Chasing Ice

https://www.youtube.com/watch?v=hC3VTgIPoGU
The Carbon Cycle
Mauna Loa
CO2 Increases

2100 Higher Emissions Scenario

2100 Lower Emissions Scenario

2008 Observed

Carbon Dioxide Concentration (ppm)

Year
CO₂ Sources

- **Electricity Generation & Heating**: 43.9%
- **Manufacturing & Construction**: 18.2%
- **Non-road transport**: 5.8%
- **Road Transport (Cars, Trucks & Buses)**: 15.9%
- **Fuel Combustion for other uses**: 12.2%
- **Other non-transport**: 4%
Greenhouse Gas Effect

Temperature Increases

The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century.”

-NASA
International Consequences:
Ocean Acidification
Local Effects: Ski Areas
Ski Areas

- Over half of the ski resorts in the Northeast are expected to close due to lack of snow by 2039
- Many ski resorts in the Rockies will have shorter seasons due to the lack of snow pack
- Snowmaking is becoming harder as water becomes more scarce, especially in places like California
Drought and Agriculture
Drought and Agriculture

- Climate change creates extreme weather patterns, like drought
- Many places are already having drought, such as California
- Drought and changes in growing seasons will have a major effect on how and where things can grow
California Drought

On April 1, 2015, the California Department of Water Resources measured the statewide water content of Sierra snowpack at 5% of average.

Snowpack, through runoff, provides \( \frac{1}{3} \) of the water used by California’s cities and farms.

80% of California’s water is used for agriculture.

- USGS
California Central Valley

More than 250 different crops are grown in the Central Valley. Estimated value of $17 billion per year.

75% of the irrigated land in California.

Produces ¼ of the nation’s food, including 40% of the Nation’s fruits, nuts and other common foods.

-USGS
Efforts to conserve:

California Governor created first ever statewide mandatory water reduction

Goal: Reduce water usage by 25% statewide.

How are they conserving?
- Lawns
- Rebate based incentives to update home appliances
- Significant cuts in water use
  - campuses, golf courses, parks etc.
- Prohibition of new home use of potable water for irrigation
King Corn

- Corn is in nearly everything that we eat, use, and drive
- It’s in nearly all processed foods, toothpaste, makeup, perfume, ethanol that powers our cars, and even in some plastics
- One-third of all U.S. cropland is corn
- Corn is a $1.7 billion industry, a huge economic powerhouse
Climate Change and Corn

- Corn is a sensitive plant, especially when it comes to changing temperatures and an increase in hot, dry air.
- Decreasing water and increasing temperatures is predicted to decrease corn production in the U.S. by 30% in 50 years.
Solutions?
Solutions

- There is no one thing that we can do to stop climate change - it’s already happening
- We can slow down its progression by reducing our CO2 outputs
- People are finding many different ways to adapt and slow down global warming
Previous successes

- Acid rain
- Term coined in 1872
  - Not considered serious environmental problem until 1970
- Emission of sulfur dioxide and nitrogen oxides
Previous successes

Acid Rain Formation

Coal-fired electric utilities and other sources that burn fossil fuels emit sulfur dioxide and nitrogen oxides.
How was successes achieved?

1970: U.S. Congress passed acid rain emission regulation through the Clean Air Act.

New England: 1990-2000 saw a 25% decrease in NOx emissions from all sources.
Between 2000-2006: 55% NOx reduction

- nsf.gov
Climate Change Collaboration

● 21st annual United Nations Climate Change Conference.
● 2015: Paris, France (November 30-December 11)
● Goal: “To achieve a legally binding and universal agreement on climate, from all the nations of the world.”
Solutions: Solar Power
Solar Power

- All products have an **LCA (Life Cycle Analysis)** that estimates environmental impacts - resources to produce, transport, use, disposal

- **LCA of Solar Panels:**
  - **Production:**
    - Quartzite rock → Silicon crystals + electrical contacts + glass cover + aluminum frame + copper wire + rubbers, plastics = solar panel
    - Just making Si produces 4.5 tons of GHG
  - **Lifespan:** 25-30 years. Some pieces can be recycled.
    - Takes approx. 2 yrs for panel to offset production energy

Solar Drawbacks

- Doesn’t work at night - requires batteries
- Unreliable on cloudy days
- Takes a large amount of land
- Very expensive
Biotecture

Design by Earthship
Taos, New Mexico
Sustainability through: rain water collection, efficient thermal heating/cooling, waste management, recycled building materials
Geoengineering

The artificial modification of Earth’s climate systems.

Two Primary methods:

- **Solar Radiation Management**- (SRM), controlling sunlight before it reaches the planet.

- **Carbon Dioxide Removal**- (CDR), refers to a number of technologies with reduce the levels of carbon dioxide in the atmosphere.
Injection of sulphur particles into the upper stratosphere, using balloons or projectiles, which are there to form aerosols. The aerosols alter the Earth’s albedo and reflect a proportion of incoming sunlight back into space, mimicking the effect of clouds or a volcanic eruption.

This approach has been discussed since the early 1990s.
Atmospheric Carbon Capture

Direct capture of CO2 in air masses by using some form of wind scrubbing with a chemical absorbent. The CO2 is bound only lightly so that it can subsequently be released and transformed chemically before final storage.

Proposed schemes have advocated using medium-sized towers to carry out the wind scrubbing, or using the wind fields around turbines. This idea has been around since the late 1990’s.
Can you think of any other solutions?
Questions?

Source: Dan Wasserman, Tribune Media Services, Inc.