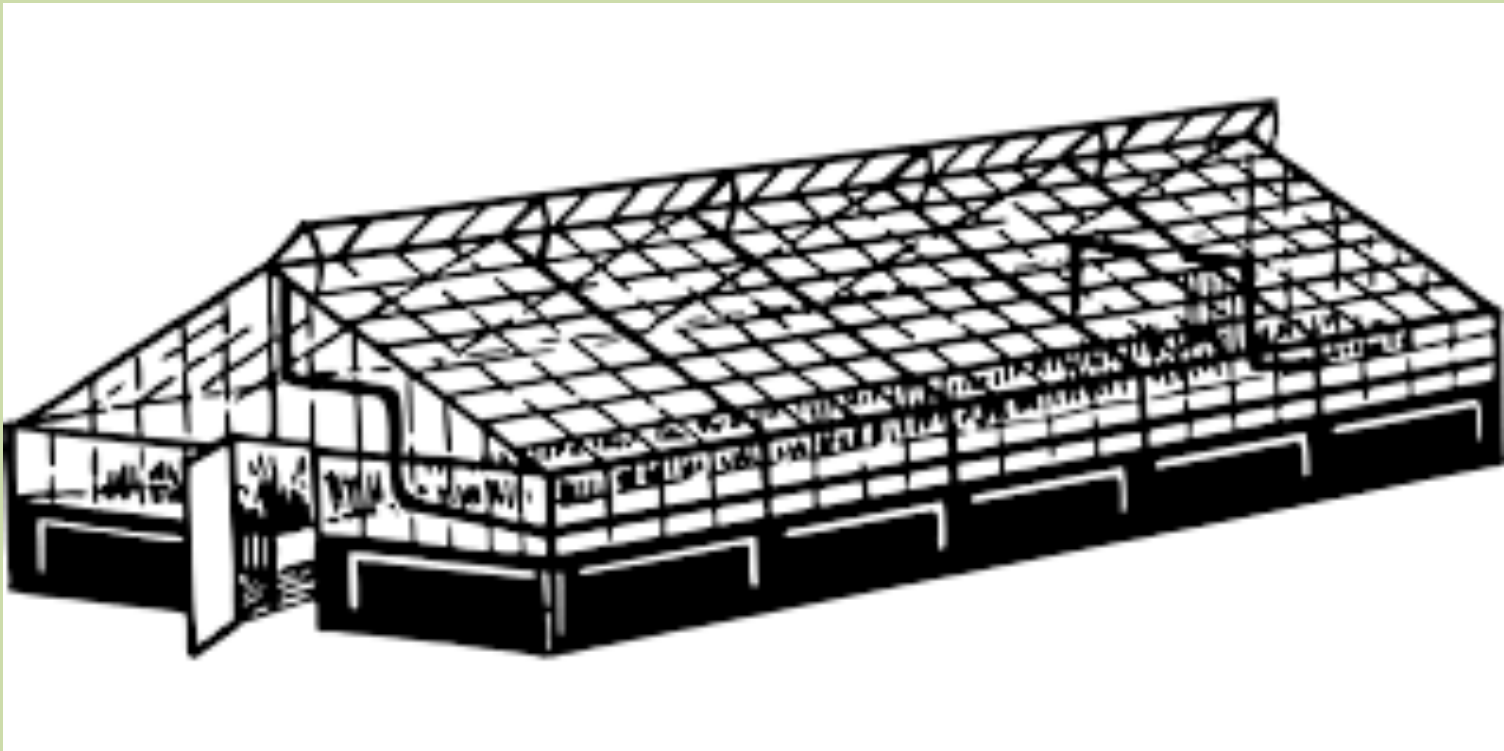


Isn't this just natural cycles?

- Milankovitch Cycle take 1000s of years for cycle to complete
- In the 20th Century, warming 10 times faster than the warming after the last Ice Age
- Solar and volcanic activities over the last 50 years should have cooled the Earth, but instead the Earth's global temperature is increasing

What are some examples of greenhouse gases?



Some of the Greenhouse Gases

Natural

- Water

Natural and human industrial activities

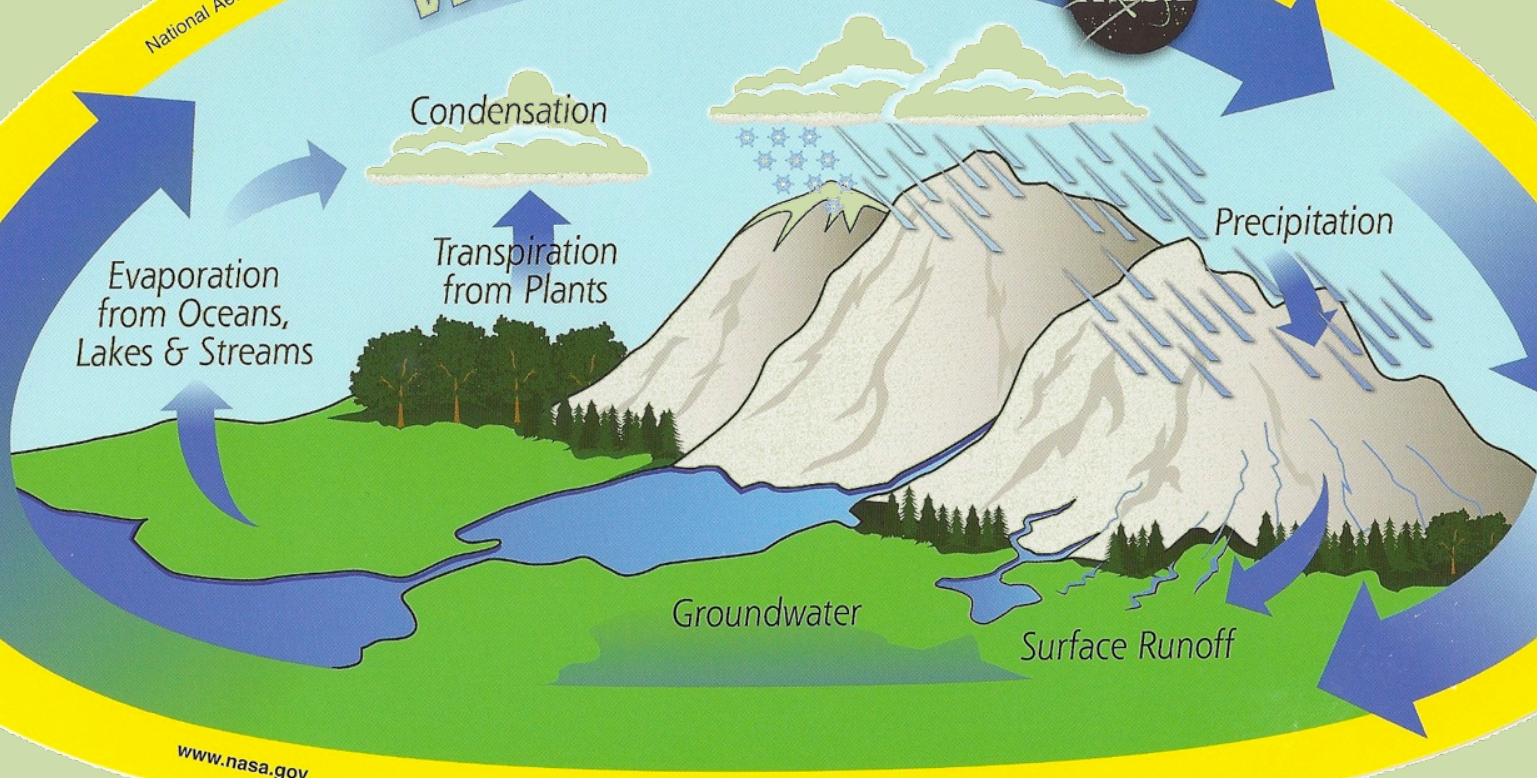
- Carbon Monoxide
- Carbon Dioxide
- Methane
- Nitrous Oxide

Human industrial activities only

- Sulfur Hexafluoride
- Carbon Tetrafluoride

National Aeronautics and Space Administration

WATER CYCLE



www.nasa.gov



8.) Do you support regulating CO₂ as a pollutant?

8.) Estimated % of adults who support regulating CO₂ as a pollutant



74% 8.) Estimated % of adults who support regulating CO₂ as a pollutant

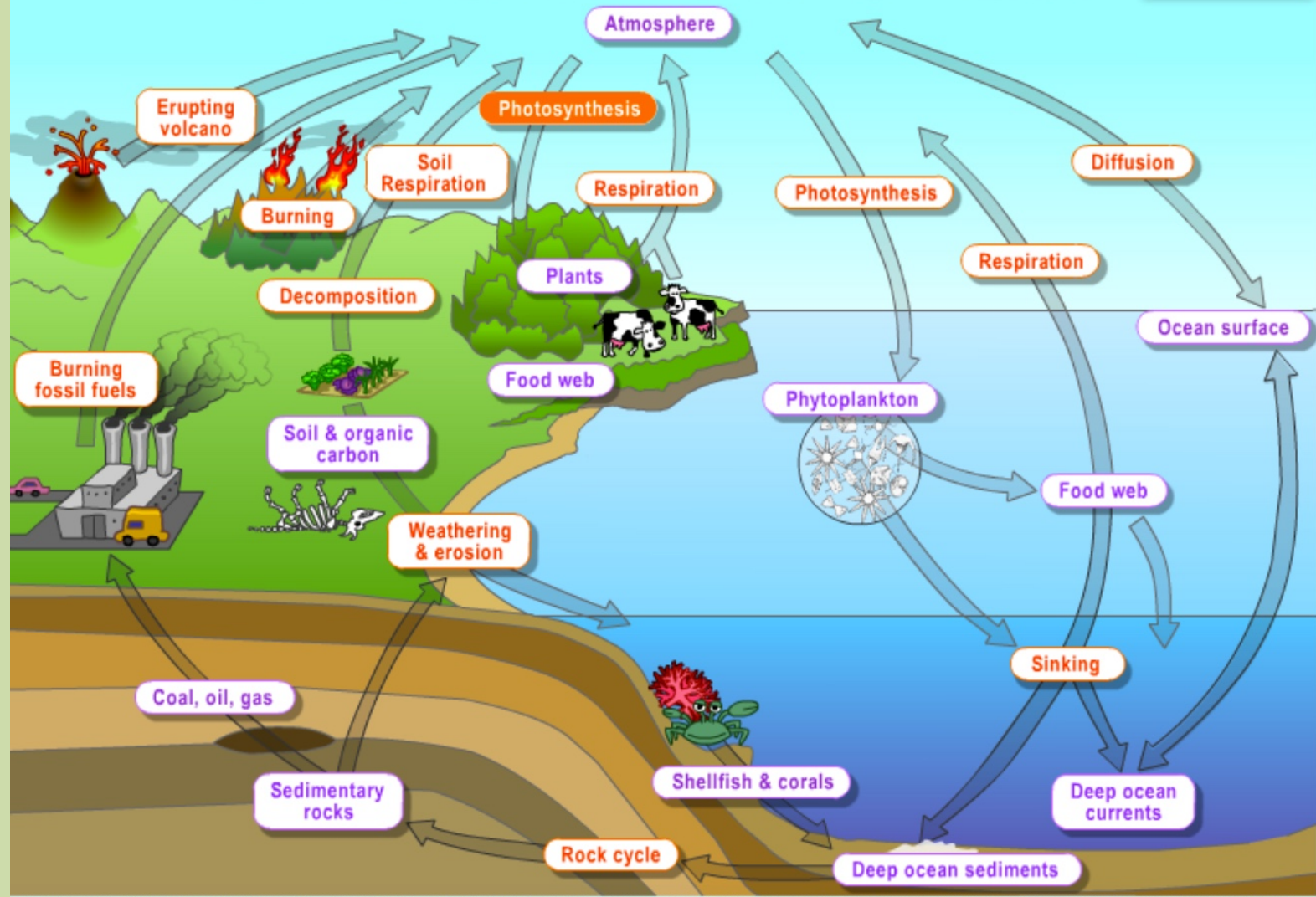
CARBON ACTIVITY TIME!

Earth's System Processes Take Place on Both Local and Global Scales

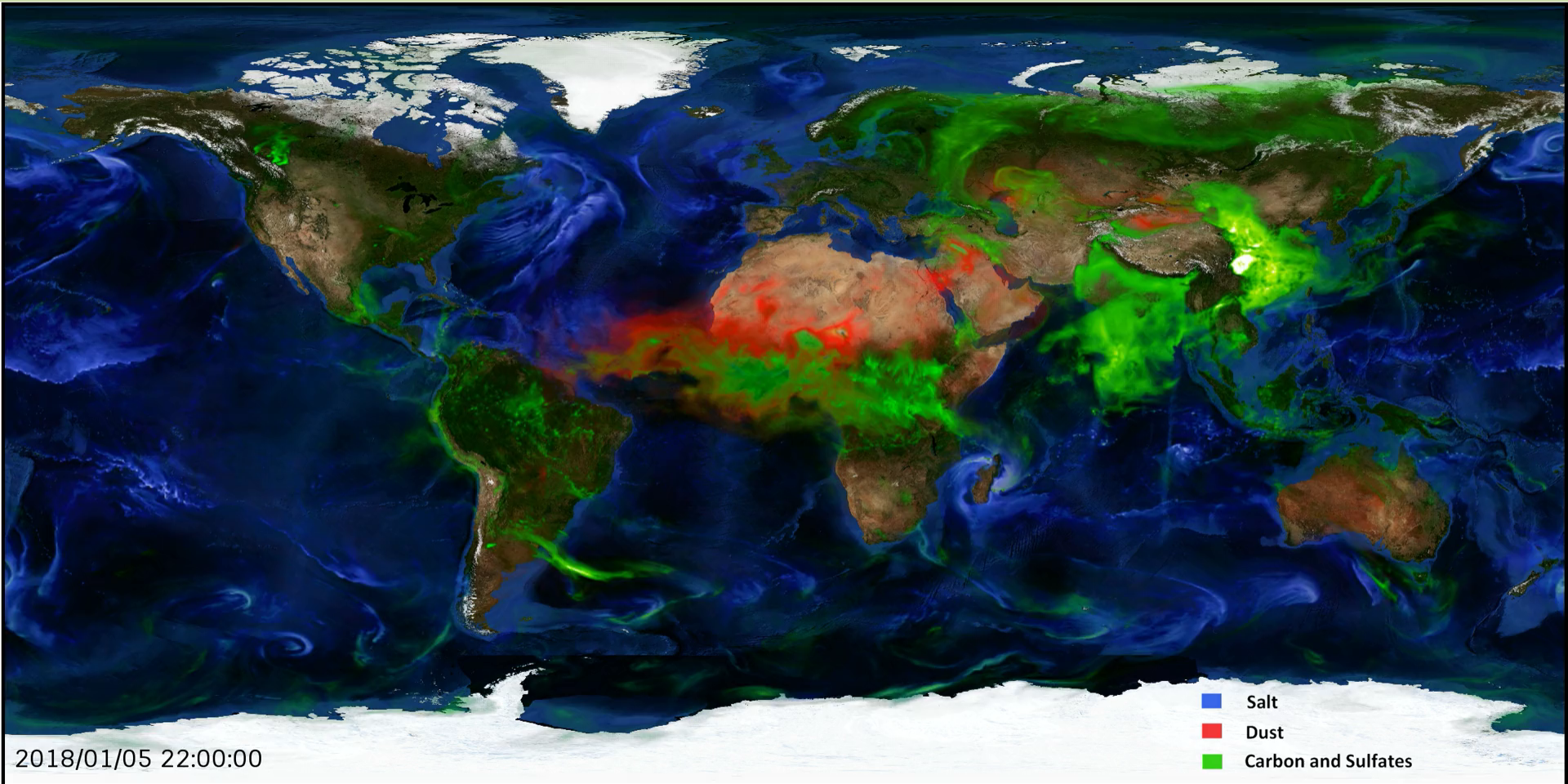
09/30/13 UNDER DEVELOPMENT for TERC's EarthLabs

THE CARBON CYCLE

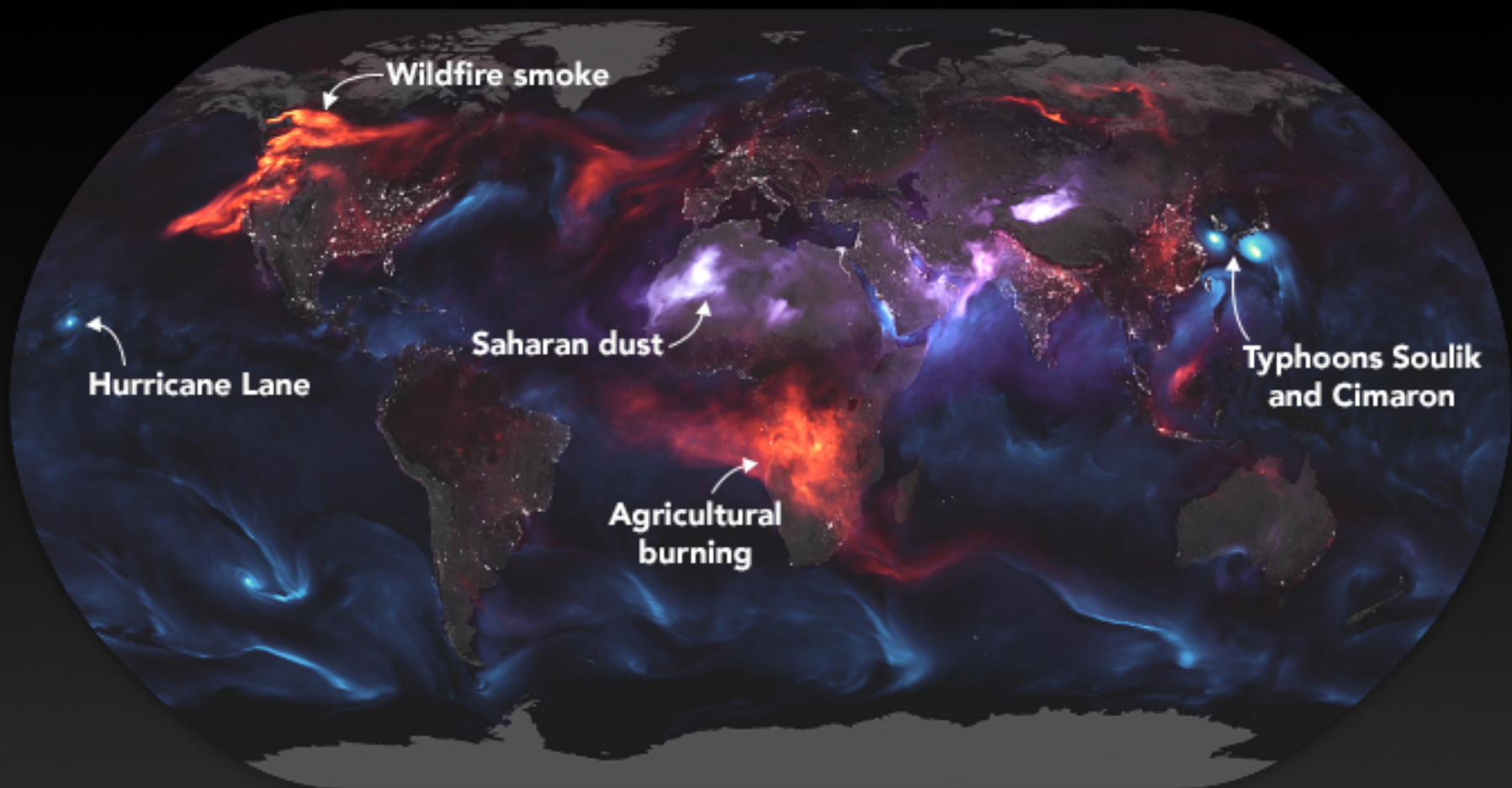
KEY
Process (orange box)
Reservoir (purple box)



GLOBAL MOVEMENT OF CARBON (green)



- Salt
- Dust
- Carbon and Sulfates



Wildfire smoke

Hurricane Lane

Saharan dust

Agricultural burning

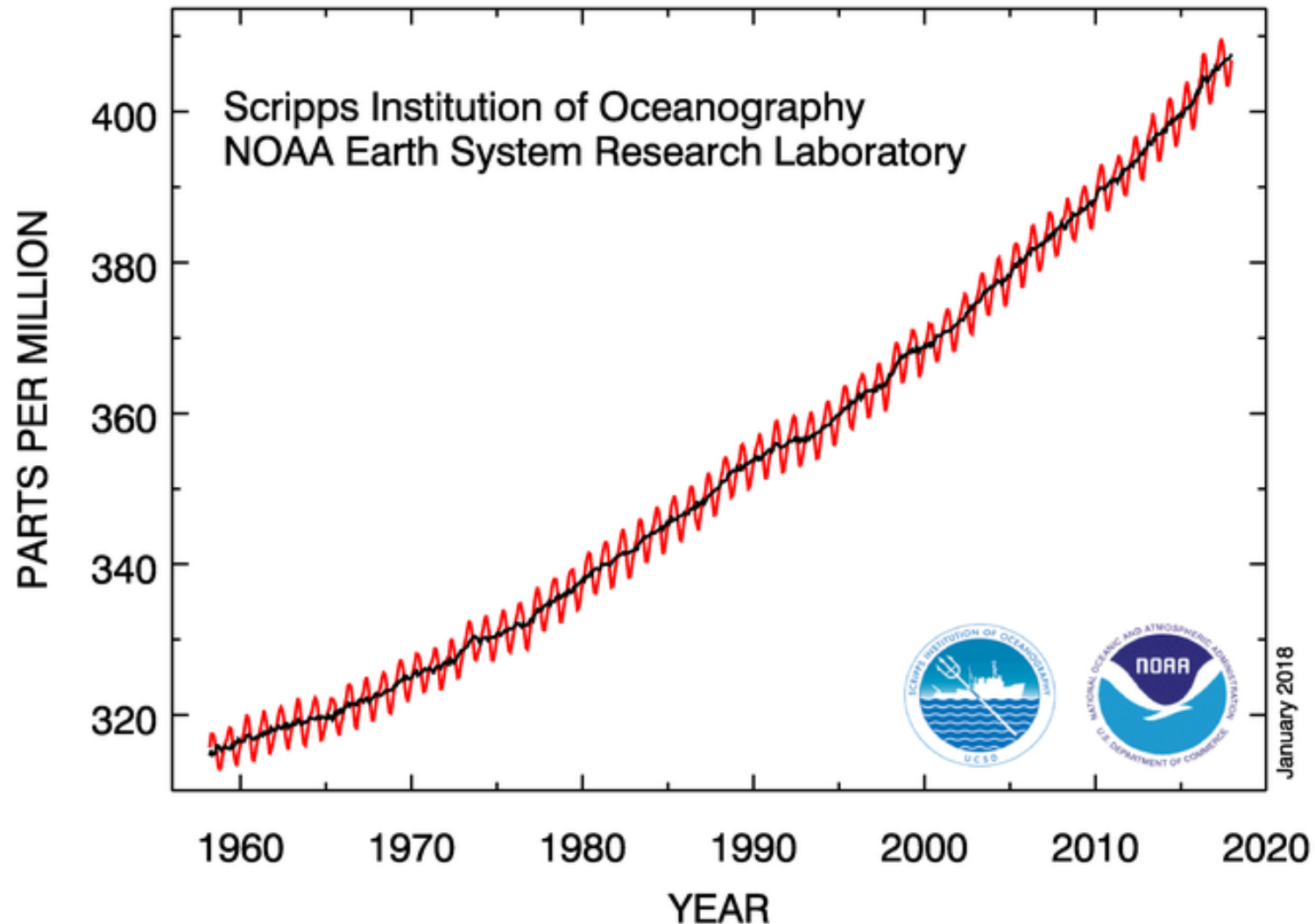
Typhoons Soulik and Cimaron

Black Carbon

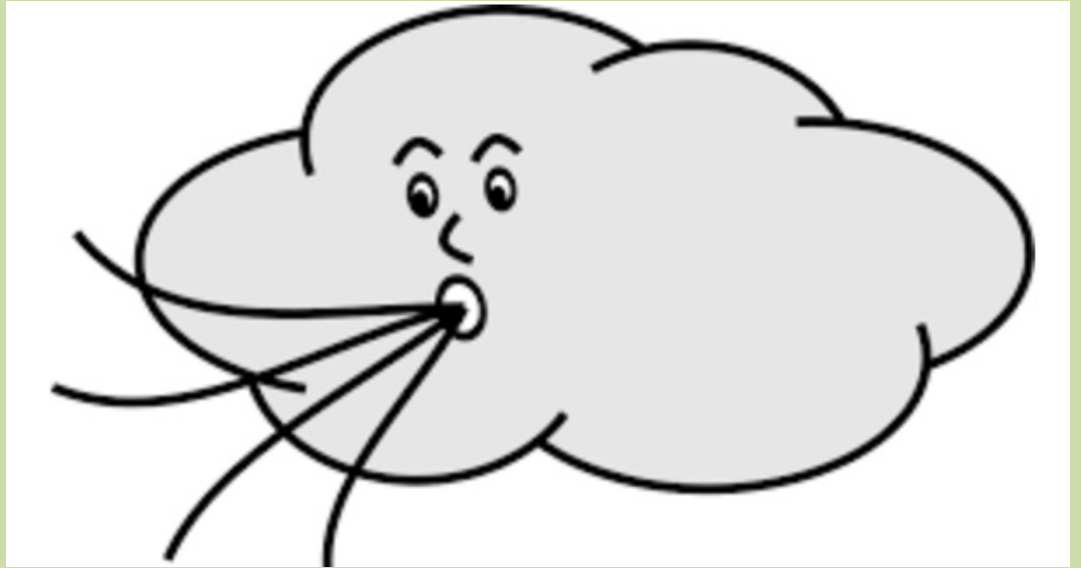
Sea Salt  Dust

Aerosols on August 23, 2018

Atmospheric CO₂ at Mauna Loa Observatory



- Coal burning produces 25% of all of world's carbon emissions
- In 2015, 5.2 million acres burned in Alaska alone
- Projection: 2 billion passenger vehicles on the roads by 2055



Anybody planning to save some green in the environment?



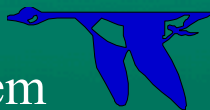


TURNBULL NATIONAL WILDLIFE REFUGE

Cheney, Washington



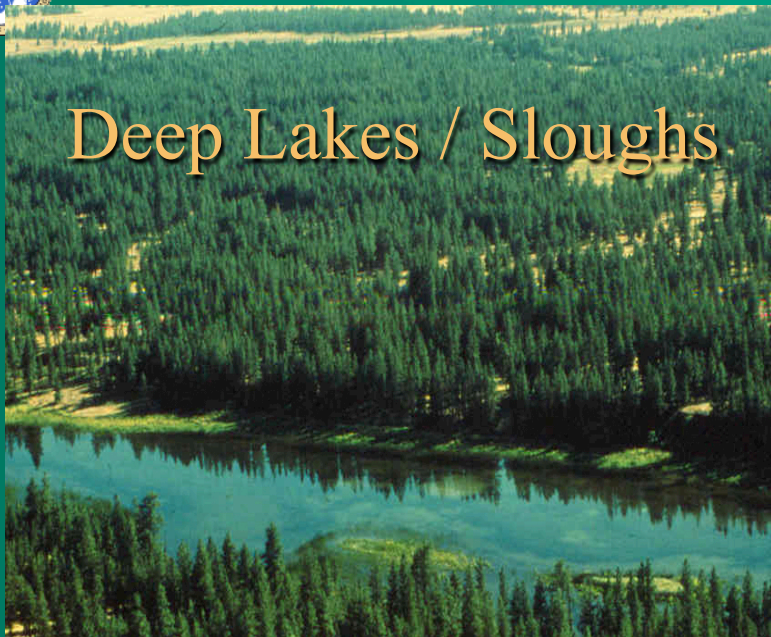
Interesting Management Strategy. . .



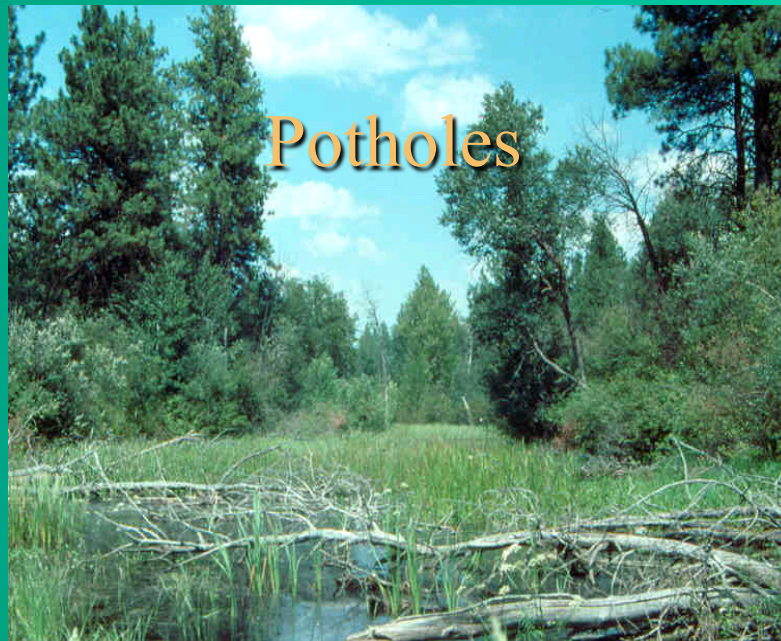


Wetlands

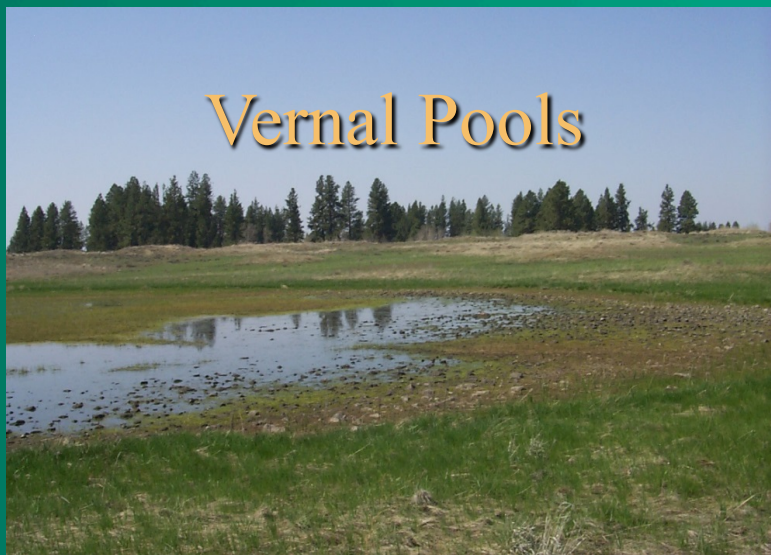
U.S. Fish & Wildlife Service



Deep Lakes / Sloughs



Potholes



Vernal Pools



Altered Wetlands

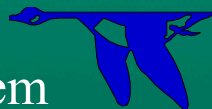




Wetland Non-climate Stressors

- Pollution
- Invasion by exotic plant and animal species
- Reduced watershed yield as a result of greater conifer forest cover

Wetland Management Practices





What's Interesting?

Wetland Planning and Managing for Expected Climate Changes





Anticipating Changes . . .

- Increase in temperature
 - Increase in evapotranspiration resulting in more rapid summer drawdown
- Little change in annual precipitation, but precipitation likely to come mostly in the form of rainfall with less snowpack
 - Snowfall accumulation especially in late winter is a significant source of wetland recharge





Long-term Adaptation Strategies

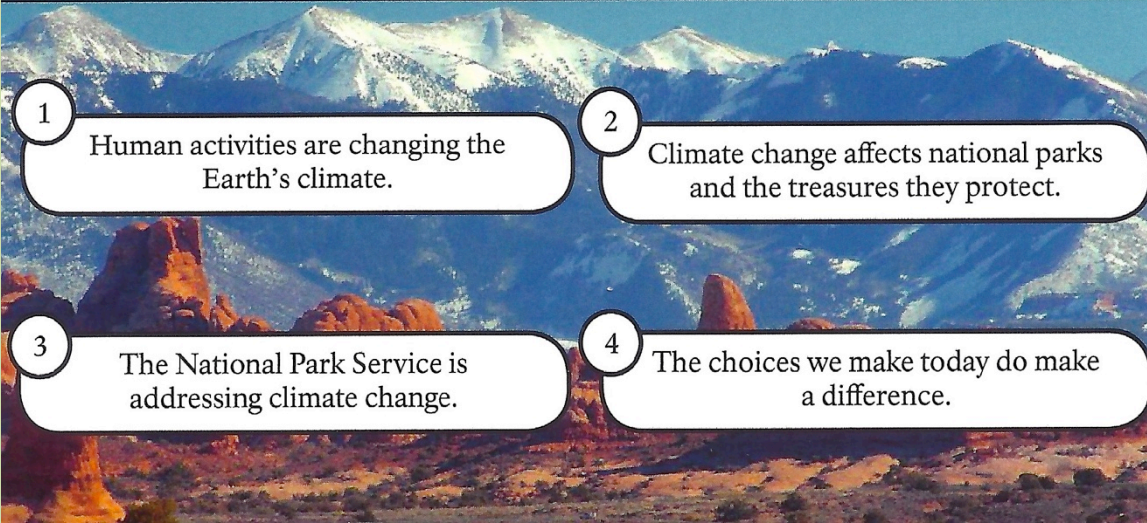
- Prioritize wetland management
 - Pass run-off through to priority wetlands
- Augment natural wetland inputs
 - Groundwater pumping
 - Tertiary treated wastewater
- Facilitate wetland transition to more xeric habitat type that provides important ecosystem functions
 - Aspen and Deciduous Shrub Communities
 - Transporting Species



Climate Change Response Program

Key Messages

National Park Service
U.S. Department of Interior



1

Human activities are changing the Earth's climate.

2

Climate change affects national parks and the treasures they protect.

3

The National Park Service is addressing climate change.

4

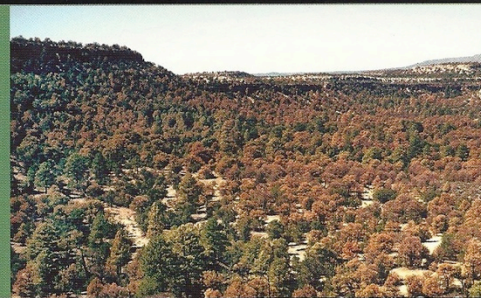
The choices we make today do make a difference.

Climate Change in National Parks



Climate Change Response Program
Natural Resource Stewardship and Science

National Park Service
U.S. Department of the Interior



What's Happening in Missouri?



The Nature Conservancy “50 State Climate Initiative”

– MISSOURI PROGRAMS



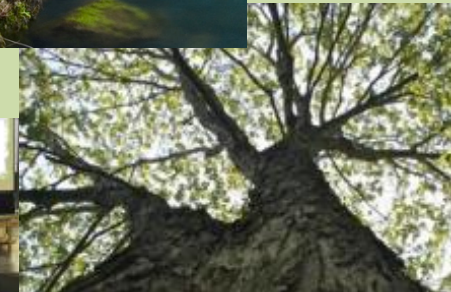
MO Fire Program

- Live trees trap carbon dioxide
- Wildfires wipe out forests. . .
- Prescribed burns and vegetation thinning create healthier forests



Current River Watershed Freshwater & Sustainable Forestry Program

- Sustainable forest practices
- Landowners can improve the health of their woodland, improve habitat for wildlife, and help keep water clean by reducing erosion and run-off



The Nature Conservancy “50 State Climate Initiative”

– MISSOURI PROGRAMS



Dunn Ranch Prairie

- Grasslands have fabulous carbon storage
- Drought tolerate native plants for ranchers
- Plant more prairies!



St. Louis Office Goes Virtual

- Moved into a smaller, more energy-efficient office space
- Staff works from home most days



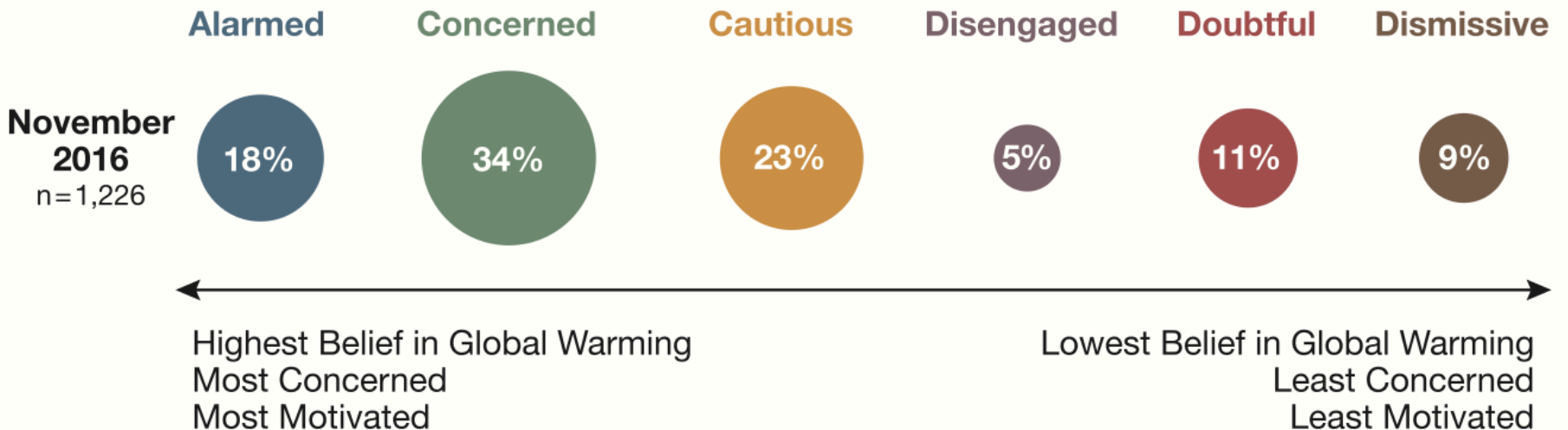
Where We've Been

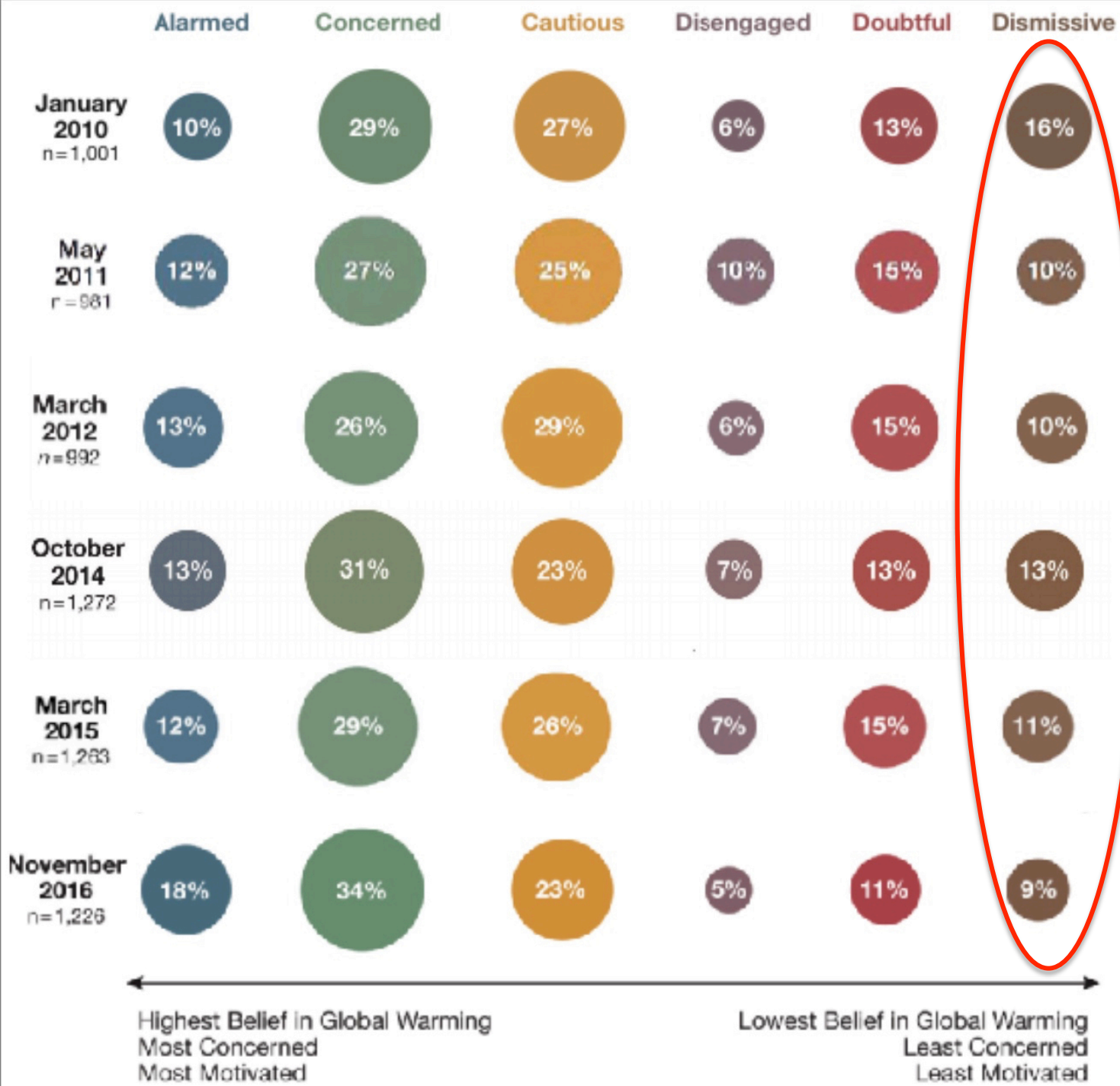
- Changes that have occurred
- How scientists gather data
- Management plans for natural areas

Where We're Headed

- The Six Americas
- Plan of Action
- ACE activity
- Talking Template
- Message of Hope!

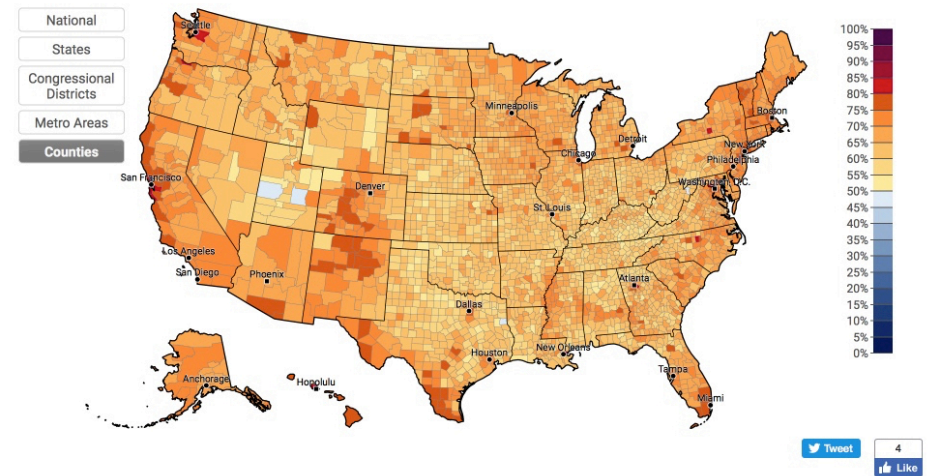
“Six Americas of Climate Change”



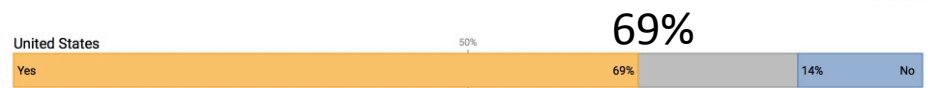


Estimated % of adults who think global warming is happening, 2016

Display model output: Global warming is happening Absolute Value Permalink
 Click on map to select geography, or: Select a State Select a County

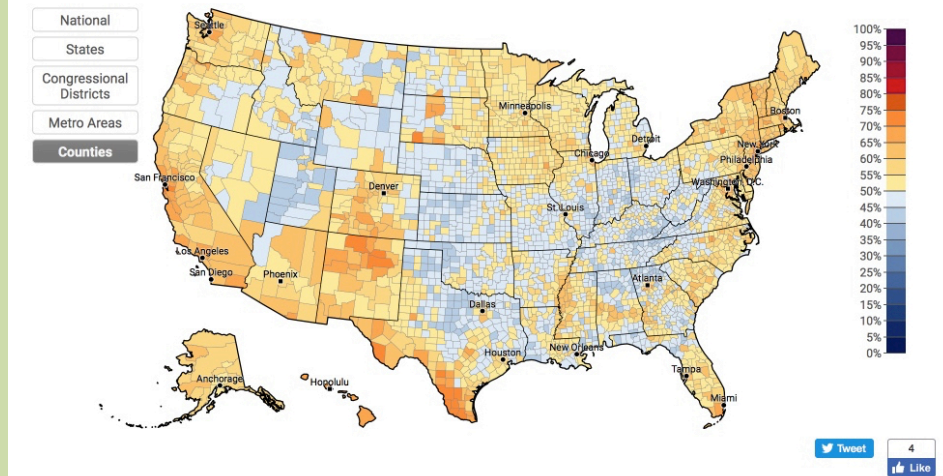


[Tweet](#) 4
[Like](#)



Estimated % of adults who are worried about global warming, 2016

Display model output: Worried about global warming Absolute Value Permalink
 Click on map to select geography, or: Select a State Select a County

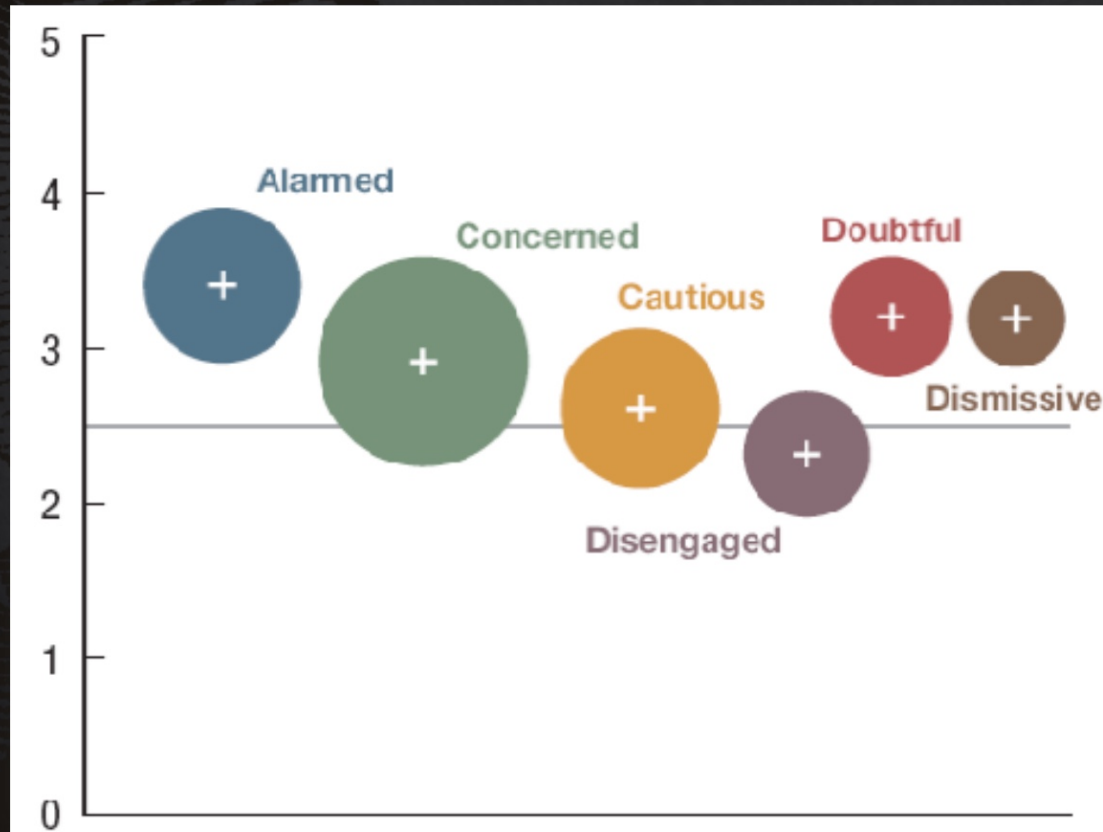


[Tweet](#) 4
[Like](#)



A caveat: remember the Six Americas

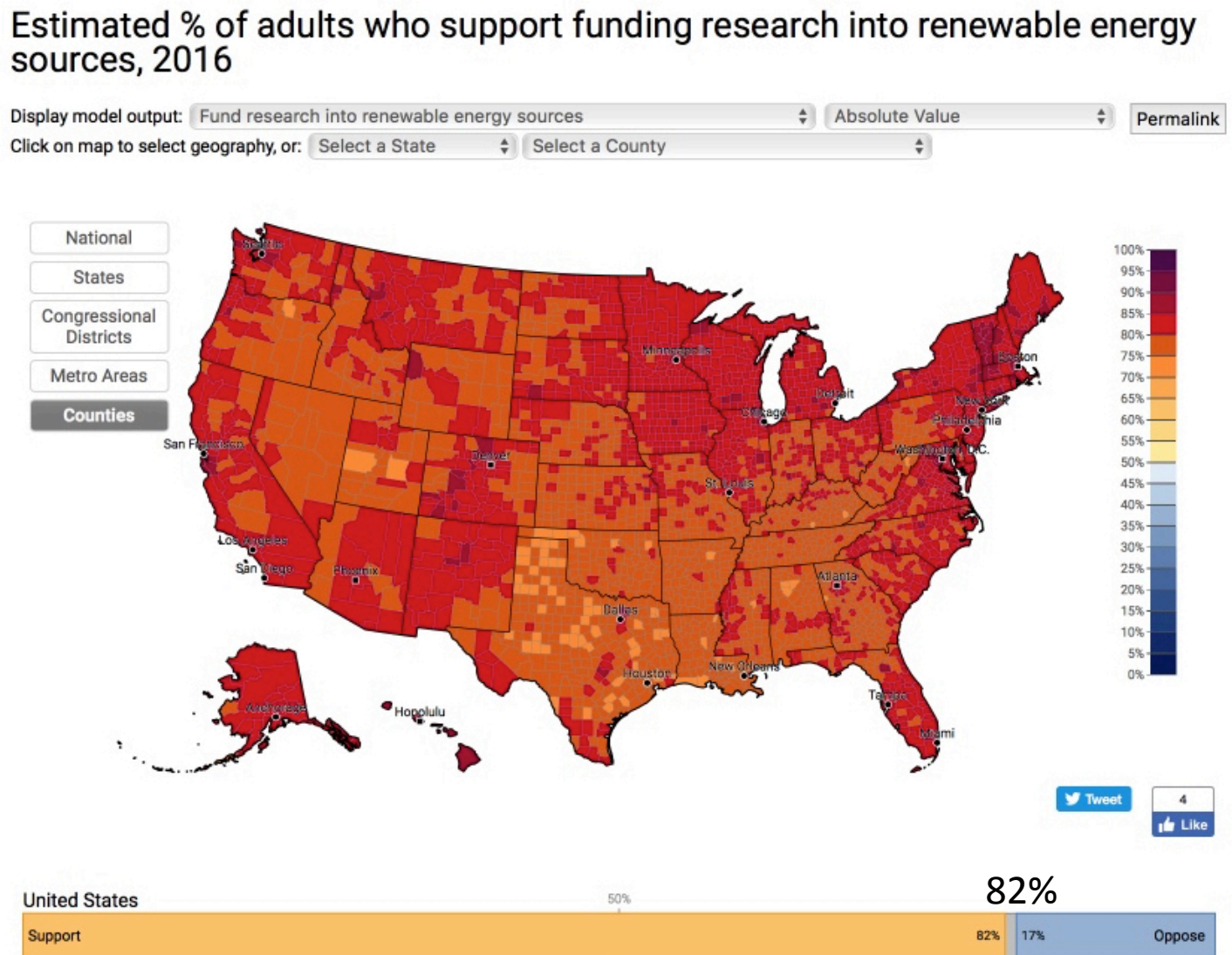
Will you make “energy efficiency improvements” to your home?





- 9.) Do you support funding research in renewable energy sources?
- 9.) Estimated % of adults who support funding research in renewable energy sources

82% 9.) Estimated % of adults who support funding research in renewable energy sources





- 10.) Do you discuss global warming at least occasionally?
- 10.) Estimated % of adults who discuss global warming at least occasionally



33% 10.) Estimated % of adults who discuss global warming at least occasionally

Plan of Action

1. Continue to gather data and learn
2. Lifestyle changes
 - Calculate your carbon footprint and do things to reduce it
 - Less pollution – saving the “green” environment
 - Save money – saving some “green” in your pocket
3. Assist with Citizen Scientist projects

**See handout for examples
of plans of action!**

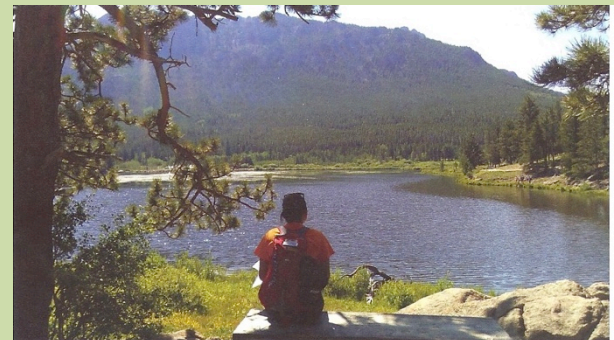
Rocky Mountain National Park

Lily Lake Climate Change Citizen Scientist Project

- Using an app, record answers to questions
 - Phenology
 - “On this bush, do you see green leaves?”
 - “On this bush, do you see ripe fruit?”
 - Sounds that visitors hear (natural or human)
 - Visibility data of Longs Peak compared to photos in the app
- Over time, will determine if Spring is coming earlier, if air quality degrading, etc.



The phenophases of wax currant from flowers to ripe fruit. These are some of the phenophases you might observe during the walk around Lily Lake.



Visitors are asked to listen and record sounds they hear at the soundscape stop at Lily Lake. Photo: NPS/Nina Lagpacan

**AUDIENCE CENTERED
EXPERIENCE (ACE)
ACTIVITY TIME!**

ACE Activity

- Write answers to questions about your own opinions on climate change (handout)
- Choose a “Stakeholder” that you do **NOT** associate with
- Gather in a group of similar stakeholders
 - Read more information on that particular stakeholder’s opinion (provided printout)
 - Discuss stakeholder questions
- Return to larger audience and have a representative from each stakeholder group summarize one “solution”

Answer the following for yourself:

Are changes occurring in the climate?

How do you form your opinions?

Where can you go for non-biased information?

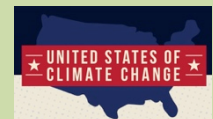
What is your plan?

STAKEHOLDERS

- Farmer
- Construction Company
- Climate Change Skeptic
- Health Care Provider
- Non-profit Relief Organization
- Coal Power Plant Worker
- Coastal Timeshare Owner
- Financial Investors



Stakeholder detailed information gathered from a special feature on Climate Change from the Weather Channel.



Don't forget:

- Not here to “convert”
- Not political
- Here to be respectful of others' opinions

QUESTIONS

1. What values or beliefs might be the foundation of the *stakeholder's* point of view?
2. Which beliefs of the *stakeholder* do you think are substantiated by evidence?

QUESTIONS

3. In your opinion, which beliefs, if any, are unsubstantiated by the *stakeholder*?
4. What, if anything, in the point of view of the *stakeholder*, challenges your own personal assumptions?

QUESTIONS

5. What solution(s) might the *stakeholder* propose? What counter-arguments would you expect from other stakeholder groups?

Please be prepared to share one possible solution with the larger audience.

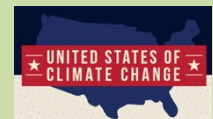
- Break up into Stakeholder groups
 - (About 15 minutes)
- Return to larger audience for:
 - Brief discussion of “ACE”
 - Talking Template
 - Message of hope!

STAKEHOLDERS

- Farmer
- Construction Company
- Climate Change Skeptic
- Health Care Provider
- Non-profit Relief Organization
- Coal Power Plant Worker
- Coastal Timeshare Owner
- Financial Investors



Stakeholder detailed information gathered from a special feature on Climate Change from the Weather Channel.



How *can* we talk about polarized issues?

BONDING and CONNECTING

What do we have in common, that we both already care about and is affected by climate change?

EXPLAINING

Why is this happening? Why might we [both] care?

INSPIRING

How can we work together to tackle this problem in a way that is compatible with our values?

HOPE!

- More than 6 million metric tons of **plastic packaging** per year are produced by these 11 companies
 - Recently, they all have committed to using only **reusable, recyclable or compostable packaging** by 2025!!!
-
- Amcor packaging manufacturer
 - Ecover household cleaning products
 - Evian bottled water
 - L'Oréal cosmetics
 - Mars candy, beverages, food, and petcare
 - M&S clothing, home products, and luxury food products
 - PepsiCo beverages, food, and snacks
 - Coca-Cola beverages
 - Unilever beverages, food, cleaning products, and personal care products
 - Walmart superstores, discount department stores, and grocery stores
 - Werner & Mertz commercial and household cleaning products

HOPE!

Red-headed Woodpeckers in chronological order
from 1880 to 2015





Mid-Day
February 13, 1936
Downtown St. Louis

Horned Larks in chronological order from 1880 to 2015



Field Museum in Chicago. Photo: Tristan Spinski

*We DO have the ability to recognize a problem
– and fix it!*

The End!



Aaron Jungbluth

Thank you!