# The Environment as Collective Action Problem

## POSC 1020 – Introduction to International Relations

Steven V. Miller

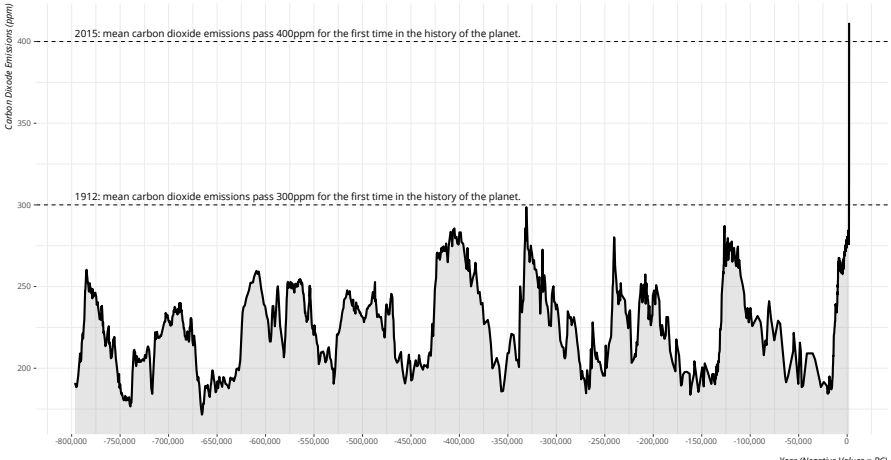
Department of Political Science

# Puzzle(s) for Today

*Why is it so hard to cooperate on the environment when threats to it constitute a threat to life on earth?*

## Estimated Carbon Dioxide Emissions Through the History of the Planet, 800,000 BC to 2017

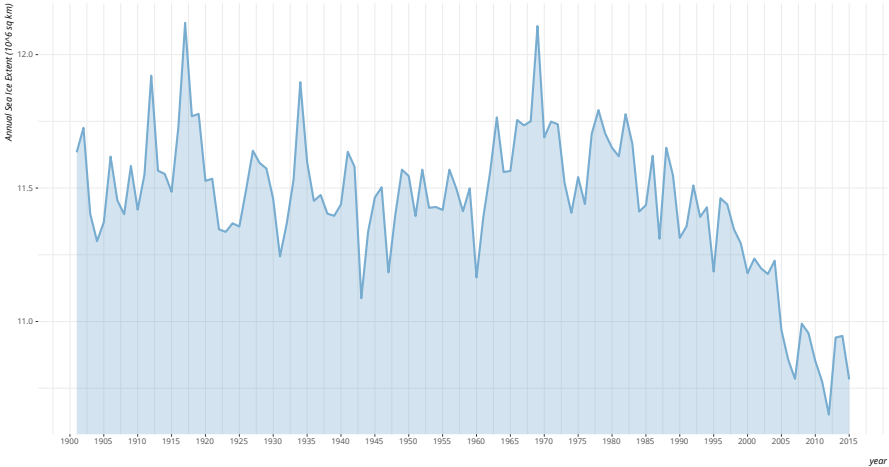
What's happening right now is more than just a normal "cycle."




*Data: cobbled from various sources, including EPA, IAC/Eidgenössische Technische Hochschule estimates, and NOAA Earth System Research Laboratory*

## The Arctic Sea Ice is Rapidly Vanishing in Our Lifetime

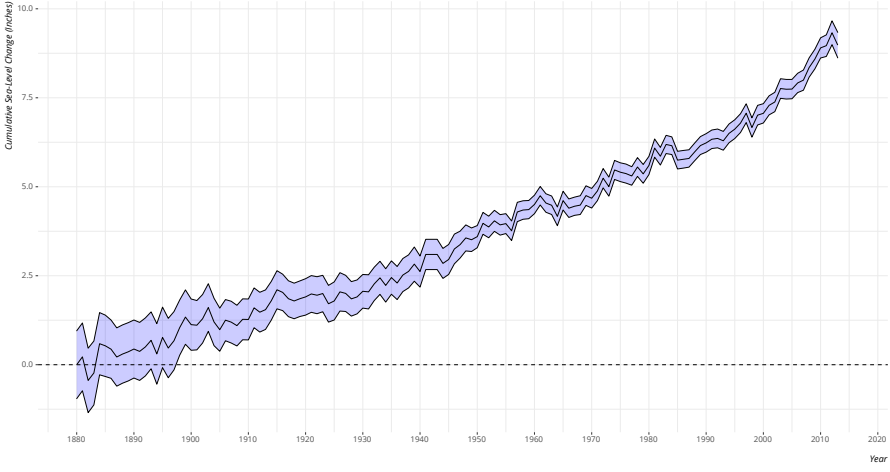
The Arctic shows no sign of returning to the reliably frozen region of recent past decades.




*Data: Connolly et al. (2017), "Re-calibration of Arctic sea ice extent datasets using Arctic surface air temperature records". *Hydrological Sciences Journal* 62(8): 1317–40.*

## Global Average Absolute Sea Level Change, 1880 to 2013

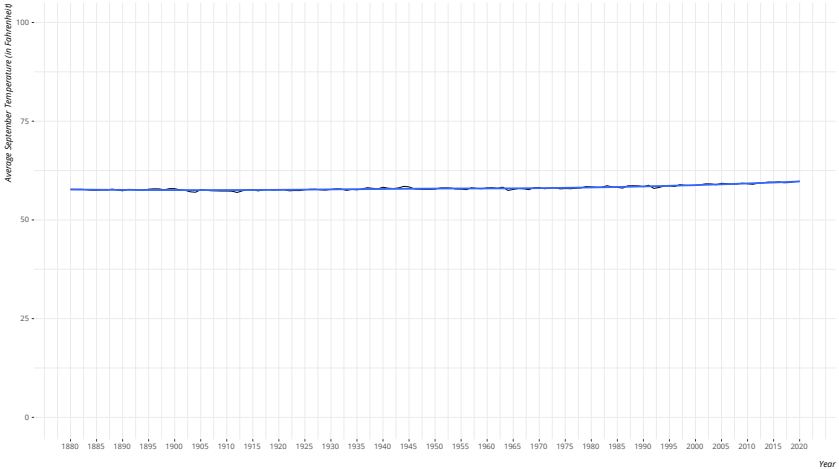
Absolute sea level change refers to the height of the ocean surface regardless of whether nearby land is rising or falling.




Data: CSIRO via EPA.

## A Very Stupid Graph on How Global Temperatures Have Changed Over Time, 1880-2020

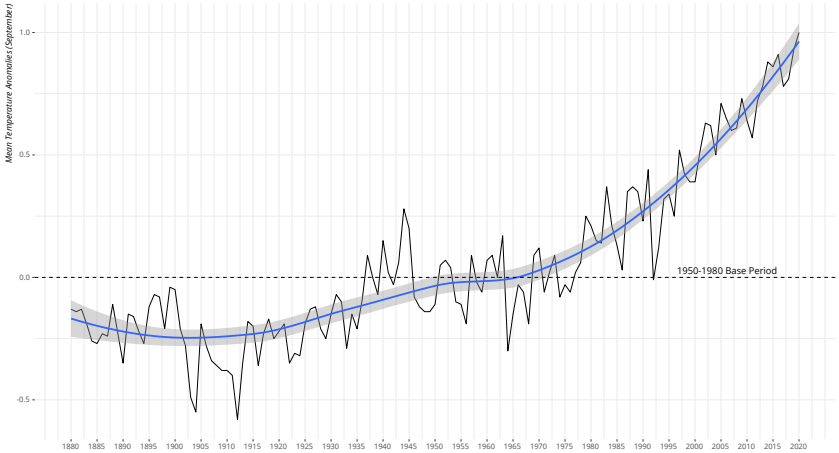
You can easily "lie" with data by misrepresenting scale and, importantly, context.




*Data: ?LOTI in stevedata (via NASA/GISS). Data subset to complete months (September in this graph). Inspiration: National Review Online (https://twitter.com/NRO/status/676516015078039556)*

## Annual Mean Temperature Anomalies (in Celsius) Relative to 1950-1980 Base Period

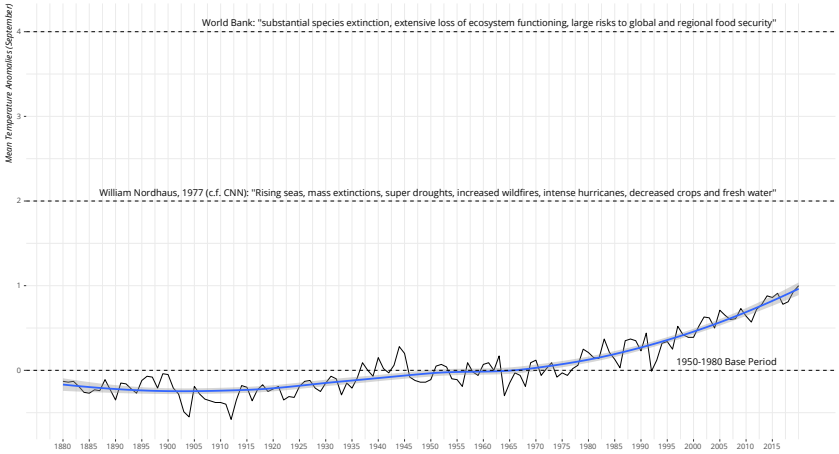
Thing is we've known about this for like the past 30 years and...




*Data: 'FLOTI in stevedata (via NASA/GISS). Data subset to most recent month in data (September).*

## Annual Mean Temperature Anomalies (in Celsius) Relative to 1950-1980 Base Period

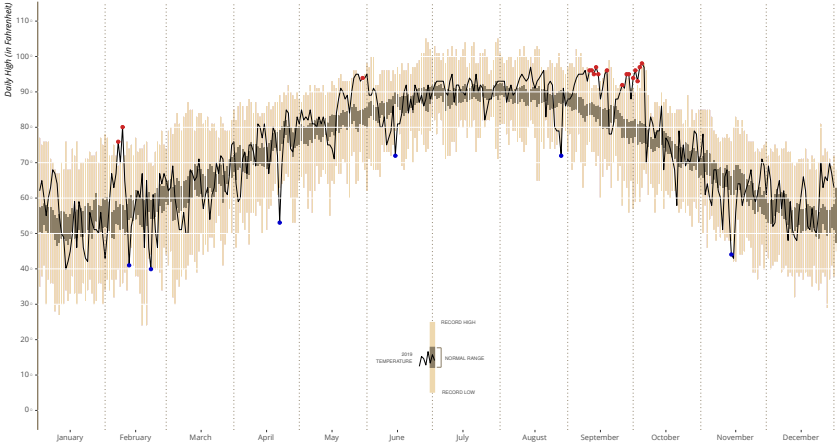
Thing is we've known about this for like the past 30 years and...




*Data: 'FLOTI in stevedata (via NASA/GISS). Data subset to most recent month in data (September).*

## Clemson's 2019 Temperatures Relative to the 1950-1980 Period

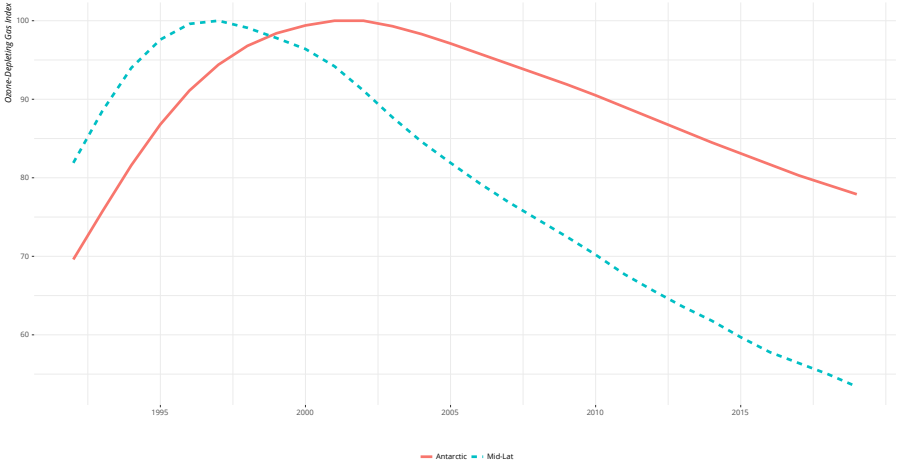
Clemson has been having milder and milder winters the past few years and the early fall months were *much* warmer than usual.




*Source: clemson_temps in stevedata (via NOAA). Inspiration: https://github.com/bradleyboehmke/Dayton-Weather-2018*
*Note: red/blue dots indicate record highs/lows relative to 1950-1980 period.*

## Ozone Depletion Constitutes a (Partial) Success on an Issue Notorious for Collective Action Problems

Overall, the ODGI-A/ODGI-ML and sum chlorines (in ppts) has fallen, as have several particular/conspicuous chlorines (e.g. CFC-11 and CFC-12) even as others (like halon and HCFC) have slightly risen.




*Data: ?ODGI in stevedata (via NOAA Ozone Depleting Gas Index)*

# Collective Action and the Environment

Remember the prisoner's dilemma? The environment looks a lot like that.

- Mutual cooperation is the Pareto optimal outcome.
- Defection is the dominant strategy.
- Benefits are diffuse; costs are concentrated.
- Temptations to free-ride are real.

# Collective Action and the Environment

Environmental politics are unique in that our choices produce **externalities.**

- i.e. a cost/benefit to a third-party not involved in the choice.

If a country pumps CFCs/CO2 into the atmosphere, or a firm dumps waste into an important waterway, others bear those costs despite not being involved in the "transaction."

- Likewise, litter-pickup volunteers create an externality for their charity.

# The Environment as Public Good

Many environmental issues assume the form of public goods/public bads.

- Nonexcludable
- Nonrivalrous

These mostly arise from nature.

- i.e. we share one atmosphere, one climate, one ozone layer, etc...

# The Environment as Commons

The environment was an unregulated “common” for the longest time.

- Countries/actors were free to use/pollute as they saw fit.

Recent efforts have tried to rein this in:

- Kyoto Protocol (1997)
- Emissions Trading Scheme (2005)

# The Environment as Commons

However, these advancements have important limitations.

- Kyoto binds only those that have signed it.
  - Countries like Canada and Russia even opted out.
  - The U.S. signed the protocol but never ratified it.
- "Cap-and-trade" harnesses private incentives but it's not clear how cost-effective they are.
  - They further may not matter "overall."

# The Environment as Commons

Other environmental issues (prominently: fishing) involve **common-pool resources.**

- i.e. resources are non-excludable, but rivalrous.

Self-interested actors pursue conventions amid this problem.

- You'll notice: it's still a prisoner's dilemma.

# Solving Collective Action Problems

Collective action problems are tough, but not impossible.

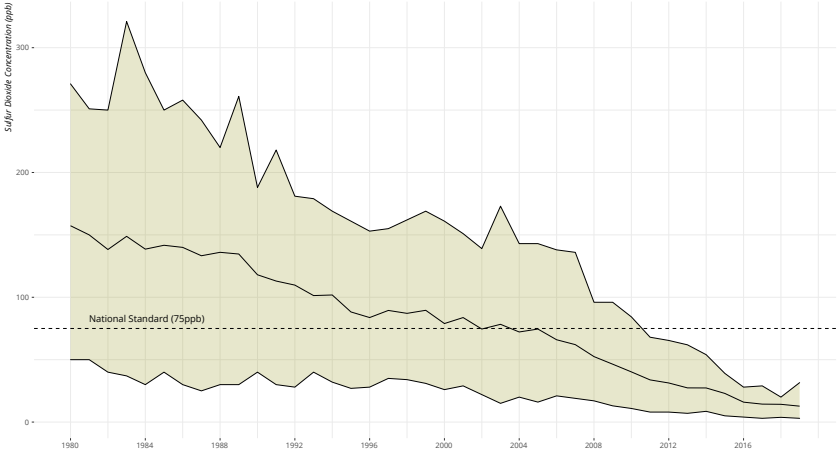
# The Importance of Group Size and Concentration

Collective action problems, like acid rain, are tractable in smaller groups and when externalities are concentrated.

- The costs of acid rain emissions fell largely on those that were the core of the problem.
- The actors involved were either isolated (e.g. US/Canada) or concentrated in Europe.
- LRTAP did well to address the problem of acid rain, at least in developed/Western countries.
    - China and India still have these problems, though.

## Sulfur Dioxide Emissions in the U.S. Have Decreased Over 87% Since 1980

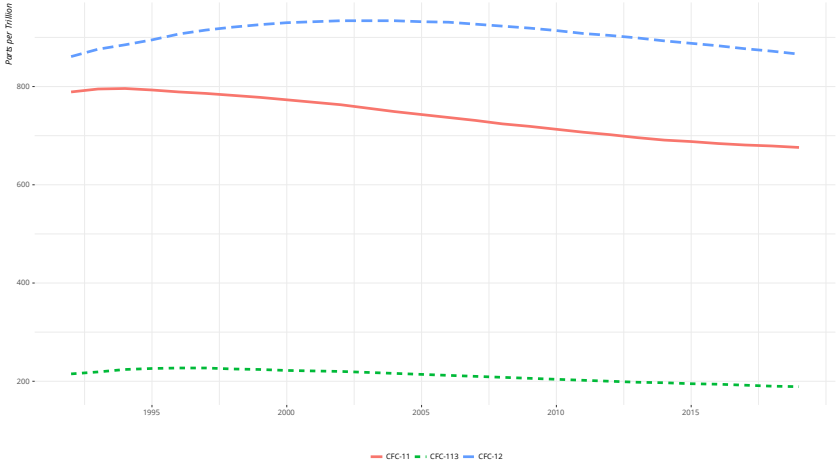
The U.S. has largely met the 75ppb line by 2010 in large measure because of the EPA and the concentrated costs acid rain pose on the populations of polluting countries.




*Data: ?so2concentrations in stevedata (via Environmental Protetion Agency)*

## Chlorofluorocarbon (CFC) Emissions Have (Generally) Fallen As Well

This followed because costs were concentrated on a few countries, as were the proposed benefits.




*Data: TODGI in stevedata (via NOAA Ozone Depleting Gas Index)*

# Solving the Prisoner's Dilemma

Same things that promote cooperation in the prisoner's dilemma help us understand cooperation on the environment.

- Iteration: repeated interaction raises costs associated with defection.
- Linkage: LRTAP was successful because it involved mutually dependent trading partners (e.g. US-Canada)

# Solving the Prisoner's Dilemma

It's useful to bundle public goods with private benefits.

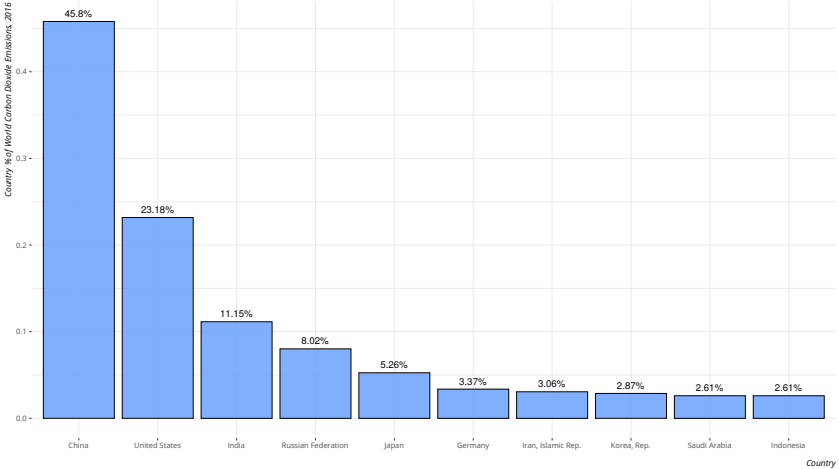
- e.g. deforestation is usually linked with erosion control and ecotourism.
- e.g. DuPont and CFC bans.

Prisoner's dilemmas become tractable with the emergence of "privileged groups."

- i.e. why the U.S. and China are key actors on the future of environmental politics.

## Country Percentage of Carbon Dioxide Emissions, 2016

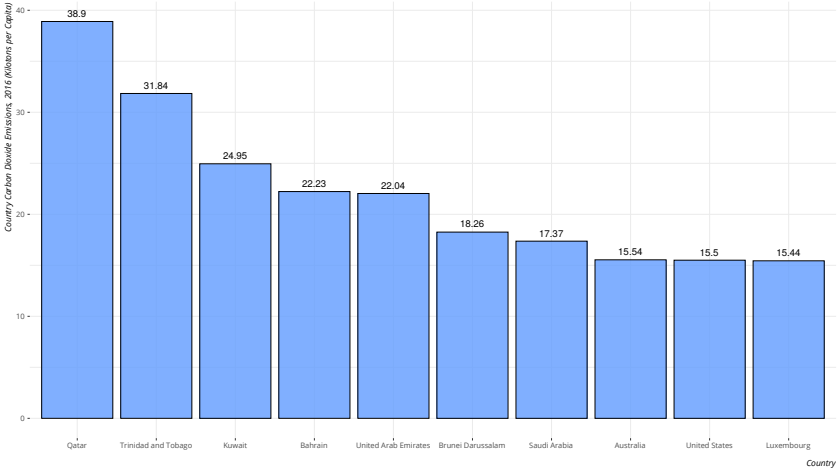
China is the biggest volume emiter of carbon dioxide and the top three are incidentally the top three in population size.




*Data: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory.*

## Country Carbon Dioxide Emissions per Capita, 2016

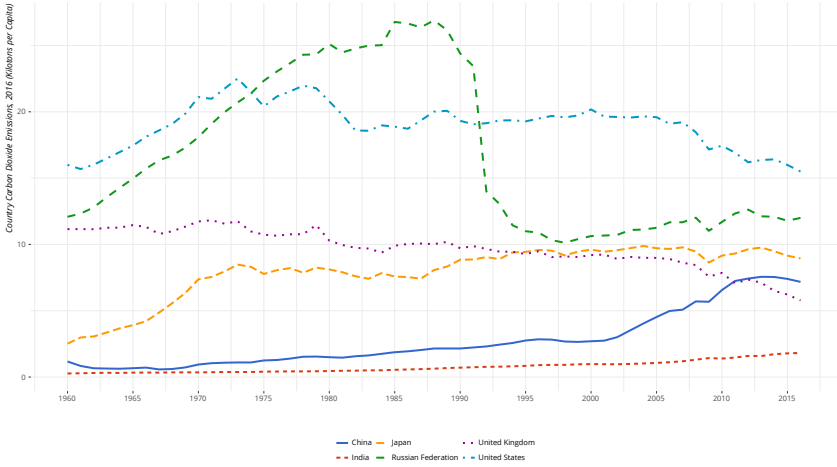
China might be the biggest emitter, but it's largely the oil-rich Gulf states (and the United States) that dominate this list of per capita emitters.




*Data: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory.*

## Carbon Dioxide Emissions per Capita for Select Countries, 1960-2016

The U.S. has always been a high-volume emitter and large per capita emitter as well. The emissions for China, always a large-population country, have risen concurrent with its development.




*Data: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory.*

# Conclusion

Environmental politics are a prisoner's dilemma.

- Cooperation is Pareto optimal but defection is dominant strategy.
- Costs get concentrated as benefits are diffuse.
- This takes peculiar forms when considering externalities and common-pool resources.

Prisoner's dilemmas are solvable, but still tricky.

- Important to link public goods with private benefits.
- The "dilemma" gets magnified the larger the group.

# Table of Contents