Climate Change: Economics and Policy

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Learning Objectives

Identify the need for policy action in dealing with climate change

Identify various policy pathways in response to the global climate change problem

Identify and understand market and non-market based environmental solutions

Climate Change

2017 was the hottest year on record without an El Niño, thanks to global warming

Climate scientists predicted the rapid rise in global surface temperatures that we're now seeing

Terry P. Hughes, James T. Kerry [...] Shaun K. Wilson

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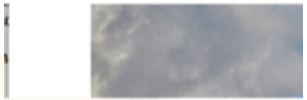

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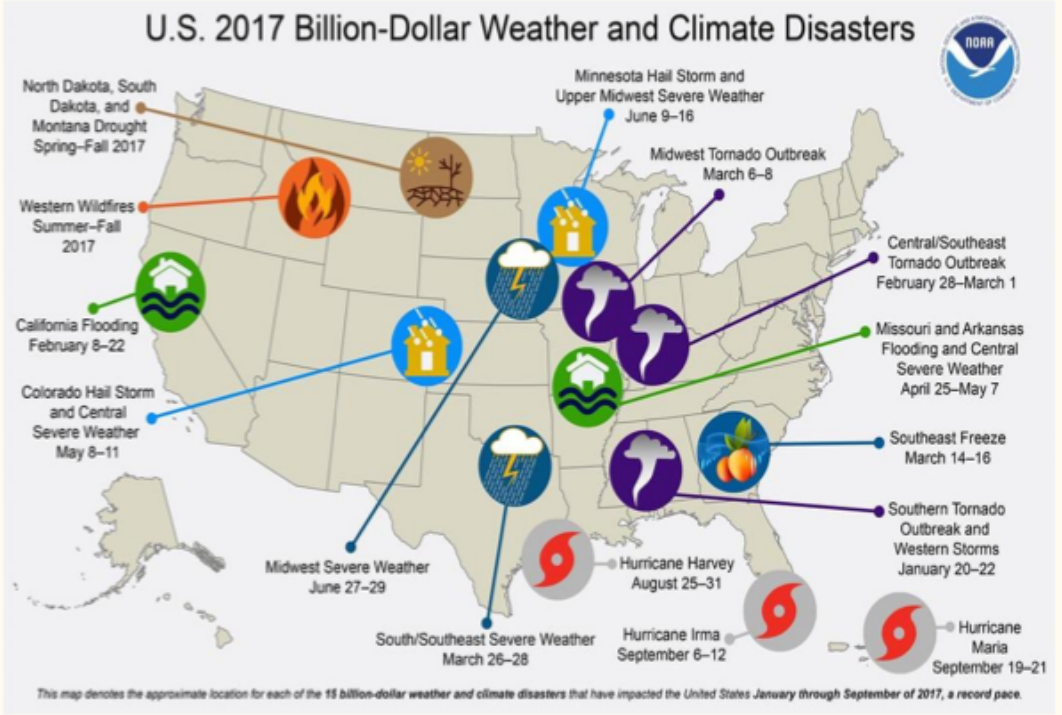
L.A. lawmakers look to sue big oil companies over climate change — and the costs that stem from it

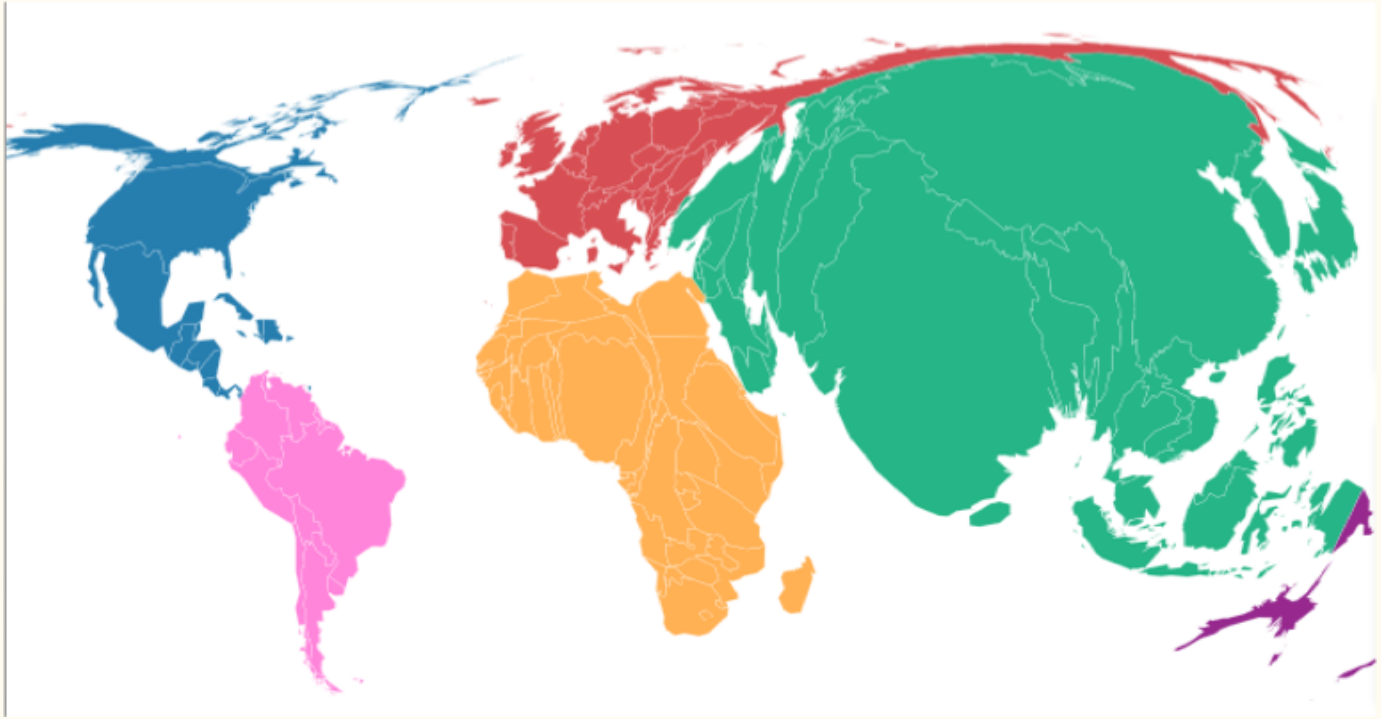
Why do we need environmental policy?

- TOC problem
- Negative externalities
- Justice
- Rights
- Equity



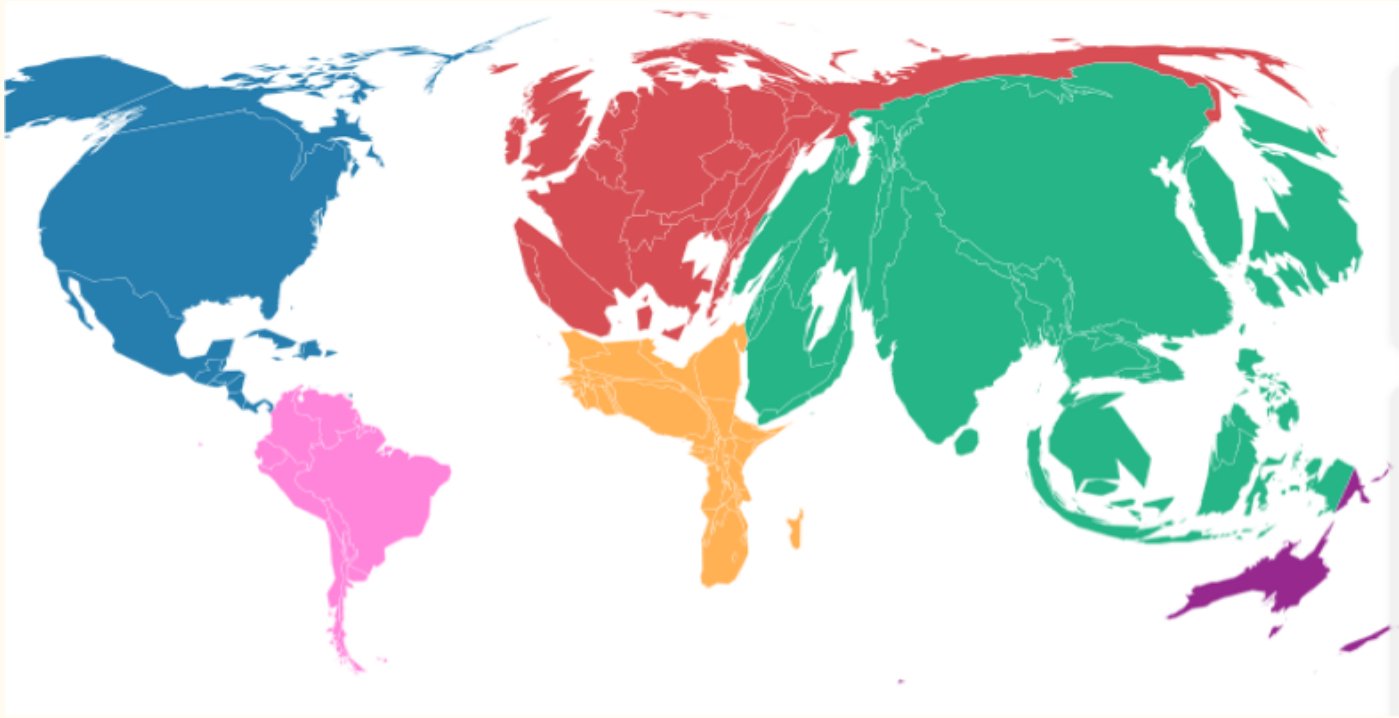
Source: National Oceanic and Atmospheric Administration

Why global action?



Source: http://www.carbonmap.org/#Emissions

Common but differentiated responsibilities but respective capabilities (CBDR-RC)



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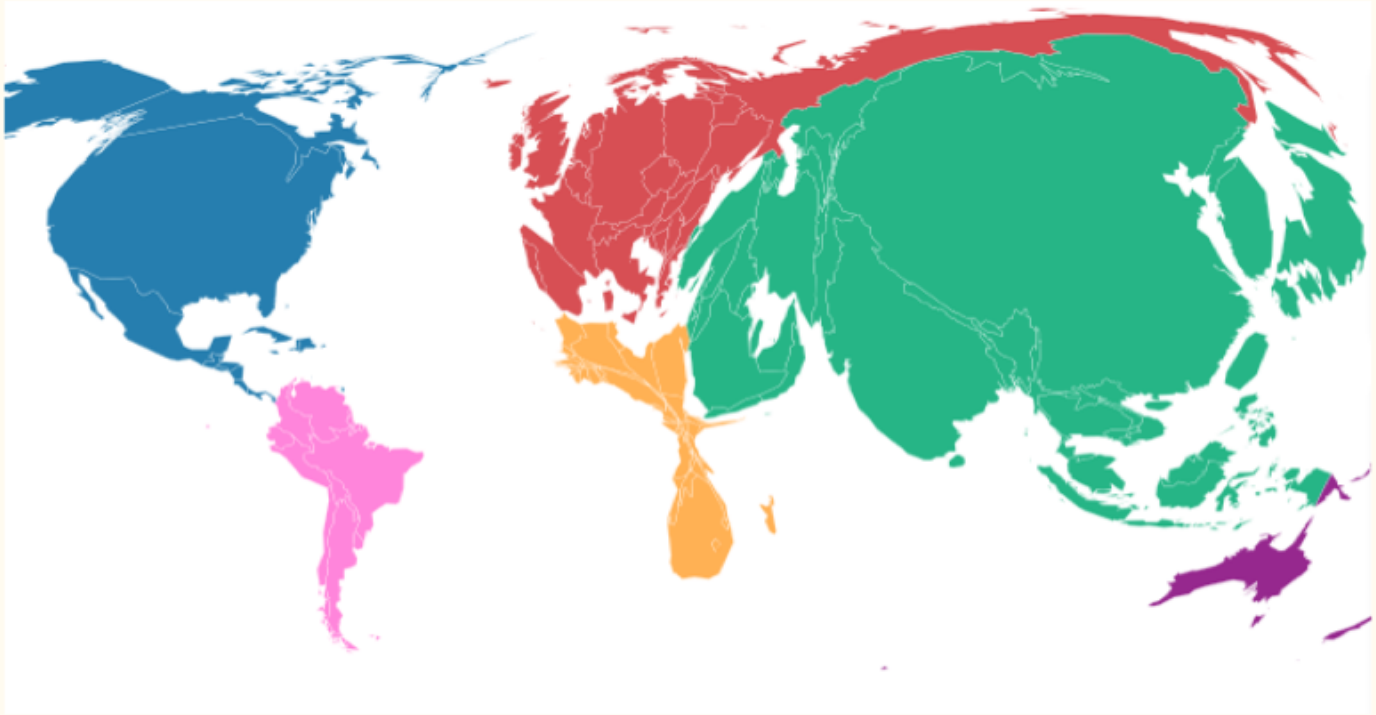


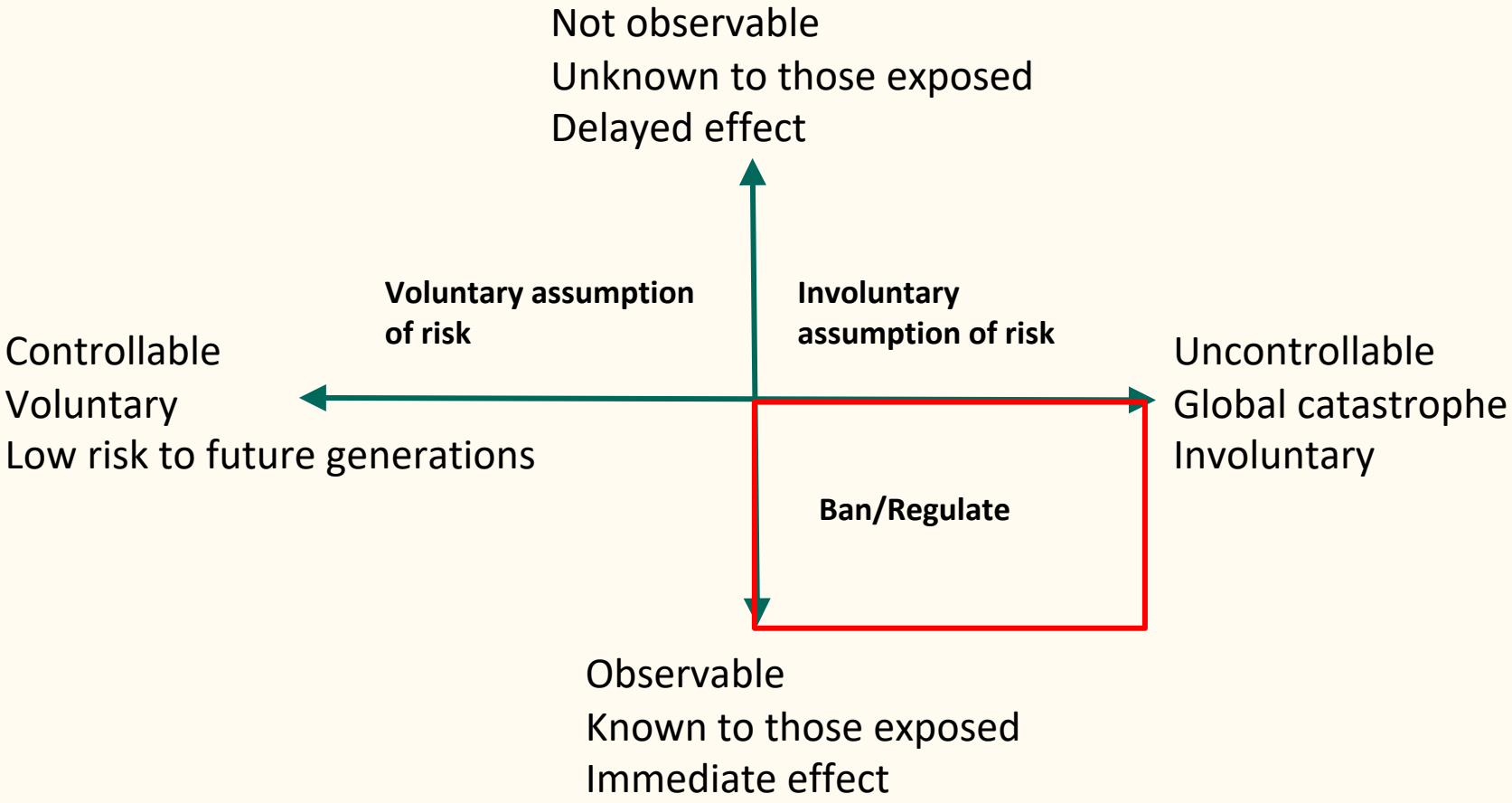
Source: http://www.carbonmap.org/#Emissions

Tragedy of the Commons

Environment is a public good

Source: https://www.youtube.com/watch?v=WYA1y405JW0

Risk Shielding

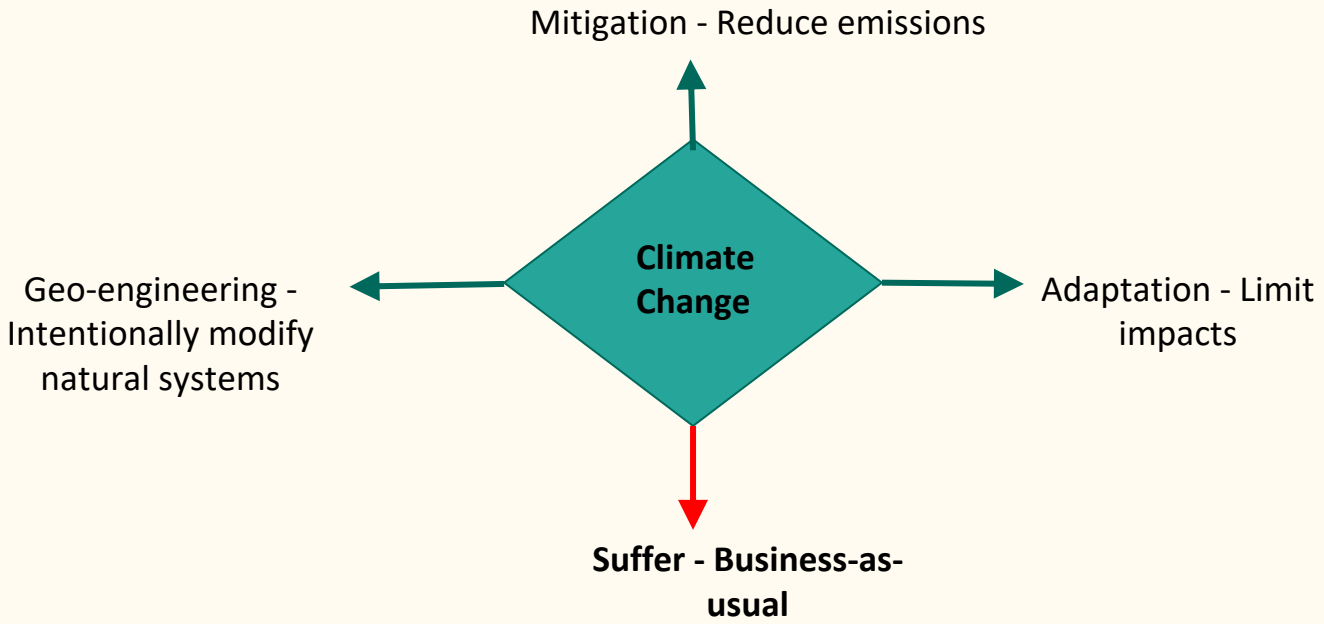


Environmental Externalities

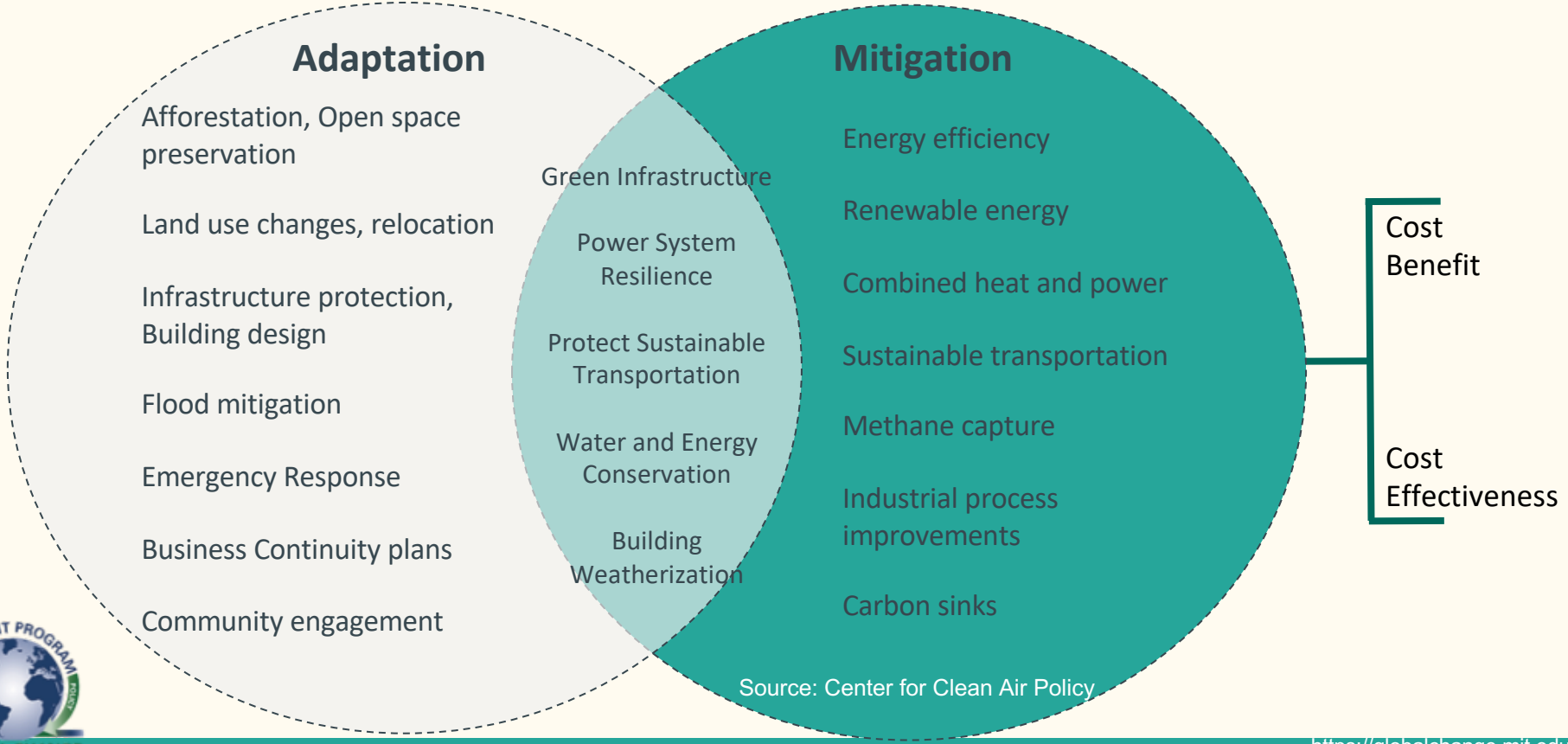
Scope of Externalities:

- Localized
- Regional
- Global

Market and non-market solutions



Policy Responses & Economic Analysis



Cost Benefit Analysis (CBA)

Cost of policy actions to stabilize or reduce CO2 emissions compared to the cost of consequences with the increase of emissions.

Benefits of policy must be equal or greater than the value/cost of projected consequences.

Determining Valuation

Stated Preference: Contingent Valuation

Individuals willingness to pay for a certain good or service (i.e. share the costs of mitigating climate change)

Revealed Preference: Hedonic Pricing

Equates the value of non-market goods and services to the difference in price between two marketed products that differ only with regard to the non-market goods and services of interest (i.e. real estate prices that change per climate shifts).

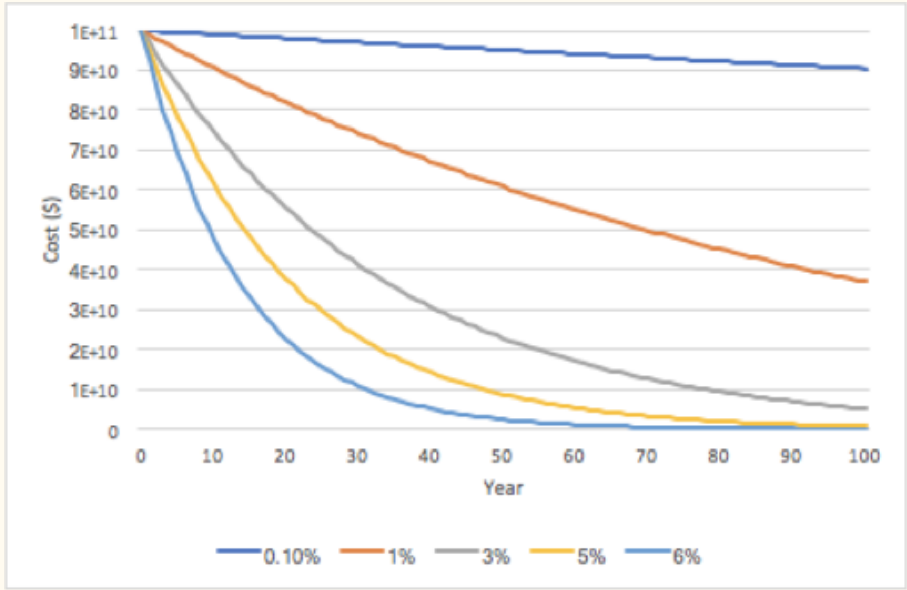
Estimating Costs and Benefits

Marginal abatement costs: Cost of reduction of one extra unit of carbon – for various measures such as energy efficiency, shifting to solar and wind power, or avoided deforestation

- Varying effects on GDP

Future costs and benefits evaluated by the use of a **discount rate.**

- How much we should value damages to future people, environment, health, etc?
- Present Value of Cost-Benefit (X) = $X / (1+r)^n$
  - Where *r* is the discount rate and *n* is the number of years in which we'd receive the benefit

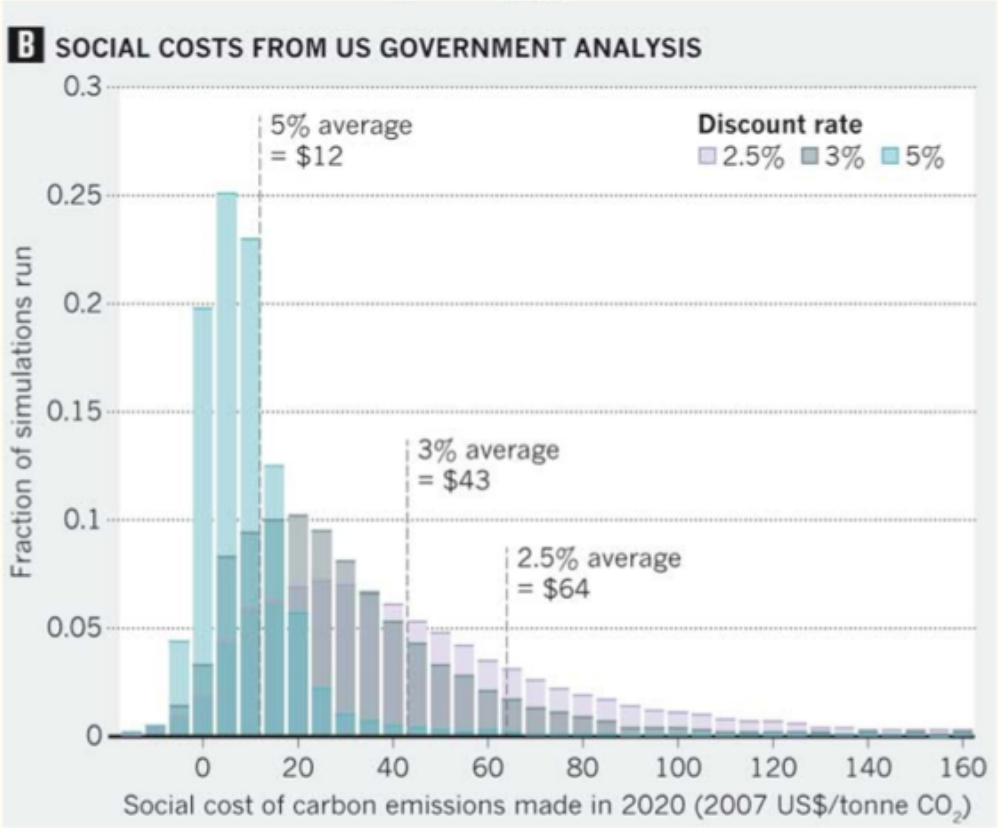


Social Cost of Carbon

The economic cost of an additional ton of CO2 emissions

- How much future climate mitigation is worth to us today?

- William Nordhaus vs Nicholas Stern
- Differences:
  - Discount Rates
  - Uncertainty
  - Economic costs of action to mitigate climate change



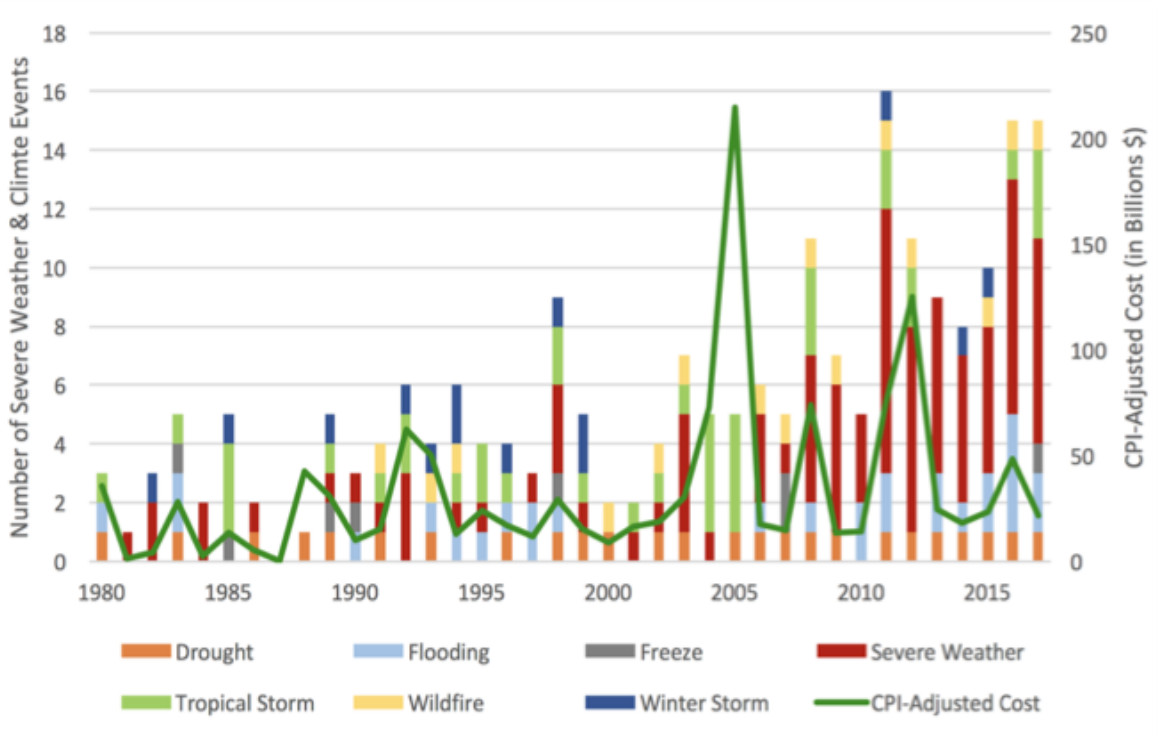
SOURCE: A, REF.1 (DICE, FUND, PAGE)/Roson, R. & Mensbrugghe, D. V. D. Int. J. Sus. Econ. 4, 270–285 (2012) (ENVISAGE)/Ackerman, F., Stanton, E. A. & Bueno, R. Ecol. Econ. 85, 166–176 (2013) (CRED); B, REF.1

Issues with CBA

Spatial and temporal scales
- Discounting

“Value of Statistical Life”

Uncertainty
- Damage estimates for rising frequencies and intensities of weather extremes
- Resulted in use of “integrated assessment models”



Billion-dollar weather and climate disasters by type and total CPI adjusted cost from 1980-2017.

Figure by Anthony Fratto. Data Courtesy of NOAA National Centers for Environmental Information

Cost Effectiveness Analysis (CEA)

Accepts a goal as given by society and uses economic techniques to determine the most efficient way to reach that goal

- i.e. target based
- Considers the outputs produced by a project (not measured in monetary terms)

IPCC: - *"Like other target-based approaches, CEA often turns into an implicit CBA, especially if even the minimum costs turn out to be too high and beyond the ability to pay of the society. The target is iteratively revised until an acceptable solution is found."*

Economic Policy Options

GHG Emissions are a negative side-effect of economically valuable activities

Coase Theorem: externalities are potentially correctable through the market if property rights are clearly assigned and there are low transaction costs.

Remedying externalities can be thought of as two separate problems:

1. What should be done?
2. Who should pay for it?

Market has yet to rectify GHG emissions due to difficulty in assigning responsibility

<u>If the Coase Theorem cannot hold, external quantity regulation is needed</u>

Command and Control

Setting a standard of performance or quantity for GHG emissions or demanding a specific technology

Requirements: Production function for each firm

Examples: EPA Clean Power Plan, Renewable Fuels and Portfolio Standards

Incentives & Advantages: Allows firms to conceal costs and their is no marginal incentive to abate

Risks, Costs, and Drawbacks: Inefficient production and a lack of innovation. Requires separate rules for each plant and monitoring output

Pigouvian Taxation

Taxing emissions to the point where desired emissions level are achieved (i.e. emitters pay for the social cost of emissions).

Requirements: Calculating the marginal social cost of emissions

Examples: U.K., Ireland, Australia, Chile, Sweden

Incentives & Advantages: Easy to implement, transparent, and minimizes GHG emissions

Risks, Costs, and Drawbacks: May over/under-predict the quantity of GHG emissions and monitoring output

Cap and Trade

Emissions are capped at the desired level and a set number of permits are required for emitting carbon dioxide. Firms can trade permits with one another to emit more.

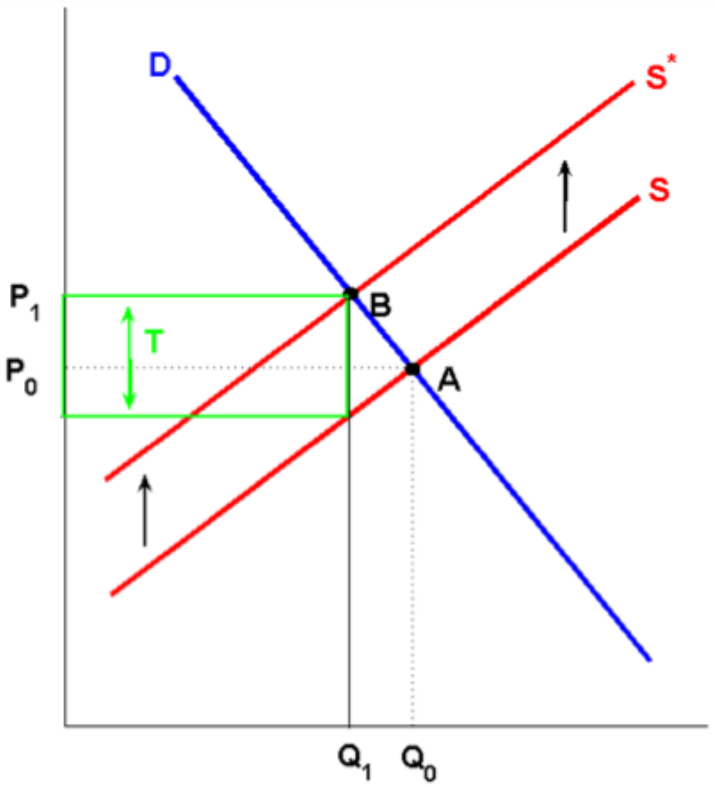
Requirements: Calculating optimal quantity of GHG emissions

Examples: SO2 permits (Clean Air Act Amendments of 1990), Regional Greenhouse Gas Initiative, European Union Emissions Trading System

Incentives & Advantages: efficiency/ease in setting levels, minimizes the externality

Risks, Costs, and Drawbacks: May over/under-predict the revenue, monitoring output, requiring bureaucratic structure to operate the permit market.

Carbon Tax (1) vs. Cap and Trade (2)



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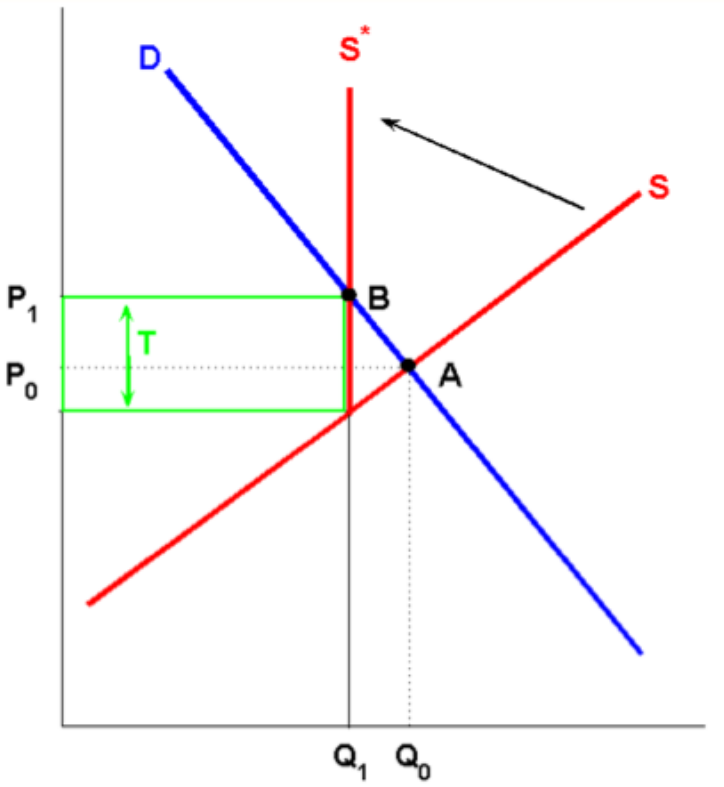

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Image Courtesy of http://www.macleans.ca/why-the-difference-between-carbon-taxes-and-cap-and-trade-isnt-as-important-as-you-think/

Summary

Climate change is a pressing policy issue.

Global action is required to effectively manage climate change.

Policy responses are assessed through cost-benefit and cost-effectiveness analysis.

Economic options in addressing GHG emissions are categorized by command-and-control, pigouvian taxation, and cap-and-trade.

Thank you.

Questions?

Sources

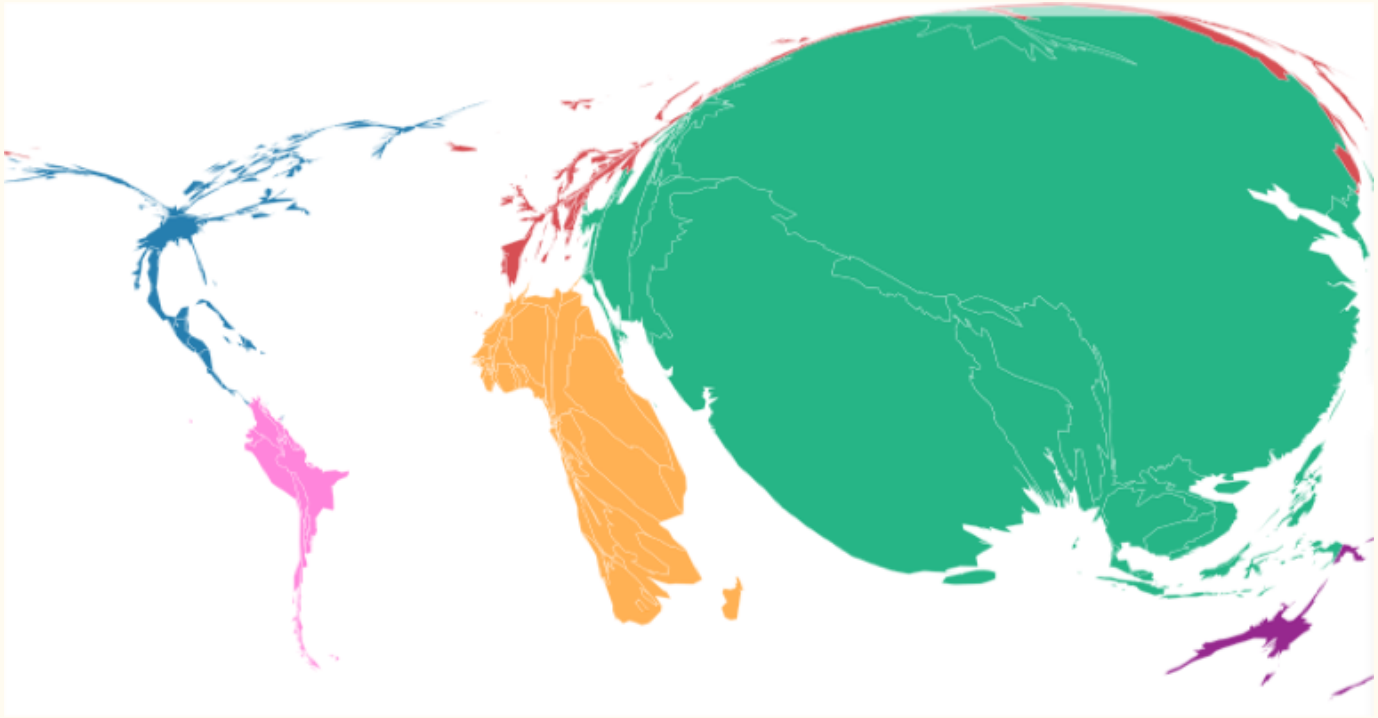
https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/jan/02/2017-was-the-hottest-year-on-record-without-an-el-nino-thanks-to-global-warming

https://www.nature.com/articles/nature24672

https://www.scientificamerican.com/article/how-far-does-obama-s-clean-power-plan-go-in-slowing-climate-change/

Extra Slides

Climate Change and Public Policy



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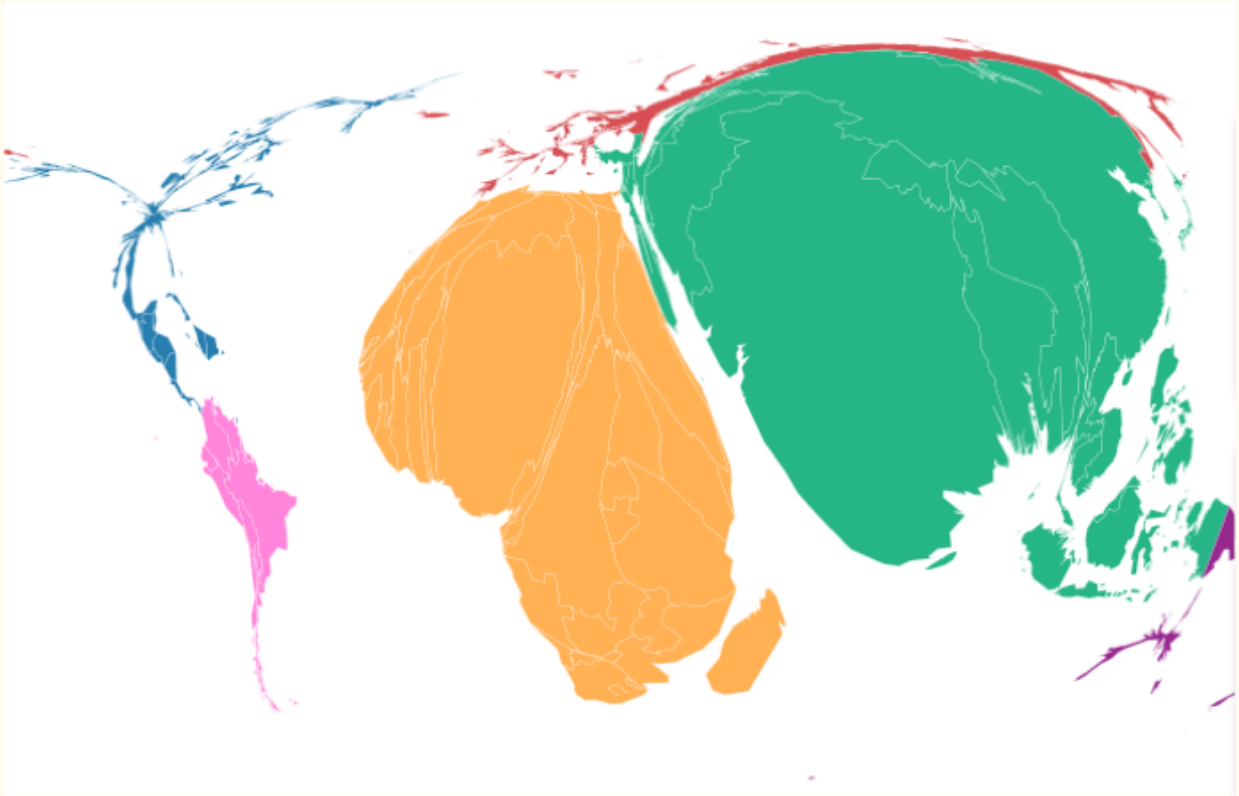
Climate Change and Public Policy



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