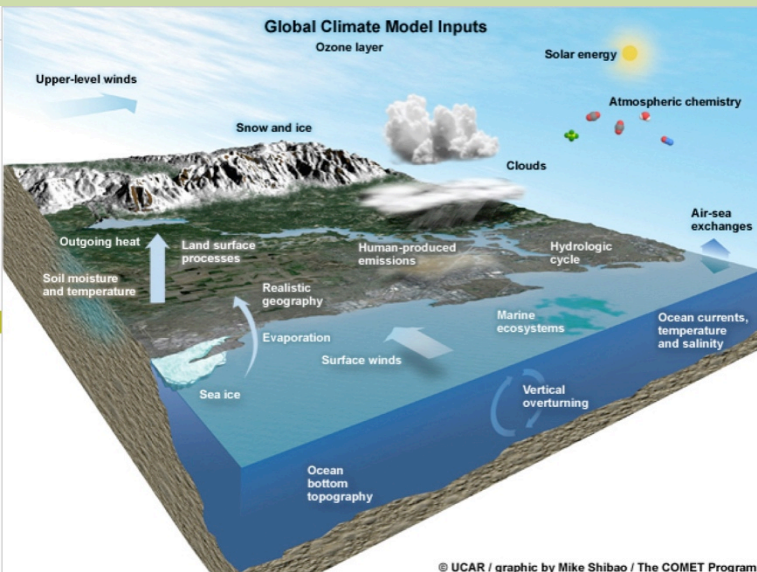


# Want To Save Some Green?

**Aaron and Angie Jungbluth**  
Volunteer Conservation Naturalists  
Certified Interpretive Guides





NATIONAL ASSOCIATION FOR  
**INTERPRETATION**



# NAI2017

Illuminating Interpretation

SPOKANE, WASHINGTON

National Association for Interpretation:  
Pre-conference Session

---

***Interpreting Climate Change:  
Understand the Science, Consider  
Audience Characteristics, and Explore  
Effective Techniques***

**November 12-13, 2017**



University  
of Idaho



## *Objectives:*

- Not here to “convert”
- Not Team A vs. Team B
- Not political
- Here to “plant a seed”
- Here to be respectful of others’ opinions

# Want To Save Some Green?

**How do you form your opinions?**

**What are your sources?**

**What is your plan?**

**What is the first vision  
that pops in your head  
when I say...**

**What is the first vision  
that pops in your head  
when I say...**

**CLIMATE CHANGE**

**or**

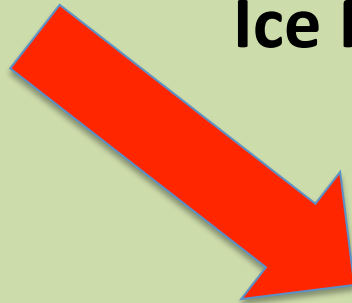
**GLOBAL WARMING**



**Polar Bears** NASA



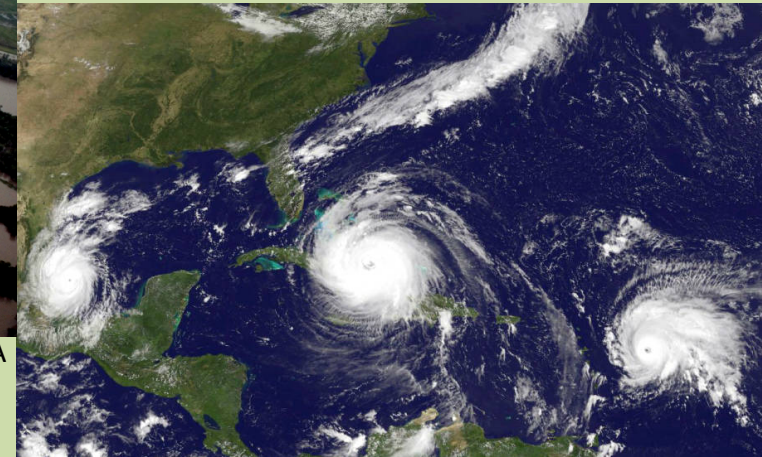
**Ice Melting** NPS



NASA

## Extreme Weather

NASA 2017







# 2016 Opinion Poll

Yale University

Yale SCHOOL OF FORESTRY & ENVIRONMENTAL STUDIES



YALE PROGRAM ON  
Climate Change  
Communication



1.) Do you think global warming is happening?

1.) Estimated % of adults who think global warming is happening

2.) Do you think global warming is mostly caused by human activities?

2.) Estimated % of adults who think global warming is mostly caused by human activities



**69%** 1.) Estimated % of adults who think global warming is happening

**52%** 2.) Estimated % of adults who think global warming is mostly caused by human activities



- 3.) Do you think global warming will harm plants and animals?
- 3.) Estimated % of adults who think global warming will harm plants and animals



**68%** 3.) Estimated % of adults who think global warming will harm plants and animals



What's wrong with this picture???

# Direct effects of late snow / early spring: Camouflage mismatch

- Some wildlife change color to match snow in winter
- As snow-free period increases, animals vulnerable in spring and fall
- Weekly survival decrease of 7%
- Can they adapt to survive?



Snowshoe hare, *Lepus americanus*



Imagine:  
You are a Caribou on migration  
looking forward to springtime greens. . .



NELLY DEGRAEVE



# Trophic mismatch: Lack of synchrony between the *phenology* of consumers and that of their resources

- Caribou in Greenland  
(Post and Forchhammer 2008)
- Plant emergence date driven by temperature
- Caribou migrate to calve in areas of high productivity
- Reproduction decreased 4-fold because Caribou missed peak green-up



Caribou (*Rangifer tarandus*)

# Glacier National Park, Montana



Aaron Jungbluth

- In 1850, GNP had 150 glaciers
- Increased melting since 1980
- Estimated all glaciers melt by 2030
- Limits fresh water for animals
- Negatively warms lakes and rivers for aquatic life

# Glacier

National Park Service  
U.S. Department of the Interior

Glacier National Park



Climate Change



Do we need to change the name of  
Glacier National Park?

Muir Glacier – Glacier Bay, Alaska



Muir Glacier – Glacier Bay, Alaska

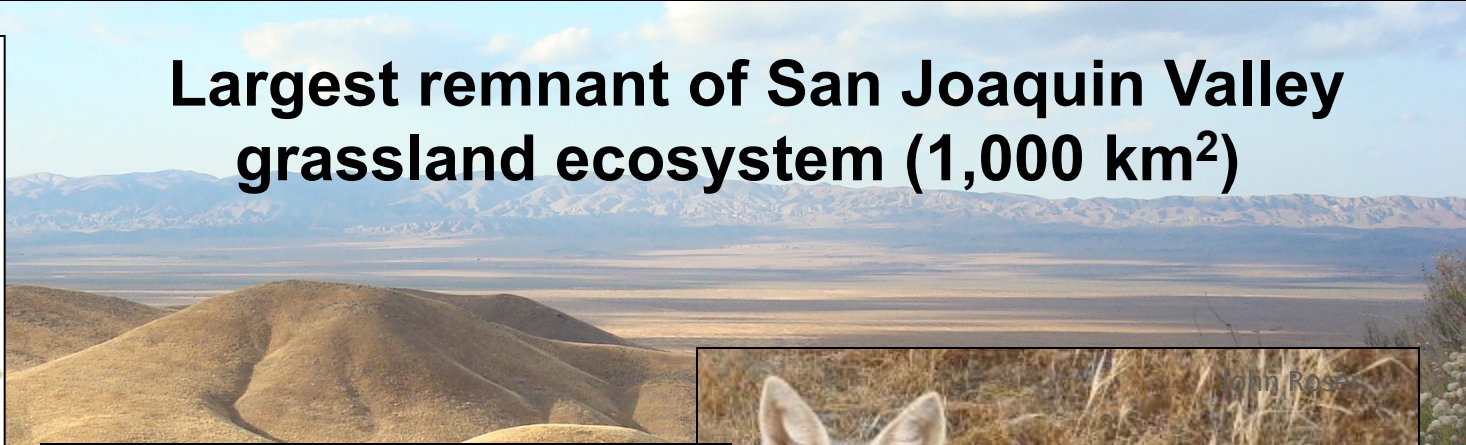


# A Change With a Twist: Carrizo Plain Ecosystem Project (CPEP)



# Carrizo Plain National Monument

**Largest remnant of San Joaquin Valley  
grassland ecosystem (1,000 km<sup>2</sup>)**

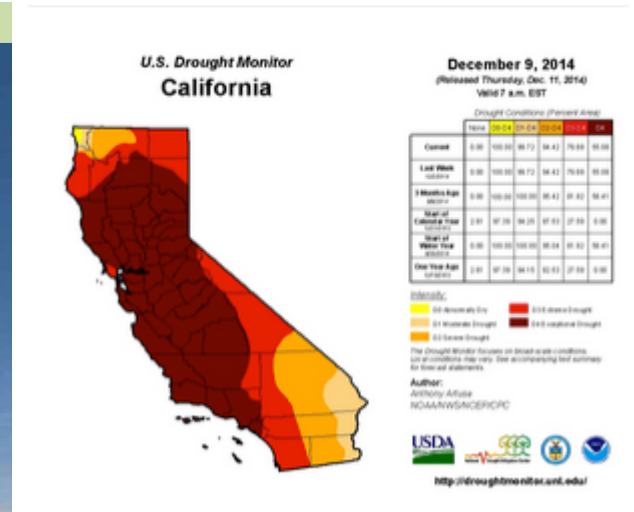


DECEMBER 10,  
2014  
BY PAUL ROGERS

# California drought the worst in 1,200 years, new study says



## DROUGHT MONITOR



# Drought Transformed the Landscape

Spring 2011



Spring 2011



Spring 2014

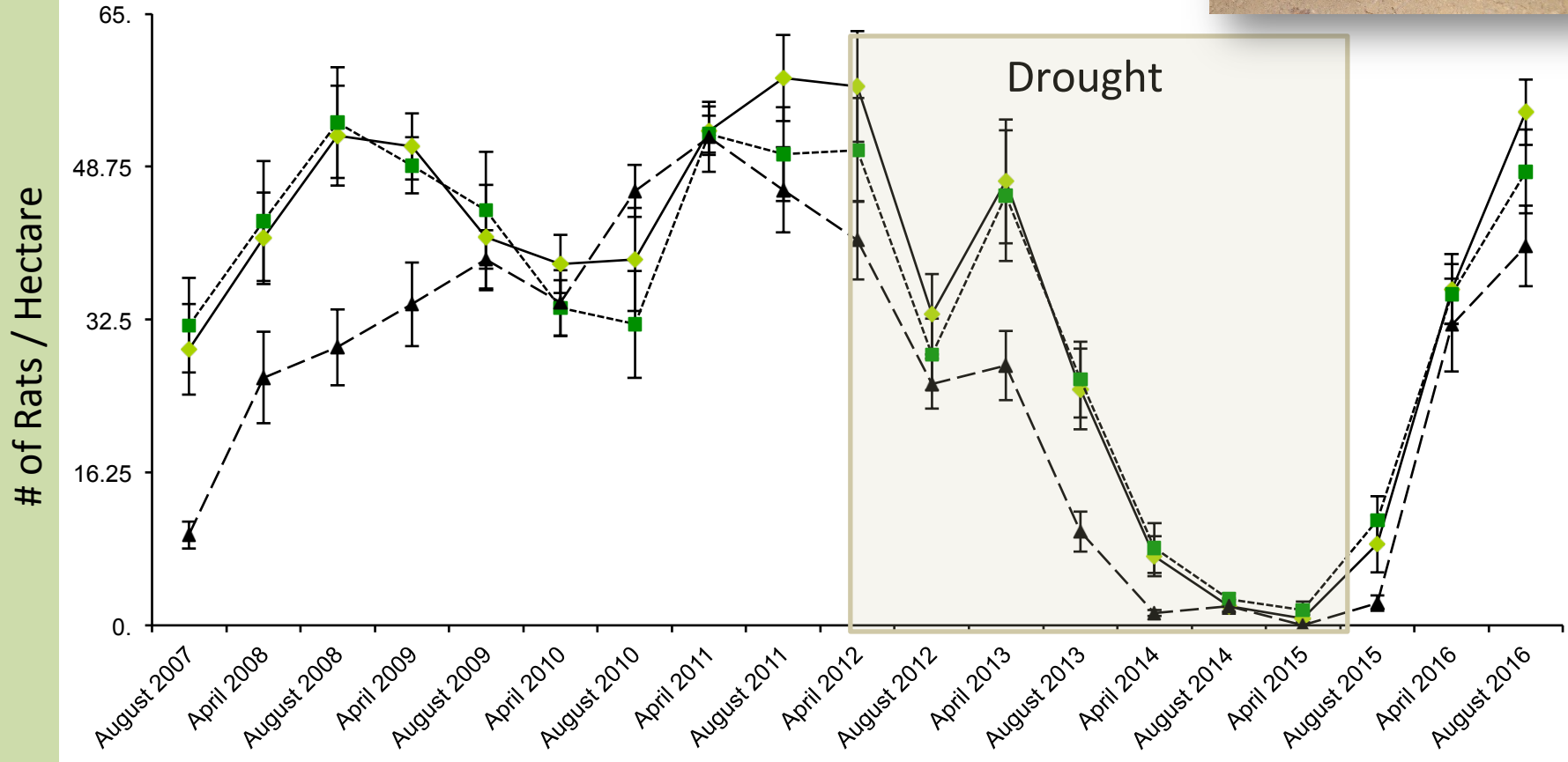


Spring 2014





# Response of a keystone species: The Giant Kangaroo Rat



- Plants were able to recover on their own when the rains came back
- What is the limit?

Have you noticed  
any changes in  
your own  
backyard?





4.) Do you think global warming will harm you personally?

4.) Estimated % of adults who think global warming will harm them personally

5.) Do you think global warming will harm people in the United States?

5.) Estimated % of adults who think global warming will harm people in the U.S.

6.) Do you think global warming will harm people in developing countries?

6.) Estimated % of adults who think global warming will harm people in  
developing countries



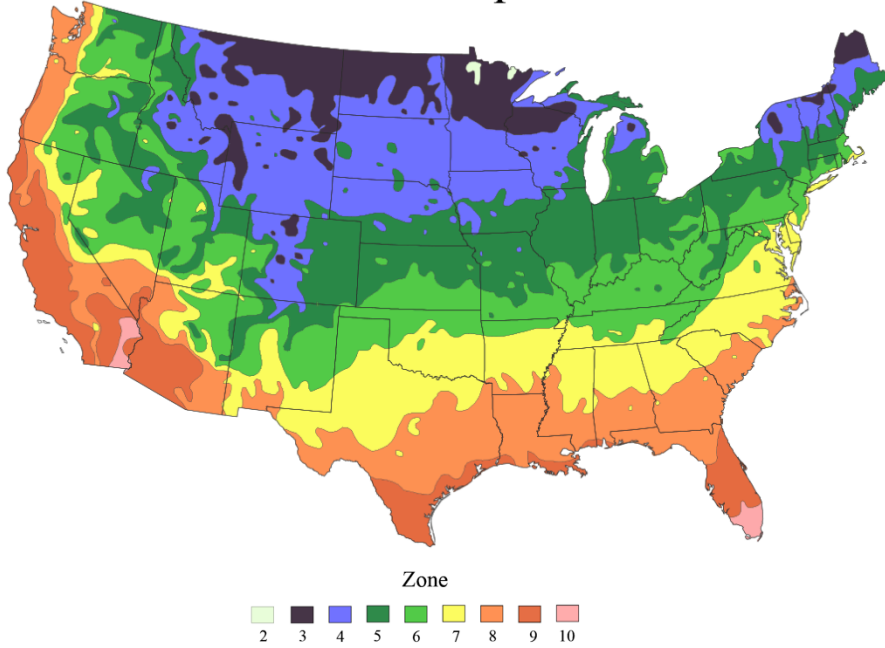
**38%** 4.) Estimated % of adults who think global warming will harm them personally

**56%** 5.) Estimated % of adults who think global warming will harm people in the U.S.

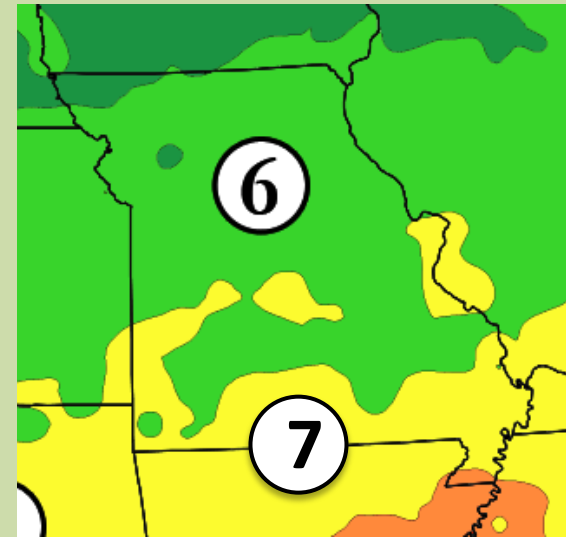
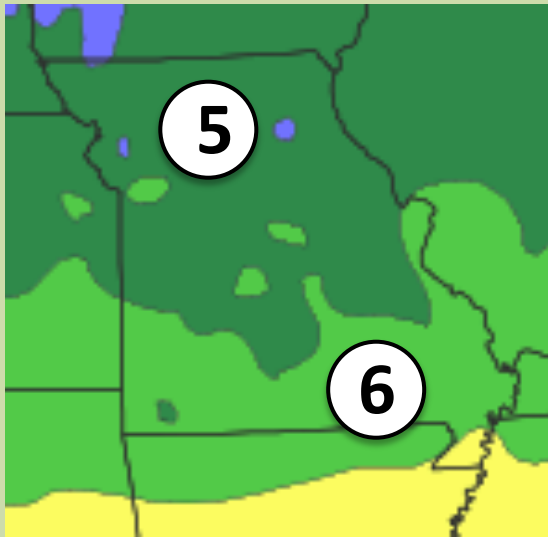
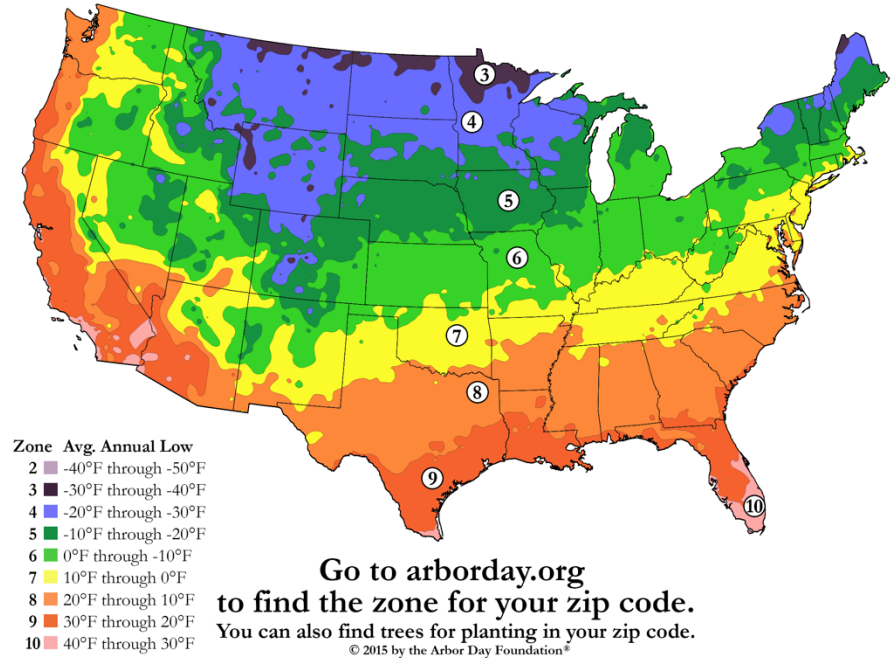
**61%** 6.) Estimated % of adults who think global warming will harm people in developing countries

# Planting Zones

1990 Map



2015 arborday.org Hardiness Zones Map



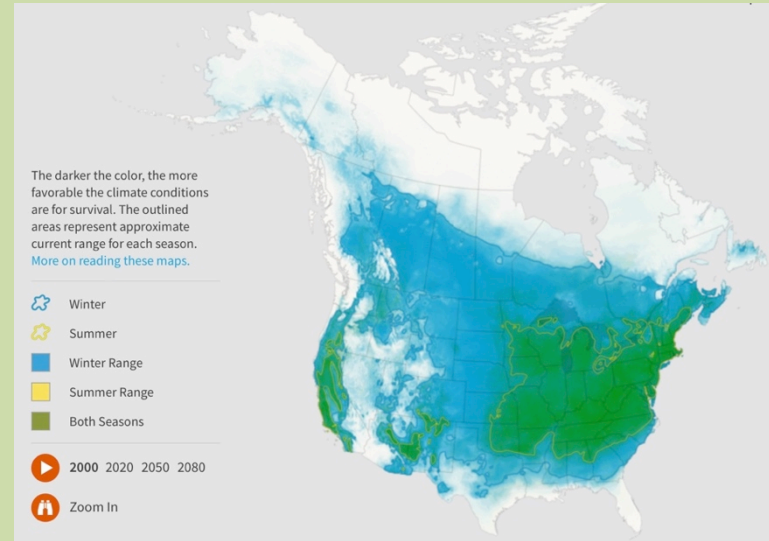
# Bird Habitat Shifts

## National Audubon Society - Study of 314 Species

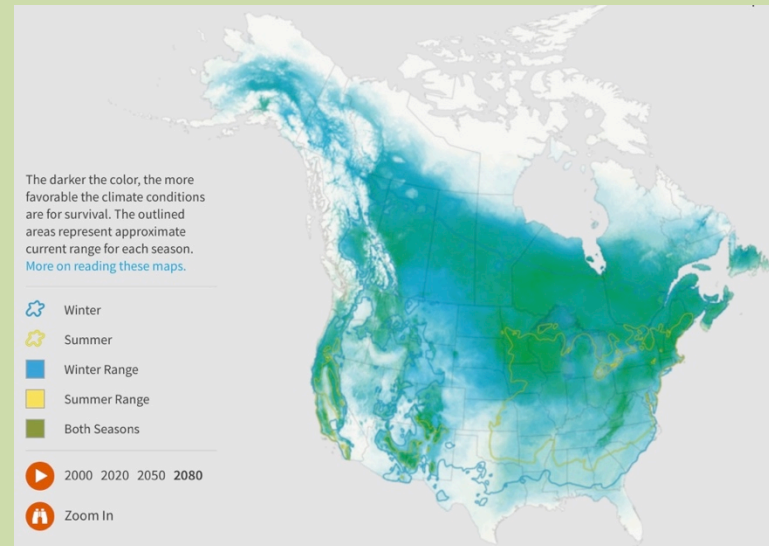


Matt MacGillivray/Flickr Creative Commons

Recorded Data  
2000





Prediction  
2080



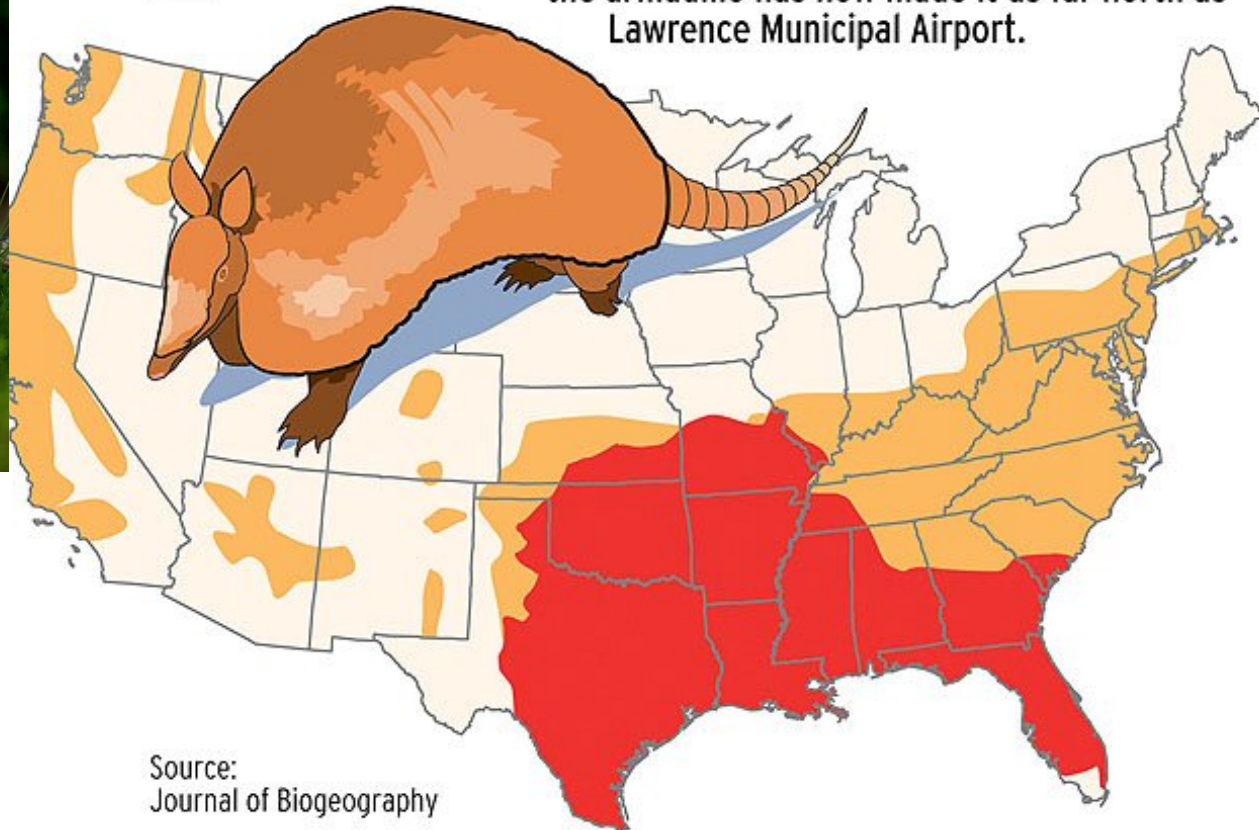
**Handout of Citizen  
Scientist Project  
Opportunities  
later. . .**

# Nine-banded Armadillo

## Expanded range

-  Current range
-  Potential range

The nine-banded armadillo has expanded its territorial range significantly over the past several years. Originally from South America, the armadillo has now made it as far north as Lawrence Municipal Airport.



Source:  
Journal of Biogeography







- 7.) Do you think global warming is already harming people in the United States now or within 10 years?
- 7.) Estimated % of adults who think global warming is already harming people in the United States now or within 10 years



**49%** 7.) Estimated % of adults who think global warming is already harming people in the United States now or within 10 years

American Red Cross did more work with disaster relief efforts in 2017 than the last 4 years combined.

Was last year simply extreme weather or is there something else going on?



# Sarichef Island, Alaska

- Inhabited for 400 years



# Sarichef Island, Alaska

## What is the difference?

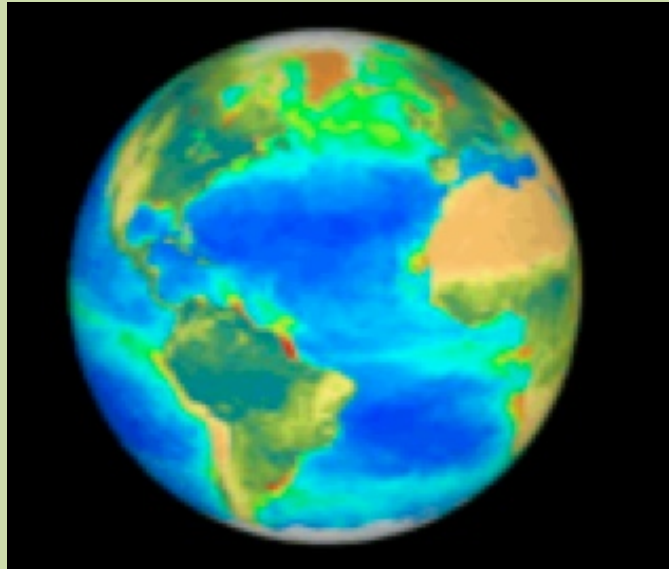


# Sarichef Island, Alaska

- Facing evacuation – “Climate Refugees”
  - Sea levels rising
  - Reduced sea ice causing higher storm surges
  - Thawing permafrost causing erosion

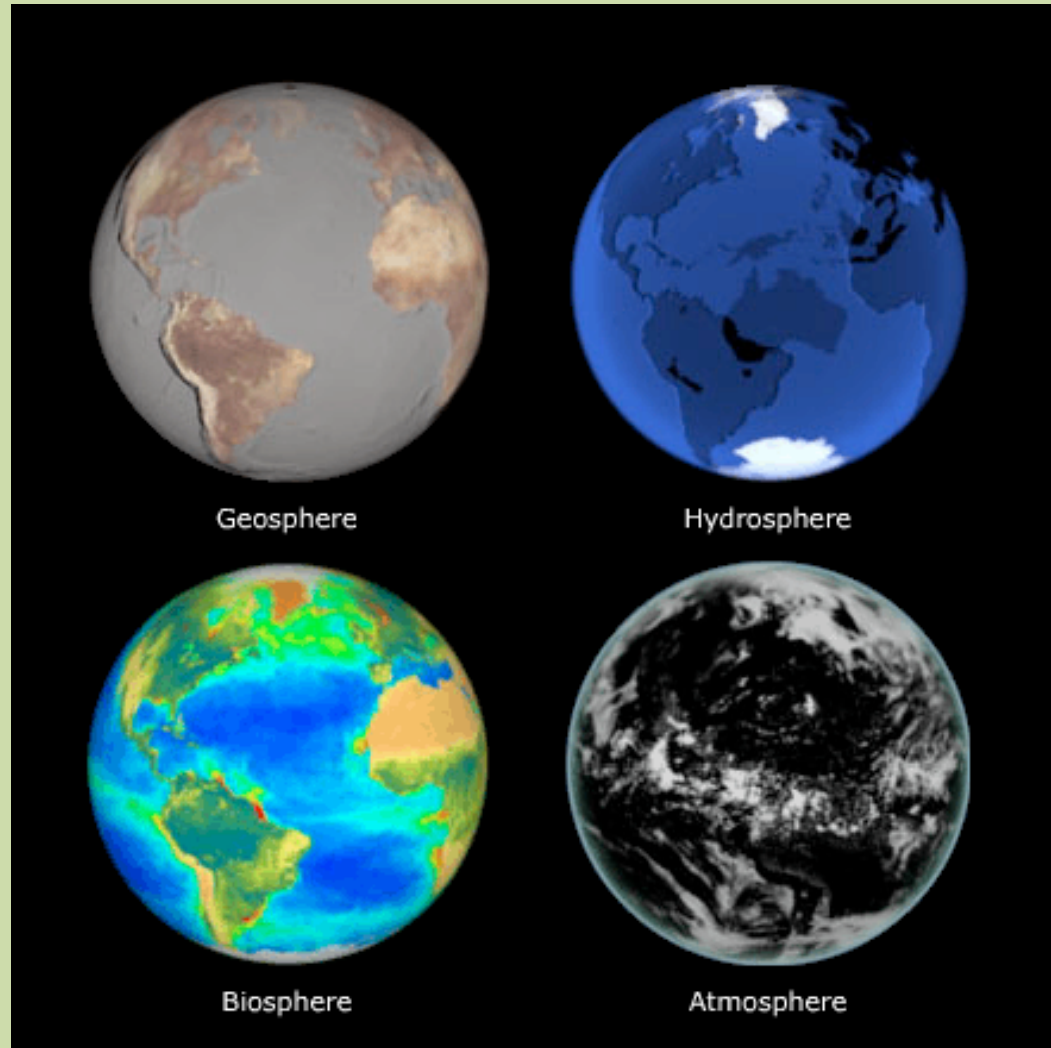


How do scientists gather data to study climate?



# Four of Earth's System Components (or "Spheres")

Earth is a system made up of multiple interconnected components.

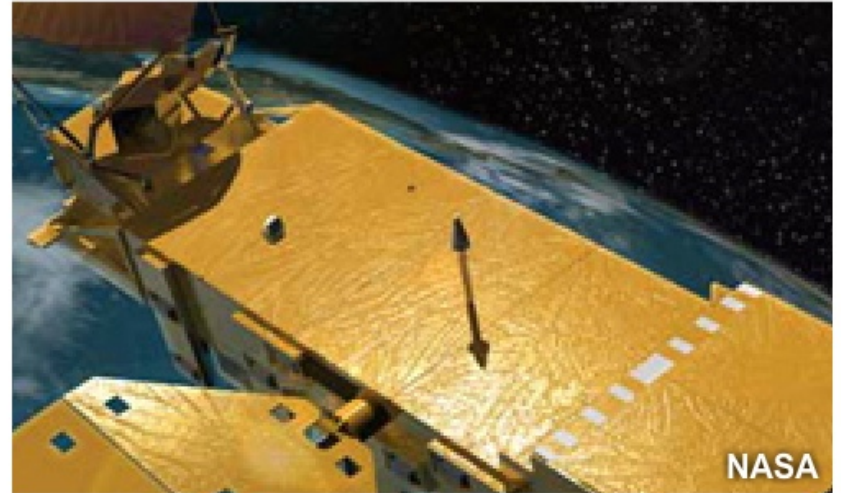




# Current Climatological Data Gathering



**Surface Observations**

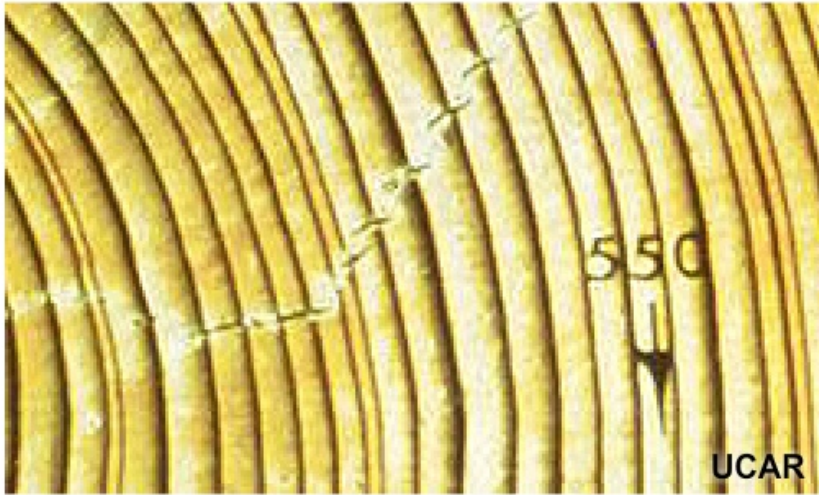


**Atmospheric Observations**



**Ocean Observations**

# Historical Climatological Data Gathering



**Tree rings**



**Ice cores**



**Coral growth patterns**



**Climate models**

# Global Climate Model Inputs

Ozone layer

Solar energy

Atmospheric chemistry

Upper-level winds

Snow and ice

Clouds

Air-sea exchanges

Outgoing heat

Land surface processes

Human-produced emissions

Hydrologic cycle

Soil moisture and temperature

Realistic geography

Marine ecosystems

Ocean currents, temperature and salinity

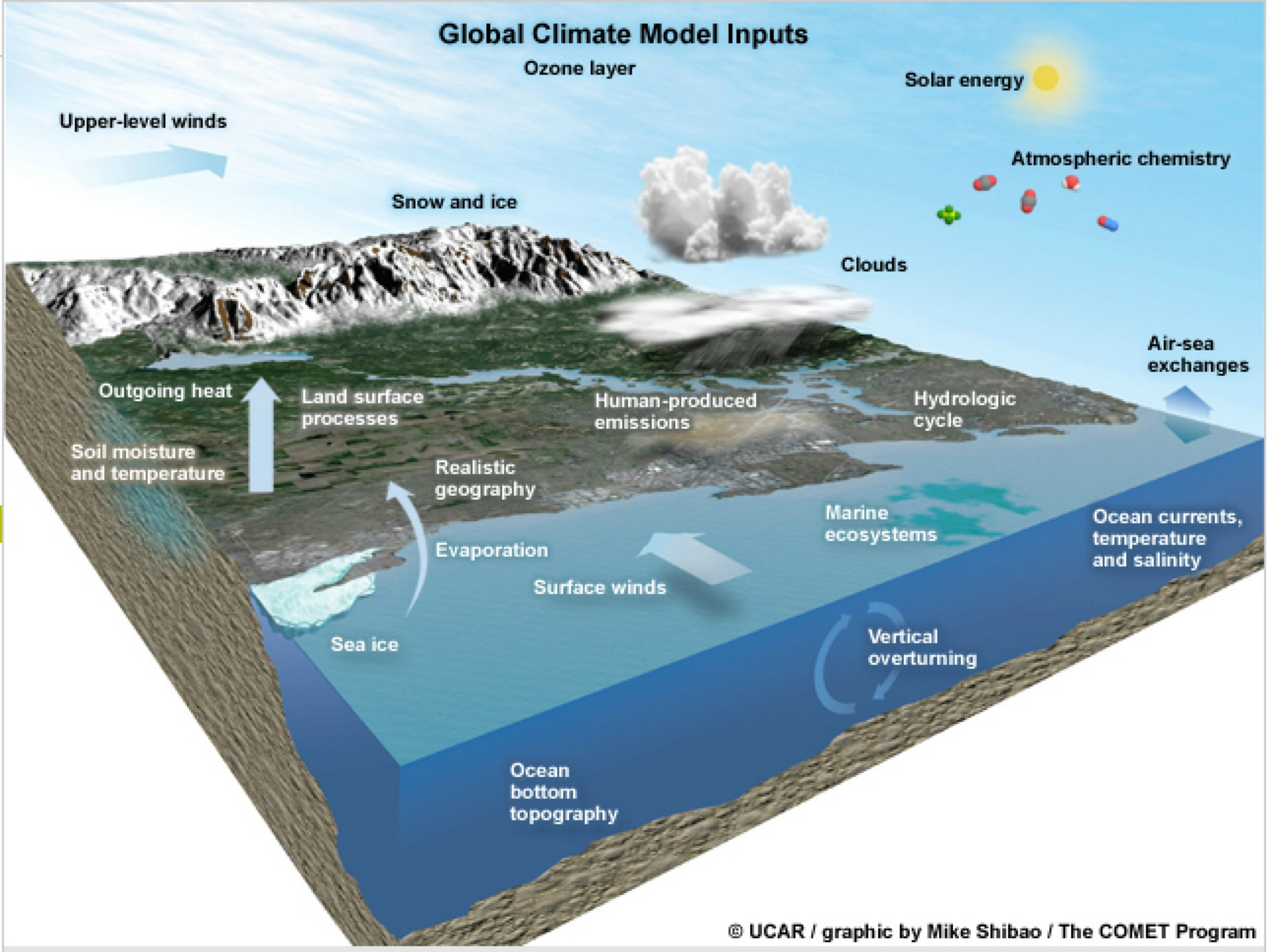
Evaporation

Surface winds

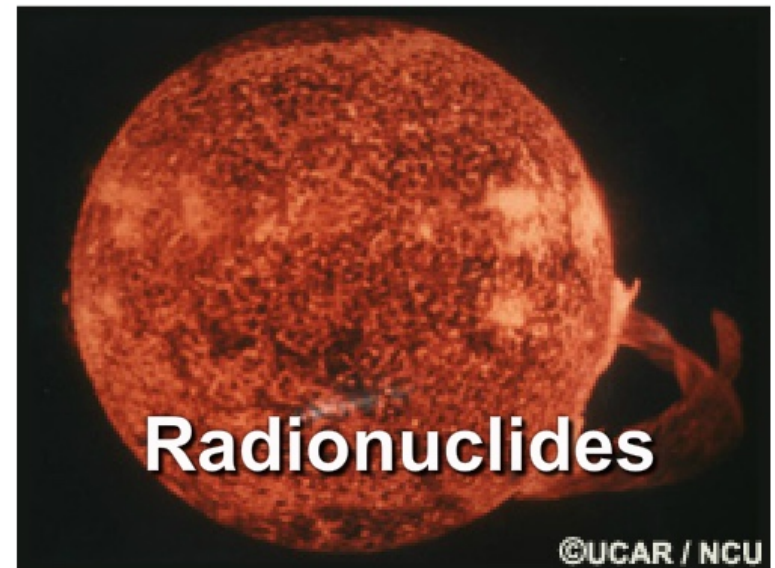
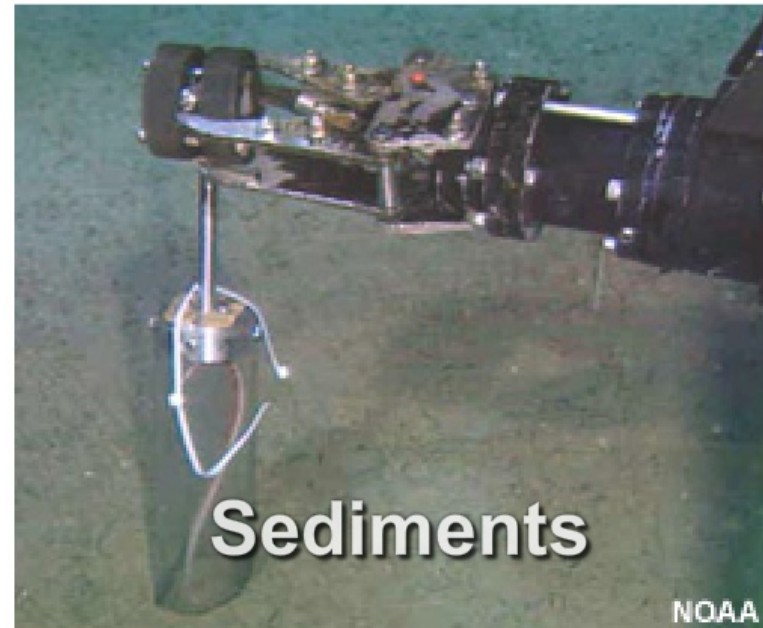
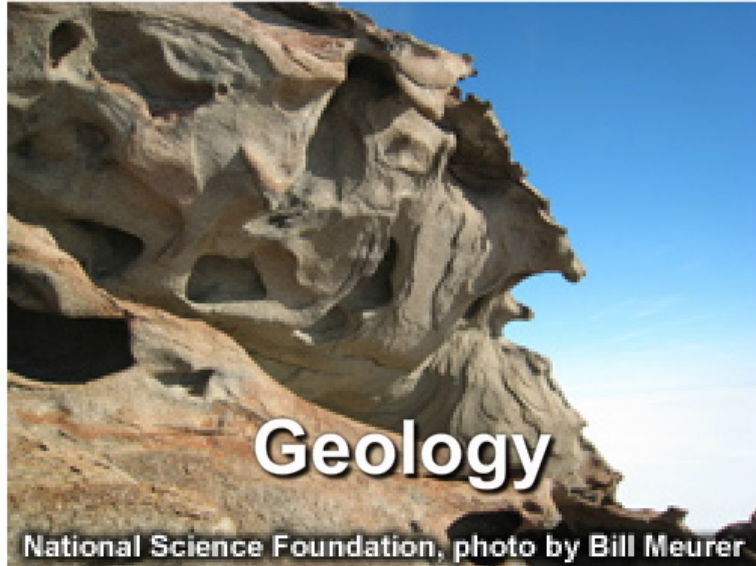
Vertical overturning

Sea ice

Ocean bottom topography



# Paleoclimatology: The study of Earth's climates throughout geologic history using such tools as:



Suspicious about all of these changes?

Suspicious about the data?

**Seek out the experts. . .**

Look for *non-biased resources*  
focused on the study of climate

# Earth to Sky Partnership

- Collaboration of NASA, NPS, and USFWS
- “.org” so not directly affiliated with the U.S. Government
- Earth to Sky charter states they are not to market themselves



# Intergovernmental Panel on Climate Change

- Established in 1988
- 2,000 specialists from over 140 countries
- Does not gather data, but performs peer reviews of others' information



See the handout for these and more websites to gather information!





# Great resource for projects: Drawdown.org

NEW YORK TIMES BESTSELLER

# DRAWDOWN

THE MOST COMPREHENSIVE  
PLAN EVER PROPOSED TO  
REVERSE GLOBAL WARMING  
EDITED BY PAUL HAWKEN



## Featured Solutions

### ELECTRICITY GENERATION



#### ROOFTOP SOLAR

Rooftop solar is spreading as its cost falls, driven by incentives to accelerate growth, economies of scale in manufacturing, and advances in photovoltaic technology.

RANKING BY 2050

#10

### WOMEN AND GIRLS



#### EDUCATING GIRLS

Education lays a foundation for vibrant lives for girls and women, their families, and their communities. It also avoids emissions by curbing population growth.

RANKING BY 2050

#6

### LAND USE



#### AFFORESTATION

Afforestation—creating forests where there were none before—creates a carbon sink, drawing in and holding on to carbon and distributing it into the soil.

RANKING BY 2050

#15

Become educated...

Find data from both sides of the story

For instance:

Marc Morano with ClimateDepot.com and interviewed in the Merchants of Doubt documentary

Jimmy Hogan of The Rational Environmentalist

Climate are the types of clothes in your closet.



Weather is the clothing that you wear that day.



# WEATHER



National Oceanic and  
Atmospheric Administration  
U.S. Department of Commerce

EXPLORE



Find your local weather +

Frequently accessed tools & resources +

Search NOAA sites



## 2017 was 3rd warmest year on record for U.S.

16 billion-dollar weather and climate disasters made for costliest year on record >

AROUND NOAA //

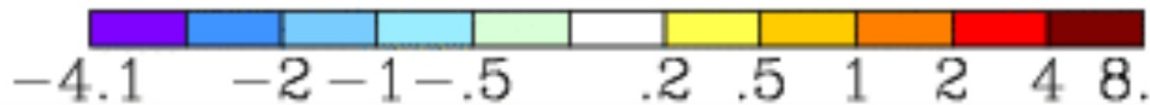
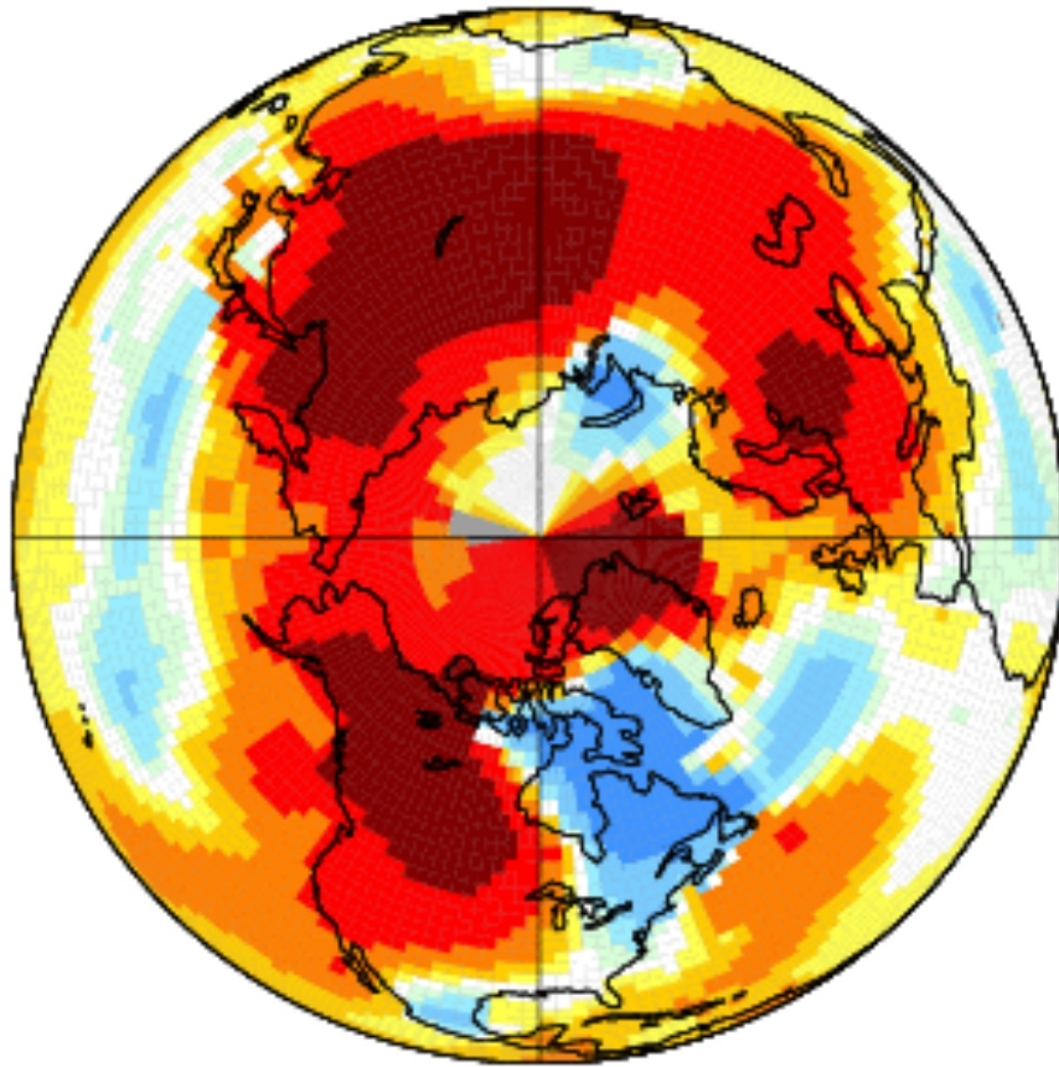
Snow squall warnings to begin this winter >

NOAA kicks off 2018 with massive supercomputer  
upgrade >

- In Europe, 2013 was the warmest summer in the past 2,000 years

- Extreme heat events occurred about every 20 years, but could become every 3 years by 2050.
- If this becomes the new pattern over time, then this indicates a change in the climate. . .

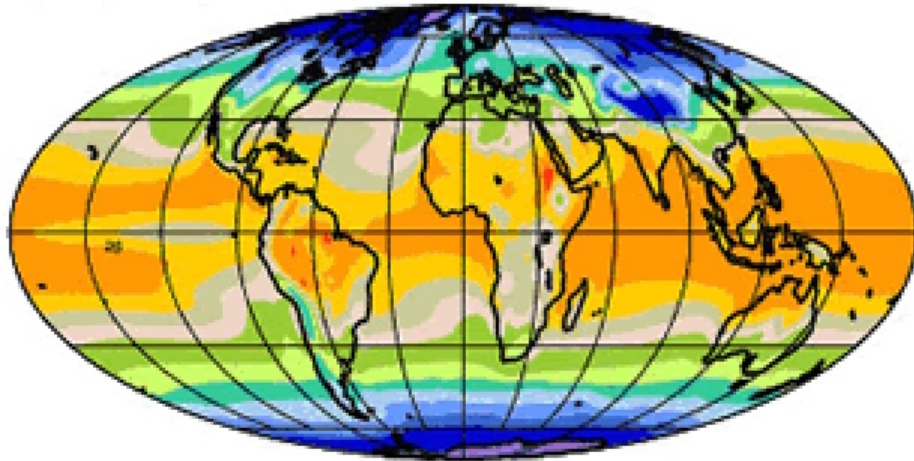
January 2015



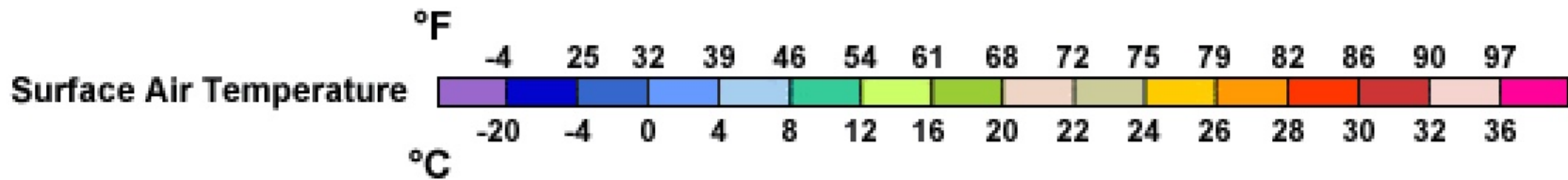
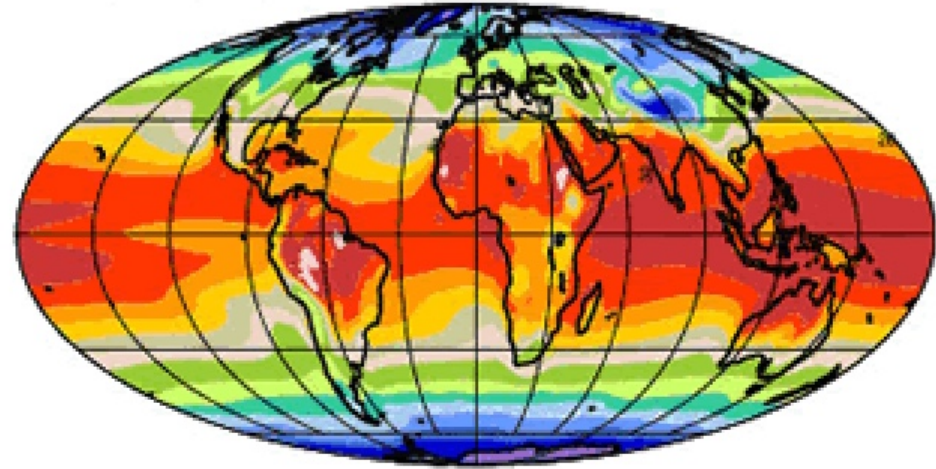
**Look  
beyond  
your own  
backyard...**

# Average Surface Air Temperature

Present Day  
(1990s)

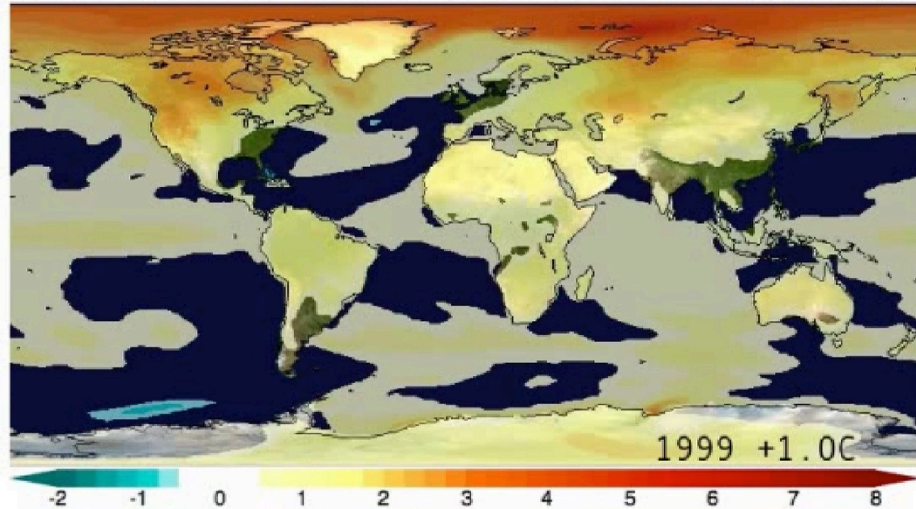


Possible Future  
(2090s)

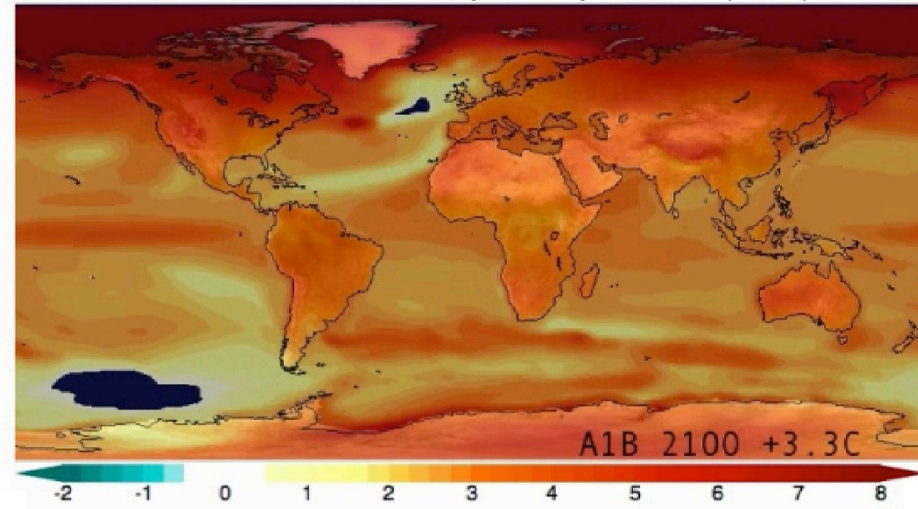


# AMOUNT OF TEMPERATURE CHANGE

Surface Temperature Change Relative to 1870-1899 Baseline  
Model Forecast from the Community Climate System Model 3 (CCSM3)



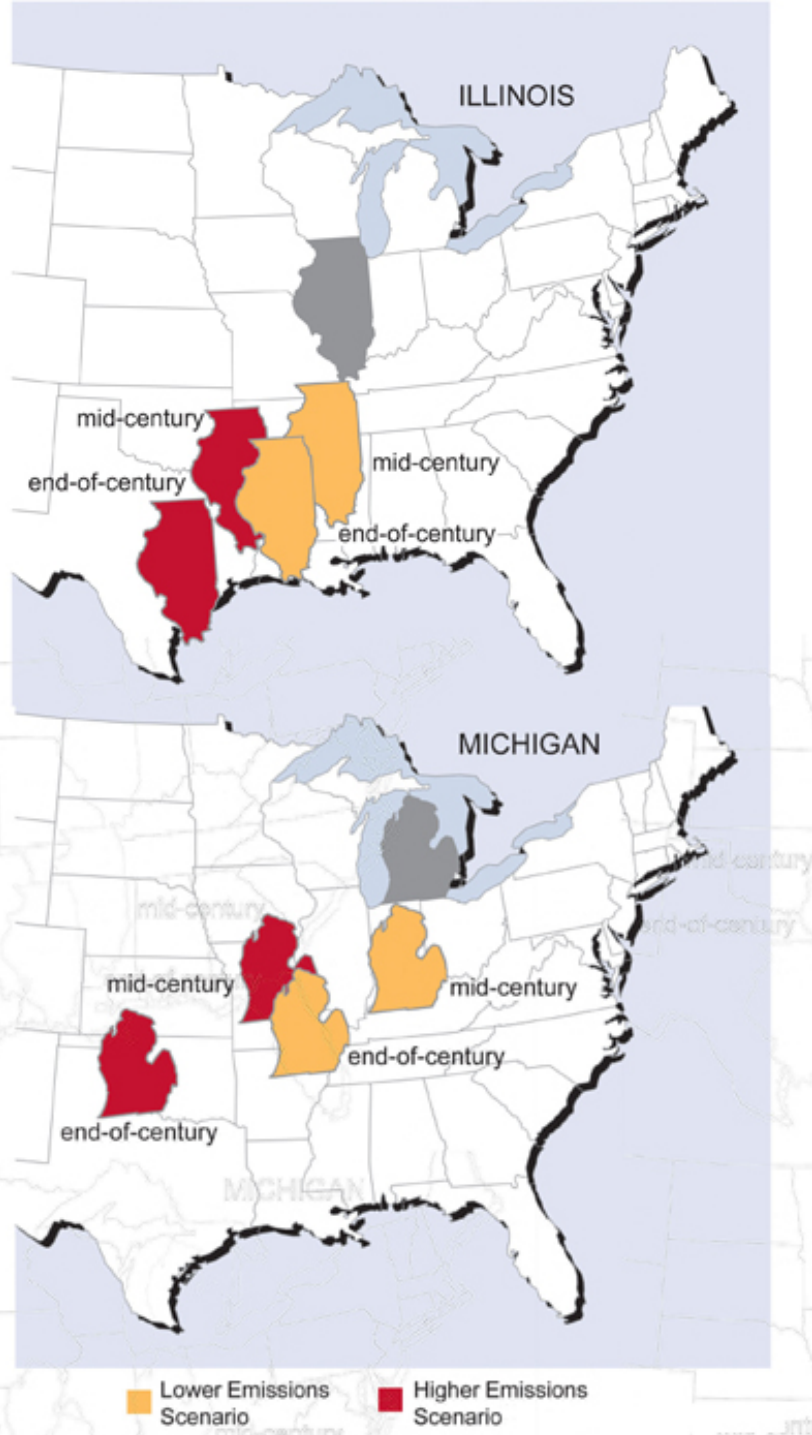
Surface Temperature Change Relative to 1870-1899 Baseline  
Model Forecast from the Community Climate System Model 3 (CCSM3)



[https://www.meted.ucar.edu/broadcastmet/climate/media/flash/warming\\_projection.swf](https://www.meted.ucar.edu/broadcastmet/climate/media/flash/warming_projection.swf)

- Arctic surface air temperature is warming twice as fast as rest of world
- Autumn Arctic Ocean ice cover is rapidly declining 13% per decade
- Climate models predict an ice free Arctic Ocean between 2030 and 2080





Projected change in summer temperatures under different warming scenarios. Summers in Illinois and Michigan might feel like current summers in Texas or Oklahoma by the end of the century. Source: USGCRP (2009)<sup>[8]</sup>

If average global temperatures rise 3-5 degrees F, the sea levels could rise 20 feet (levels from about 3 million years ago)

- Not only by melting glaciers, but warmer water takes up more volume

