

IMPACTS OF CLIMATE CHANGE

DR. CAROLYN ENQUIST
USGS ACTING DIRECTOR
SOUTH CENTRAL CLIMATE ADAPTATION SCIENCE CENTER
U.S. GEOLOGICAL SURVEY



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

CLIMATE CHANGE IMPACTS TO...

Agriculture



Water



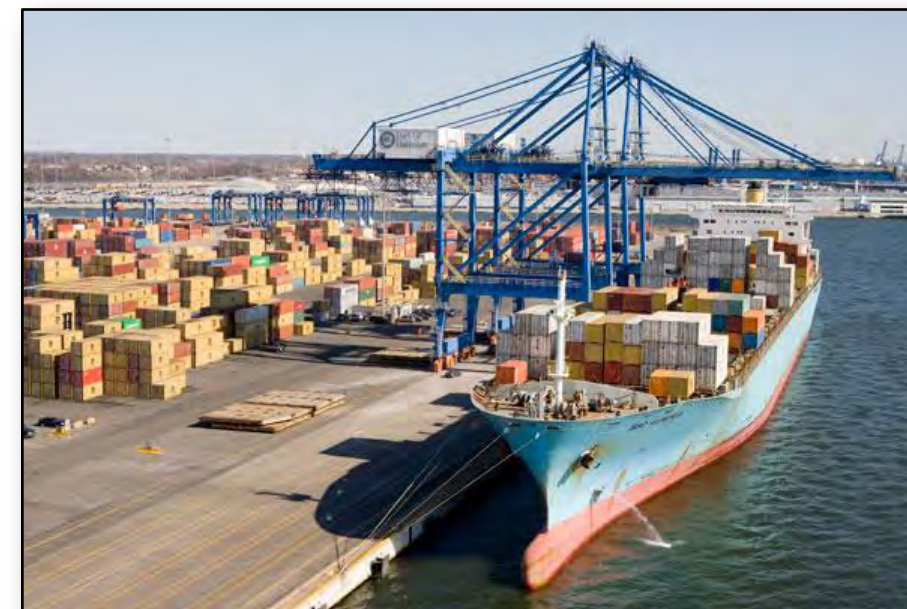
Ecosystems



Communities



Commerce



Health



Energy

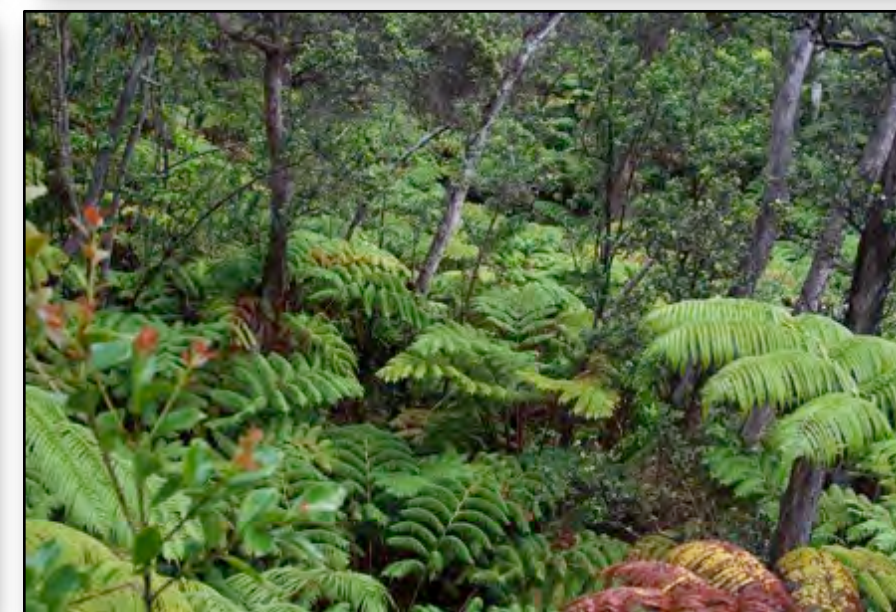


Coastal

Infrastructure



Forests

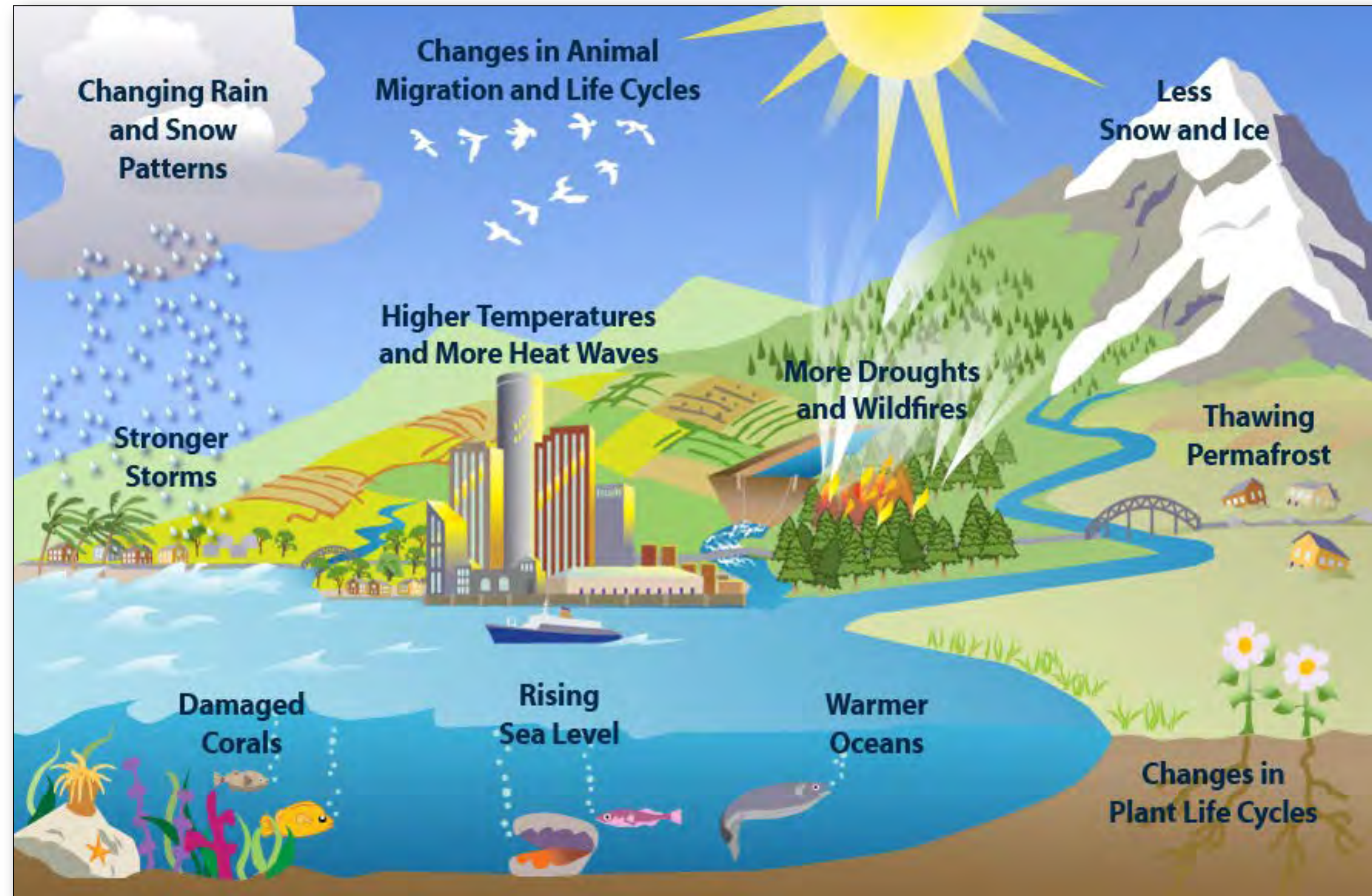


Carlye Calvin & Wikipedia photos



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

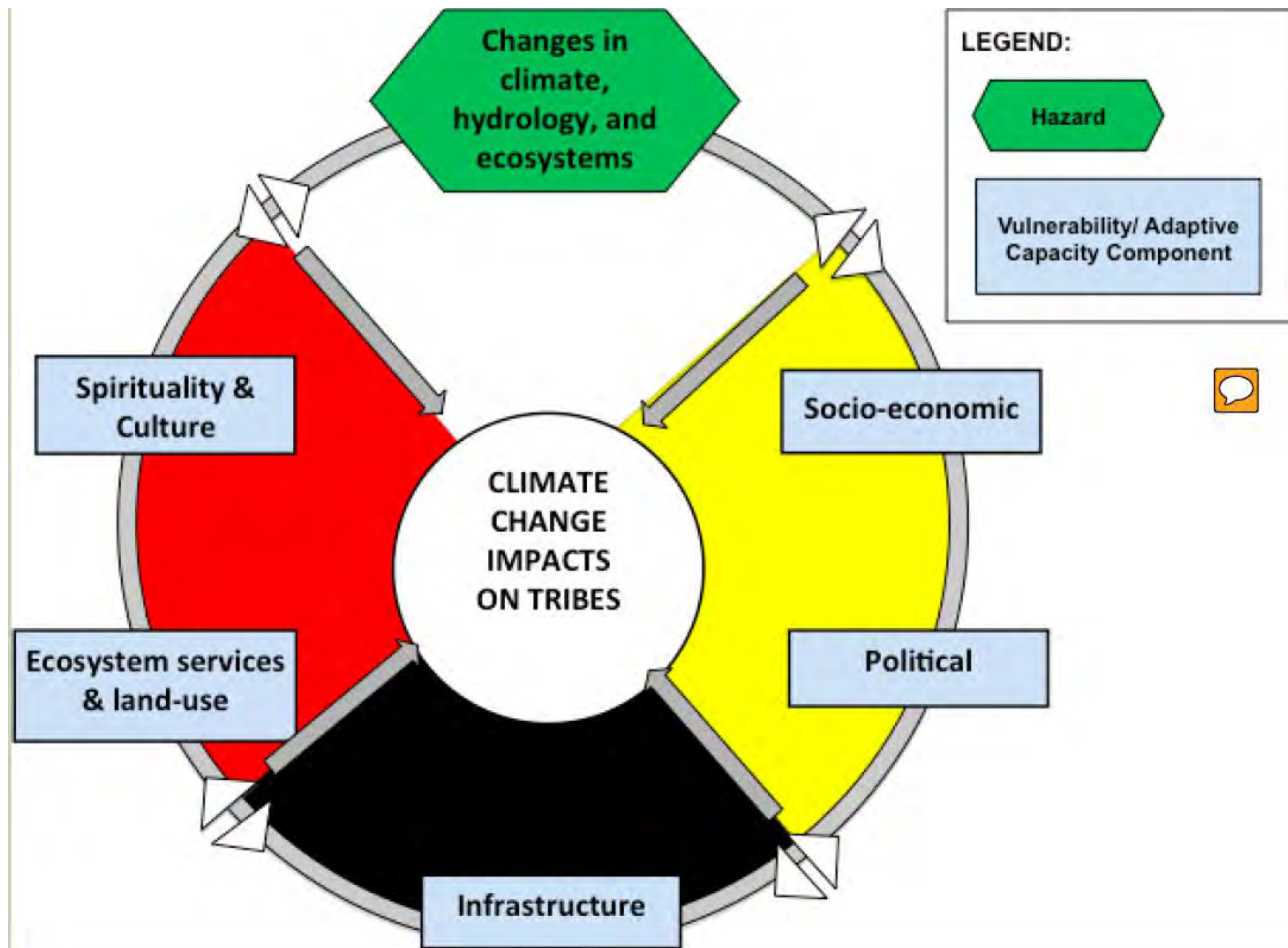
IMPACTS OF CLIMATE CHANGE



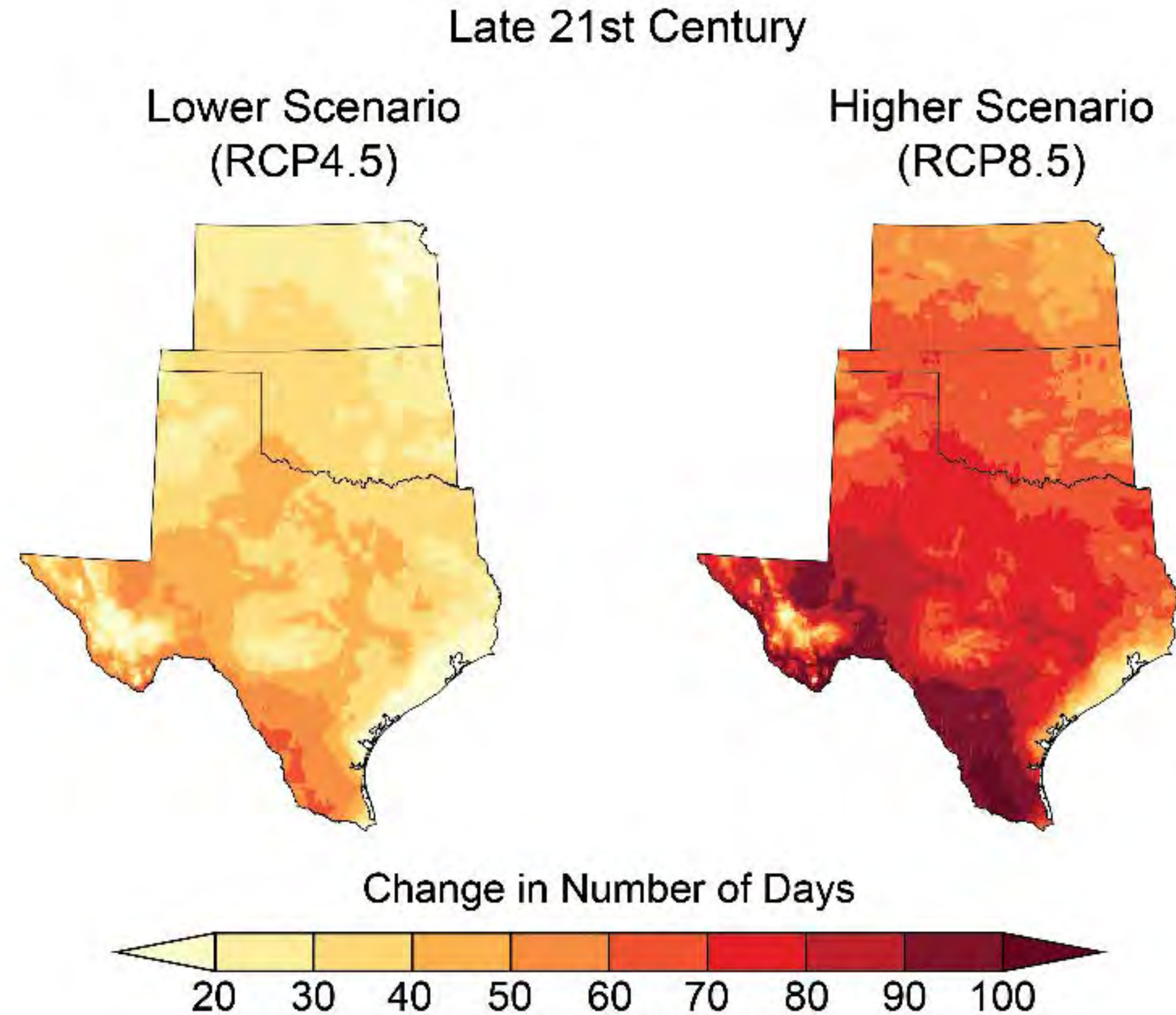
Environmental
Protection Agency



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER



NUMBER OF DAYS ABOVE 100°F

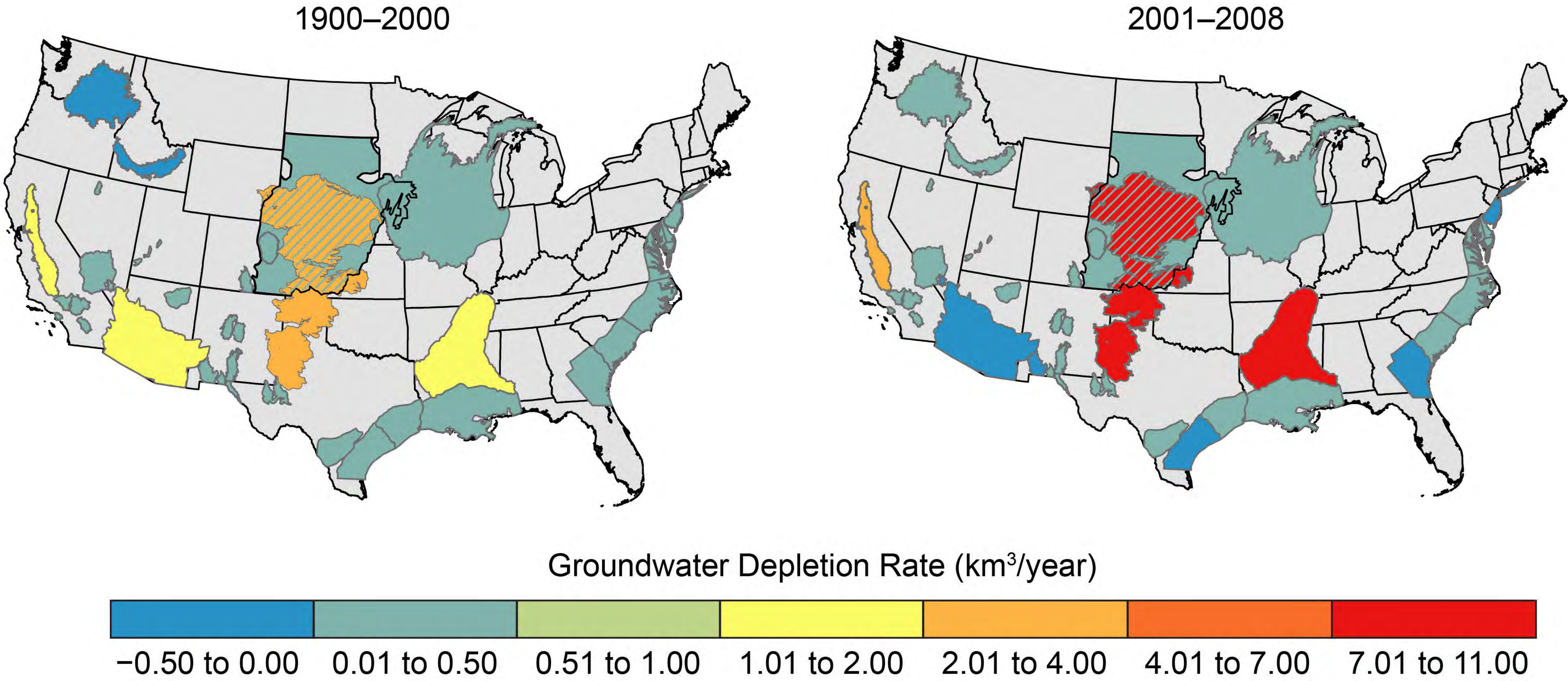


USGCRP NCA 2018



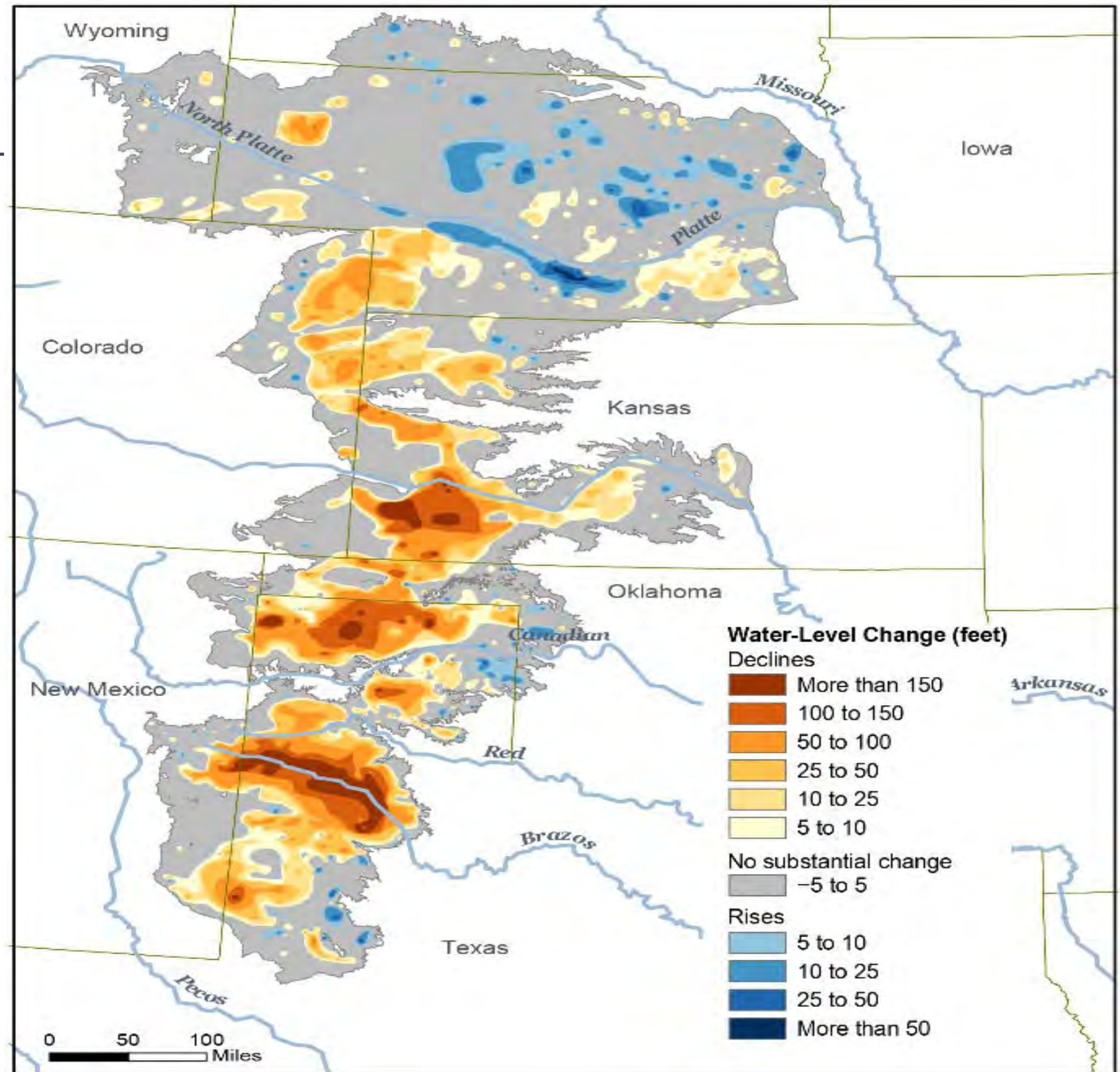
SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

DROUGHT IMPACTS: GROUNDWATER



CHANGES IN THE OGALLA AQUIFER SINCE 2015

USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

DROUGHT & WATER STRESS

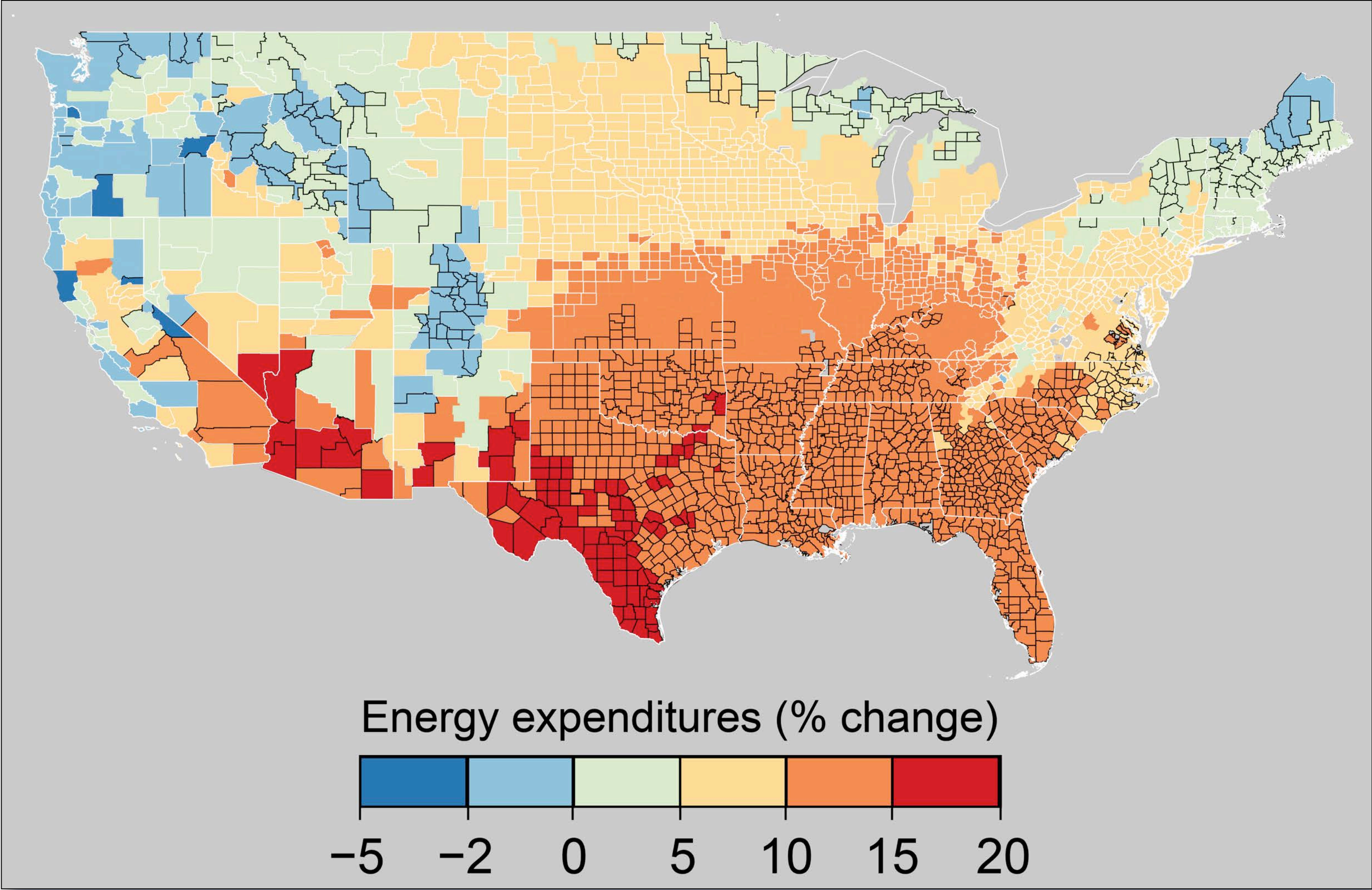
- Less water released from reservoirs affects irrigation & environmental flows
- Diminished agricultural production has ripple effects in rural economies (*note photo dried up stock pond near Kurtain, TX*)
- Limited water constrains operation of energy production activities

USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

PROJECTED CHANGES IN ENERGY EXPENDITURES



USGCRP NCA 2018

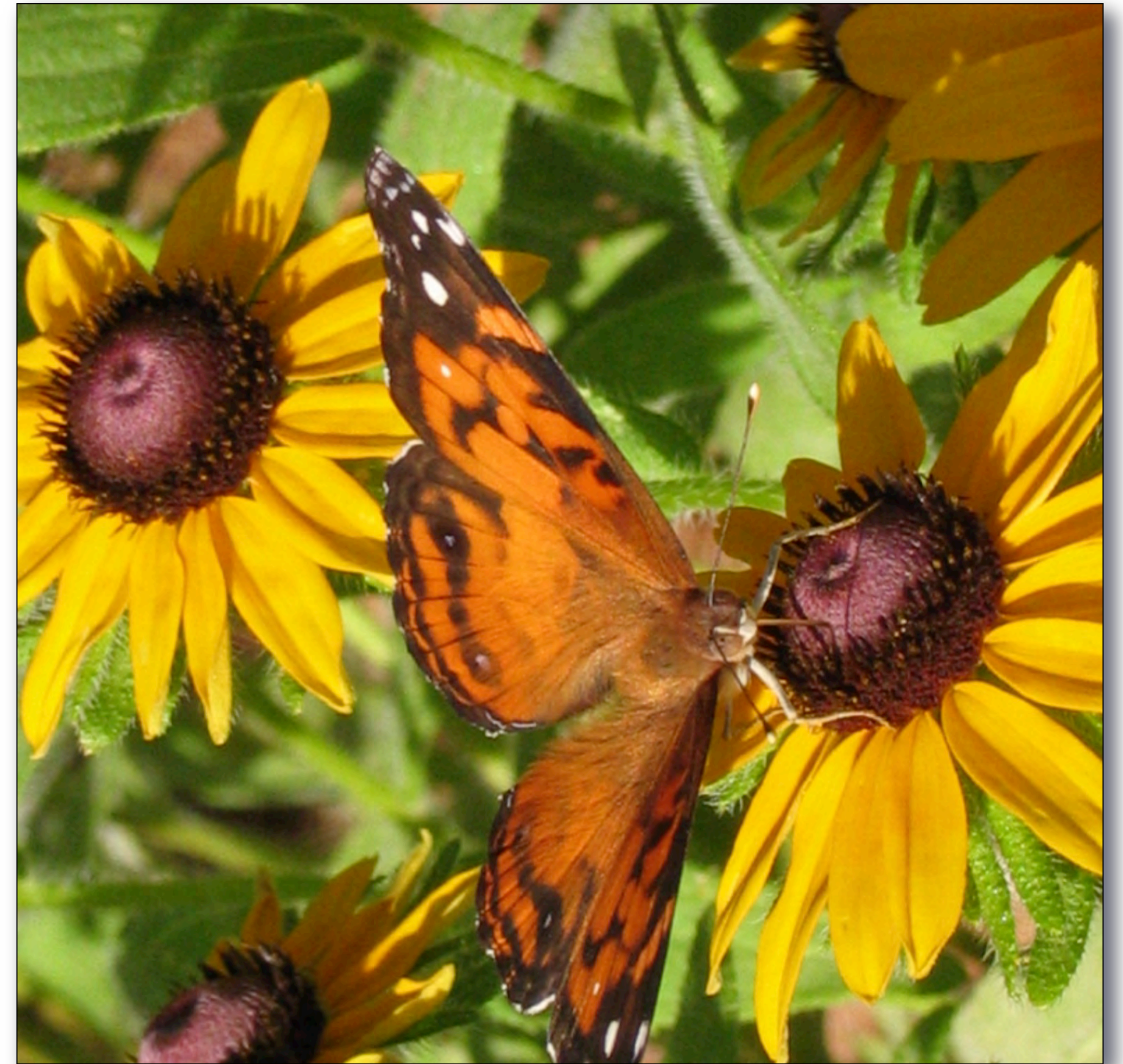


SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

HOTTER SUMMER DAYS & NIGHTS

- Strain on cooling systems & energy utilities, road surfaces, & water resources
- Reduction of heating demands & winter road maintenance costs
- Increased evaporation, heat stress, & heat-related diseases, esp. in hot cities

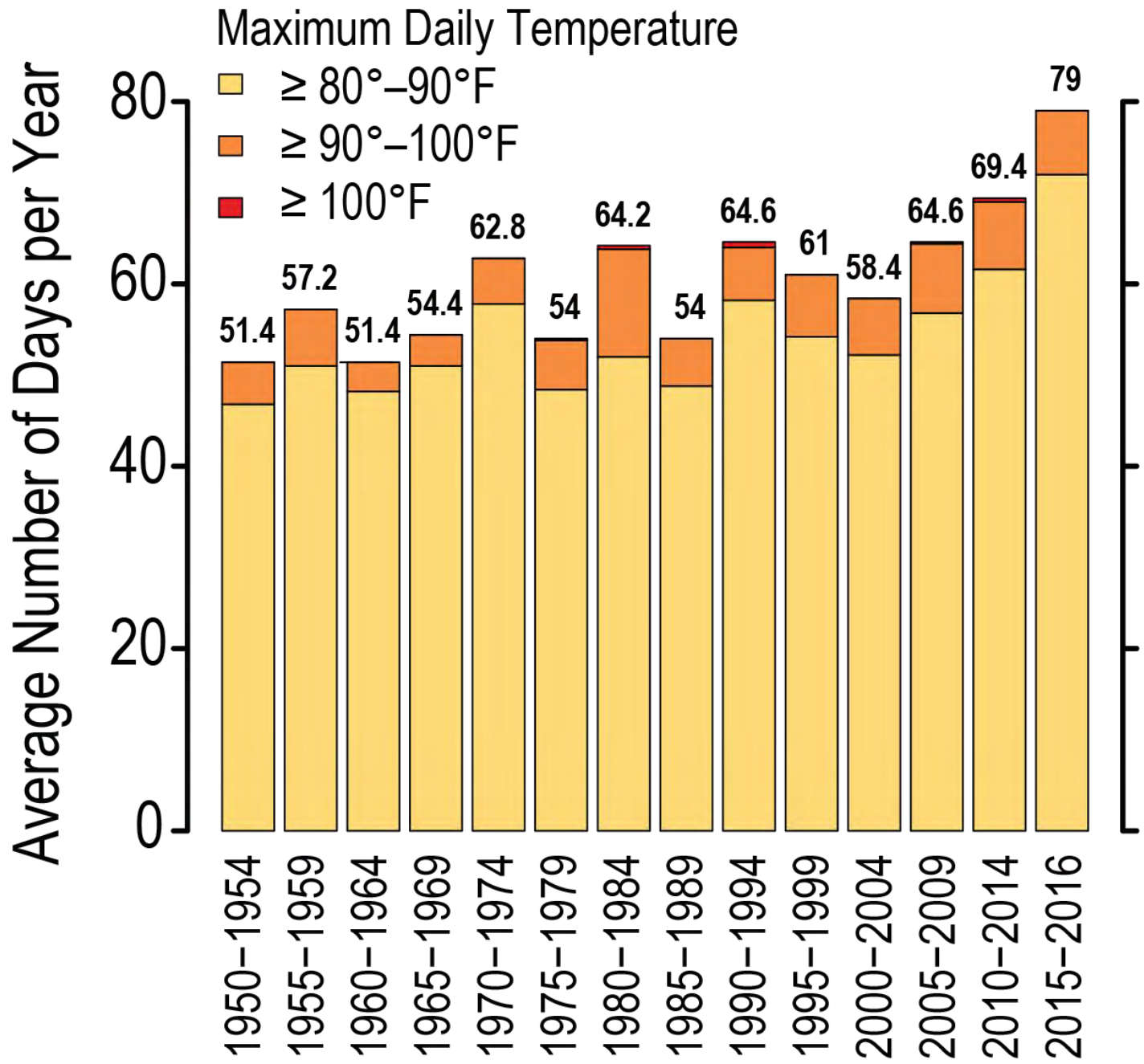
USGCRP NCA 2018



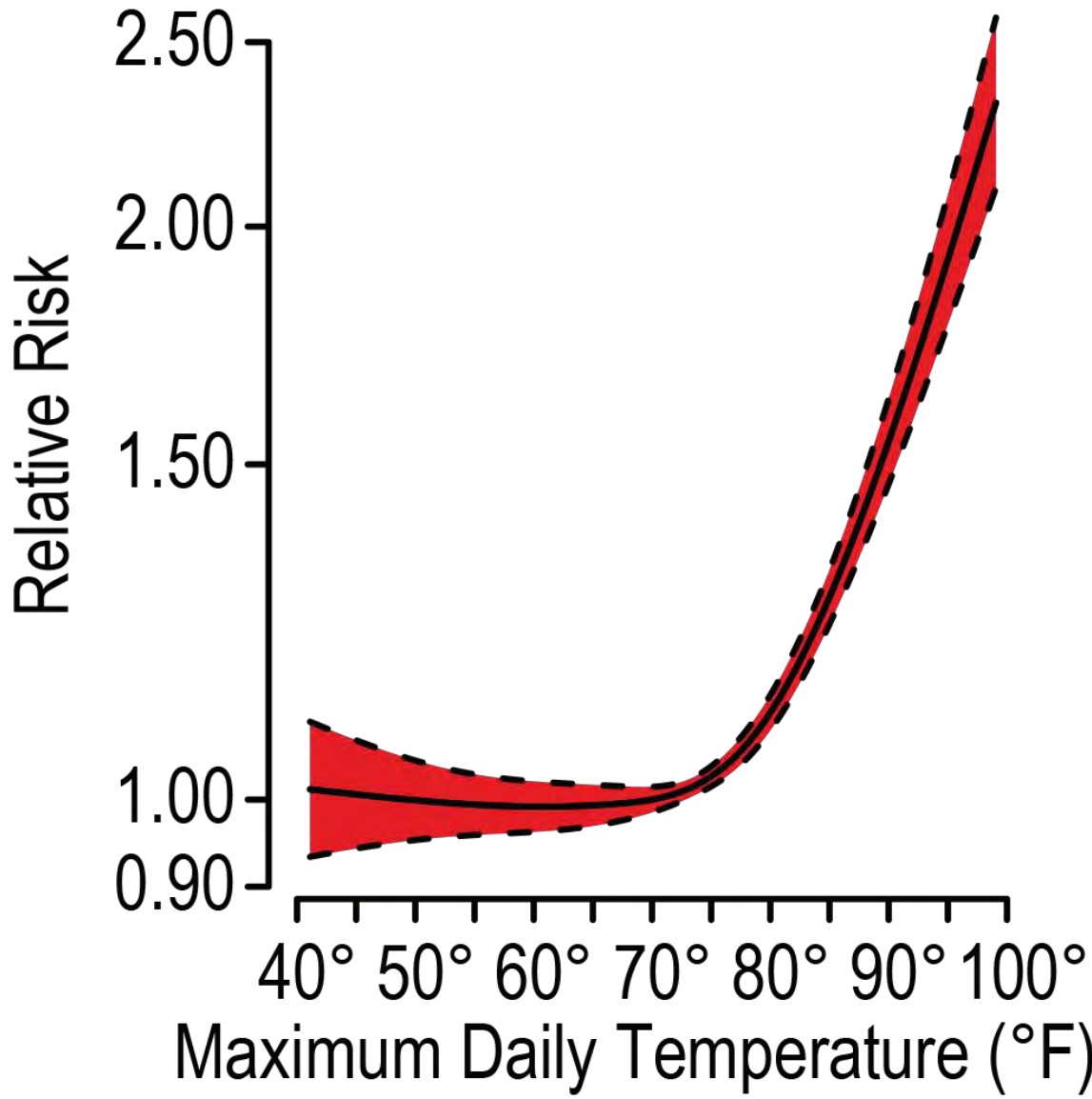
SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

HEAT-RELATED HEALTH STRESSES

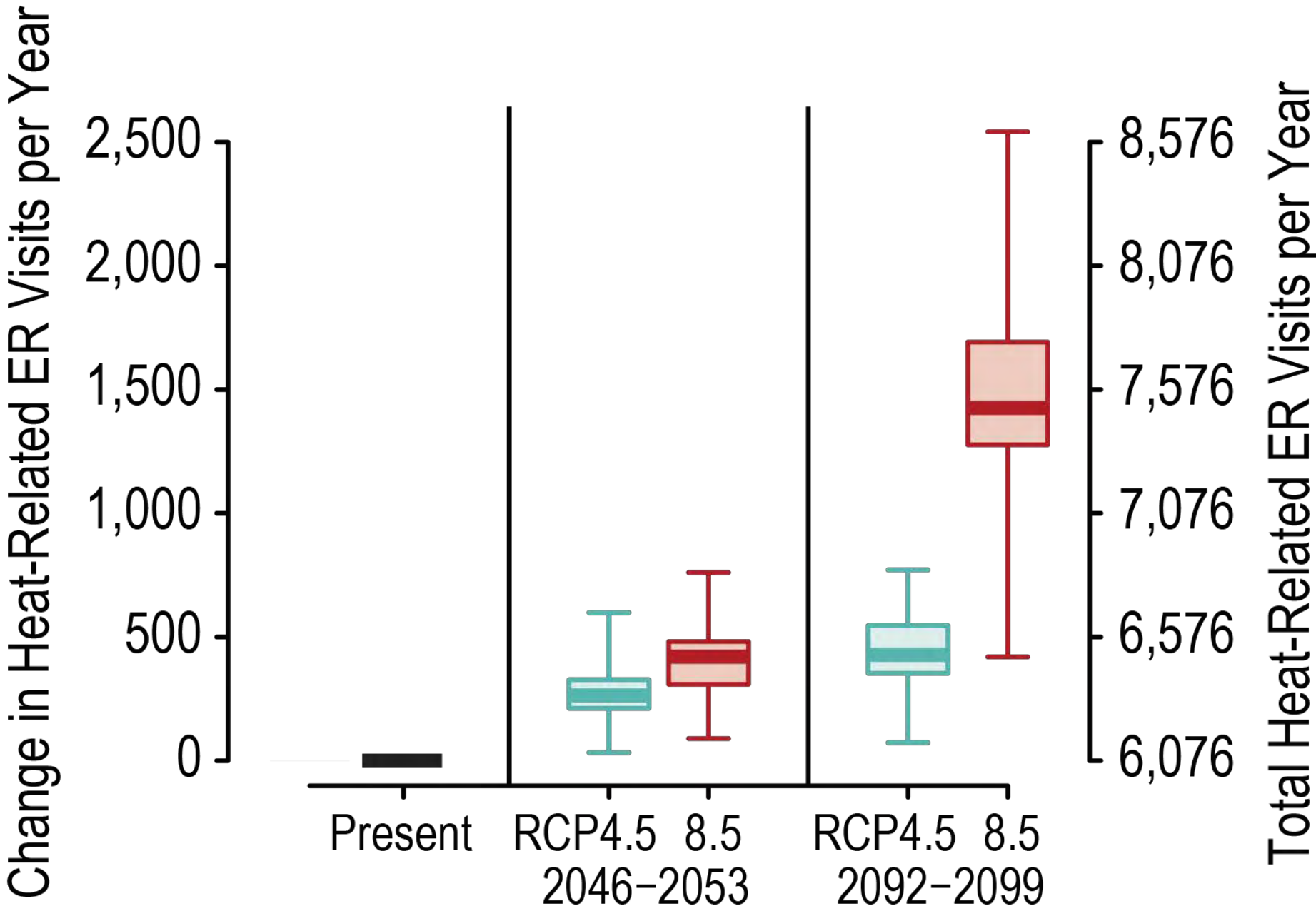
Number of Days per Year with Extreme Heat in RI



Association Between Maximum Daily Temperature and Heat-Related Emergency Room Visits



Projected Number of Future Heat-Related Emergency Room Visits

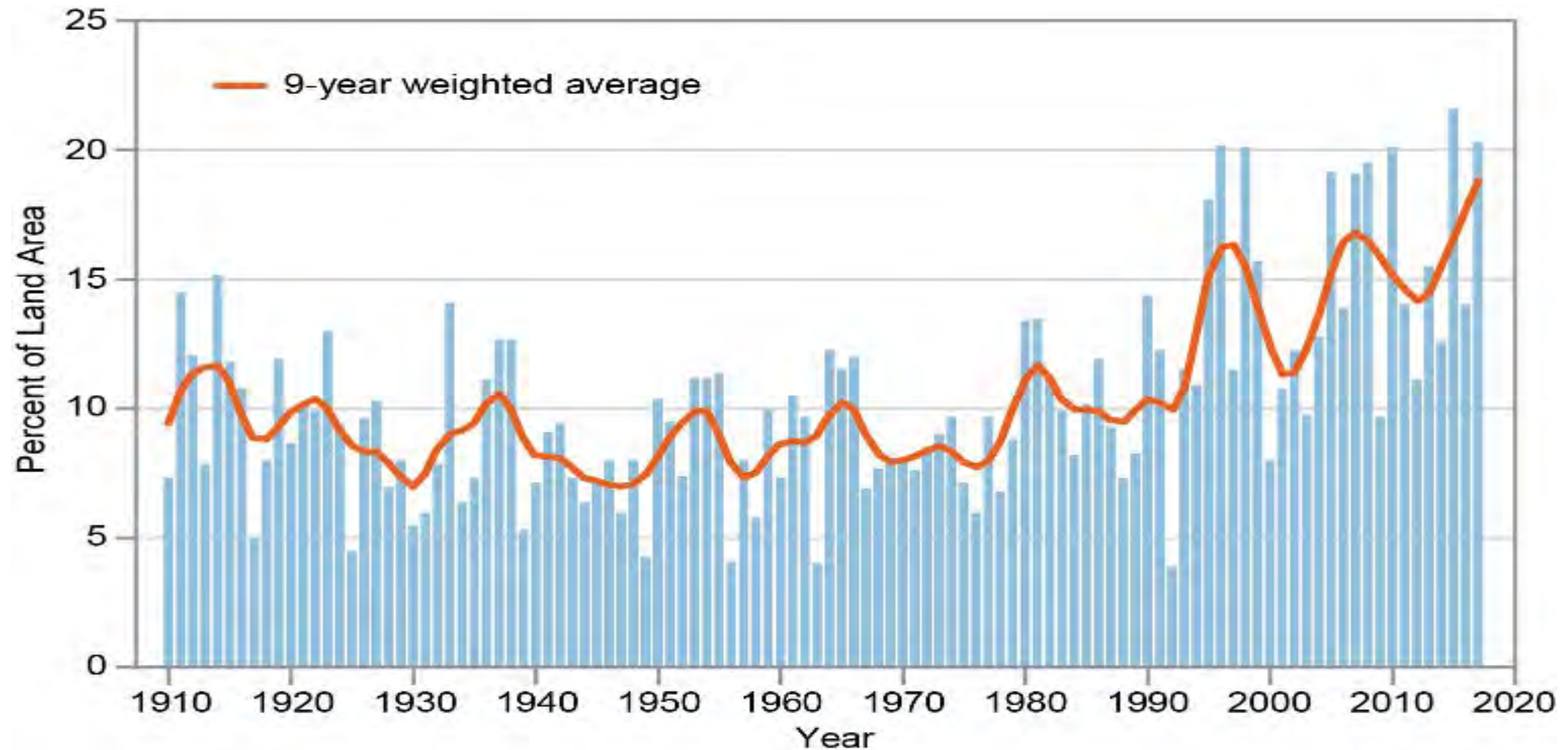


USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

EXTREME STORMS & LAND AREA



USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

EXTREME STORMS & FLOODING

Rapid swings between severe drought and extreme storms have become more common, driving the intensification of fire and flood cycles

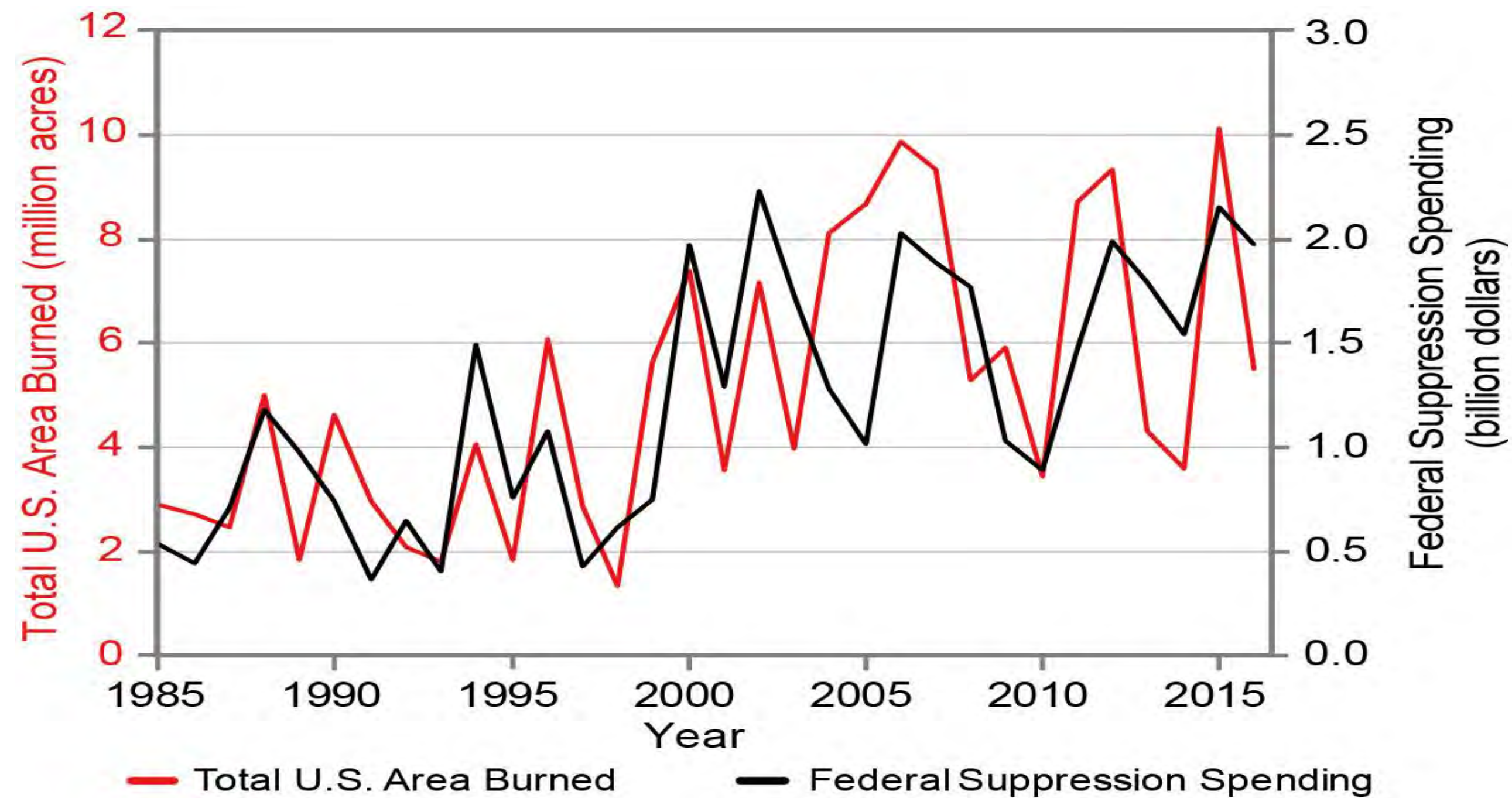


USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

WILDFIRES



USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

WILDFIRE POLLUTION HARMS HEALTH

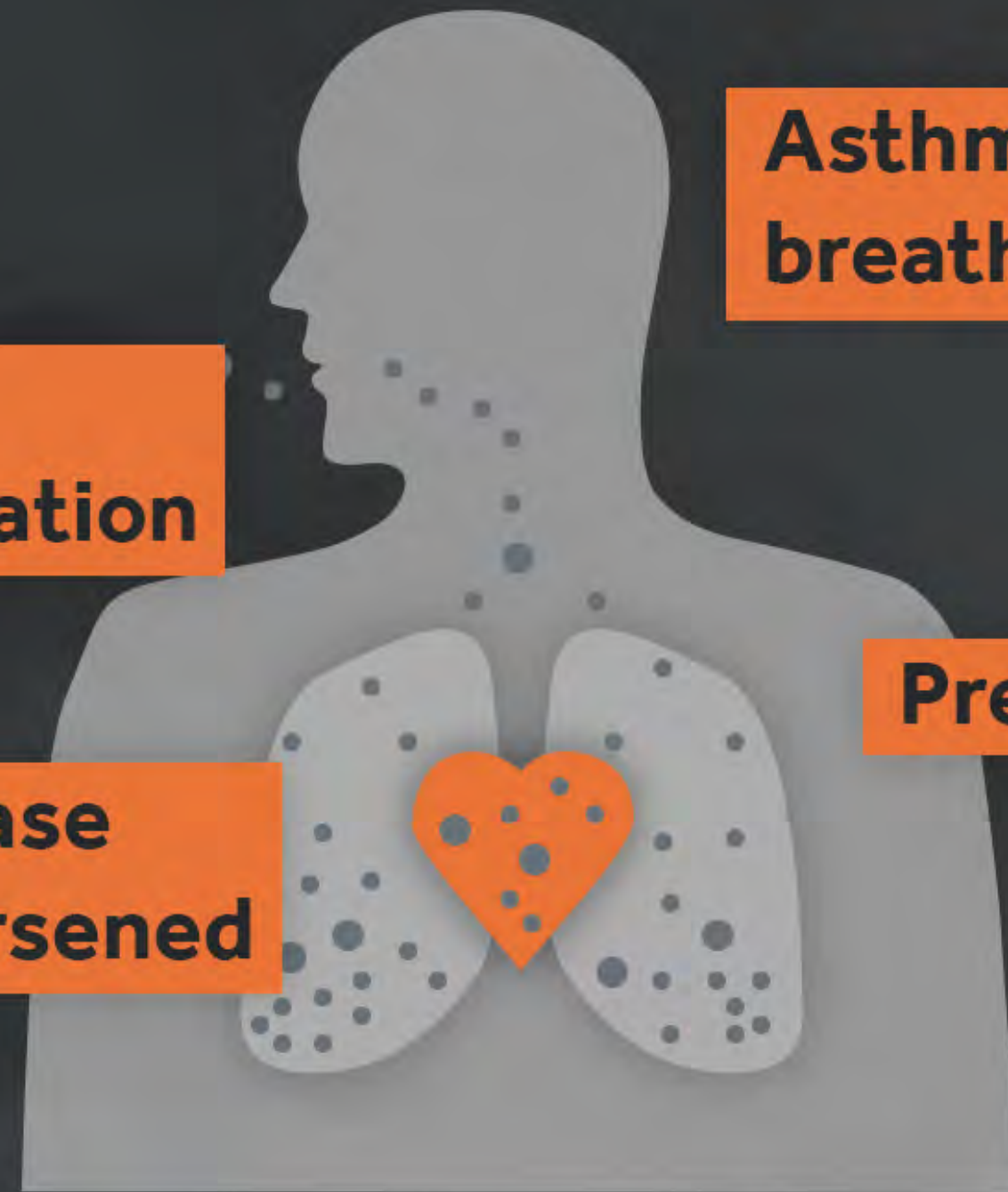
Fine particle (PM_{2.5}) effects

Eye, lung,
throat irritation

Asthma attacks,
breathing problems

Heart disease
effects worsened

Premature death



CLIMATE  CENTRAL

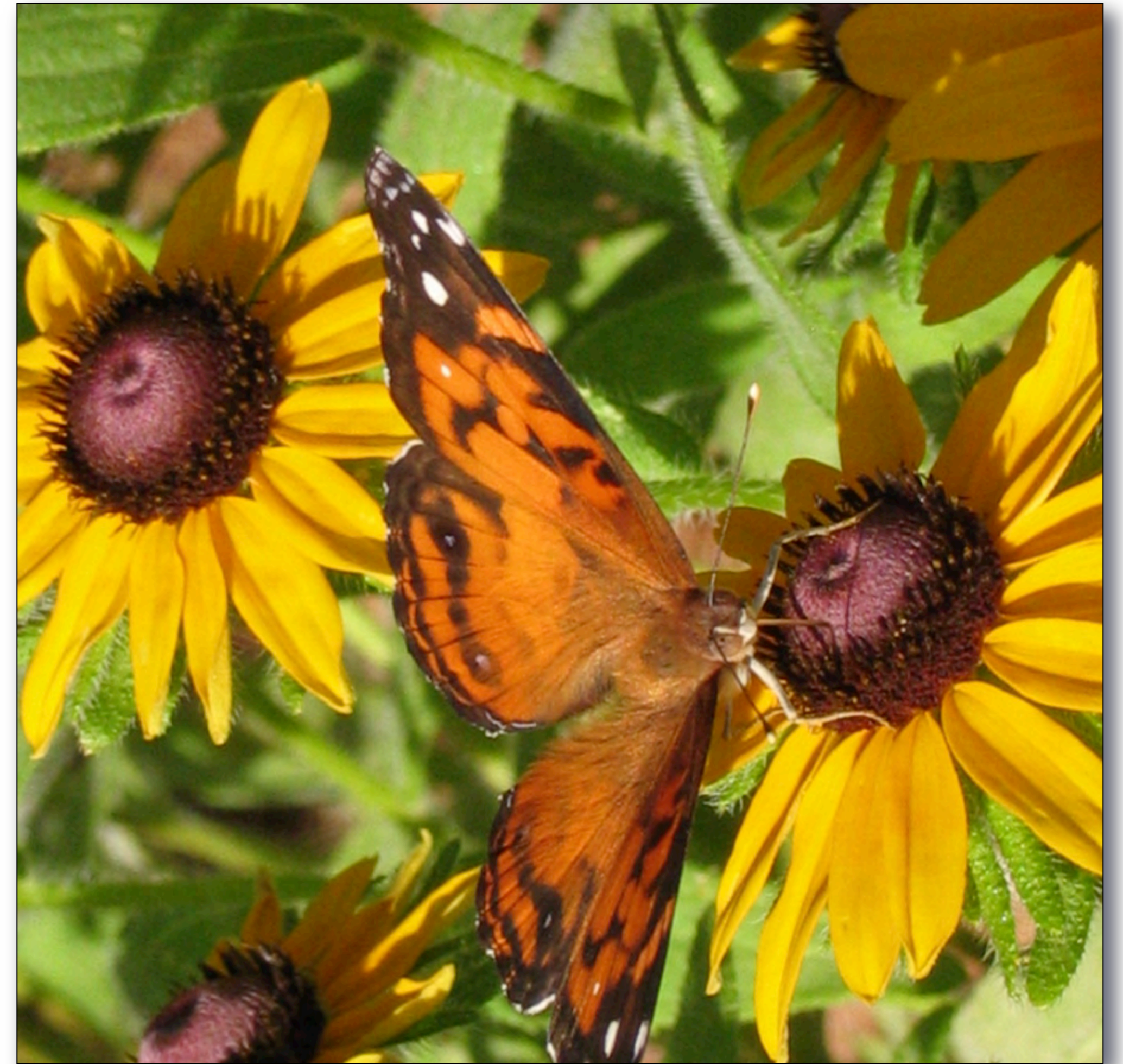


SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

STRESSES ON ECOSYSTEMS

Terrestrial and aquatic ecosystems are experiencing direct and indirect effects:

- Some species can adapt to extreme droughts, unprecedented floods, and wildfires from a changing climate, while others cannot, resulting in significant impacts to both services and people living in these ecosystems.
- Landscape-scale ecological services will increase the resilience of the most vulnerable species.

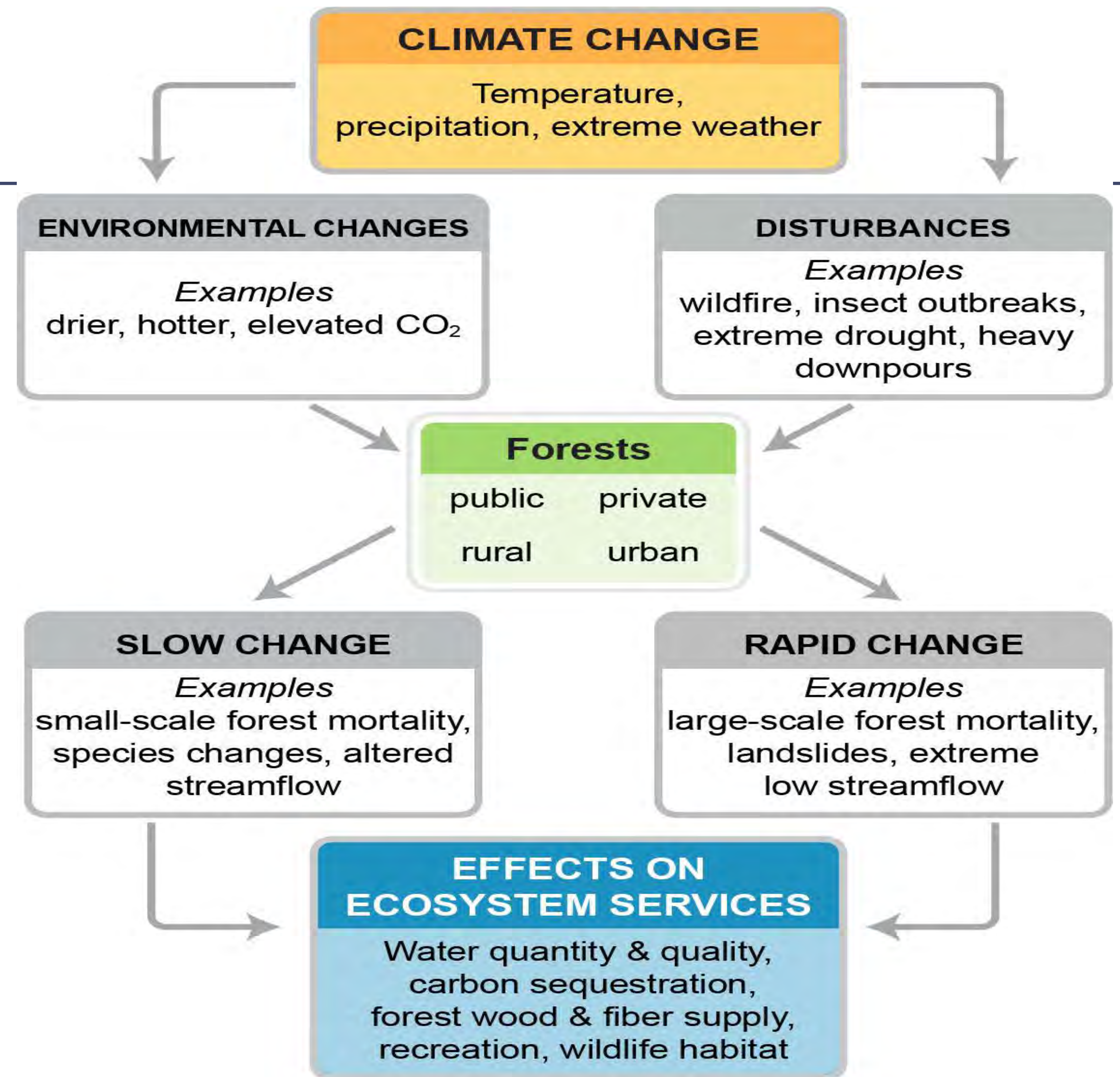


SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

FORESTS



Tree Mortality at Bass Lake Recreation Area.
Photo credit: Marc Meyer, U.S. Forest Service.



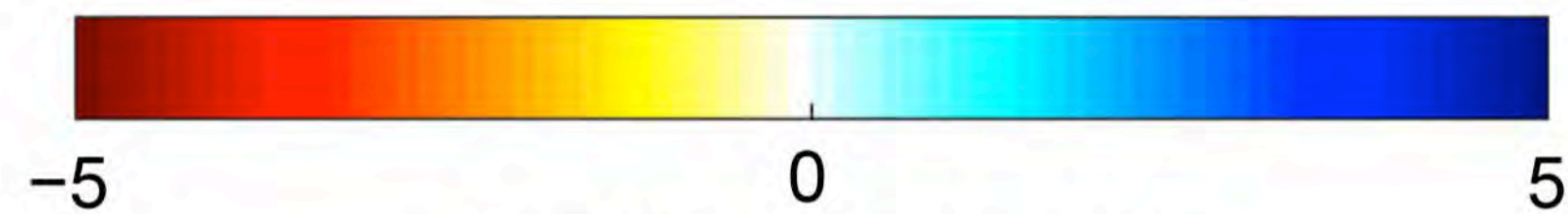
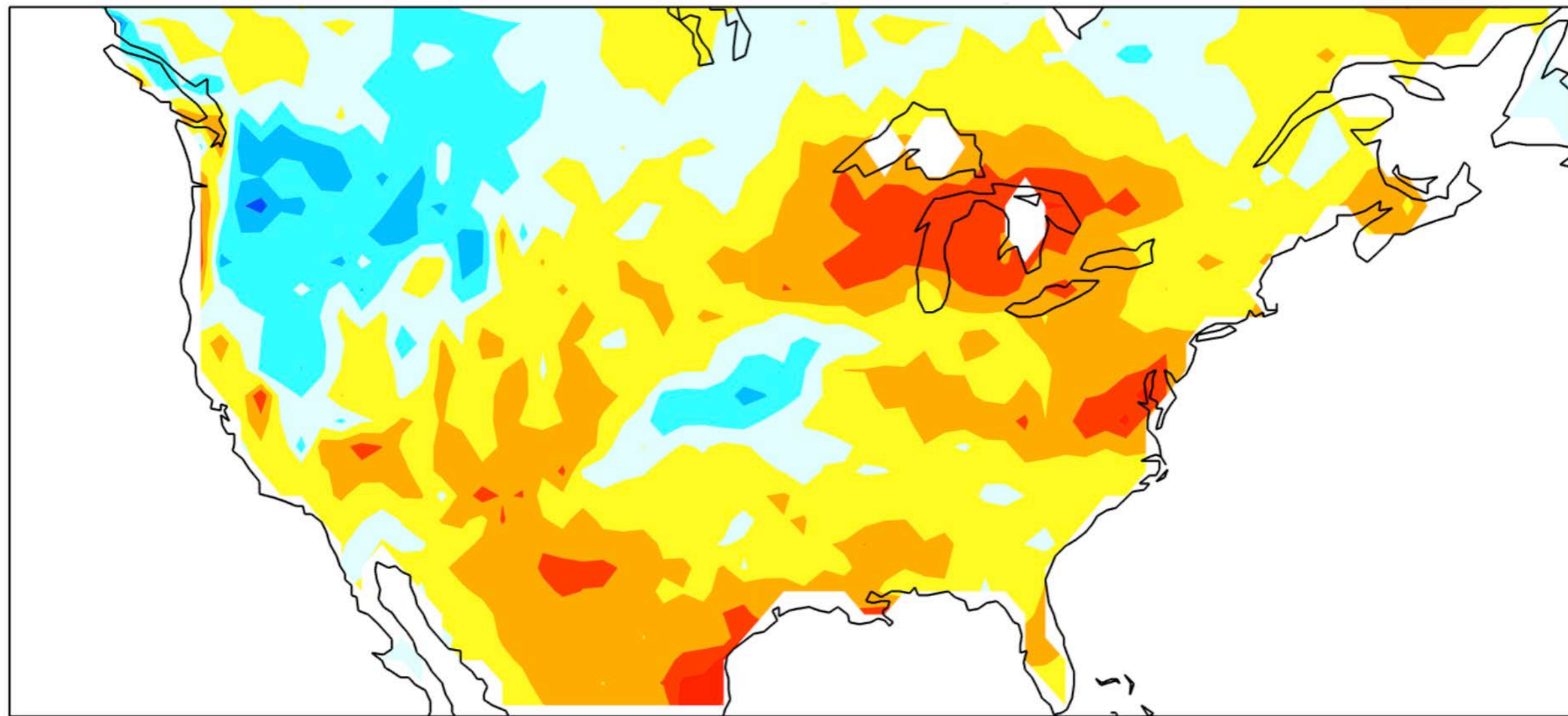
USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

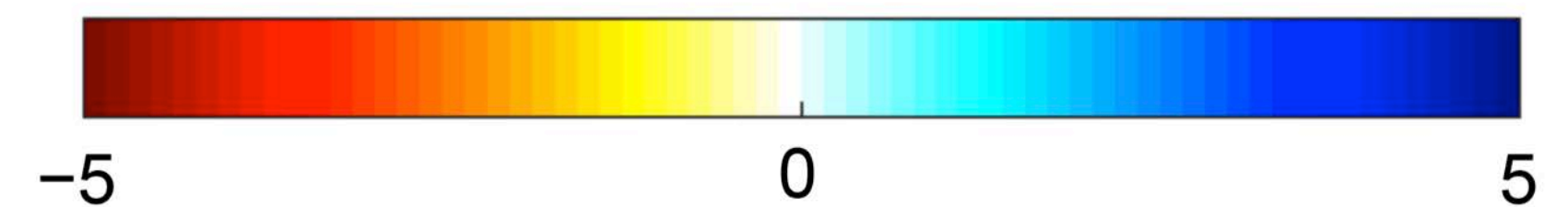
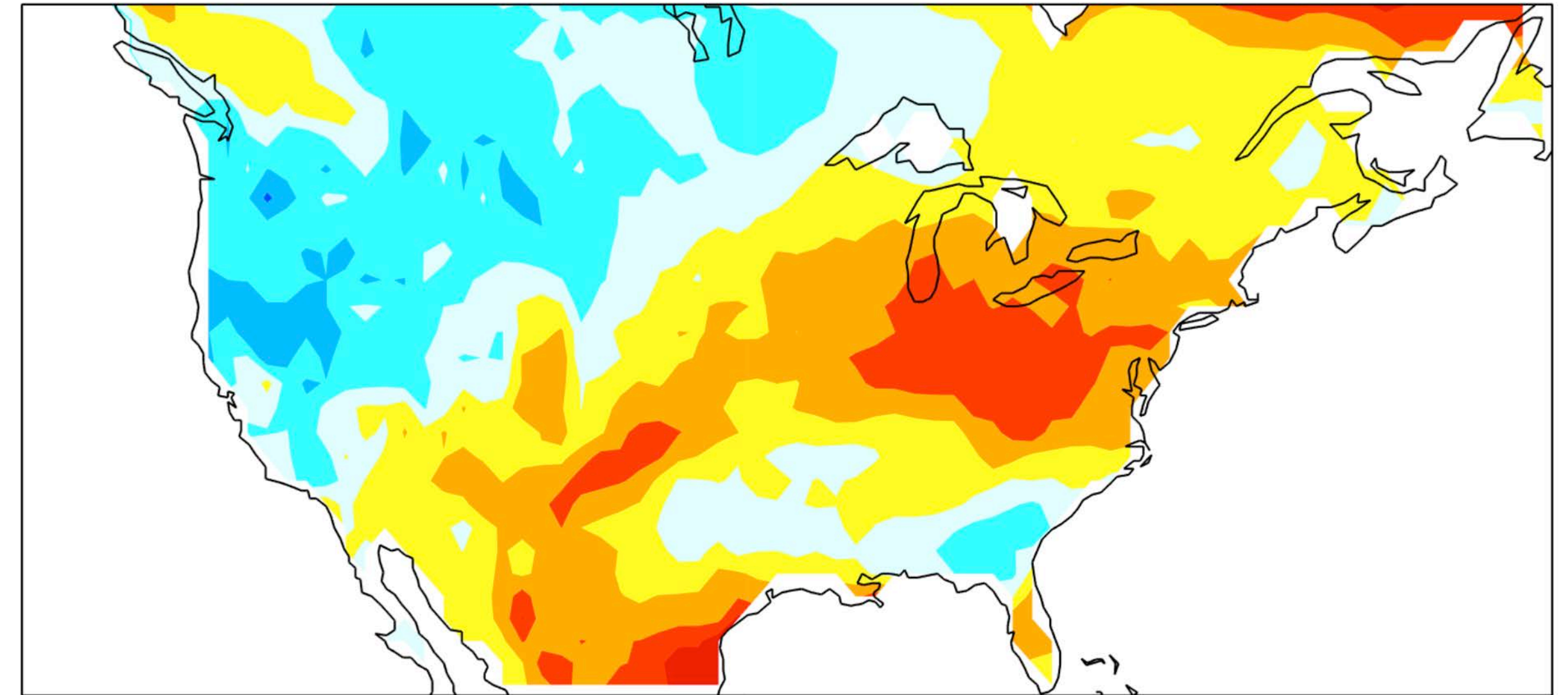
CHANGES IN PLANT LIFE CYCLES

Trends in First Leaf Dates



Trends (days/decade)

Trends in First Bloom Dates



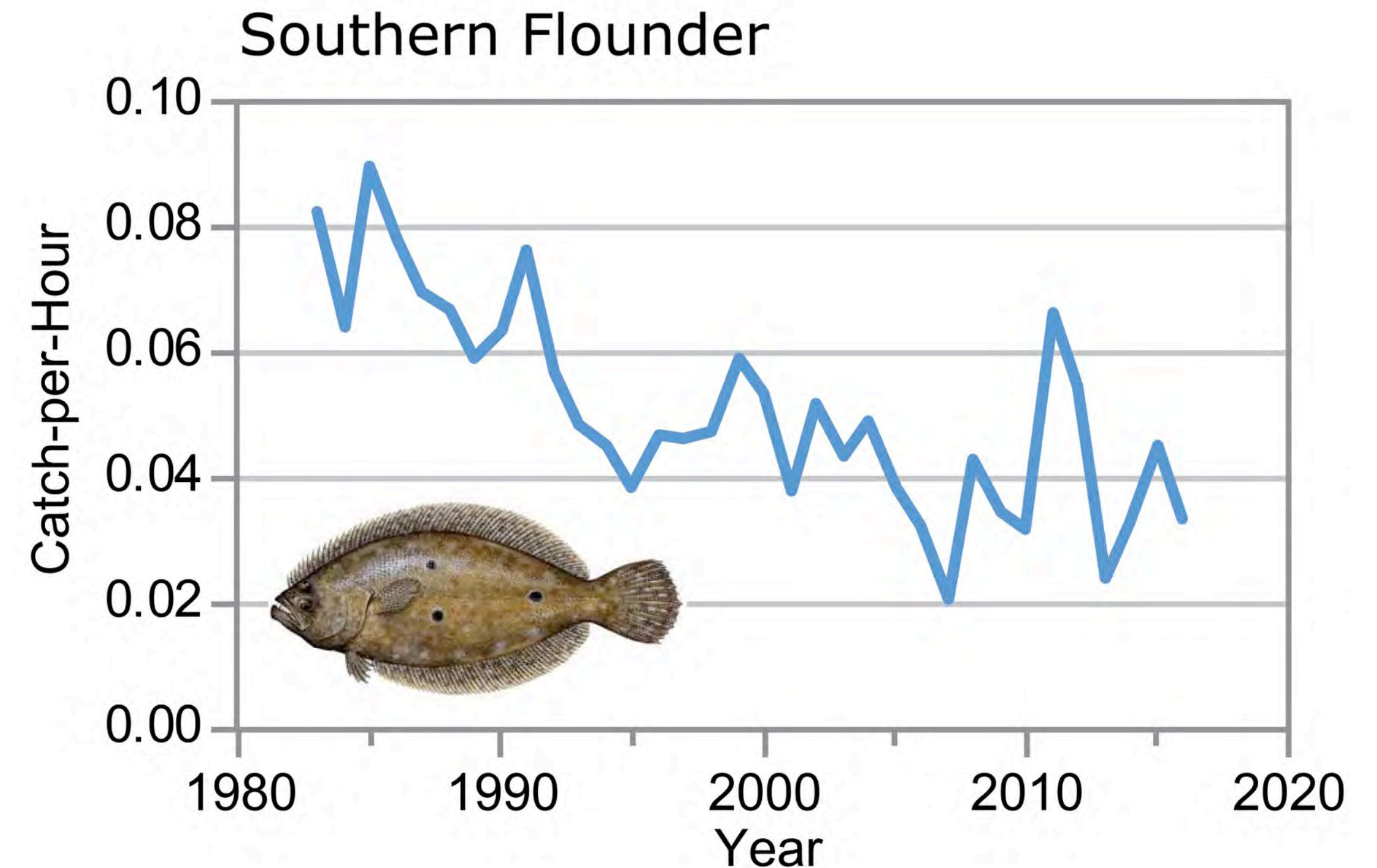
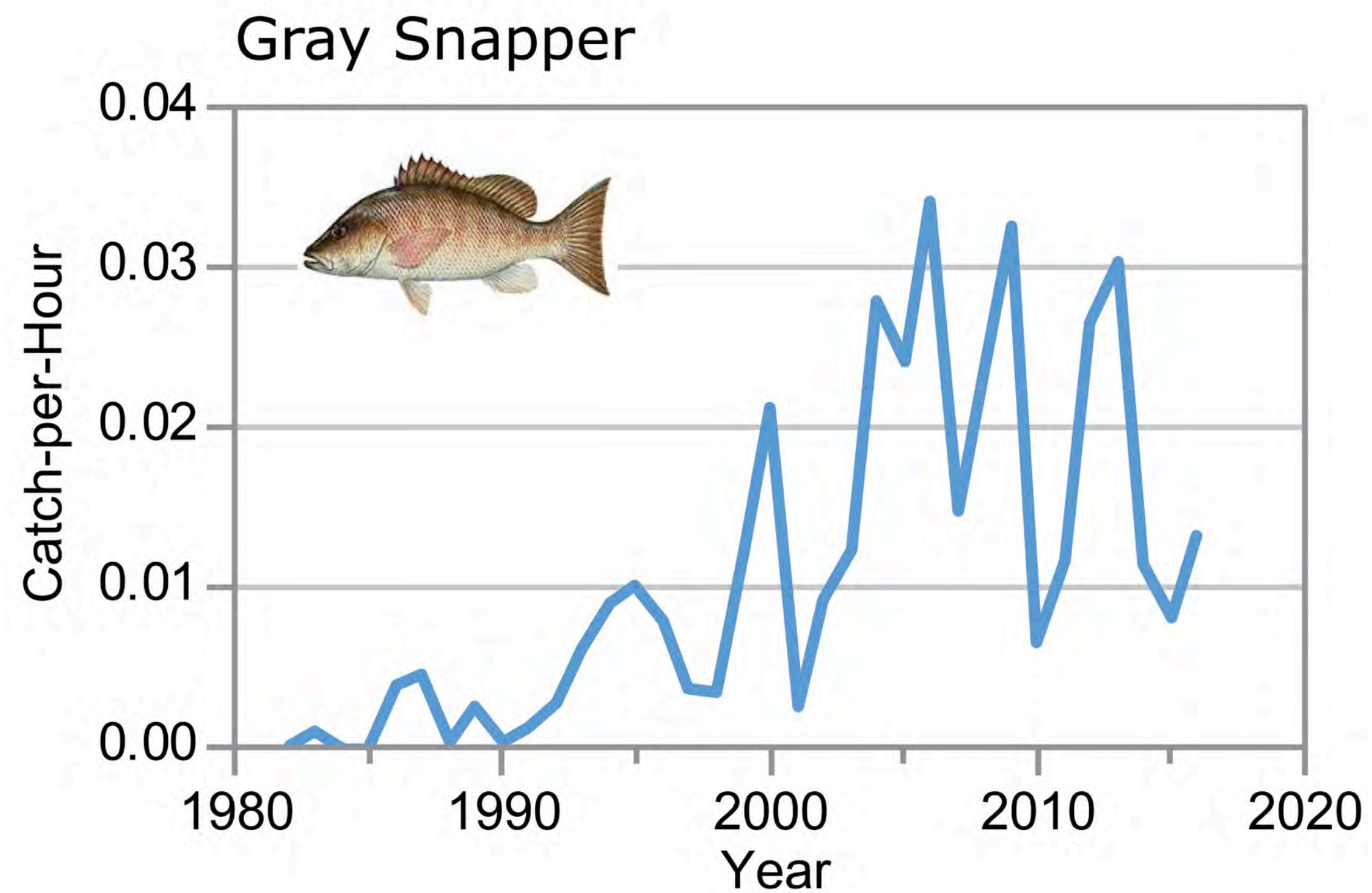
Trends (days/decade)

USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

CHANGES IN FISH POPULATIONS

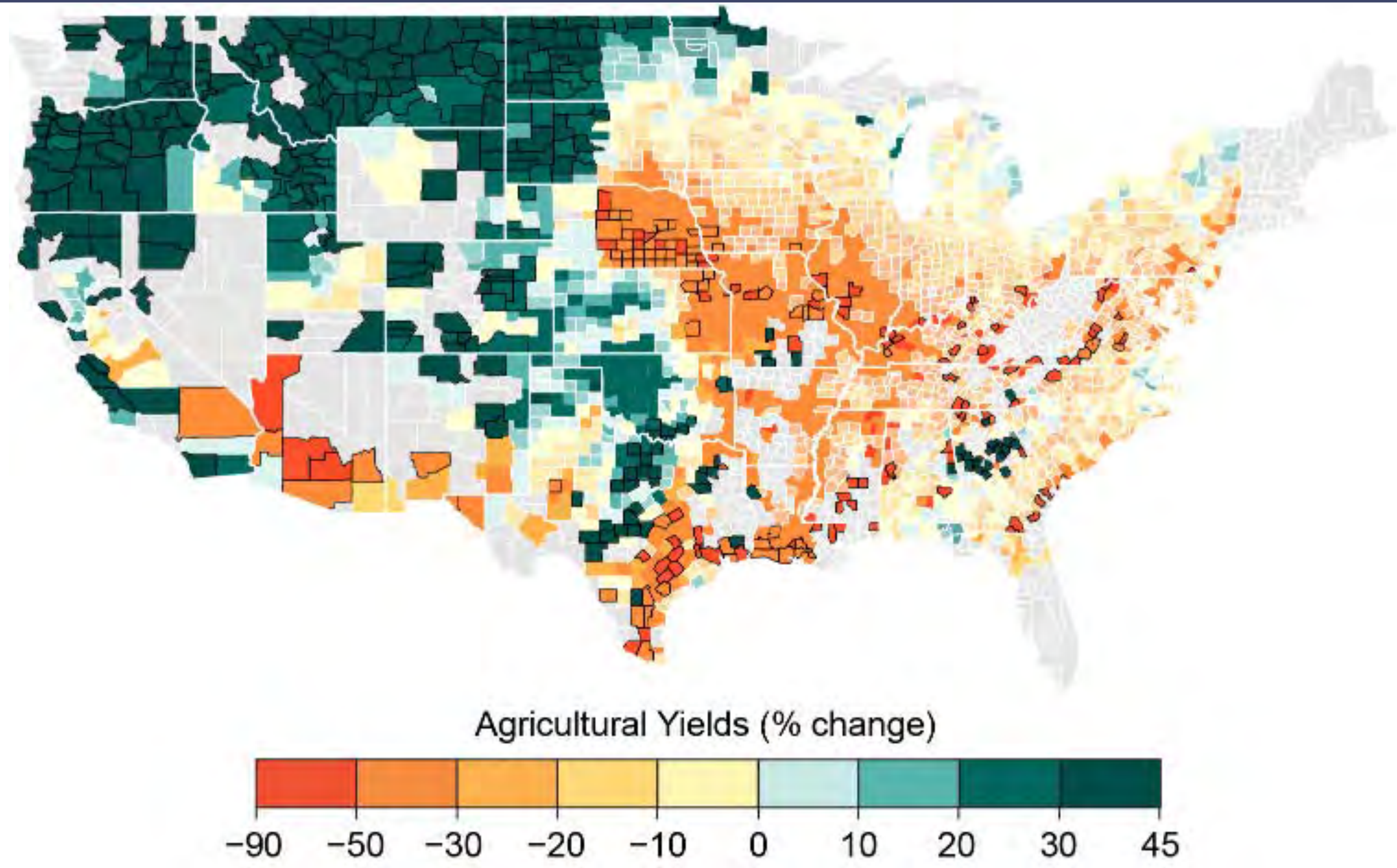


USGCRP NCA 2018



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

PROJECTED CHANGES IN AGRICULTURAL PRODUCTIVITY

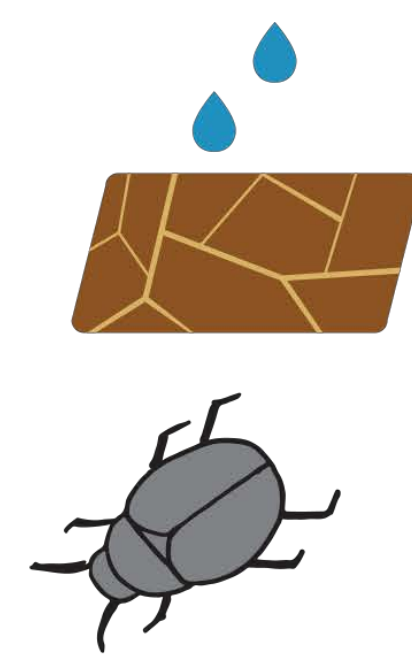


VULNERABILITY & ADAPTATION OPTIONS

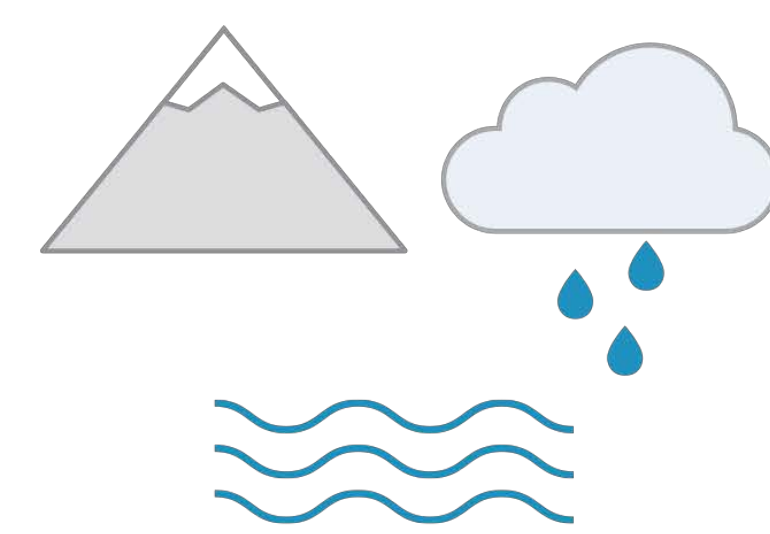


Climate Change Vulnerabilities

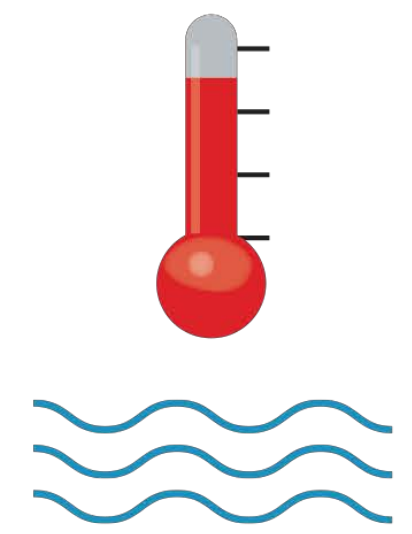
Increasing wildfire area burned and fire season length



Increasing drought severity and incidence of insect outbreaks



Lower snowpack, increasing precipitation intensity, and higher winter peakflows



Lower summer streamflows and increasing stream temperatures

Adaptation Options

Reduce hazardous fuels with prescribed burning and managed wildfire

Reduce forest stand density to increase tree vigor; plant drought-tolerant species and genotypes

Implement designs for forest road systems that consider increased flooding hazard

Use mapping of projected stream temperatures to set priorities for riparian restoration and coldwater fish conservation

REFLECTION

- Are you aware of climate-related changes that are affecting you?
 - *Have they affected you in positive or negative ways?*
 - *Have you taken any action to reduce or change the way you are affected?*
 - *Why or why not?*



**Native People have adapted to many changes...
Today the challenges are different,
but the adaptability of Native people is still here,
so is our ability to recognize changes around us**

**When looking at people who have weathered catastrophes,
Being able to recognize the problem at hand,
and address vulnerabilities is the key to survival**

So too, is the need for people to work together and help each other

These are the characteristics most needed for communities to survive

By: Margaret Hiza Redsteer, USGS



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER

QUESTIONS?



SOUTH CENTRAL
CLIMATE ADAPTATION SCIENCE CENTER