



Climate Change

Global Connect @ UCI




Personal Introduction

A little about me



Why I love Earth and Environmental
Sciences



What I study and research



Outline

What is Climate?

Causes of Climate Change

- Greenhouse Gases

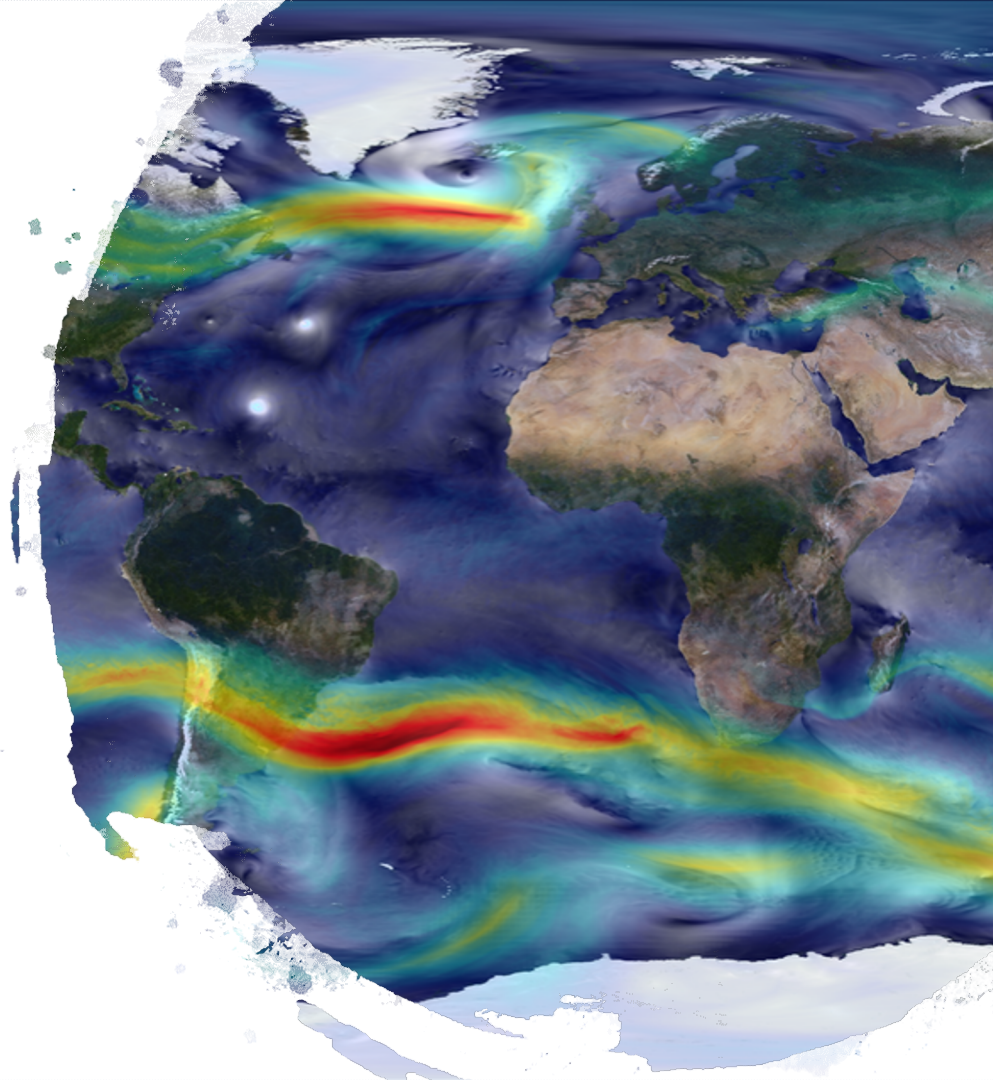
Impacts of Climate Change

- Physical
- Ecological
- Social

International Environmental Policy

U.S. Environmental Policy

What can you do?





Climate Change

What is the difference between **climate** and **weather**?

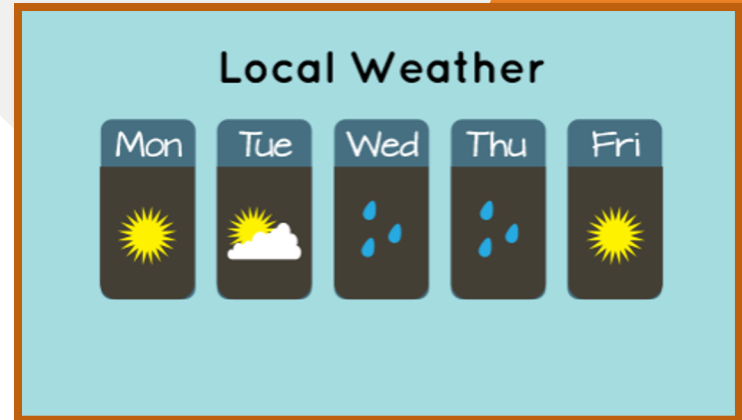
This vs That

CLIMATE

- Long-term (seasons, years, decades)
- Regional or global average of temperature, humidity & rainfall patterns

WEATHER

- Short-term (minutes, hours, days, week)
- Local atmospheric patterns such as, rain, snow, clouds, winds, floods or thunderstorms, ect.





Statement A:

Every summer the average temperature in San Diego is usually in the 70's.

Statement B:

I am planning on visiting south San Francisco tomorrow and noticed the temperature high for the day will be 62 degrees.

This vs That

CLIMATE CHANGE

All climate transformation phenomena that is especially caused by humans

GLOBAL WARMING

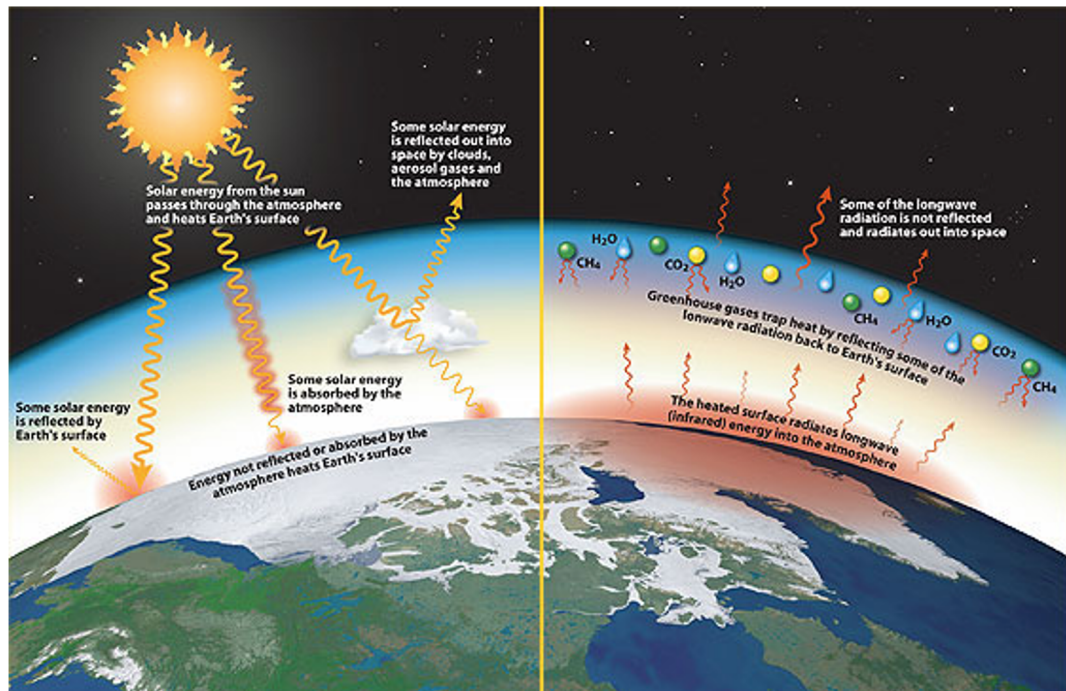
The long-term heating of Earth's climate system observed due to human activities

The Greenhouse Effect

Greenhouse gasses are not all bad!

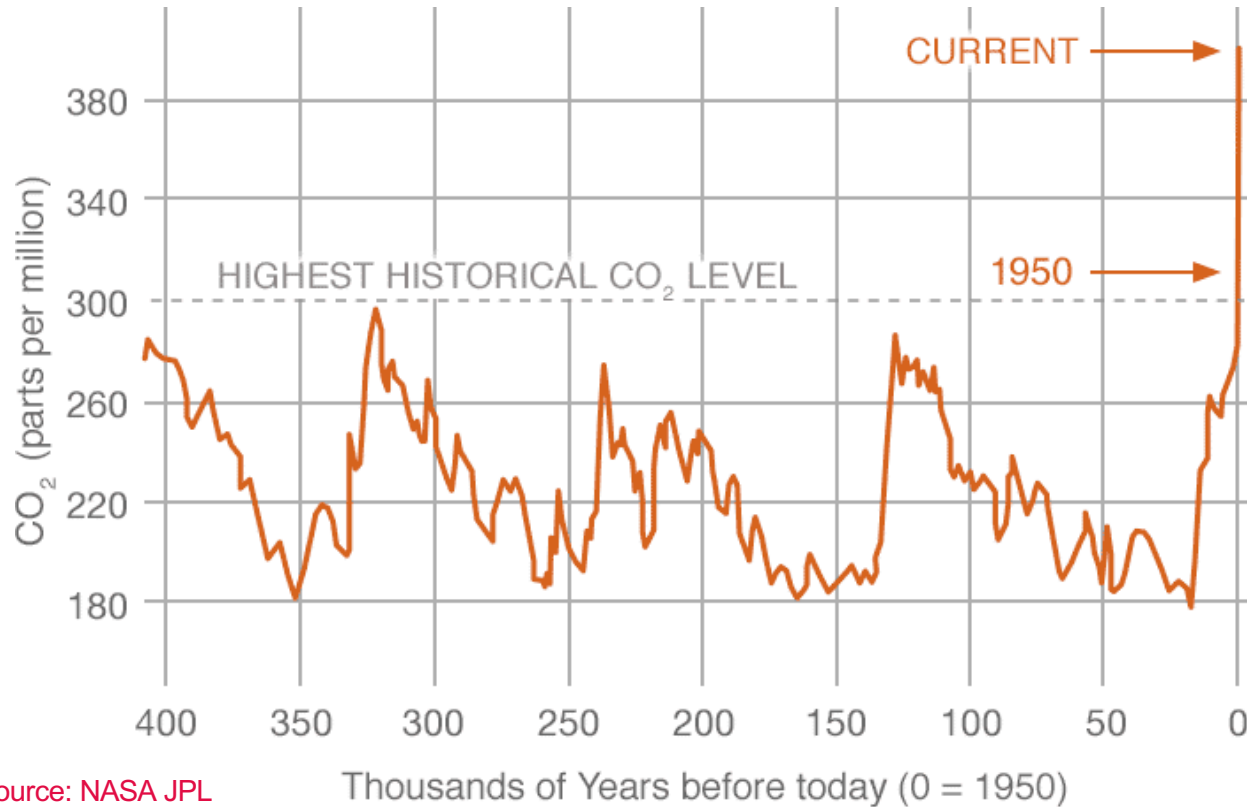
Without GHGs, Earth would be a very **cold**, uninhabitable place.

The problem for life on Earth is when the concentration of GHGs rises too high and/or too quickly.



Greenhouse Gases

412 ppm
as of June
2019



Source: NASA JPL

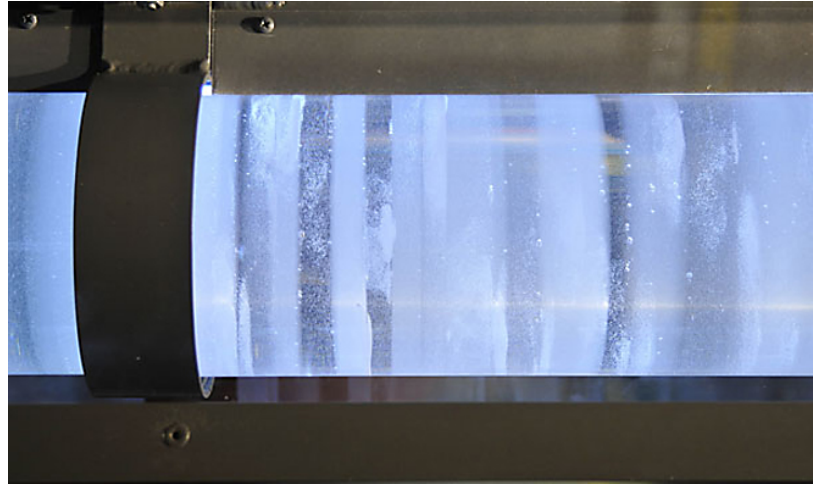
Ice cores!

The ice in Antarctica and Greenland is compressed snow.

As each layer of snow fell and then was compressed into ice, the *air*, *chemicals*, and *particles* caught within the snow were trapped.

Winter and summer snow have different chemistry and texture, which looks like bands within the ice core.

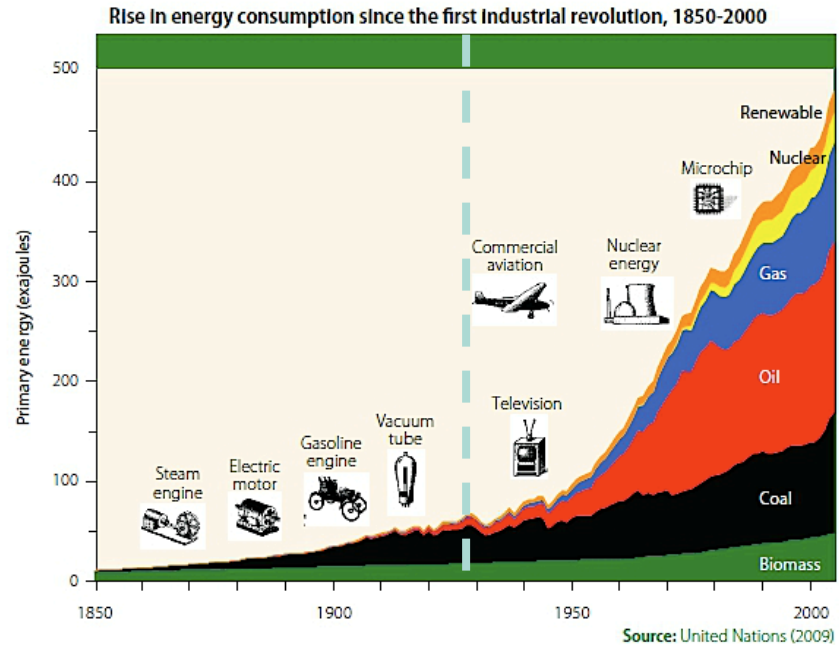
The ice cores are cataloged and stored at the National Ice Core Laboratory.



Antarctica deep ice core drilling

Greenhouse Gases

- . Industrial Revolution (Started in the 1850s)
- . Replaced manual labor with machines. Used fossil fuels for production of tools, textiles, agriculture, and for transportation
- . What are fossil fuels?
- . Why are they non-renewable?
- . Corresponds with rapid increase in concentrations of CO₂ in the atmosphere



Greenhouse Gases

Electricity production

- Electricity generation by burning coal or natural gas

Agriculture

- Crops, livestock, and deforestation

Industry

- By-product of manufacturing the things we use everyday

Transportation

- Cars, ships, trains, and planes

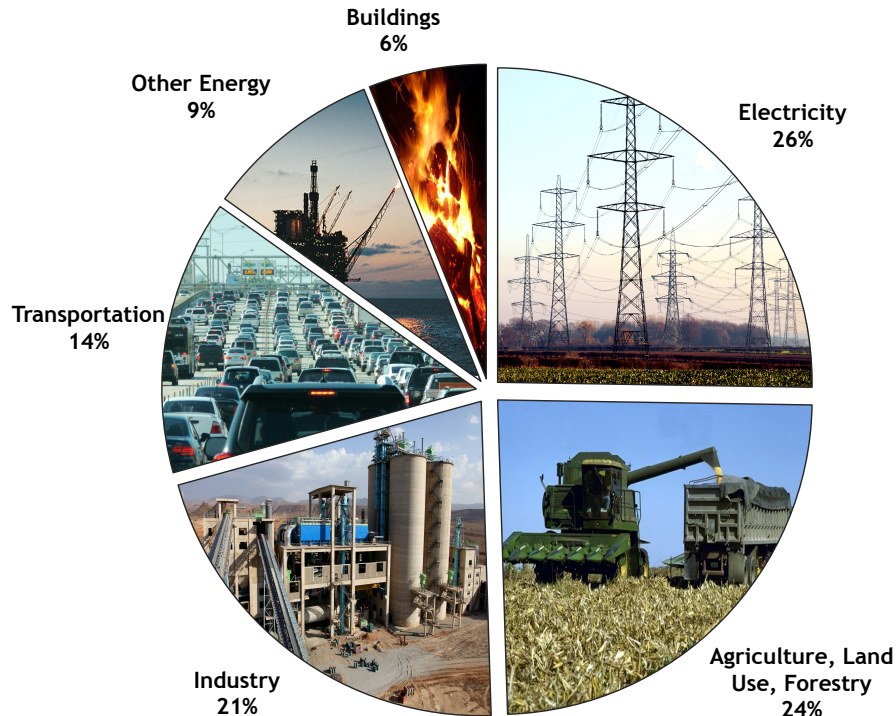
Other Energy

- Energy used to extract, refine, & transport fossil fuels

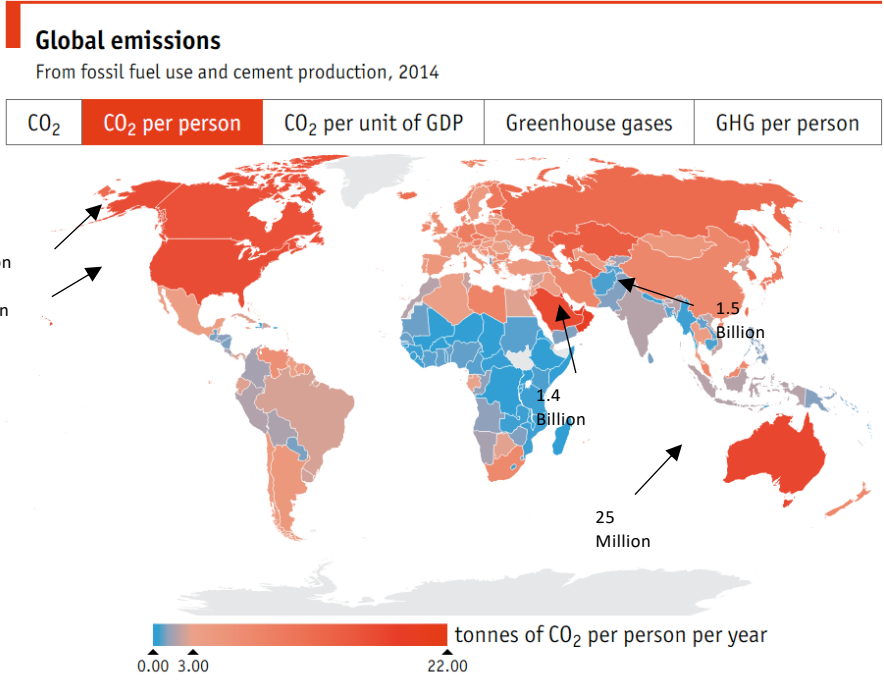
Buildings

- Direct use of natural gas, wood, or coal for heating and cooking

Global Greenhouse Gas Emissions by Sector



Emissions per Person, by Country



Source: Emission Database for Global Atmospheric Research *CO₂, CH₄, N₂O, F-gases †\$2012 at purchasing-power parity

What would happen if China and India started producing as much CO₂ per person as we do?

Effects of Climate Change

What are some effects that you have heard about?

Effects of Climate Change

Changes in weather patterns

- Heat waves
- Drought
- Intensification of storms



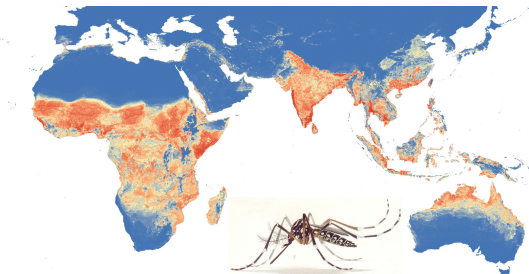
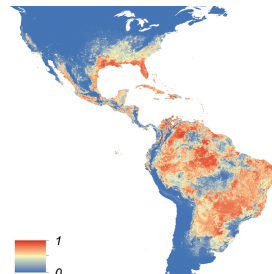
Ecological

- Deforestation
- Ocean acidification
- Shifting habitats



Social

- Displacement
- Water scarcity
- Interruption of food production
- Public health



Global *Aedes aegypti* distribution



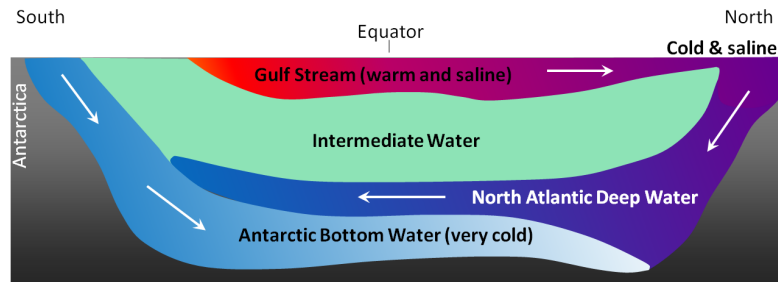
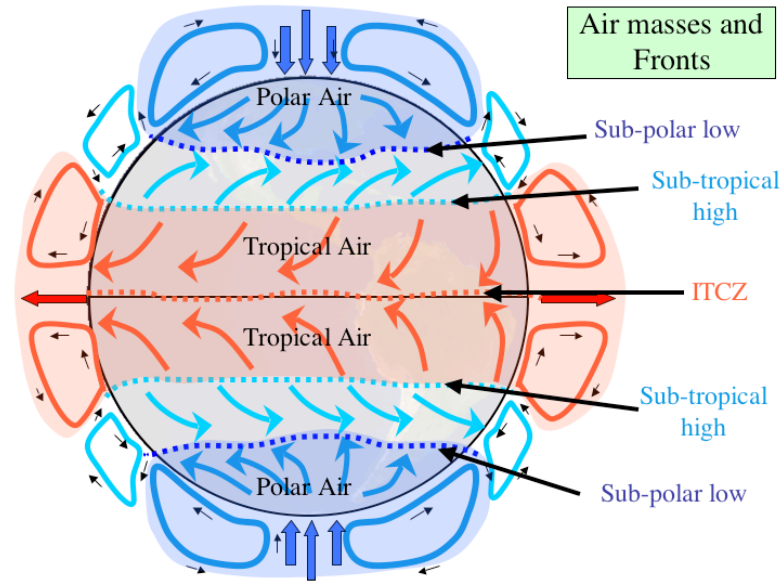
Physical Events

- Heat waves
- Wildfires
- Magnified air pollution
- More intense storms
- Flooding
- Mudslides
- Damage to homes, cities, roadways, bridges, pipelines, dams, and levees



Physical Effects

- How do greenhouse gases relate to the strength and patterns of our weather events?
- Winds and ocean currents are generated by **heat**.
- Warm** air and water **rise** (less dense). **Cold** air and water **sink** (more dense).
- This heating and cooling is what drives our weather.
- So, trapping more heat in the system changes our climate. It becomes more energetic, because **heat is energy**.



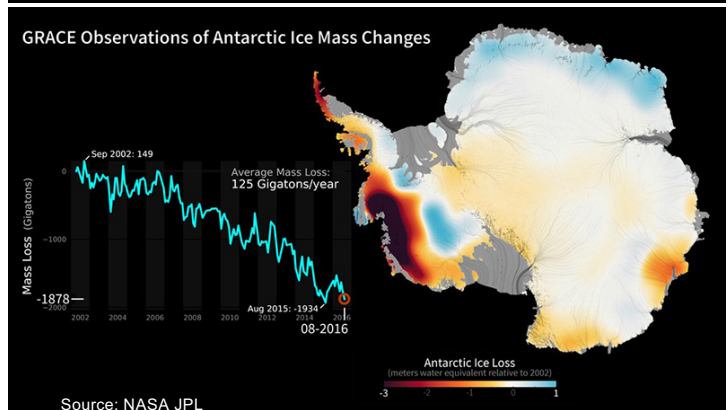
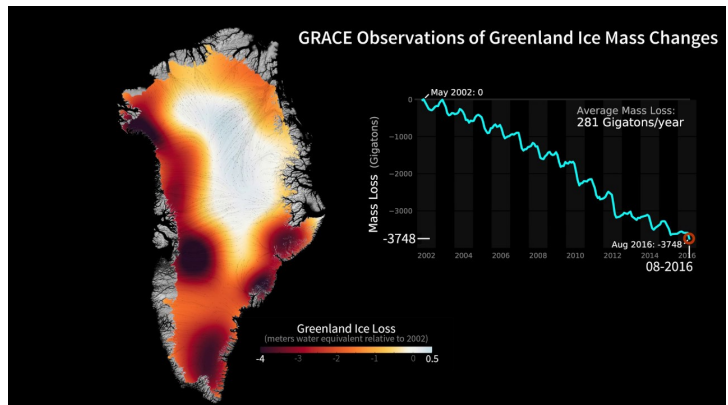
Melting Ice in Polar Regions

Arctic Sea Ice (North Pole)

- Less **sea ice** is forming and more of it is melting
- less habitat for Arctic species

Greenland Ice Sheet (near North Pole) & Antarctic Ice Sheet (South Pole)

- Land ice** melting – sea level rise, changes in ocean temperatures & salinity
- 20 feet** of SLR if all of Greenland melts
- 200 feet** of SLR if all of Antarctica melts!!
- Costa Mesa would have 122 feet of ocean water above it! Disneyland would be under 66 feet of water.



Source: NASA JPL

Ecological Problems

Change is
happening
already

Temperature affects
the life cycle of many
species



What happens when
warm water species
migrate northward?



Species that depends on cool
temperatures are migrating
toward the poles. Predators
that depend on smaller
species for food either
migrate too or starve.

In the News



Death Valley Smashes Heat Record, 2nd Year in a Row

August 01, 2018 | Article

The hottest place in the U.S., Death Valley, was not left out of this year's record-breaking heat wave.

[Read More »](#)

Shocking Global Map Shows the Extent of a Global Heat Wave

By Yasemin Saplakoglu, Staff Writer | July 27, 2018 06:05pm ET

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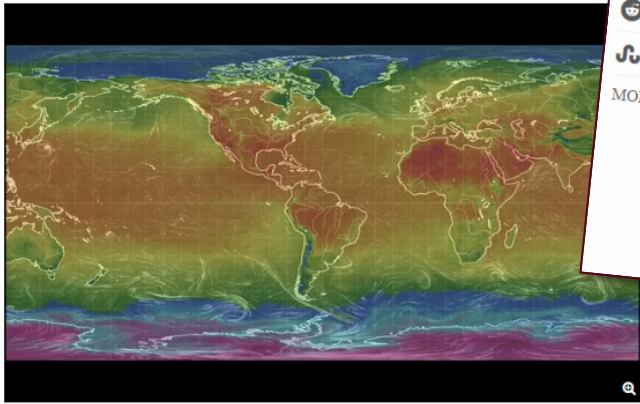
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Arctic Circle Burns As Record Heat Broils Northern Europe

By Kimberly Hickok, Staff Writer | July 19, 2018 12:01pm ET

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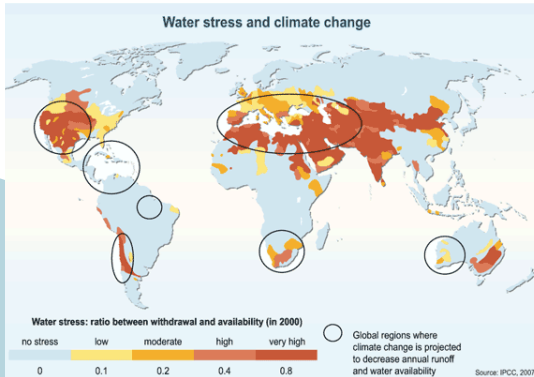


A fire vehicle is seen as fire burns in Karbole, Sweden, on July 15, 2018. The unusually hot and dry weather is helping fuel dozens of fires in the country.

2020 has been even hotter!

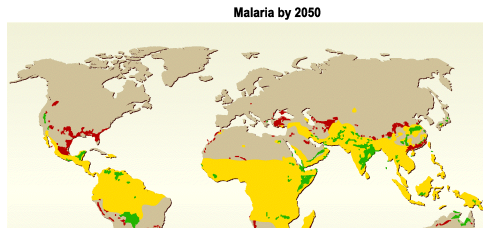
Water Scarcity

- Highly populated & agricultural (farming) regions will become water stressed.
- Can lead to resource conflicts between regions.



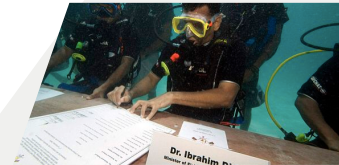
Public Health

- Shifting range of **suitable habitat for diseases** like Malaria, Dengue fever, Lyme disease
- Extreme heat events** lead to heat related health dangers
- Increased extreme weather events (e.g., flooding, hurricanes) impact **infrastructure** that is meant to protect public health



Displacement

- Sea level rise** floods low lying regions
- Storms and wildfires** destroy homes and property
- Persistent **lack of water** forces migration





Inequality in the Environment

Climate Change

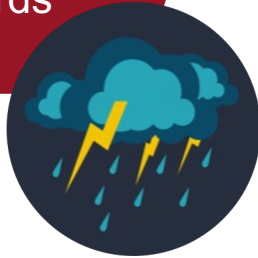
Climate change impacts everyone, but...

**Climate change worsens
existing inequalities**

Three Affects of Environmental Inequality

Inequality

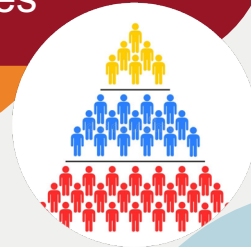
Greater exposure to climate hazards



Greater likelihood of experiencing damage due to climate hazards



Less social mobility to cope with & recover from climate damages



Disproportionate loss and increased inequality

Environment

The environment is not just a physical event, but also a social event



International Policy

Kyoto Protocol

- 1997
- First international framework addressing climate change.
- Established that climate change exists and is worsened by man-made CO₂ emissions.



International Policy

Paris Climate Agreement

- First comprehensive climate agreement
- Adopted in December 2015
- Signed and ratified in August 2017



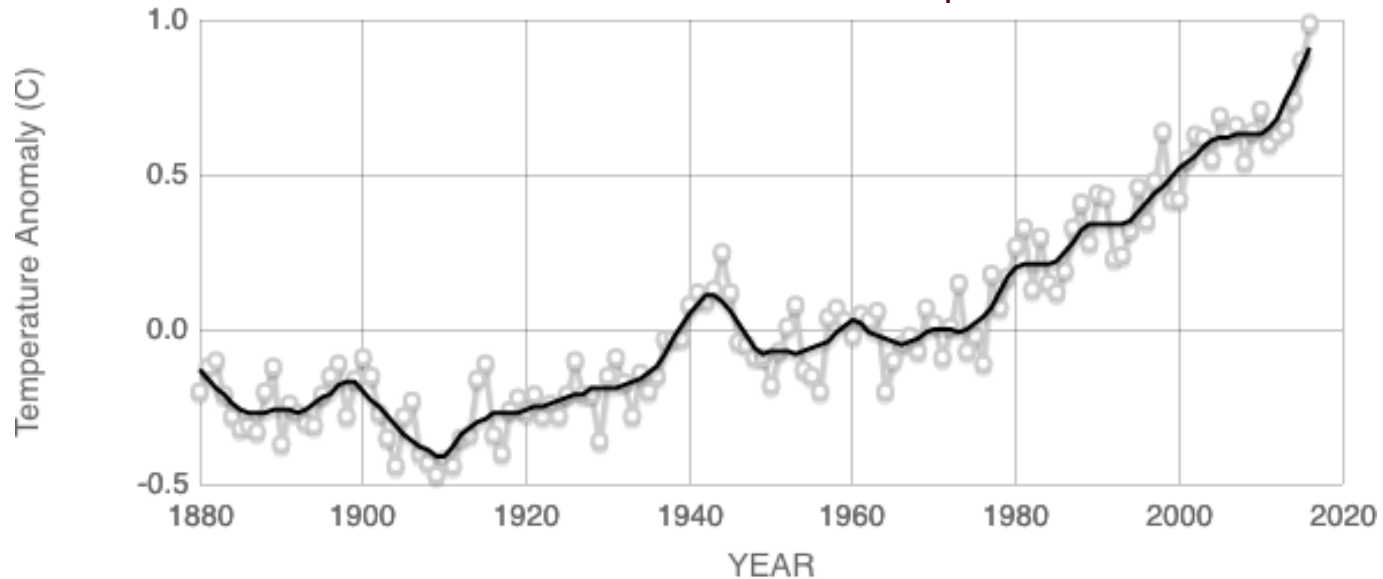
International Policy

Paris Climate Agreement Goals:

1. Keep the global **temperature well below 2 °C** above pre-industrial levels (no more than 1.5 °C above would be best);
2. **Increase ability to adapt** to impacts of climate change and cultivate climate resilience;
3. **Invest in technologies** that encourage low greenhouse gas emissions and climate-resilience.

Keeping it below 2 °C of change

0.8 °C above the
1951-1980 mean
temperature



Source: climate.nasa.gov

But why 2 degrees? 2 °C (3.6 °F) is the threshold at which warming becomes catastrophic.



International Policy

- United Nations Development Program (UNDP)
- 2030 Agenda for Sustainable Development, Adopted in 2015
 - Goal 13: Climate Action
 - “Strengthen resilience to climate-related hazards...”
 - “Investments in sustainable development...”

United States Policy

EPA (Environmental Protection Agency)

- Entrusted with setting carbon pollution standards
- Currently in danger of large cutbacks in authority



Clean energy standards

- Renewable energy industry



Preparing for climate change impacts

- Recognized as a national security threat by the Pentagon and the Department of Defense (US Military, US Army Corps of Engineers)
- Resulting land loss, environmental and economic losses



America's Pledge

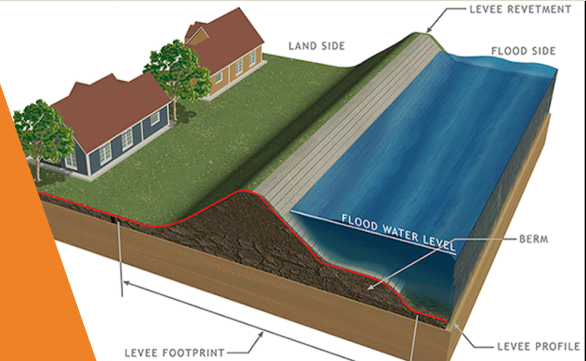
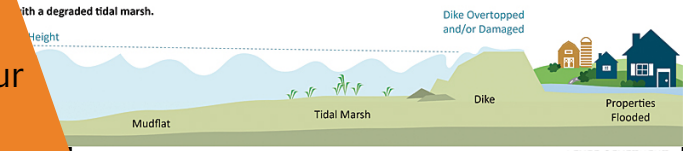
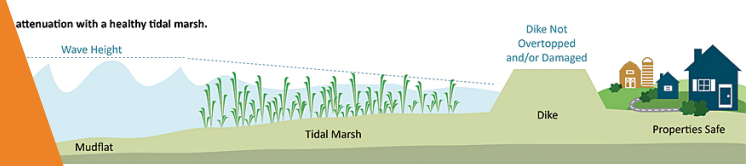
- States, cities, businesses, universities, and individuals across the U.S. that have banded together to continue fighting climate change and protect public health
- Will uphold the U.S. commitment to the Paris Climate Agreement
- They also want to be sure the U.S. is not left behind economically as the rest of the world continues to develop and invest in renewable technology

How can society prepare?

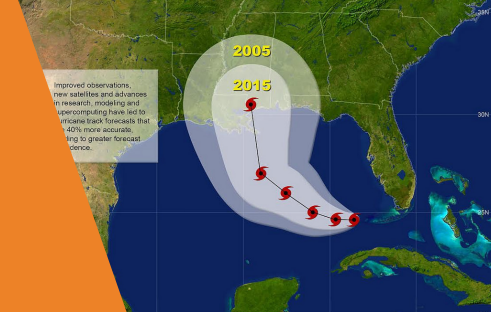
The big question is - how do we **adapt** to our changing climate?

Some ideas that are already being explored:

- Improve infrastructure (updating dams and levees, energy efficient buildings)
- Add coastal defenses (natural barriers protect from storm surge)
- Water conservation, and new technologies (desalination, irrigation technology)
- Renewable energy (solar and wind)
- Electric cars, more public transportation
- Improve weather forecasts and early storm warnings



Katrina's Forecast Uncertainty: Today vs 2005



What can we do?

Awareness

- Knowing your carbon footprint
- Learn which daily activities and products contribute to climate change

Action

- Find ways to reduce carbon footprint – at home, at school, in transportation
- Every little bit helps by giving the environment a chance to recover!

Advocacy

- Spread knowledge on the topic!

Positive Action You Can Take

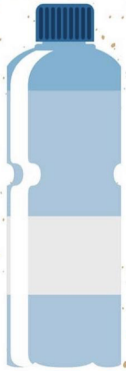
- **Reduce fossil fuel use** – Choose to walk or bike places, take public transportation, or carpool.
- **Purchasing power** – Choose products that don't use fossil fuel-based plastics, that instead use natural materials that last longer. Avoiding single-use items = less products that must be made and shipped.
- **Buy local** – Buy products and food that are made or grown locally. Less shipping = less CO2 emissions and you support your local economy!
- **Innovation** – Help by inventing, designing, producing, and using alternative products and technologies. Get creative!
- **Volunteer** – Help organizations that are working to make a difference



Stay informed on Social Media

DITCH plastic drink bottles

@zerowastenerd



Reusable water bottle



glass jar



GREEN TIP

GO PLASTIC-FREE BY FIRST TACKLING THE BIG FOUR: PLASTIC BAGS, WATER BOTTLES, STRAWS, AND COFFEE CUPS.

GREEMATTERS

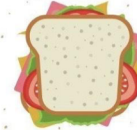
DITCH DISPOSABLE utensils

@zerowastenerd



40 billion plastic utensils per year in the United States alone, are wasted.

Carry your own with you. Use what you already have!



Using a reusable spork eliminates carrying multiple utensils.



Choose meals that don't need utensils.



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