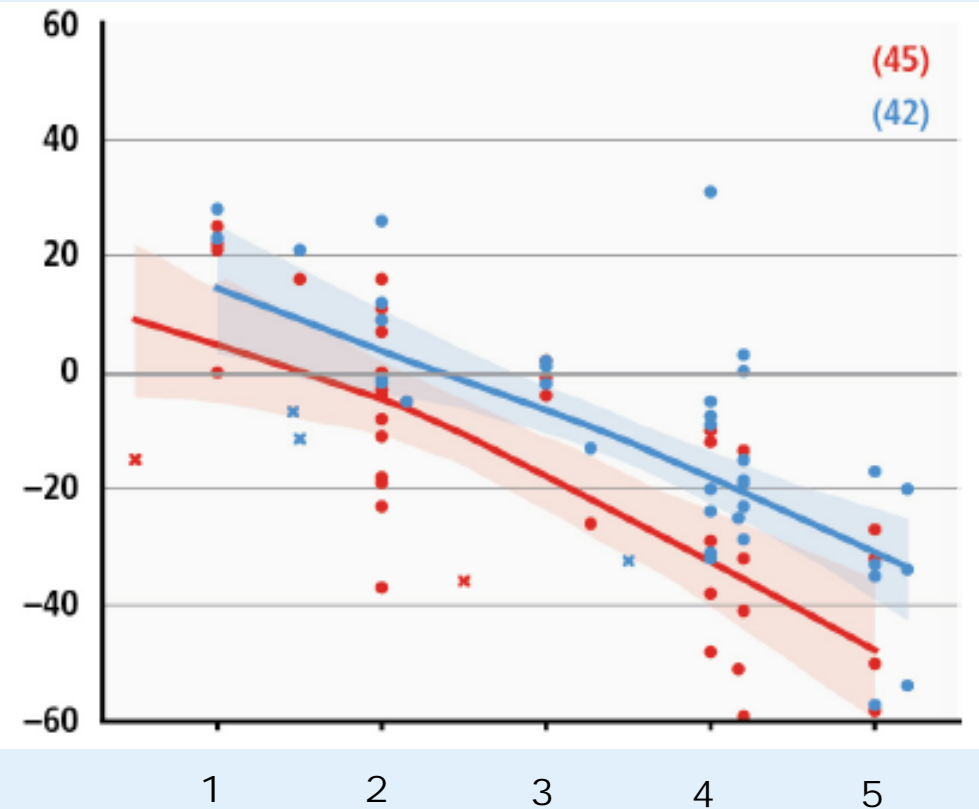


Wheat yields % change vs. local temperature change

Temperate regions



Tropical regions



Local mean temperature change (°C)

FIGURE 2.1 Climate change could sharply reduce crop yields

(Change in yields compared to no climate change)

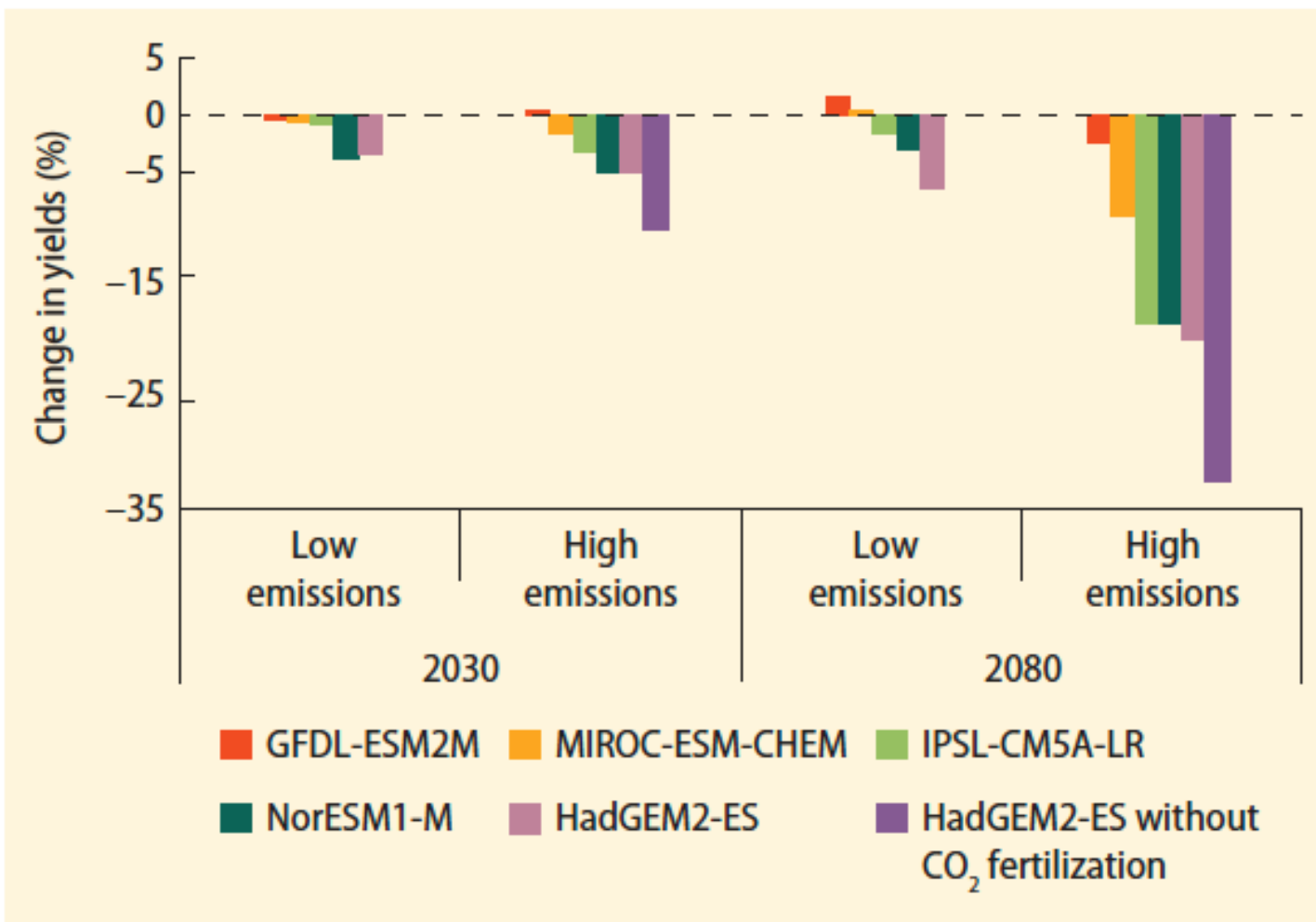
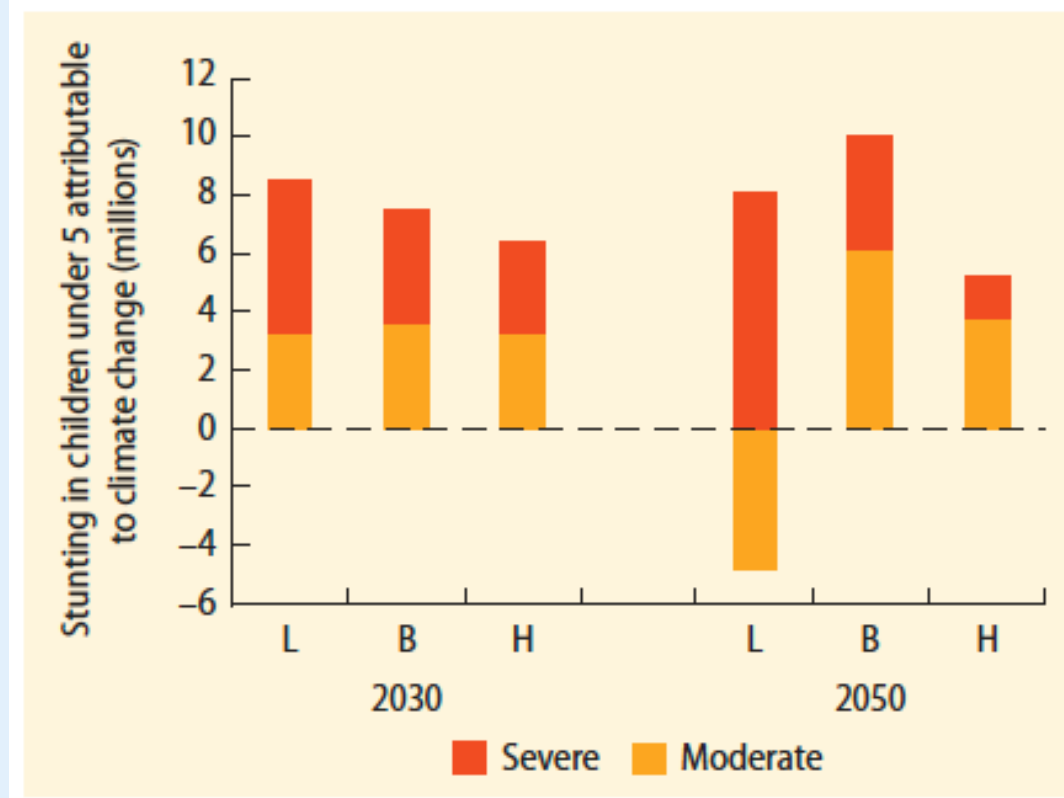
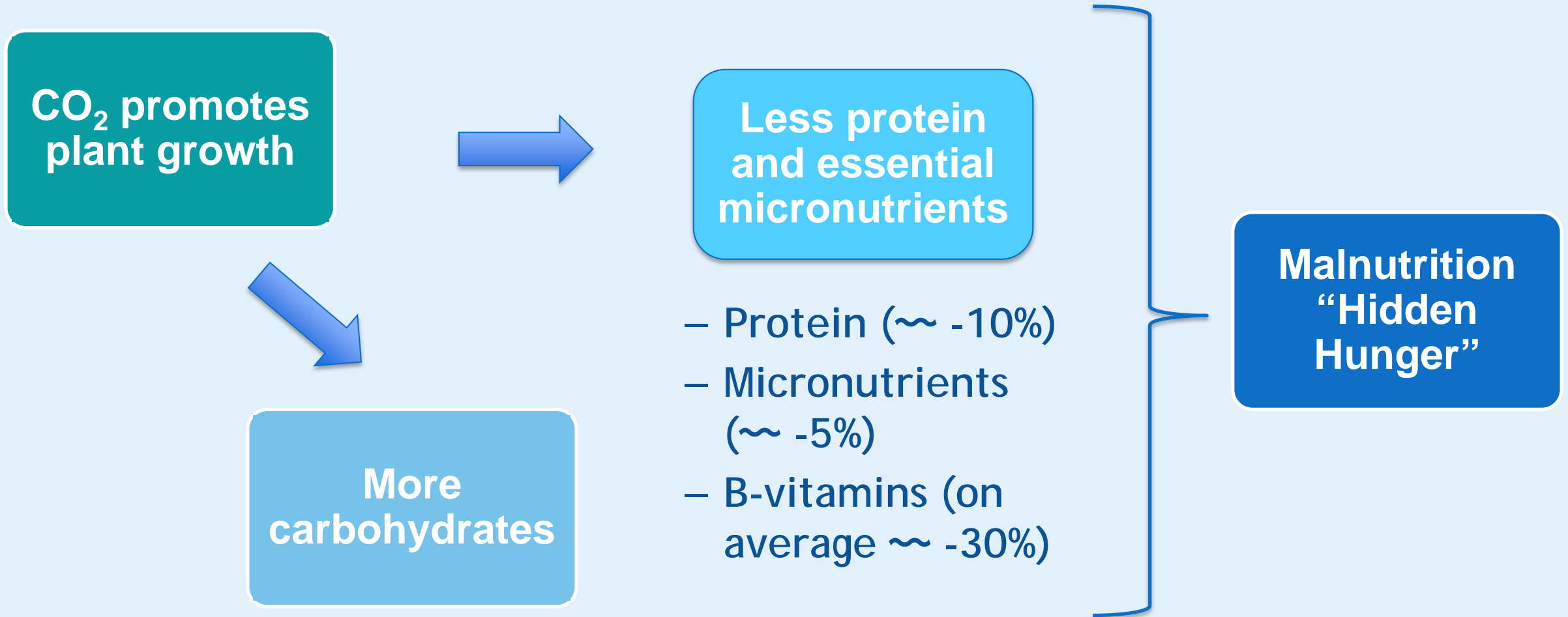


FIGURE 4.6 Stunting projections for 2030 and 2050 suggest that regardless of the socioeconomic scenario, climate change will increase severe stunting among children under 5



High CO₂ and warming temperatures are expected to alter the nutritional quality of C₃ crops



Positive influence:

- Technology change
- Market responses
- CO₂ fertilization

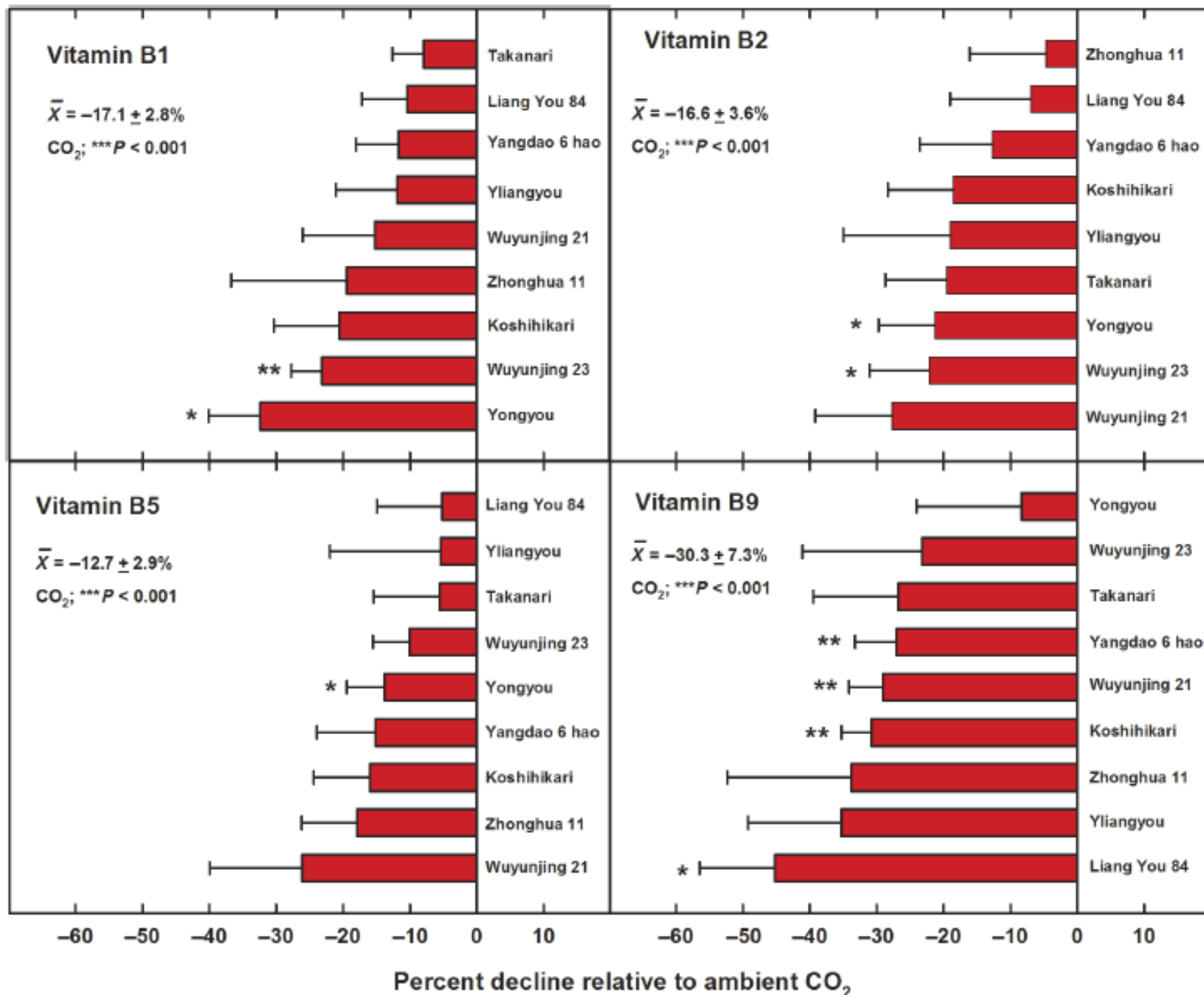
Global availability of dietary protein, iron, & zinc

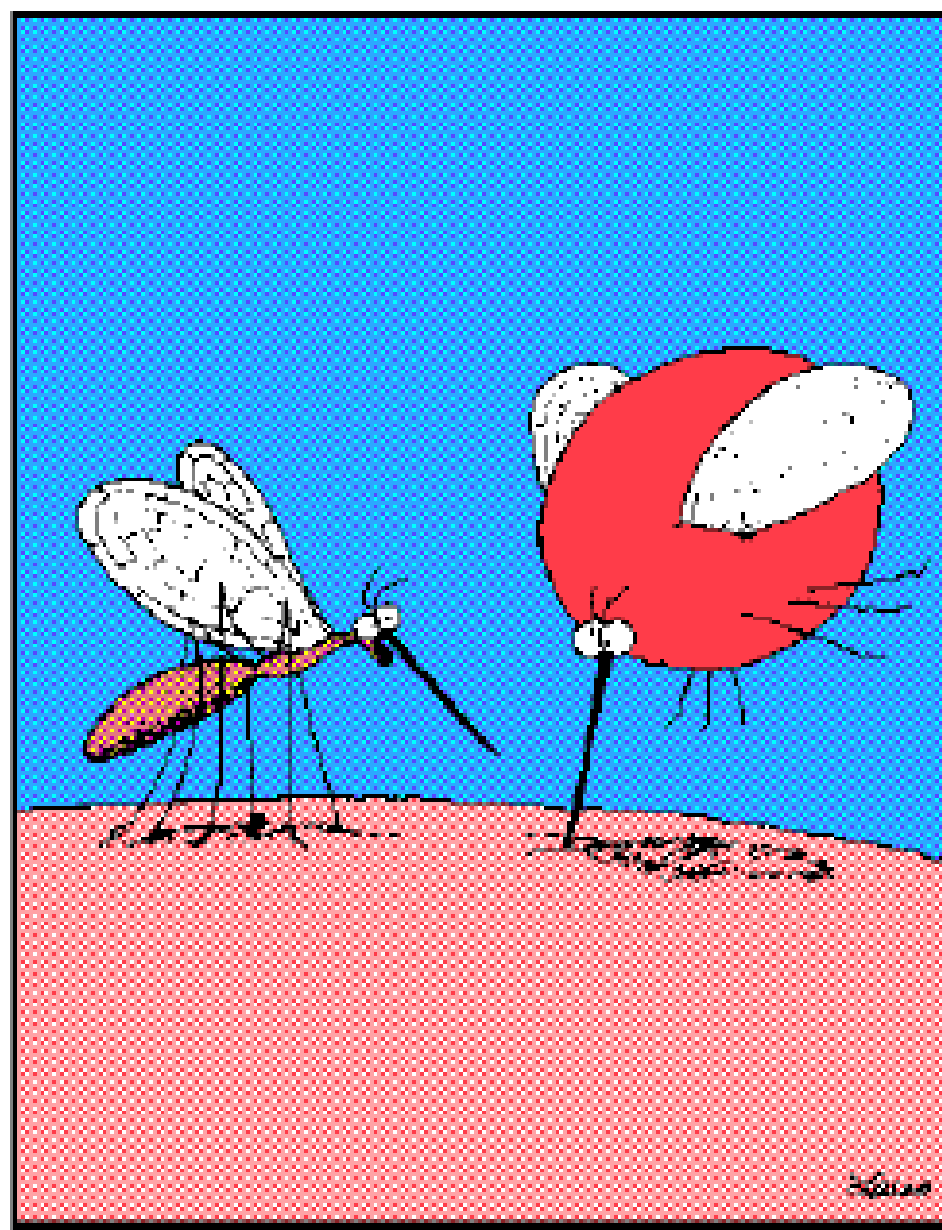
Negative influence:

- Climate change impacts on productivity
- Carbon penalties on nutrient content

Combined impacts in 2050: decreased growth in global availability of

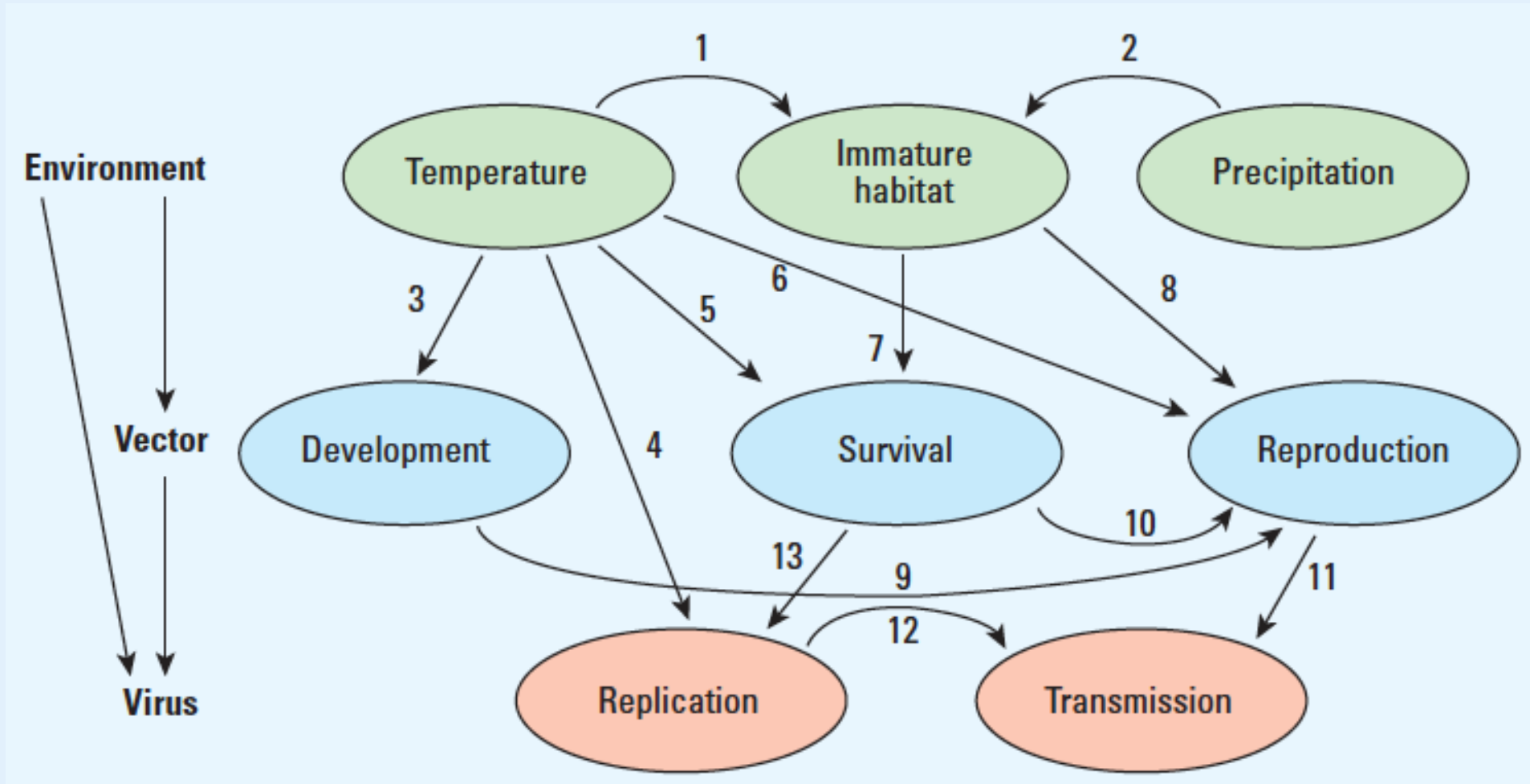
- Protein by 19.5%
- Iron by 14.4%
- Zinc by 14.6%





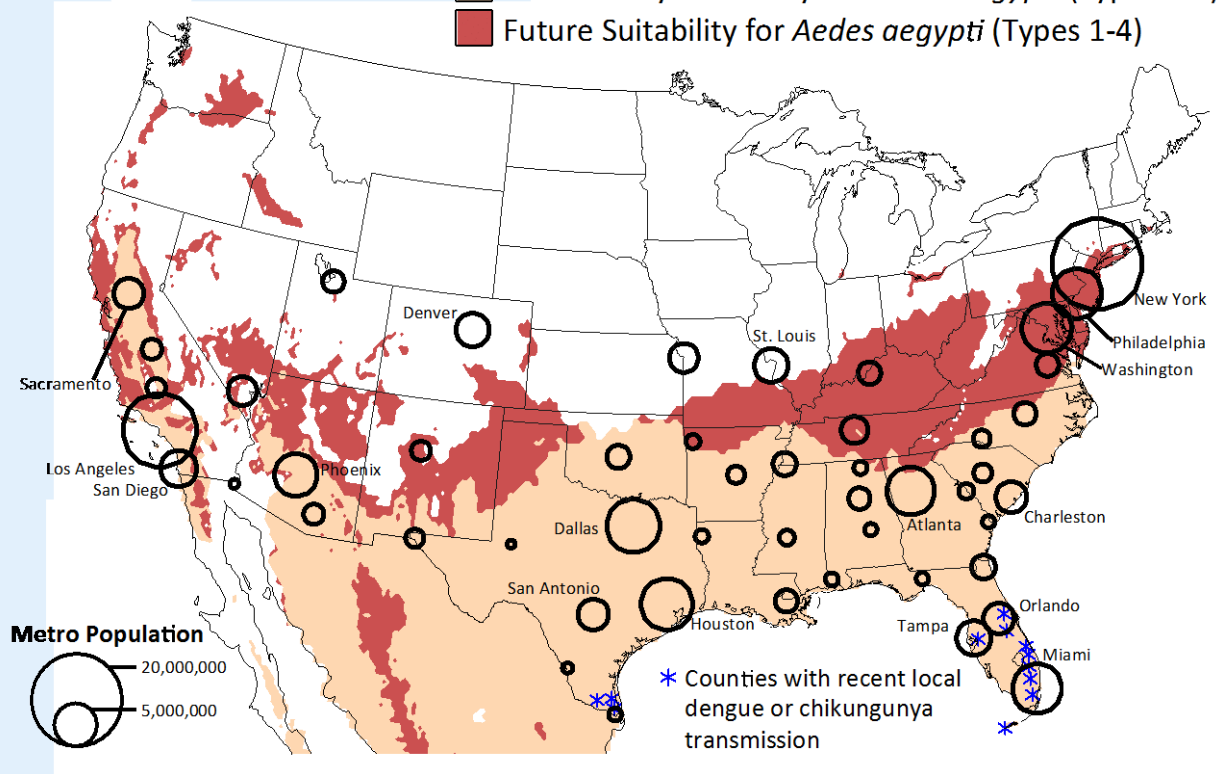
“Pull out, Betty! Pull out! ...
You’ve hit an artery!”

Biophysical influences on dengue ecology showing the interactions between climate variables, vectors, and the virus



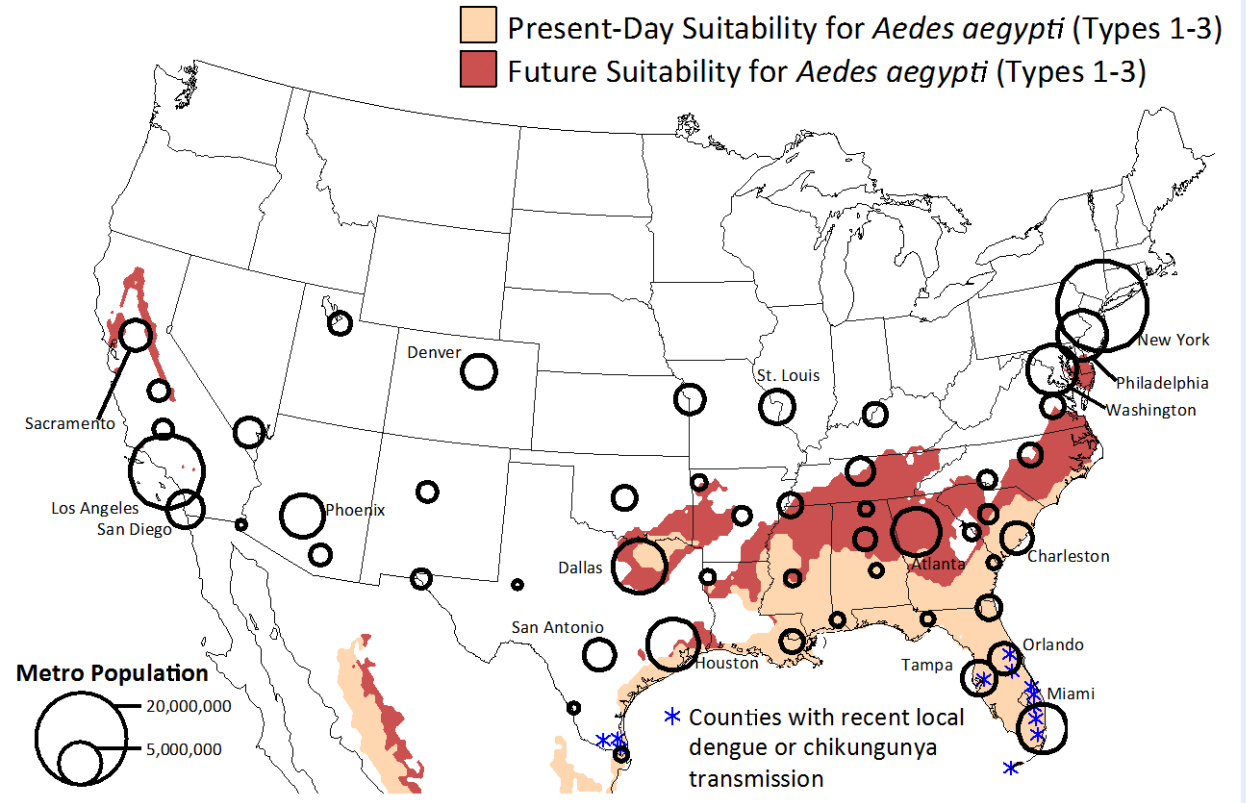
Ae. aegypti suitability

- Present-Day Suitability for *Aedes aegypti* (Types 1-4)
- Future Suitability for *Aedes aegypti* (Types 1-4)



Ae. aegypti transmission suitability

- Present-Day Suitability for *Aedes aegypti* (Types 1-3)
- Future Suitability for *Aedes aegypti* (Types 1-3)



Map shows the range of the *Aedes aegypti* mosquito for present-day (1950-2000) and future (2061-2080; RCP8.5) conditions. Larger cities have higher potential for travel-related virus introduction and local virus transmission. Adapted from: Monaghan et al. (2016)

Mosquito species capable of carrying Zika virus found in Ontario

23 Aug 2017



MORE MOSQUITO DAYS

SAN FRANCISCO

1980s

182
DAYS PER YEAR

2010s

217
DAYS PER YEAR

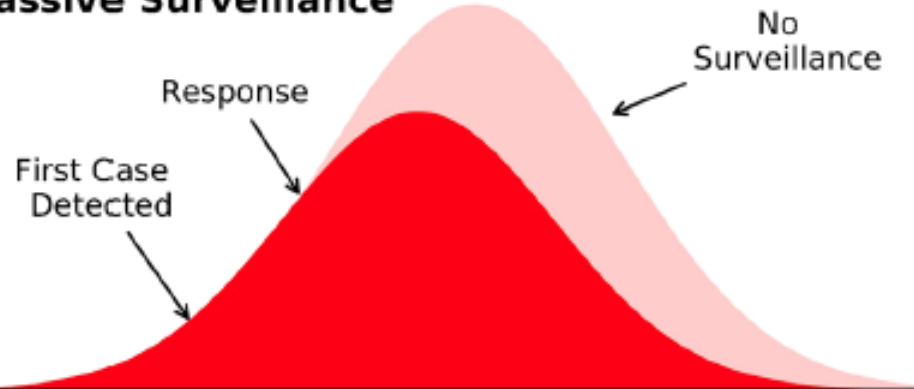


Mosquito days: 50-95°F, relative humidity >42%
Source: Yamane and Eltahir (2013)

CLIMATE  CENTRAL

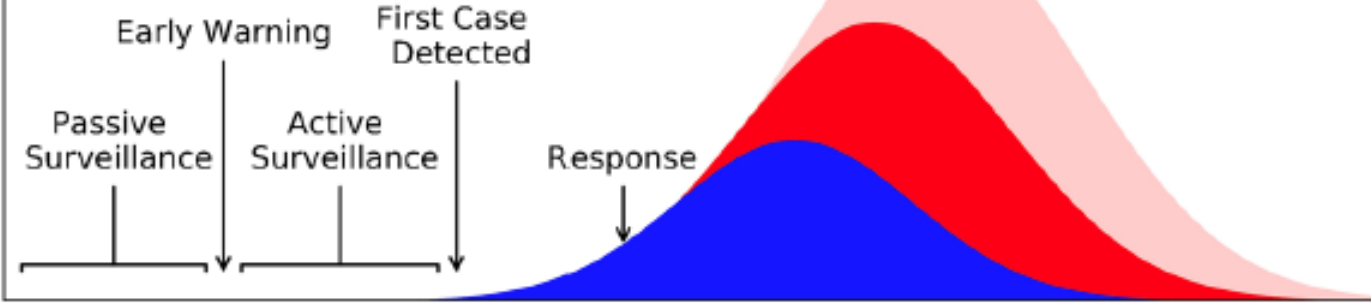
No Surveillance vs Passive Surveillance

Cases

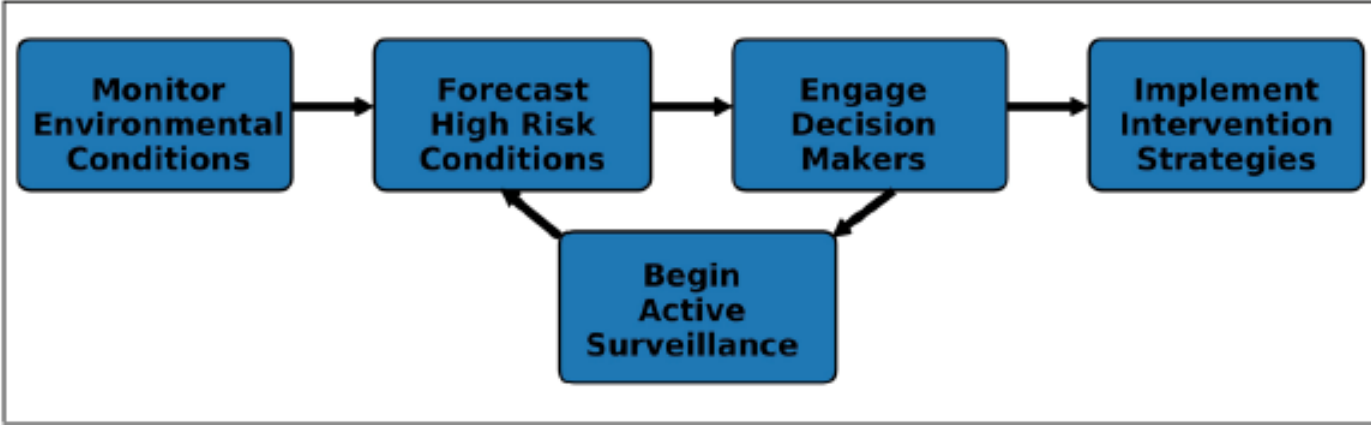


Surveillance with Early Warning

Cases

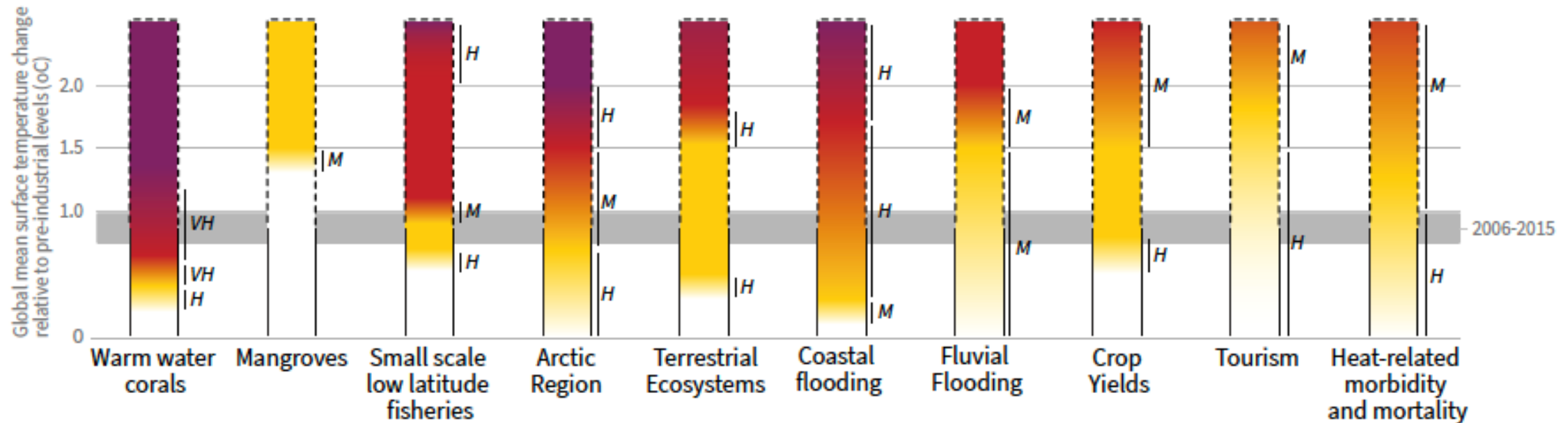


Time



How the level of global warming affects impacts and/or risks for selected natural, managed, and human systems

Impacts and risks for selected natural, managed and human systems



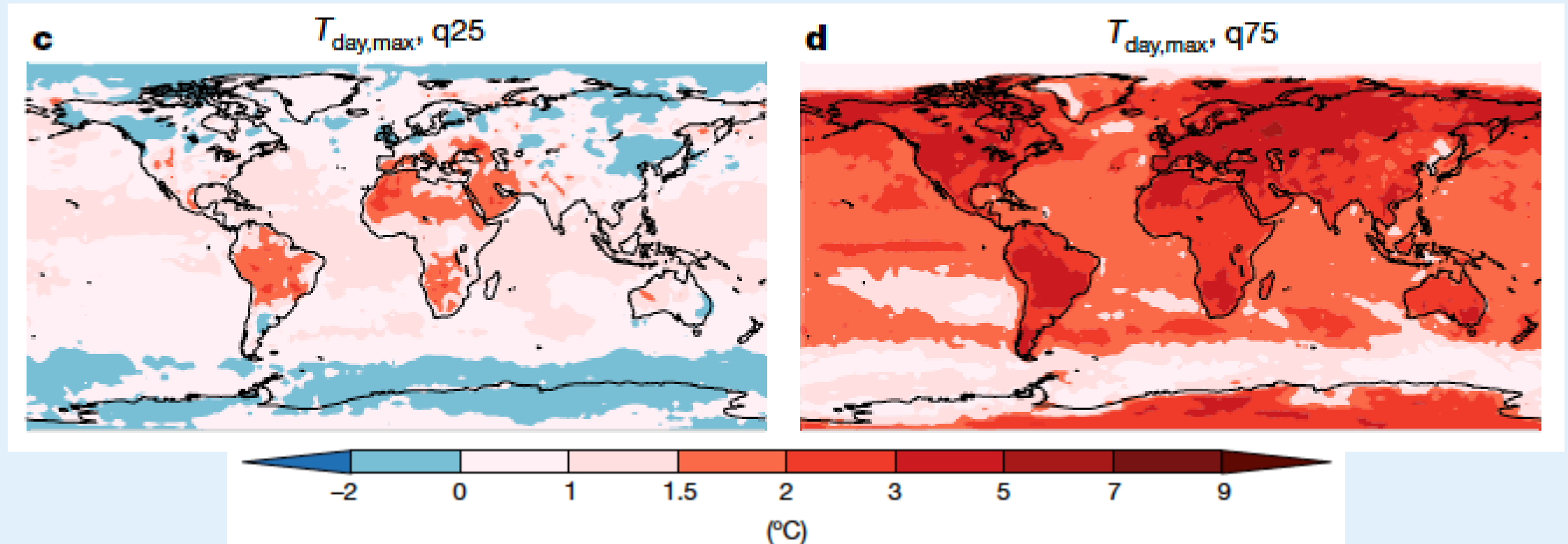
Purple indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.

Red indicates severe and widespread impacts/risks.

Yellow indicates impacts/risks are detectable and attributable to climate change with at least medium confidence.

White indicates that no impacts are detectable and attributable to climate change.

Yearly maximum daytime temperature with a 25% chance of occurring at warming of 1.5°C above preindustrial



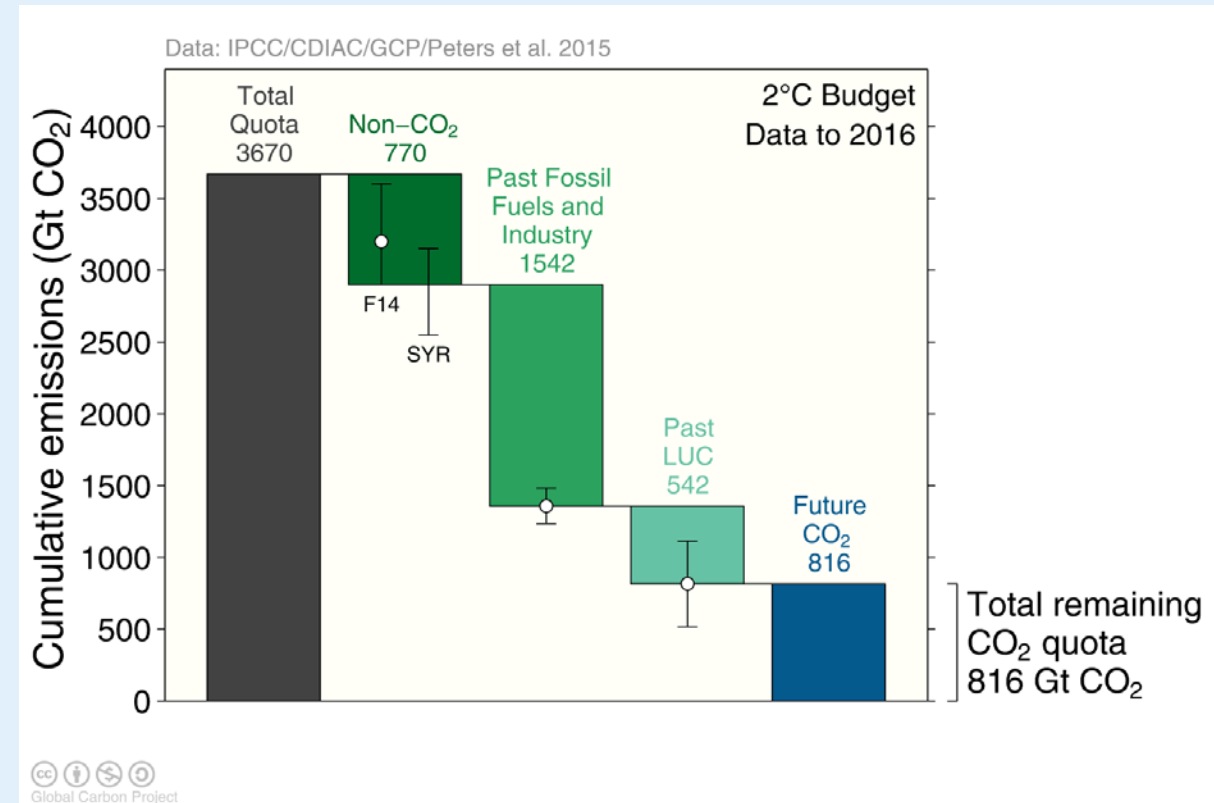
25th percentile

75th percentile

Carbon quota for a 66% chance to keep $< 2^{\circ}$ C

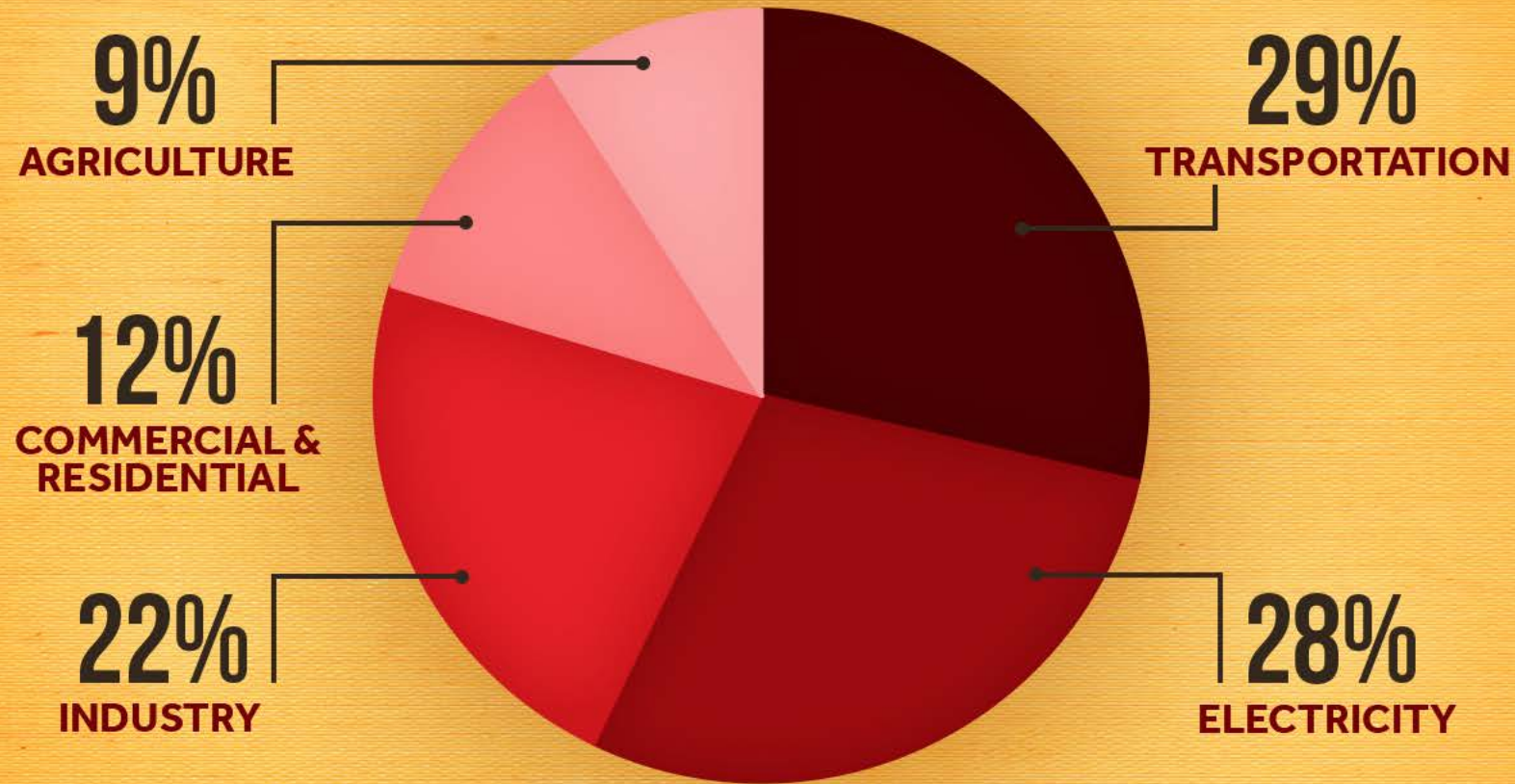
- The total remaining emissions from 2017 to keep global average temperature $< 2^{\circ}$ C
- 800 GtCO₂ will be used in around 20 years at current emission rates

- Grey: Total CO₂-only quota for 2° C with 66% chance. Green: Removed from CO₂ only quota. Blue: Remaining CO₂ quota.
 - The remaining quotas are indicative and vary depending on definition and methods
- Source: [Peters et al 2015](#); [Global Carbon Budget 2016](#)



GREENHOUSE GAS SOURCES

UNITED STATES EMISSIONS BY SECTOR



Source: U.S. EPA 2017 (released 2019)

EMISSIONS FLIP

Transportation is Biggest Source of U.S. Emissions

Million Metric Tons of Carbon Dioxide



Source: EIA, Annual Energy Review

CLIMATE CO CENTRAL



Co-benefits – early health gains from wise climate moves

Shifting 5% of short urban car trips to bicycles in New Zealand would save annually

- 22 million liters of fuel
- 116 deaths due to increased physical activity (vs. 5 extra road crash deaths)
- \$200 million in health costs



Estimated % of adults who are interested in news stories about the impacts of global warming on your local community (78%), 2020

Select Question:

Click on map to select geography, or:

- National
- States
- Congressional Districts
- Counties**

