

Climate Change: Interconnectedness and Co-Benefits



THAWING PERMAFROST

COAL MINING

COAL PLANTS

AIR TRANSPORT

OIL PRODUCTION

FERTILIZATION

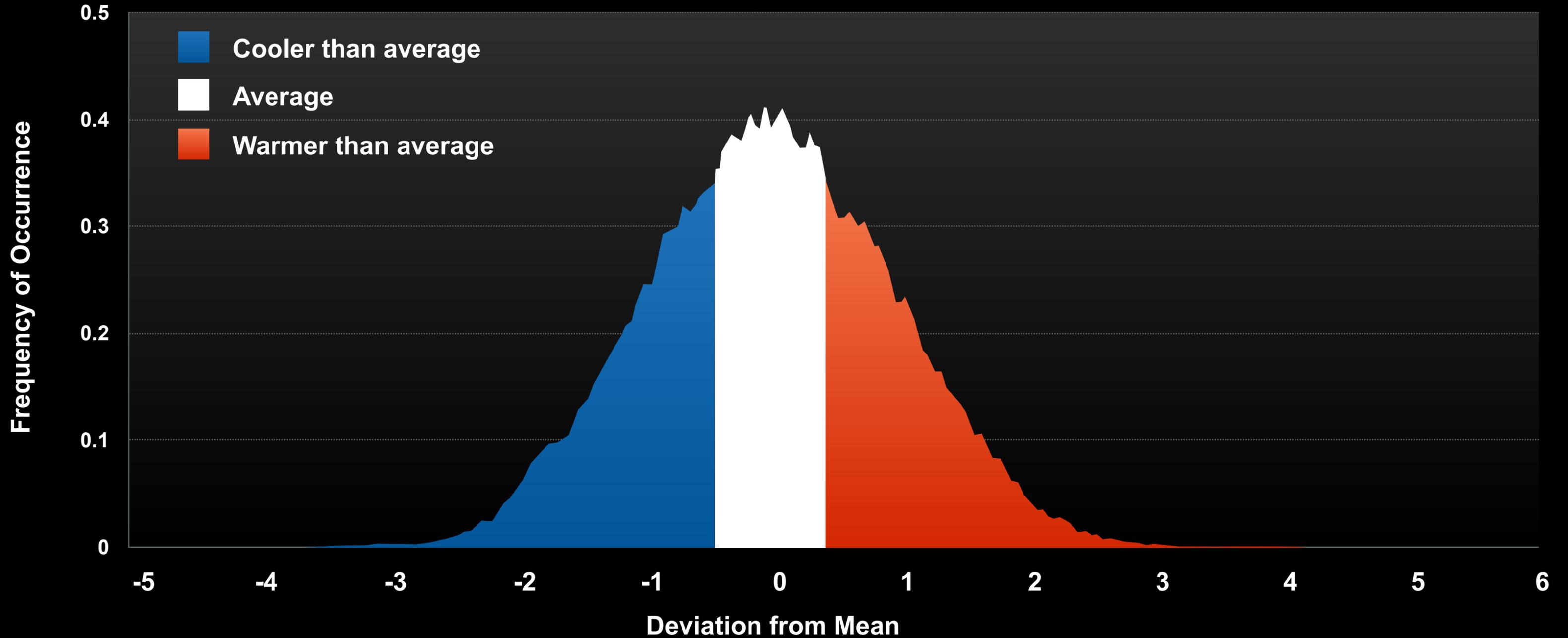
LAND TRANSPORT

INDUSTRIAL PROCESSES

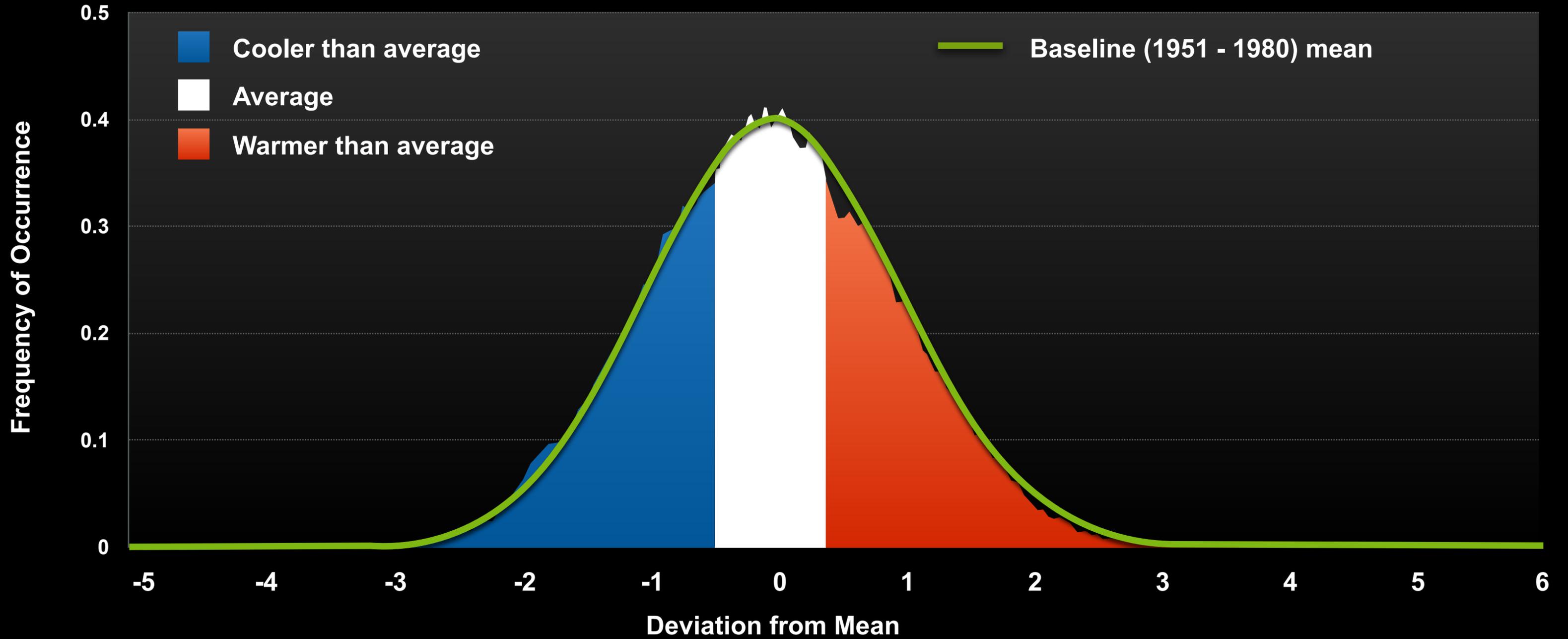
LANDFILLS

Northern Hemisphere Summer Temperatures Have Shifted

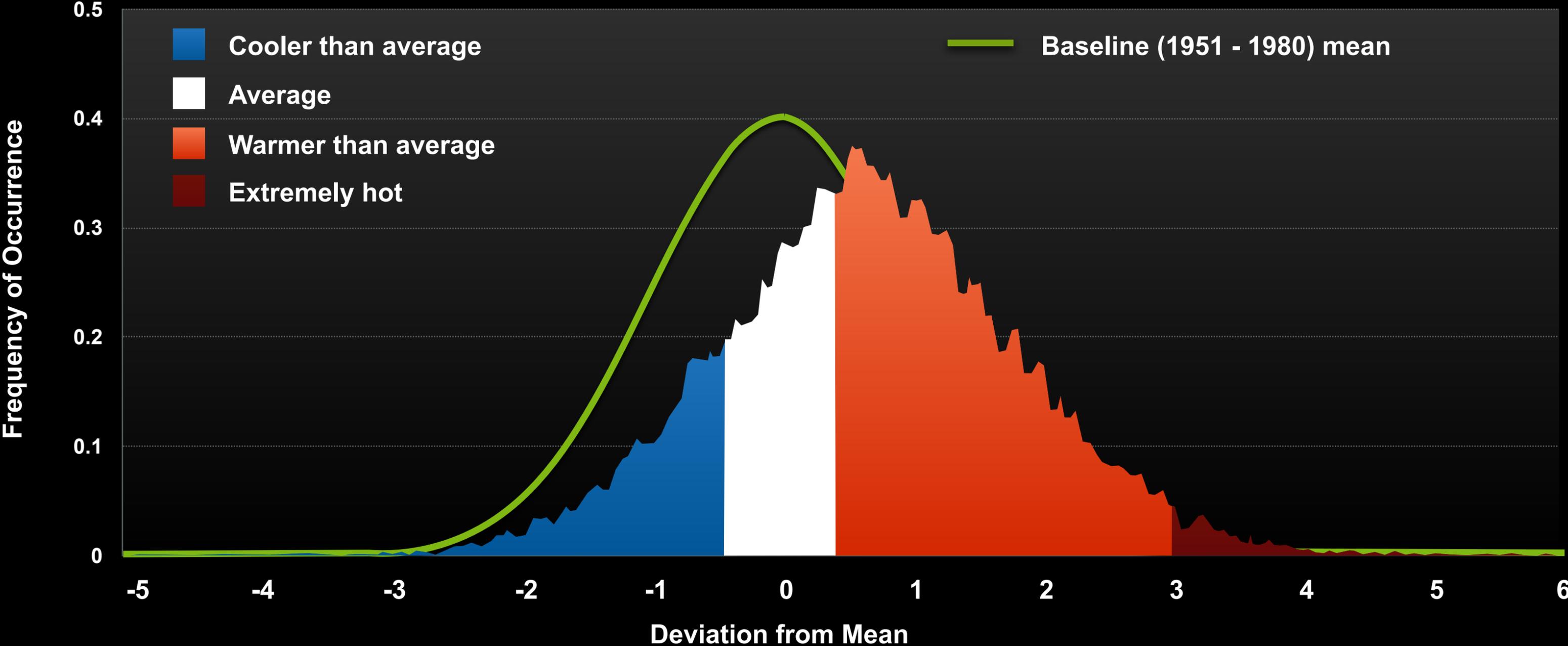
1951 – 1980



1951 – 1980

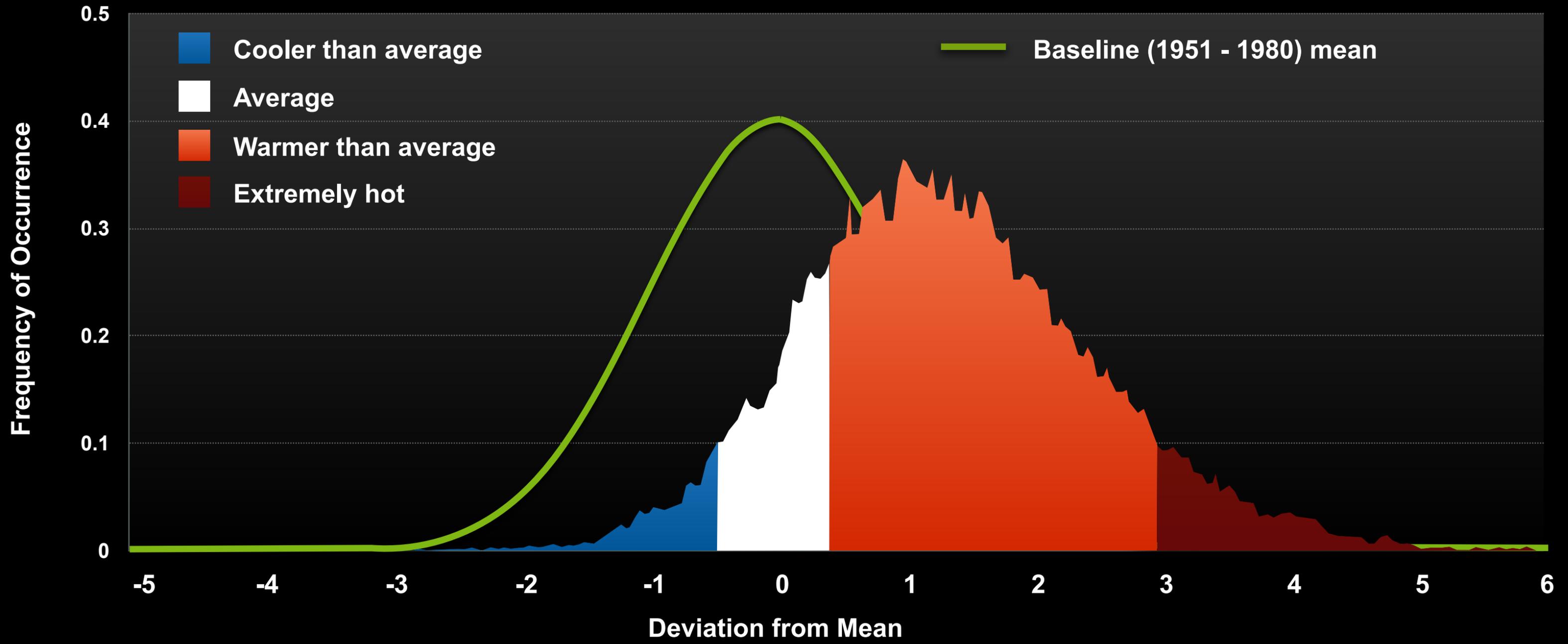


1987 – 1997

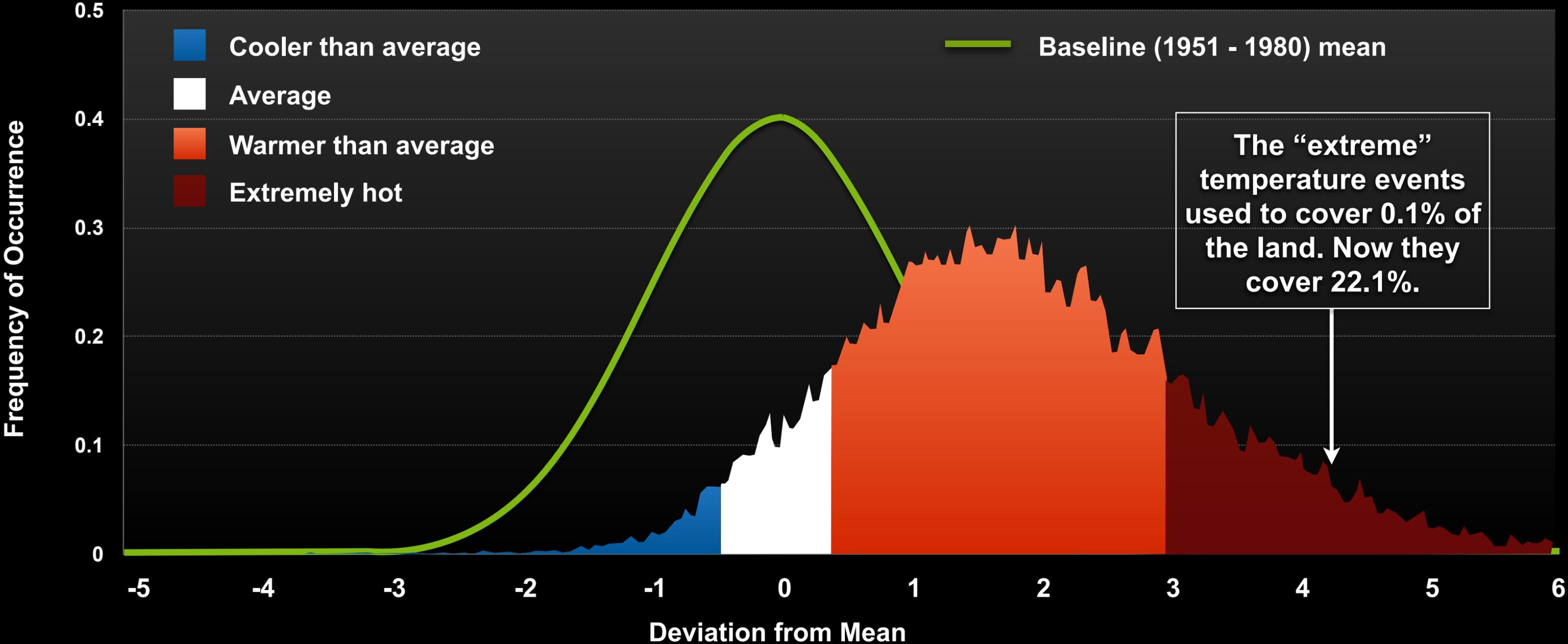


Data: James Hansen and Makiko Sato, July 2020

1998 – 2008



2009 – 2019



Externality

The cost or benefit that affects a third party who did not choose to incur that cost or benefit.

Honey Bees



Pig Farms

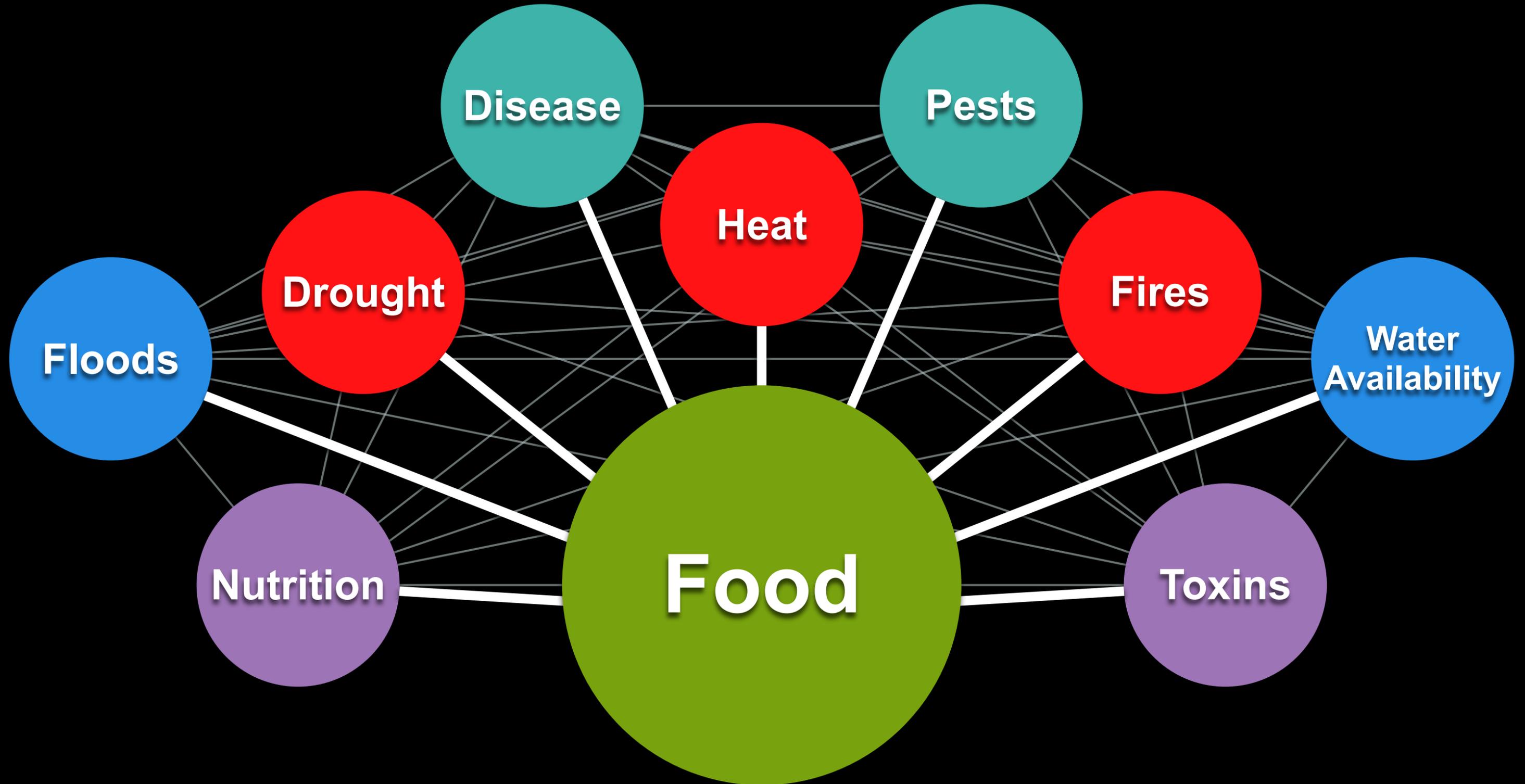


Lifecycle Costs

Sum of all recurring and non-recurring costs over a specified period for a good, service, structure, or system.

- **Lifecycle costs are especially important to consider for solutions with higher upfront costs and low operating costs.**
- **The incentives for elected officials (short election cycles) are often in conflict with a focus on lifecycle costs.**
- **Financing mechanisms can be as important as the technology. PACE (Property Assessed Clean Energy) is an example of financing innovation.**

How Does Climate Change Affect Food Supply?

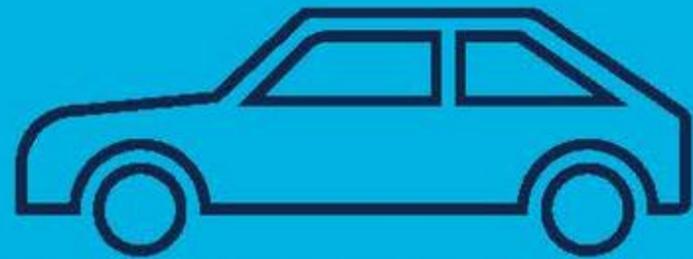


Food Waste - More than Just Food is Lost

MORE THAN JUST FOOD

THE U.S. WASTES TONS OF RESOURCES WHEN WE WASTE FOOD

2.6% OF ALL U.S. GREENHOUSE GAS EMISSIONS ANUALLY



37 MILLION PASSENGER VEHICLES' WORTH

21% OF THE U.S. AGRICULTURAL WATER USAGE

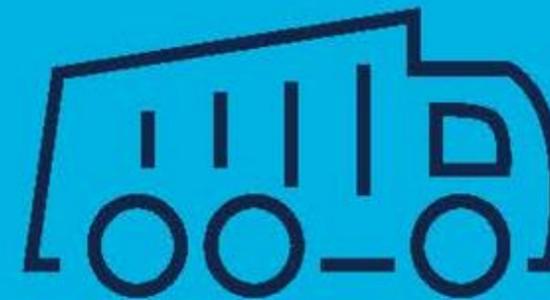


MORE THAN: TEXAS + CALIFORNIA + OHIO

1,250 CALORIES PER PERSON PER DAY
THAT IS HALF OF THE RECOMMENDED DAILY INTAKE FOR ADULTS

19% OF ALL U.S. CROPLANDS
THAT IS MORE LAND THAN ALL OF NEW MEXICO

21% OF U.S. LANDFILL CONTENT



THE NO. 1 CONTRIBUTOR BY WEIGHT

18% OF ALL FARMING FERTILIZER
WHICH CONTAINS 3.9 BILLION POUNDS OF NUTRIENTS

\$218,000,000,000

WHICH IS EQUAL TO 1.3% OF THE U.S. GROSS DOMESTIC PRODUCT (GDP)

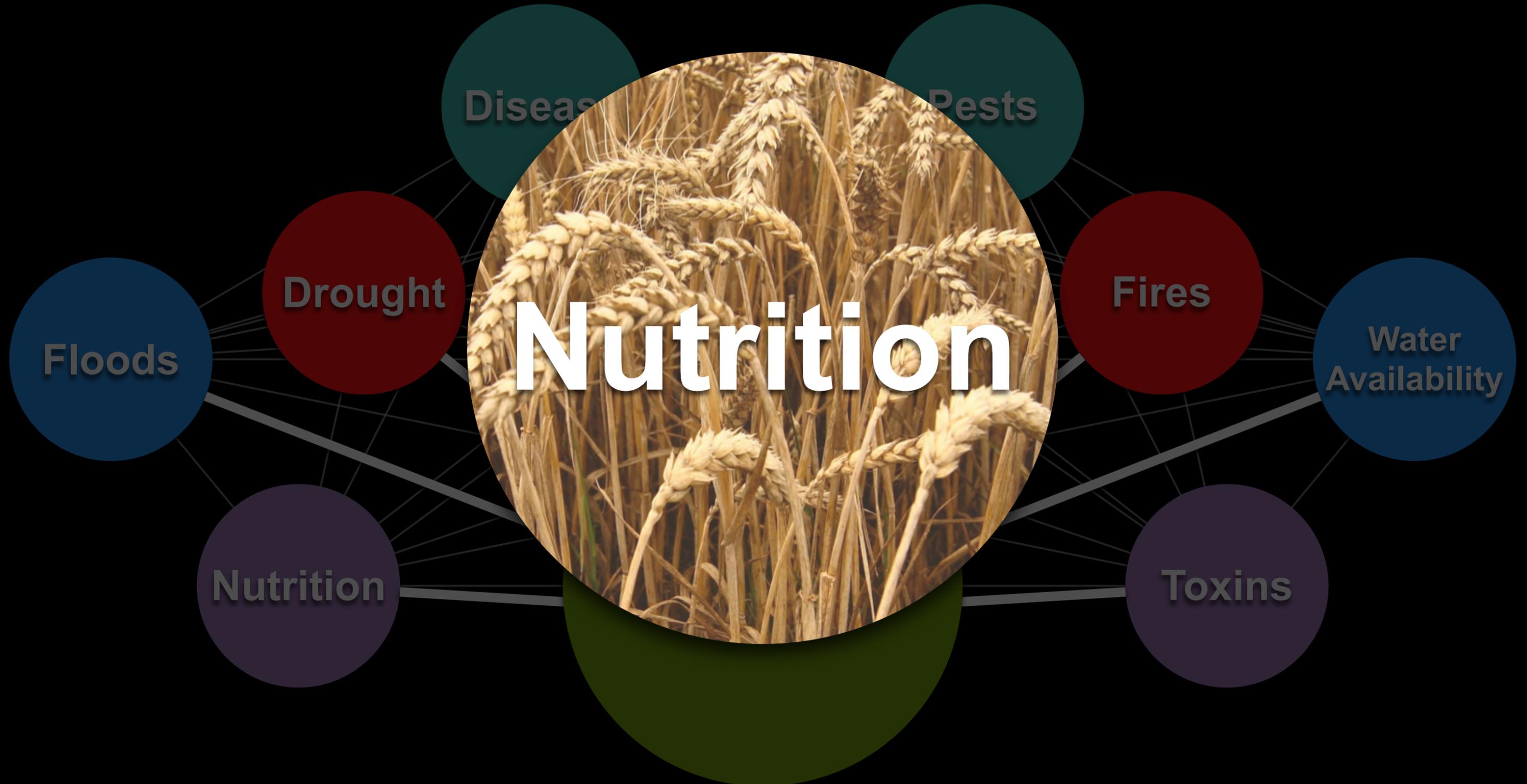


Food Waste - More than Just Food is Lost

As stated in Livable Frederick, the county has a goal to achieve a 60% food waste recycling target for 2025, which represents recovery of 15,000 tons annually.

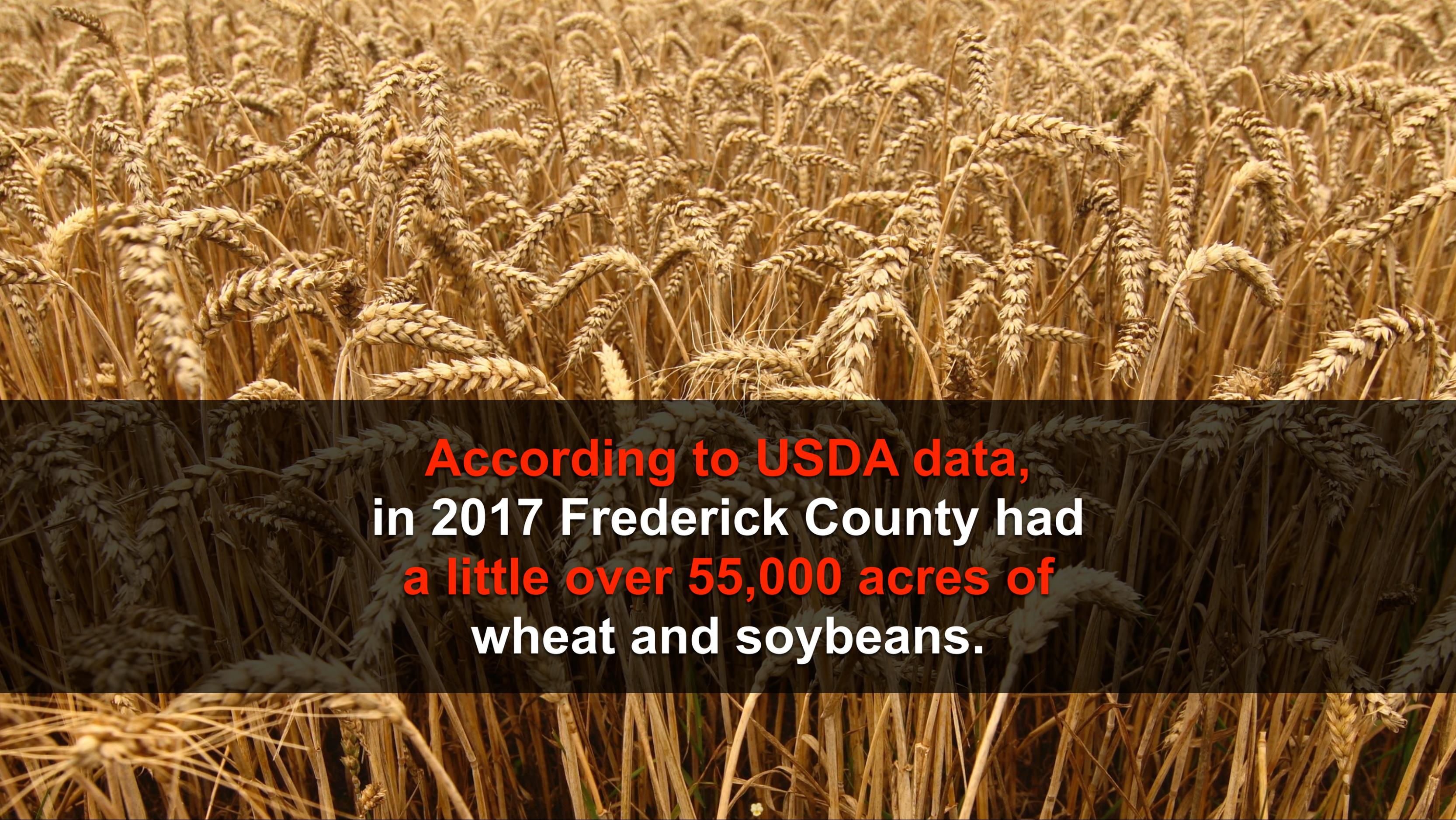
We are not currently on track for this goal.

How Does Climate Change Affect Food Supply?



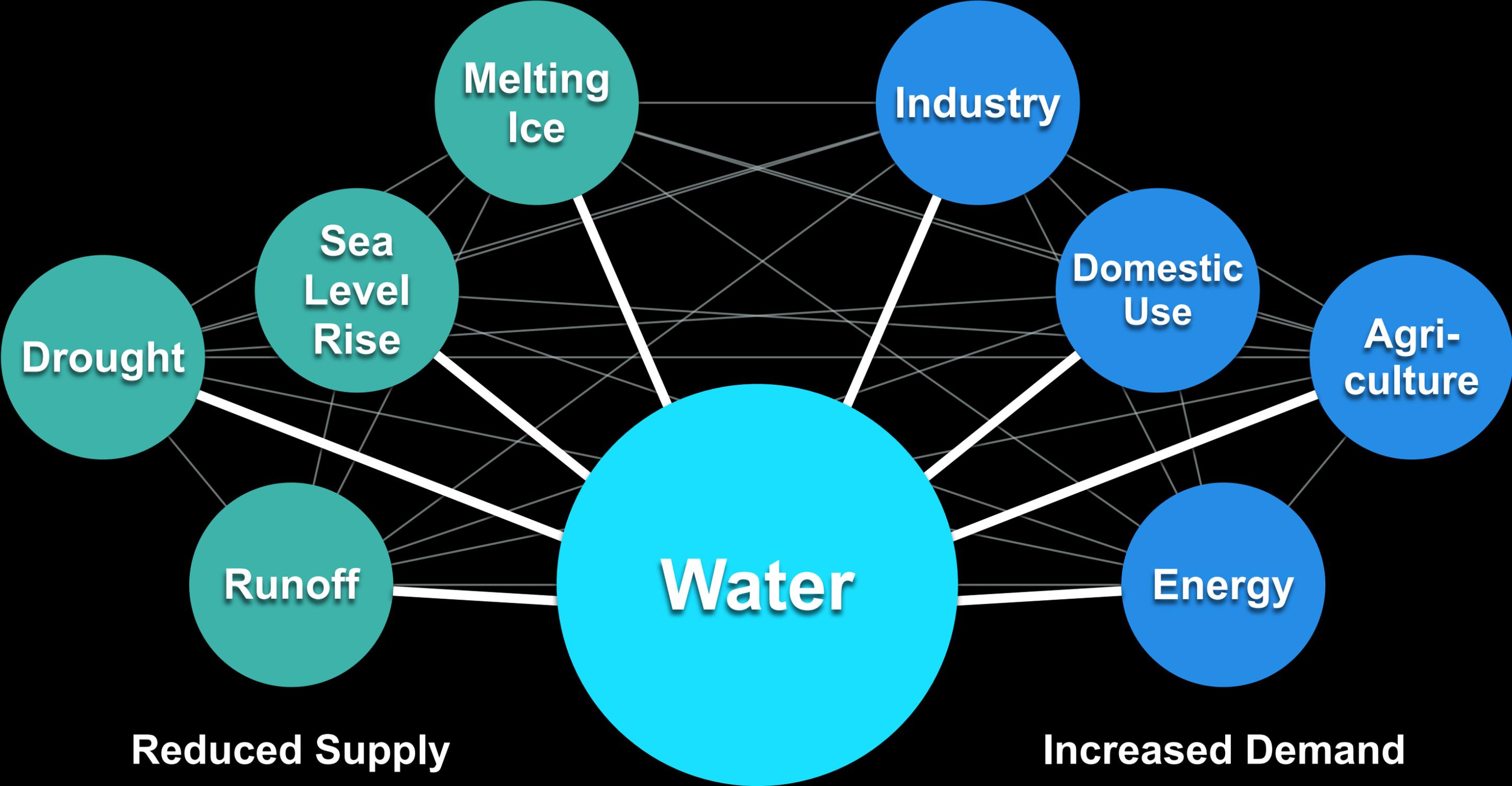


Rising concentrations of CO₂ are
threatening global nutrition by
reducing levels of nutrients
in food crops like rice, wheat, and soybeans.

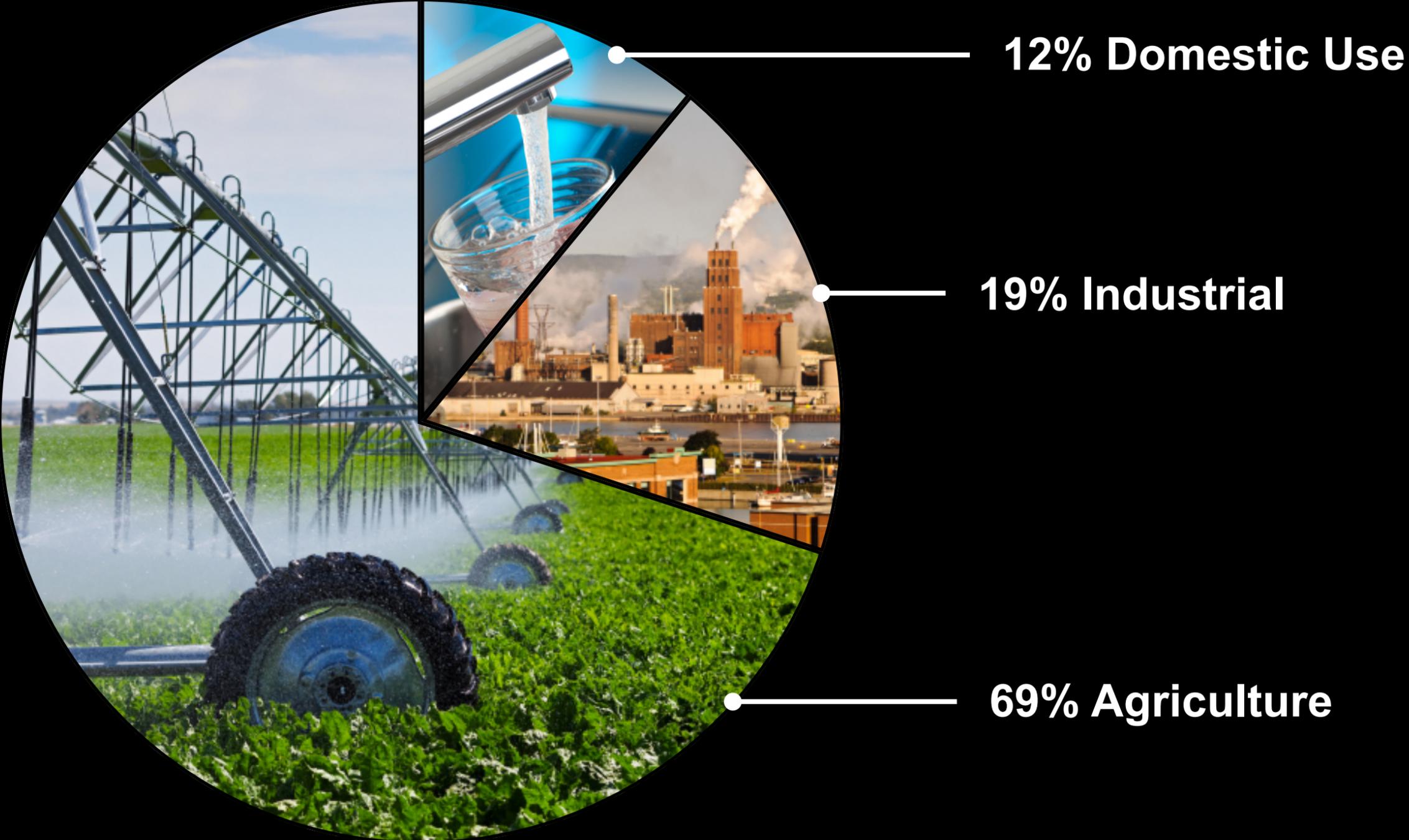


According to USDA data,
in 2017 Frederick County had
a little over 55,000 acres of
wheat and soybeans.

How Does Climate Change Affect Water Availability?



Global Water Use



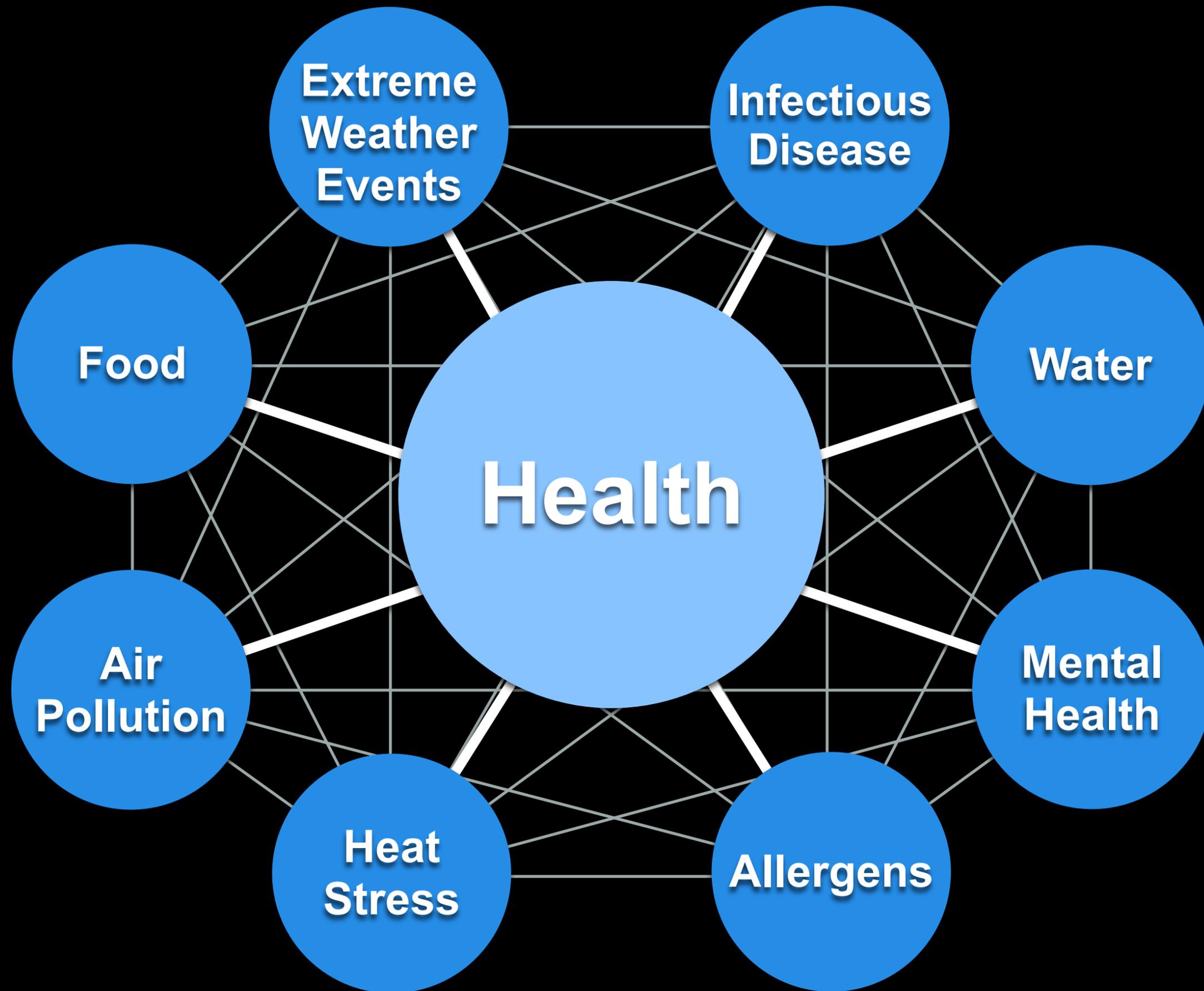
Source: FAO, 2012. Photos: © iStockphoto/Kenneth Wiedemann; © iStockphoto/Courtney Keating; © iStockphoto/Brenda A. Carson

Flooding in Frederick County

Impacts Include:

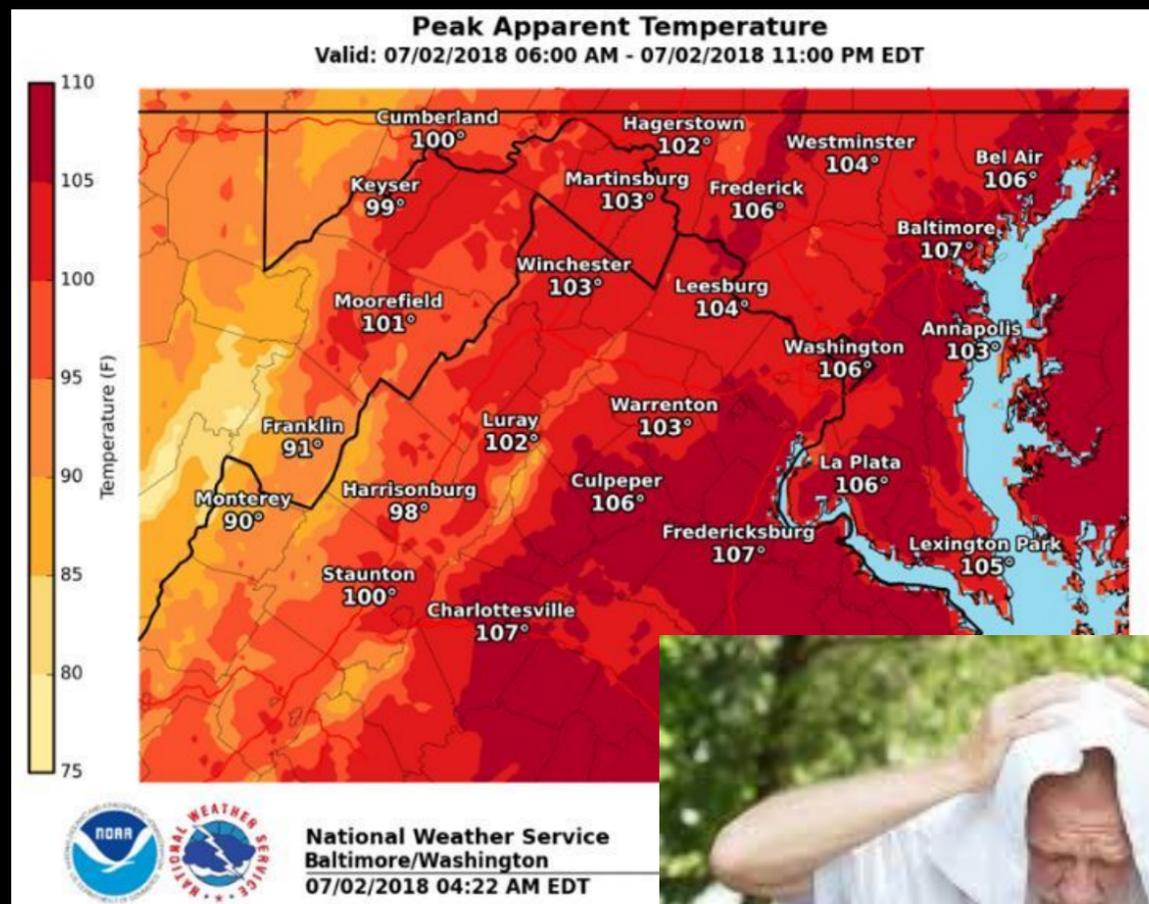
- Damage to infrastructure
- Personal risk/injury
- Damage to homes, businesses, and farms
- Loss of income
- Impacts to farm operations





Heat Stress

Rising and abnormally high temperatures are a risk for many groups in Frederick County including outdoor workers and older populations.



Interconnectedness

Types of Infrastructure at Risk from Extreme Weather

Dams

Flood Barriers

**Stormwater
Drainage**

Sewage Systems

Roads

Train Tracks

Airport Runways

**Building
Foundations**

Power Plants

Power Lines

Aqueducts

**Drinking Water
Systems**

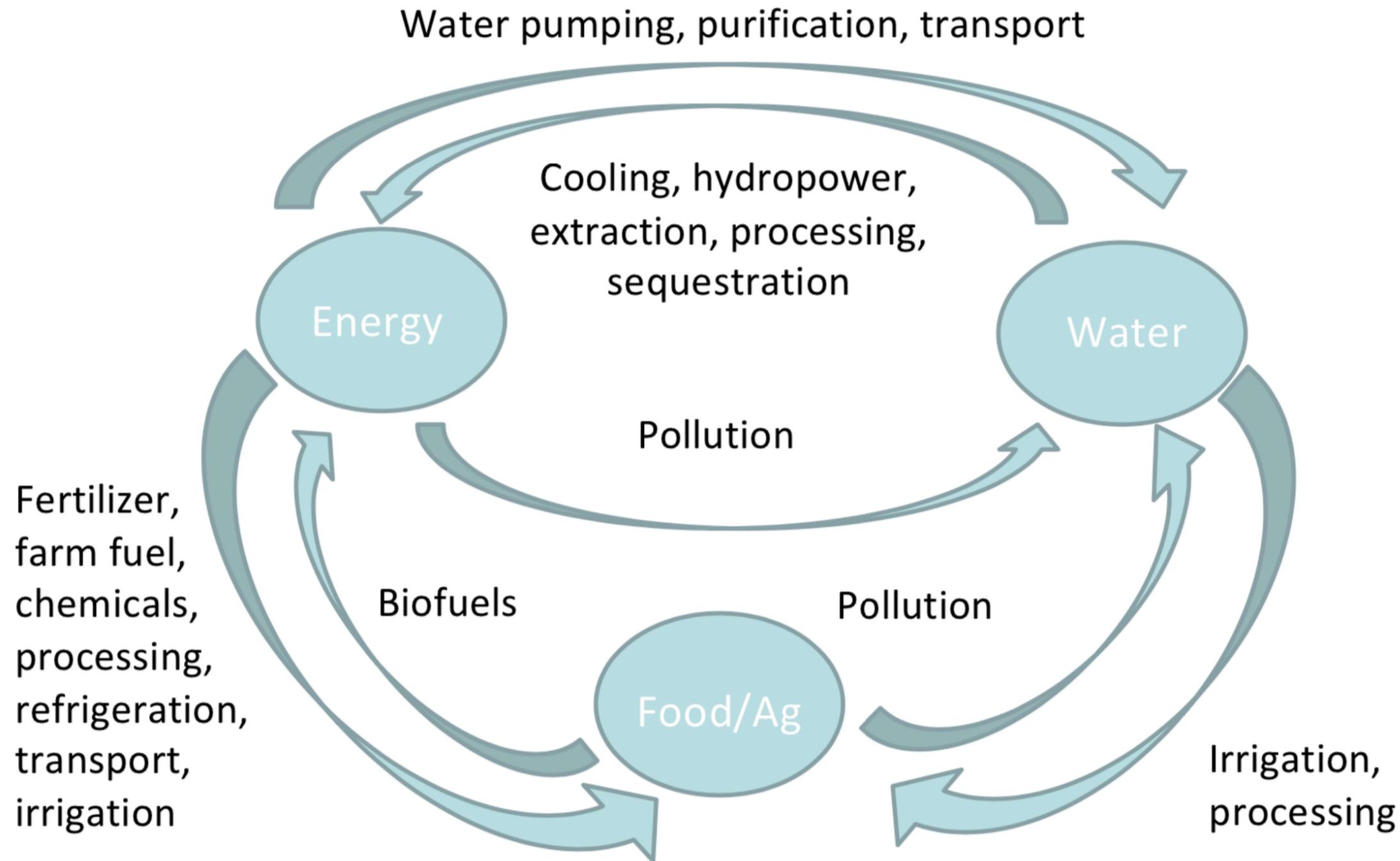
Bridges

Agriculture

**Oil and Gas
Pipelines**

Communications

Energy-Water-Food System Interdependencies



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Live Online CC-P® Prep Program #3

GHG-102: Fundamentals of the Energy-Water-Food Nexus

August 17, 2020



Subgroup Interconnectedness Examples

**Energy, Buildings, and
Transportation**

Impervious Pavement

**Lower Emissions, Reduction
in Fossil Fuels**

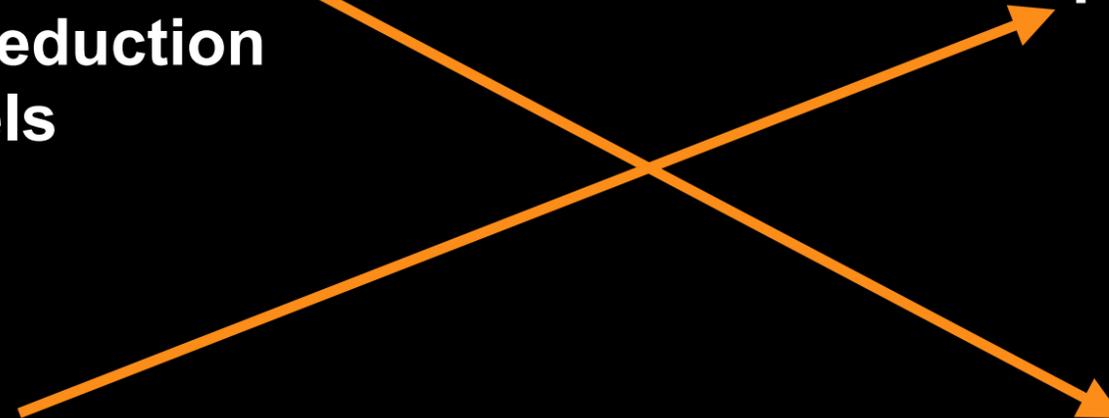


Better Health Due to Less Pollution

**Health and Extreme Weather
Adaptation and Resilience**

**Public Outreach and
Awareness**

**Health Benefits Encourage
People to Embrace Change**



Water and Ag Benefits

**Agriculture, Forestry, and
Sequestration**

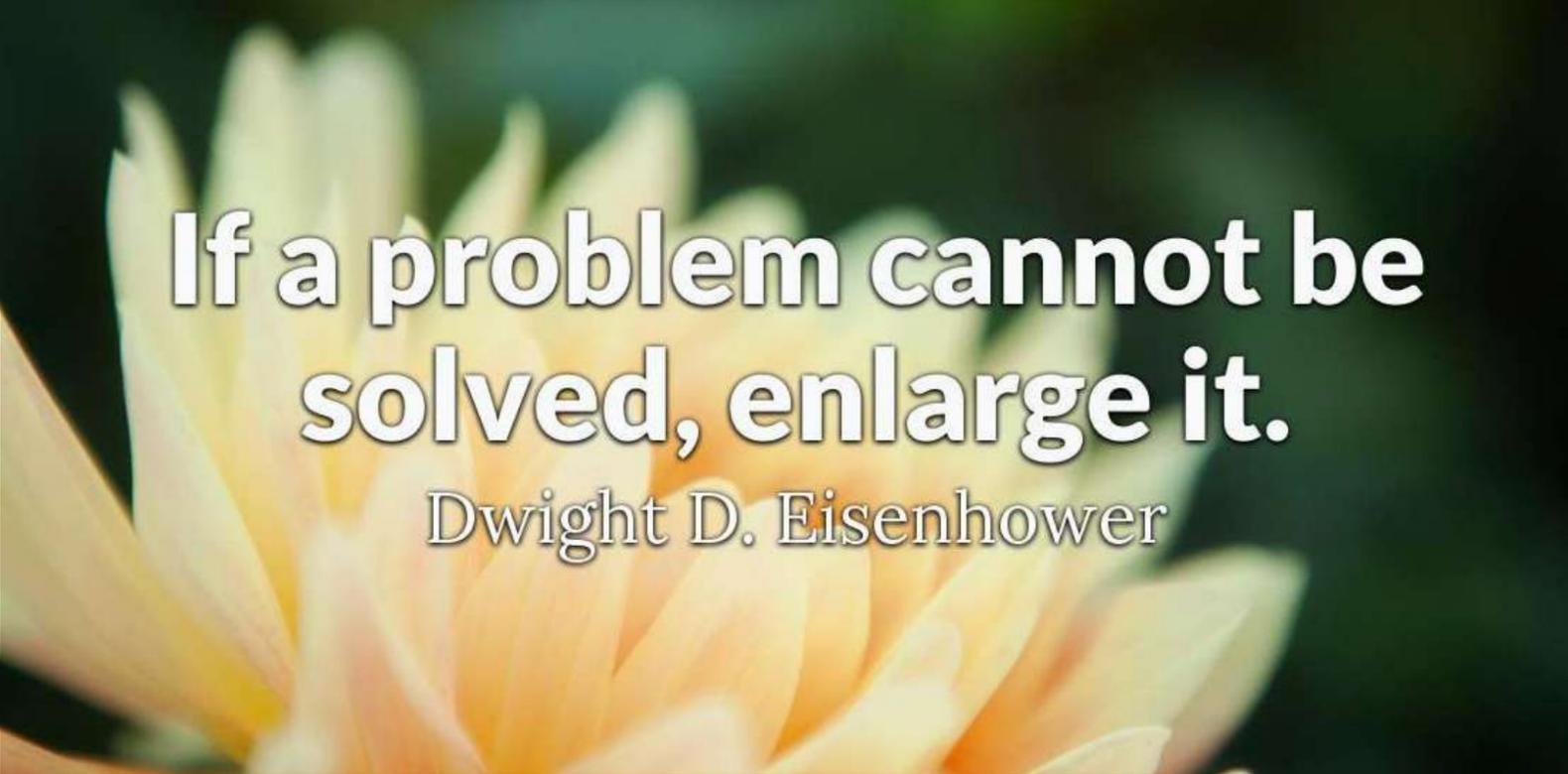
Co-Benefits

Benefits that occur as the result of actions taken to address another issue or concern.

- Benefits can be economic or quality of life.
- May or may not be quantifiable.
- Even when not quantifiable, cost savings are real.
- Often referred to as a win-win scenario.
- May increase stakeholder engagement.

Co-Benefits

Air Quality and Health and Fossil Fuels



If a problem cannot be solved, enlarge it.

Dwight D. Eisenhower

- Research is showing that air pollution is much worse than we thought.
- A transition away from fossil fuels would result in vast improvements in air quality and massive health cost savings.
- This cost savings would more than offset the cost of a transition away from fossil fuels.

Regenerative Ag

Reduction in water use, increases in soil carbon and soil health, reduction in chemical fertilizer usage.

Policy

Legislative and market mechanisms including rules, regulations, and policy.

Eliminating Food Waste

Addressing food waste also addresses the energy, water, fertilizer, and labor embodied in the wasted food.

Renewables

Zero-emission, renewable energy with vast reductions in pollution and water usage.

2030 and 2050

- We need to reduce Greenhouse Gases 50% by 2030 and 100% no later than 2050 to avoid the worst climate impacts.
- We are not acting quickly enough. While slower, emissions are still increasing.
- The economics/lifecycle costs are now mostly positive for climate action. The challenge can be upfront costs.
- Inaction is far costlier than action.
- Co-benefits and multi-win scenarios are real. Look for them.
- We need to be bold, ambitious, and data/science driven.