

RENEWABLE RESOURCES

RESOURCES THAT ARE REPLENISHED AT A
HIGHER RATE THAN CONSUMPTION

RENEWABLE RESOURCES



Renewable natural resources

- Sunlight
- Wind energy
- Wave energy
- Geothermal energy



Nonrenewable natural resources

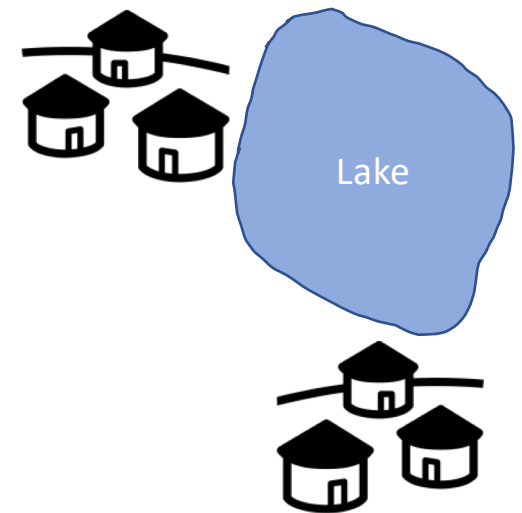
- Crude oil
- Natural gas
- Coal
- Copper, aluminum, and other metals

- **Perpetually available:** sunlight, wind, wave energy
- **Renewable over short periods of time:** timber, water, soil, wildlife
- **Non-renewable resources:** Oil, coal, minerals



Drain or sustain?

- The M&M represents fish in a big lake.
- Each group represents a village (name it!) around the lake with its villagers.
- Each pile of M&M represent the fish that the villagers have access to.
- 4 fish per villager are awarded at the beginning of the game.
- In each round, each villager will take, in order, as many fish as they want from the lake and they must take at least one to survive.
- At the end of one round, fish will reproduce and will generate as many offspring as the remaining fish. For example, if 4 fish remain in your lake, 4 more will be added in a total of 8.
- The number of rounds is unknown.
- At the end, villages and villagers with more fish will win the game.

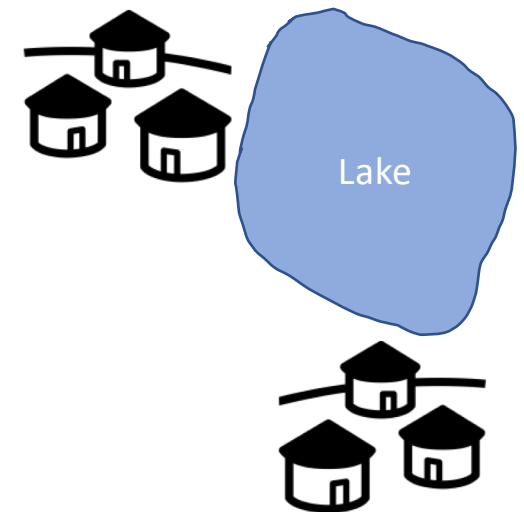




Drain or sustain?

Data analysis:

- Which village did better in the end? Why?
- Within each village, which villager did better in the end? Why? Did this have an impact on the decision of the other villagers?
- Which village managed better its fish stock?
- Which village contributed more and less to the sustainability of the fish stock in the lake?
- Is the overall fish stock in the lake better or worse in the end?
- Plot the variation of your village fish stock across rounds. Was the stock stable or was there much variation?
- Would you have played differently if you knew there was a fixed number of rounds (let's say 3)?
- Was communication important for your strategy?



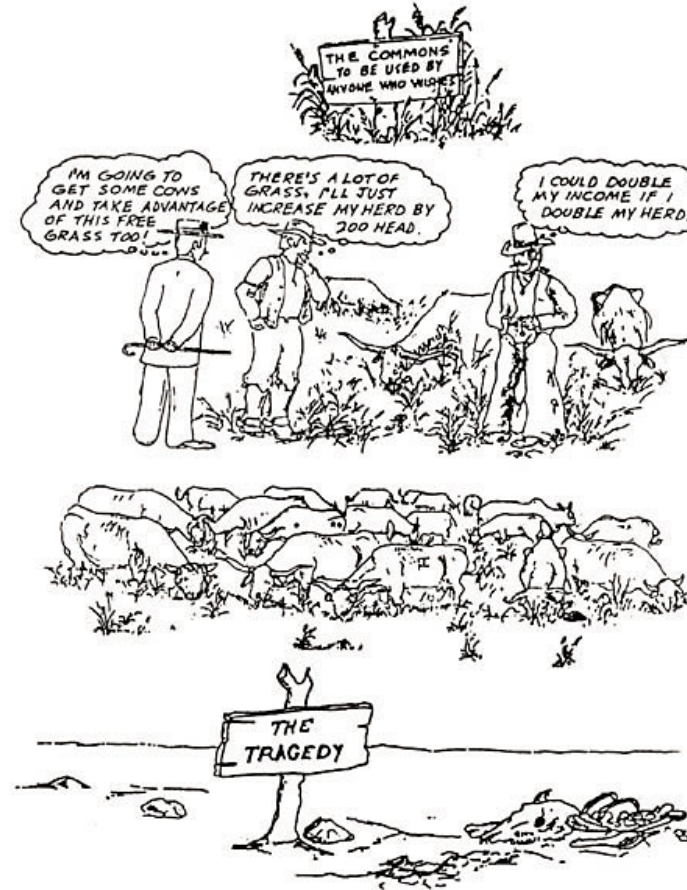
RENEWABLE RESOURCES

The Tragedy of the Commons

Garrett Hardin, 1968*:

In a “commons” open to all, unregulated use will deplete limited resources.

**Check original paper*



RENEWABLE RESOURCES

What do you think is the best way to combat the “tragedy of the commons”?

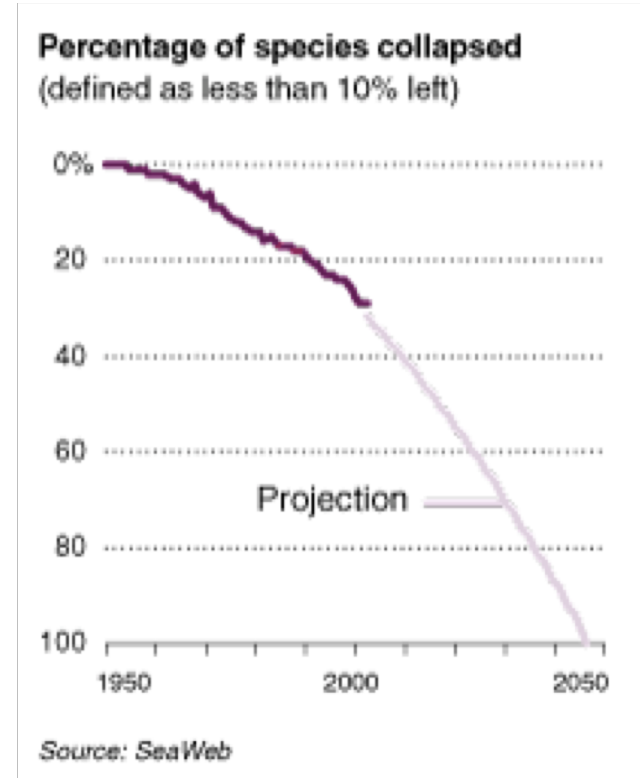
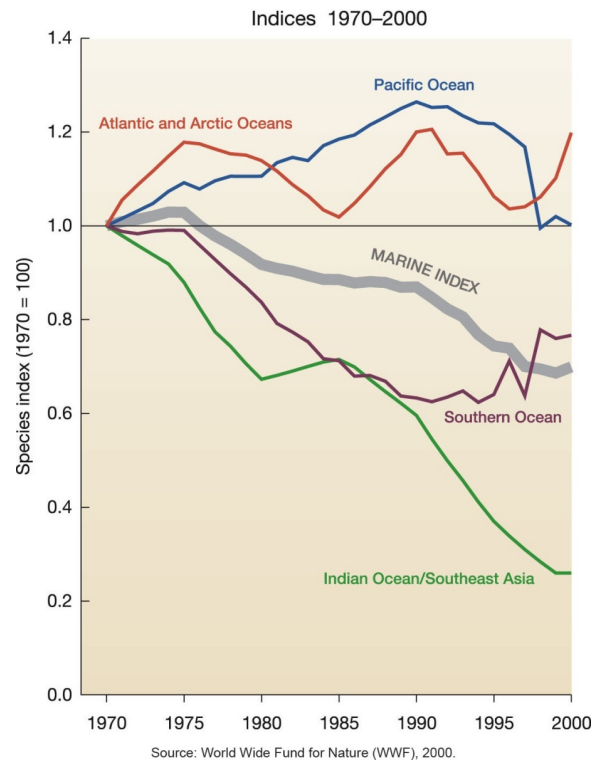
- a.** Sell the commons into private hands, so owners have incentive to manage resources.
- b.** Have government regulate the amount of resources individuals take from the commons.
- c.** Have users work out cooperative systems among themselves to police resource use.

Can you think of real-world examples of the Tragedy of the Commons?

RENEWABLE RESOURCES

Overfishing

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



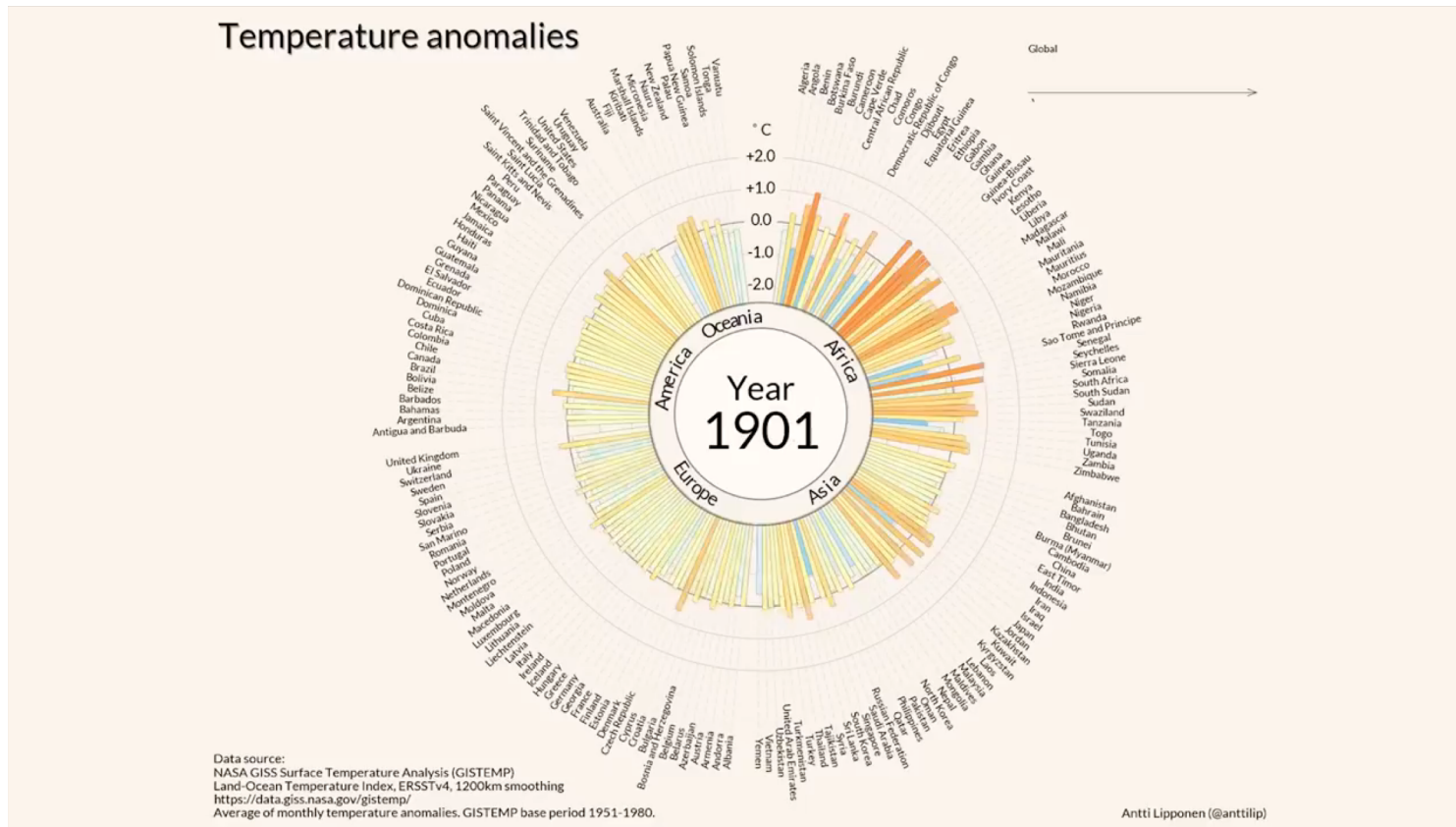
Overfishing

Class discussion

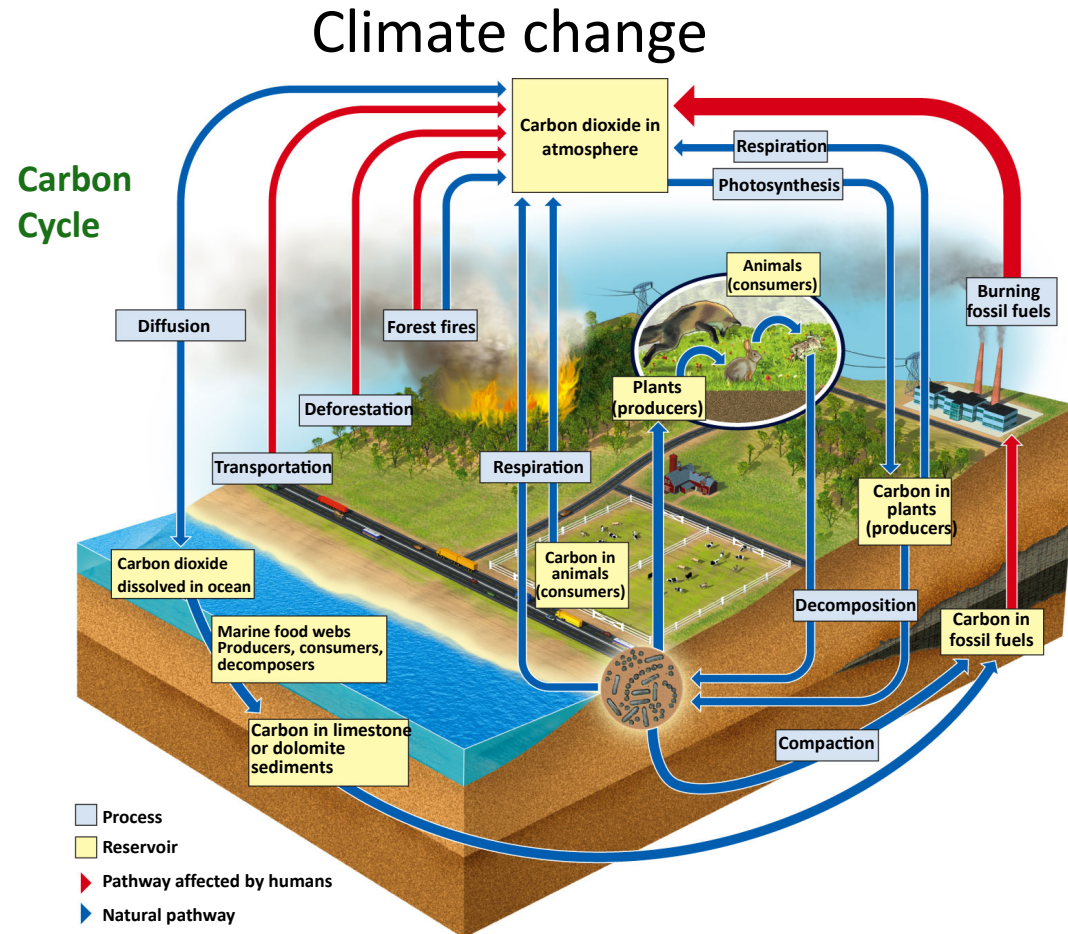
- What kind of fish do you eat? Do you know its origin?
- Do you think overfishing is your problem or the government should handle it?
- Remember the M&M's game...

RENEWABLE RESOURCES

Climate change

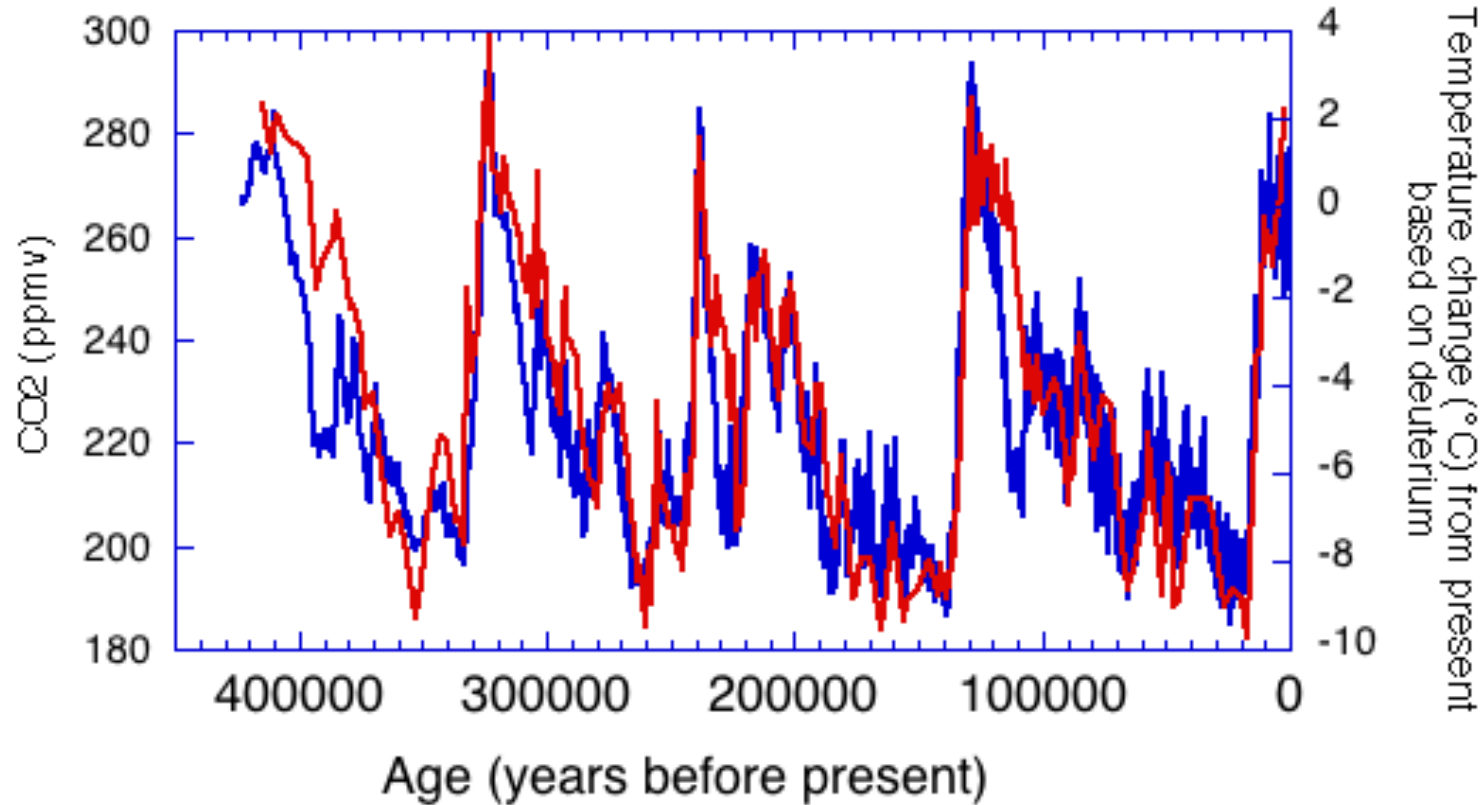


RENEWABLE RESOURCES



RENEWABLE RESOURCES

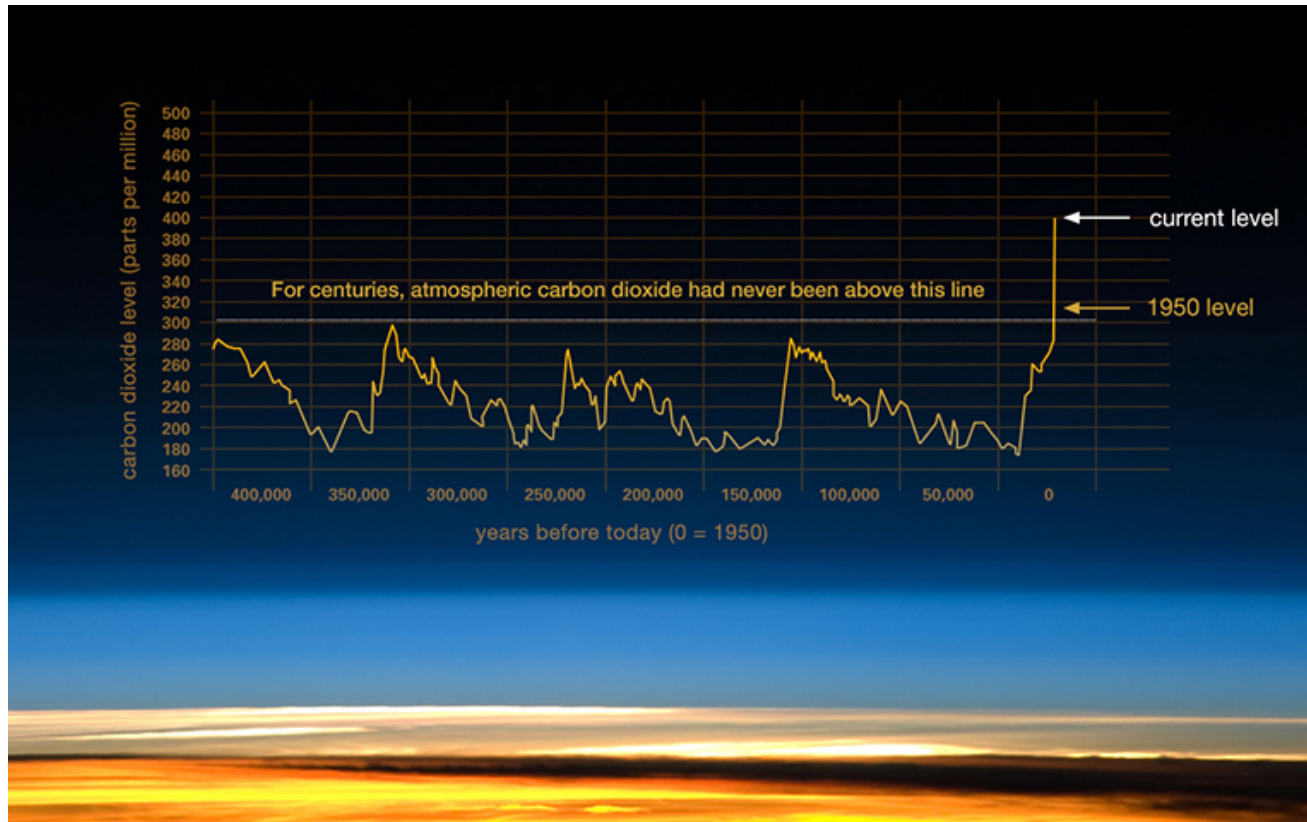
Climate change



Temperature change (blue) and carbon dioxide change (red) observed in [ice core records](#) *Many other records are available*

RENEWABLE RESOURCES

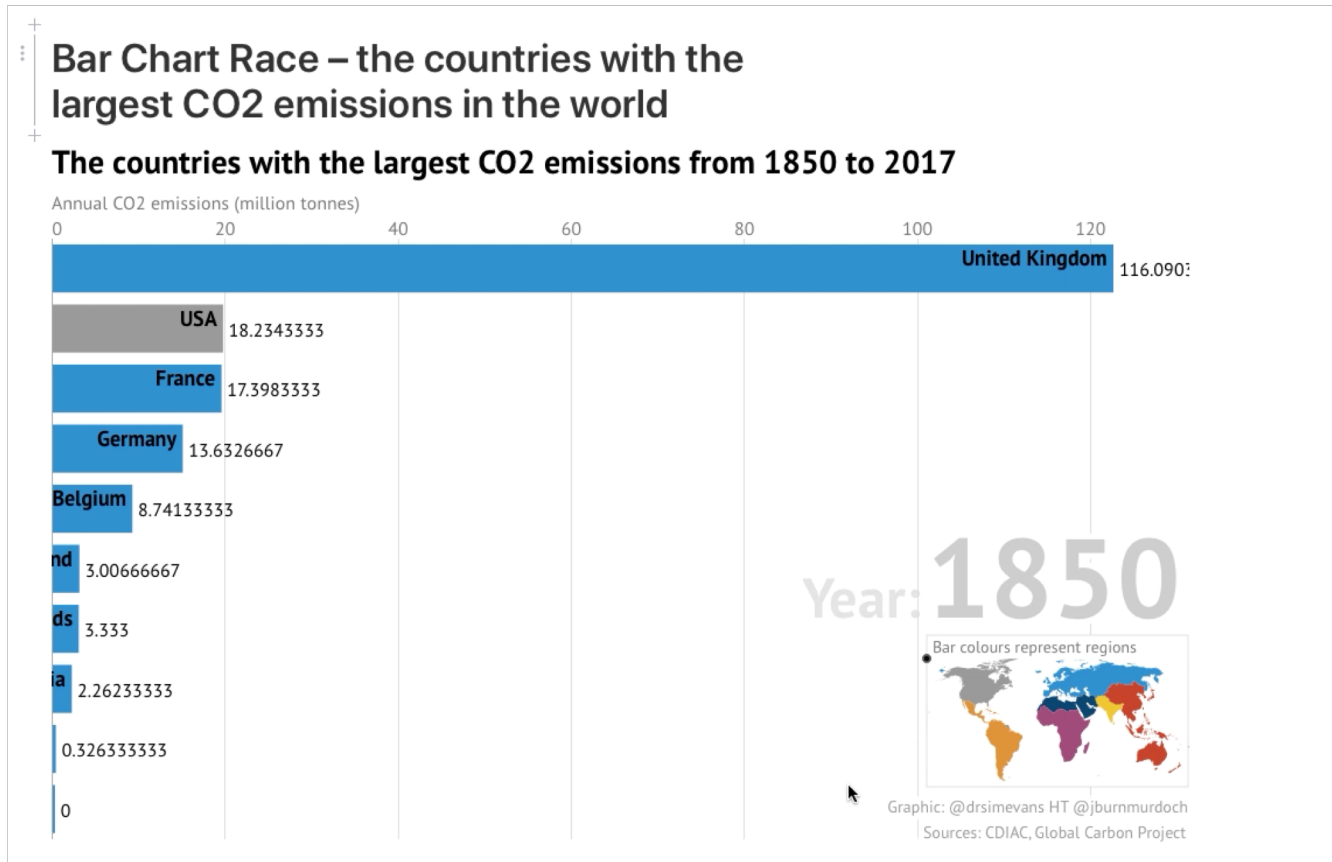
Climate change



Data from NOAA

RENEWABLE RESOURCES

Climate change



Climate change

Class discussion

- Whose responsible for climate change?
- What's the connection between inequality and the CO2 emissions?
- Which could be some possible solutions to avoid the tragedy of the commons in the context of CO2 emissions?

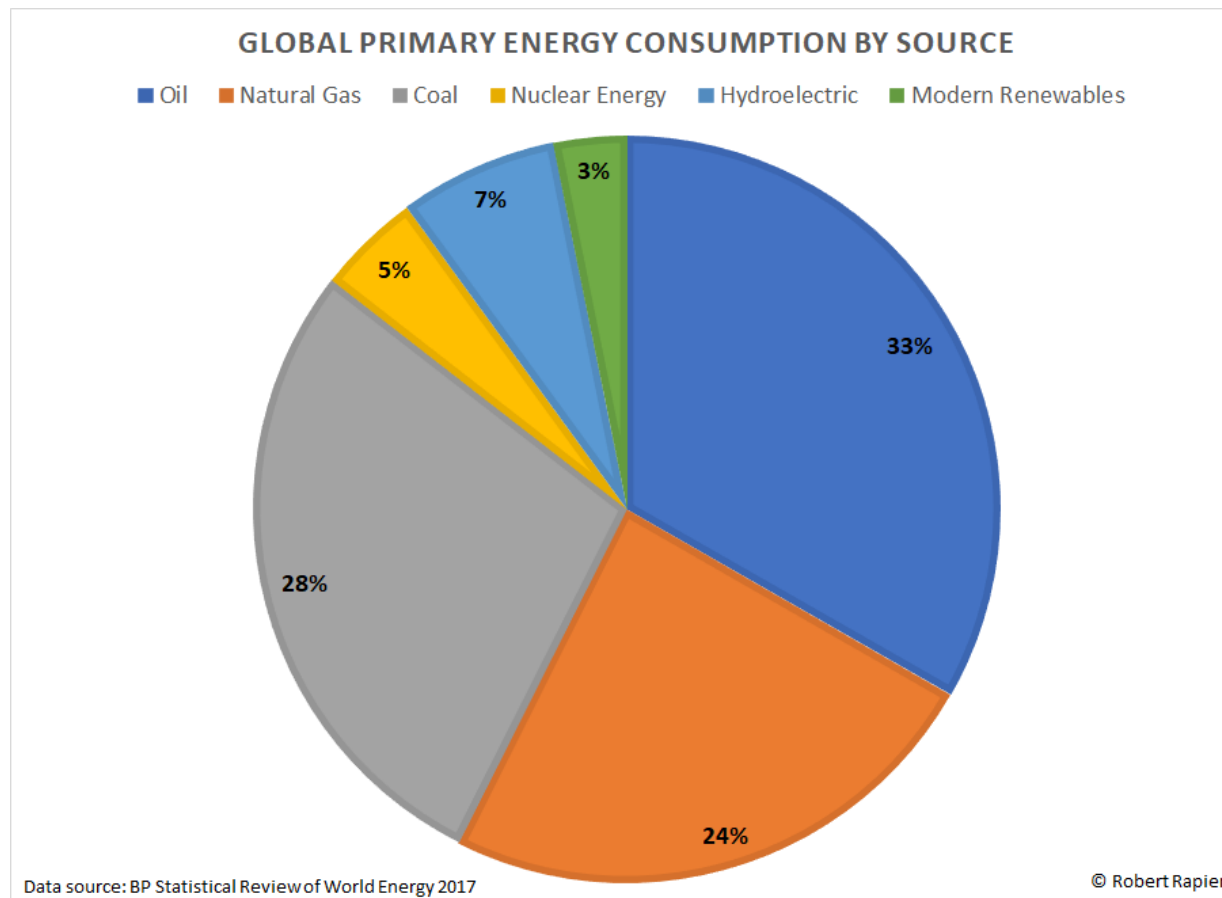
RENEWABLE RESOURCES

Energy

“Renewable energy sources are types of natural energy flux useful for human ends regularly occurring on or near Earth’s surface and replenished within the **time frame of conceivable human use**. Renewable energy sources are practically inexhaustible though some sources such as geothermal and ocean thermal energy conversion may become locally depleted by human use at a rate that exceeds replenishment by natural flux.”

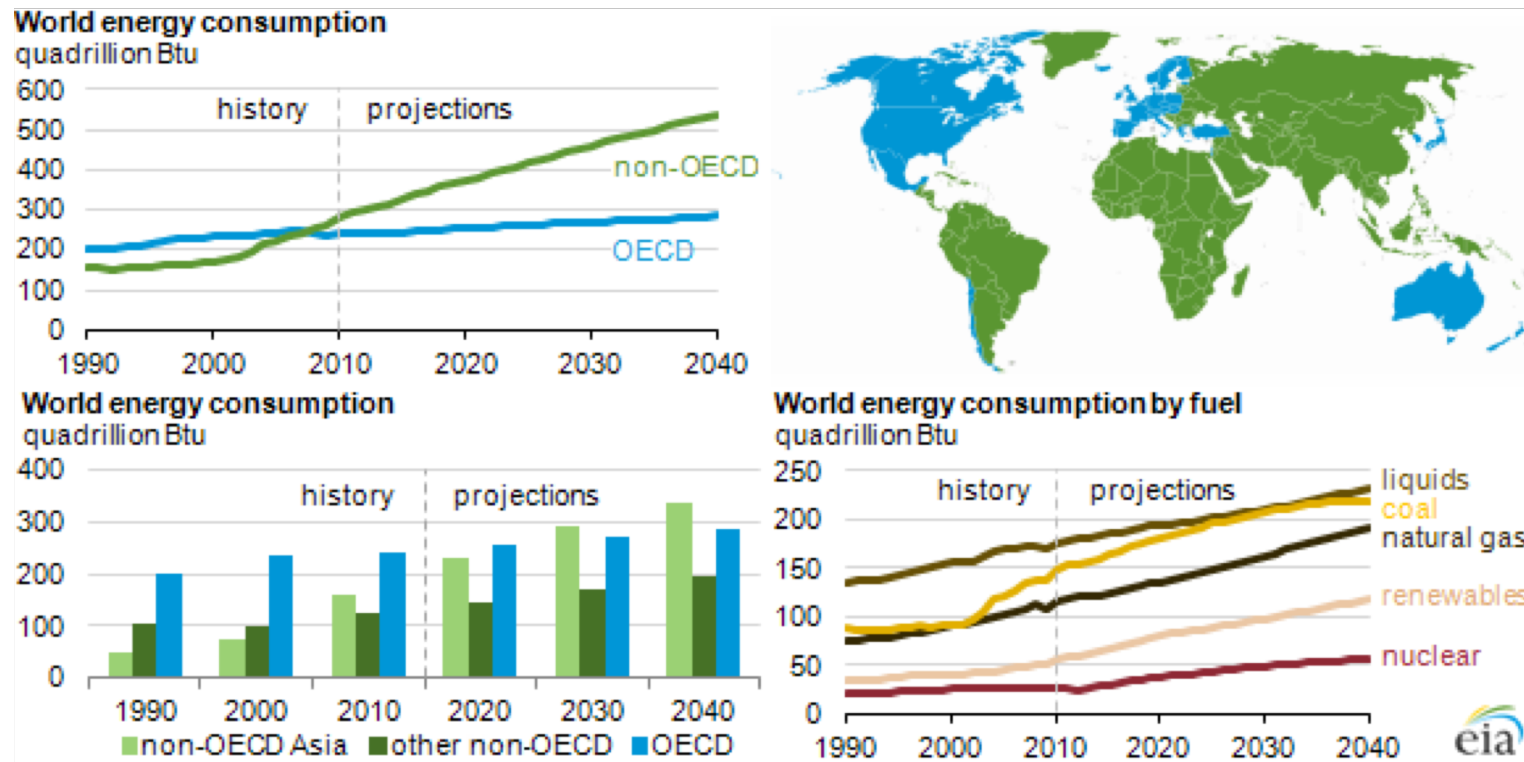
RENEWABLE RESOURCES

Energy



RENEWABLE RESOURCES

Energy



- World energy consumption will grow 56% between 2010 and 2040
- Renewables and nuclear energy are the fastest growing sources
- Fossil fuels will continue to supply ~80% of the energy

The importance of renewable energy sources

- Place 100 pebbles in an opaque bag, 15 of one color (renewables) and 85 of another (non-renewables).
- Have one group member remove 10 pebbles in each round and return to the jar any renewable pebbles collected (as these are always available).
- Repeat until having only renewable pebbles in the jar.
- Record in Table 1 the number of renewable and non-renewable pebbles collected in each round.
- Repeat for Table 2 (growing energy needs).

- Group
- Individual

Class objectives: data analysis, data visualization, critical thinking, raise environmental awareness

The importance of renewable energy sources

- Compare the number of years it took to deplete the non-renewable energy sources with predictions
- Compare the numbers of years it took to deplete the non-renewable energy sources under constant or growing energy demand
- How does the experiment tell you about the future of energy use?
- What are the challenges to make a full transition into renewable energy?

- Group
- Individual