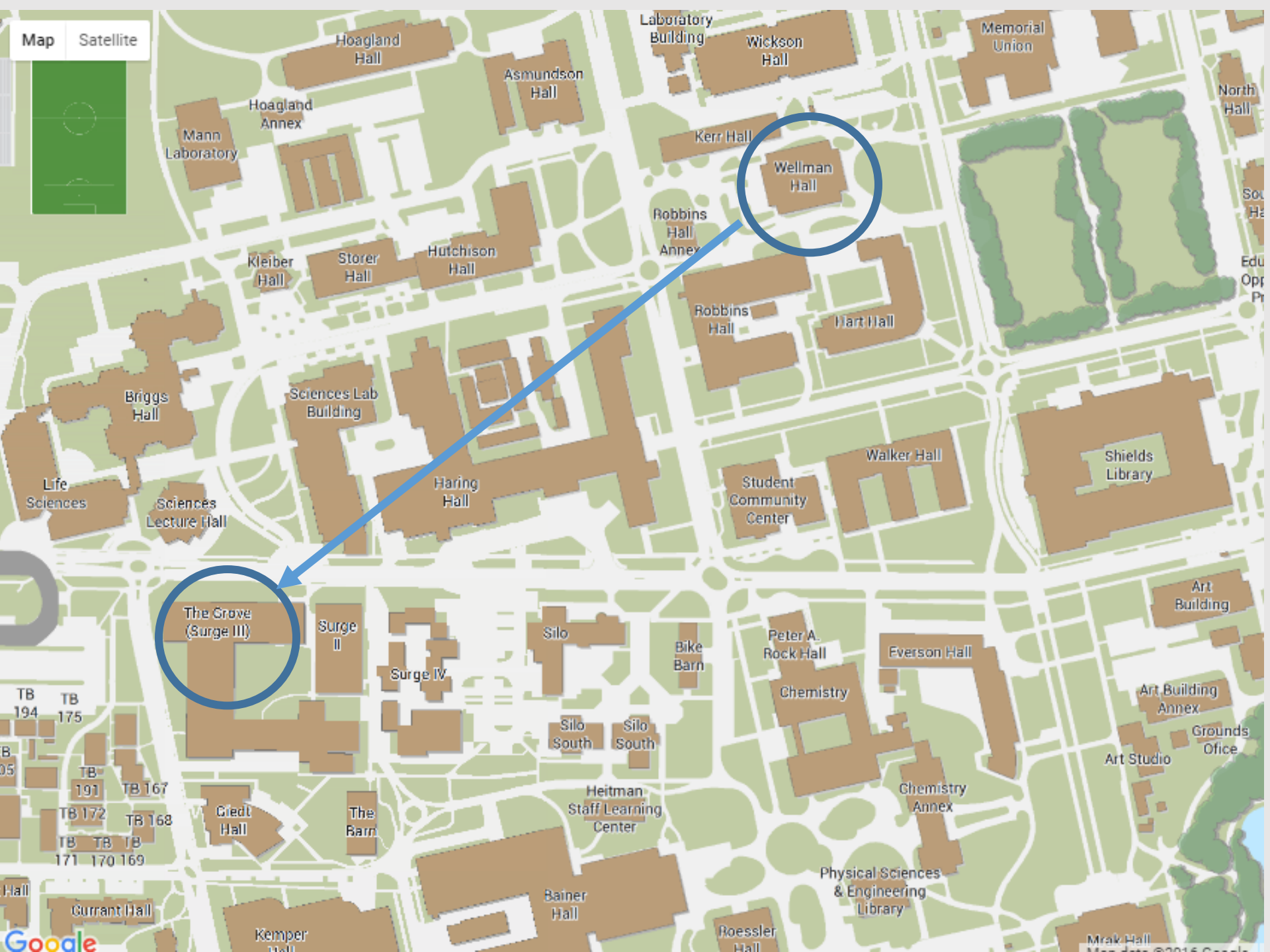


Early Final Exam – Room Change

1309 SURGE III (The Grove)

Monday, March 14

5:00-7:00 pm



TB 194
TB 175
TB 191
TB 167
TB 172
TB 168
TB 171
TB 170
TB 169

Regular Final Exam

Saturday, March 19

6:00-8:00pm

Wellman 106 (normal lecture room)

Extra Credit Discussion Section with Department of Fish and Wildlife

March 9

3:10-4:00 pm

<http://ucoe.adobeconnect.com/sas25swisher/>

To earn extra credit, you must submit a question/discussion topic to the discussion forum on piazza. In addition, there will be an extra credit question on the final exam that will come from the discussion section.

Rebecca Fris – Environmental Program Manager for the Scientific Assessment and Monitoring Unit within CDFW’s Watershed Restoration Grants Branch. The Cap-and-Trade auction system, part of the Global Warming Solutions Act of 2006 (AB 32) funds the Department Branch. Rebecca leads efforts in developing science-based protocols, guidance and performance measures for grant-funded projects and coordinates across agencies to implement [Proposition 1 \(Links to an external site.\)](#) and the greenhouse gas reduction grant programs (Proposition 1 authorized \$7.12 billion for state water supply infrastructure projects, including ecosystem and watershed protection and restoration). Rebecca previously was the Science Coordinator for the California Landscape Conservation Cooperative, a state-management partnership that brings climate science to landscape conservation. Specifically, she worked on climate adaptation planning and translation of climate science for resource managers. She received her undergraduate degree from the University of California, Santa Barbara and a Masters in Environmental Management in resource ecology from Duke School of the Environment.

- *Topics you might want to ask Rebecca about:*
- Climate smart conservation/climate adaptation planning
- State grant programs for Prop 1 and the Greenhouse Gas Reduction Fund
- Working across agencies and organizations (state, federal and NGOs)

Melanie Gogol-Prokurat – Lead ecologist with the CDFW Conservation Analysis Unit, which conducts analysis and research to address conservation questions with a focus on landscape-level spatial analysis, such as species range and distribution modeling, climate change vulnerability assessments, and habitat connectivity modeling. Melanie has worked on CDFW climate change analysis projects including climate change vulnerability assessments for rare plants and mammals, which evaluate species vulnerability based on spatial climate models and species traits; and identification of land facet habitat corridors resilient to climate change. Melanie holds a B.S. in Biology and a Ph.D. in Conservation Ecology from UC Davis.

- *Topics you might want to ask Melanie about:*
- Climate change vulnerability assessments
- Species distribution models
- The interaction of species life history traits and climate change
- Climate resilient habitat corridors

Patrick McIntyre - Lead scientist with the [California Natural Diversity Database \(Links to an external site.\)](#) (CNDDDB), a program tracking rare and special status species in California, where understanding how climate change may affect these species is a central question. Patrick has also been involved in research documenting historical consequences of climate change in California forests, and the role of biological interactions in species responses to climate change.

- *Topics you might want to ask Patrick about:*
- Using GCMs
- How climate change has/will affect plants/animals in California

Whitney Albright - Climate Change Coordinator with the California Department of Fish and Wildlife where she works to incorporate climate change considerations into Department programs and activities, and disseminate climate change information to CDFW employees through various education initiatives. She also works with state, federal, and Non-Governmental Organization (NGO) partners and stakeholders to coordinate and advance CDFW's climate change priorities. Whitney holds a B.S in meteorology from the University of Oklahoma and an M.S. in forestry from the University of Washington.

- *Topics you might want to ask Whitney about:*
- Planning for climate change (adaptation)
- Climate change education/outreach
- State actions to address/plan for climate change
- Working with many different stakeholders

Leonardo DiCaprio – Best Actor



- Thanks Yumi!
- DiCaprio used his acceptance speech for best actor to urge a global audience to reject the “politics of greed”, and support leaders willing to take action against climate change.
- “Climate change is real, it is happening right now, it is the most urgent threat facing our entire species, and we need to work collectively together and stop procrastinating.”

Global Climate Change and the Law



Climate Change and the Law

- Private enterprise in a free market can not adequately address the problem of global climate change
- Governments have the right and responsibility to do so



International Law

Sovereign state: a political association with independent authority over a geographical area and the people living there

- 195 sovereign states in the world
- 10 others whose legitimacy is disputed

Different forms of government, enviro regulations/enforcement

Treaties and Agreements

A document that binds the participating sovereign states to behave in a specified manner

- **Convention:** a formal treaty negotiated by an international organization with a large number of participants
 - Outlines broad objectives without providing details
- **Protocol:** the next step. A treaty that specifies substantive obligations to implementing objectives of a convention

Signing vs Ratifying

- Signing: largely ceremonial. The state is obliged to refrain from acts that would defeat the object and purpose of the treaty
- Ratification: state establishes in international law its consent to be bound by a treaty



Compliance and Enforcement

- Compliance: is a state conforming to a treaty?
- Enforcement: the set of actions to take to ensure compliance



Monitoring for Compliance

- Inspections by program officers
- Self-monitoring by regulated community
- Citizen complaints
- Monitoring areas near facilities

GHGs are colorless, odorless, tasteless. Many natural (non human-related) sources.

–Monitoring emissions requires sophisticated equipment

Enforcement

- Return violator to compliance
- Impose sanction/penalty
- Remove any economic benefits of noncompliance
- Require violators to provide accurate information
- Remediate past damages
- Correct internal management problems of a violator



Enforcement

- International treaties usually leave enforcement to the participants
- Enforcement takes place at the local, regional and national scale



Climate Change Treaties

- The United Nations Law of the Sea
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Kyoto Protocol to the UN Framework Convention on Climate Change

UN Law of the Sea

- Began in 1956
- Came into force in 1994
- Defines the rights of states with respect to their territorial seas, continental shelves, use of the high seas, and management of marine natural resources

The Law of the Sea

- 167 states have ratified
- The US did not ratify the treaty. Requires 2/3 vote of Senate
- “States have an obligation to protect and preserve the marine environment”
 - Prevent, reduce and control pollution that endangers marine ecosystems. Includes pollution that enters waters from the shore, pipelines, cables, vessels or **atmosphere**

The Law of the Sea and Climate Change

- Classifies atmospheric CO₂ as a pollutant. Would require the US to reduce GHG emissions
- Carbon capture and storage in the sea would be highly regulated

Seas Are Rising at Fastest Rate in Last 28 Centuries

<http://www.nytimes.com/2016/02/23/science/sea-level-rise-global-warming-climate-change.html?mwrsm=Email>

- Feb. 22, 2016, New York Times. Thanks mom!
- Scientists reported Monday that **flooding in coastal communities was largely a result of greenhouse gas emissions, and likely to grow worse**
- Miami Beach; Charleston, S.C.; and Norfolk, Va.: these types of floods often produce **only a foot or two of standing saltwater**. But they are straining life in many towns by **killing lawns and trees, blocking neighborhood streets and clogging storm drains, polluting supplies of freshwater and sometimes stranding entire island communities for hours by overtopping the roads that tie them to the mainland.**

1955 to 1964, Charleston S.C. registered 34 days with flooding; in the decade from 2005 to 2014, the number jumped to 219.



Miami Beach, Florida



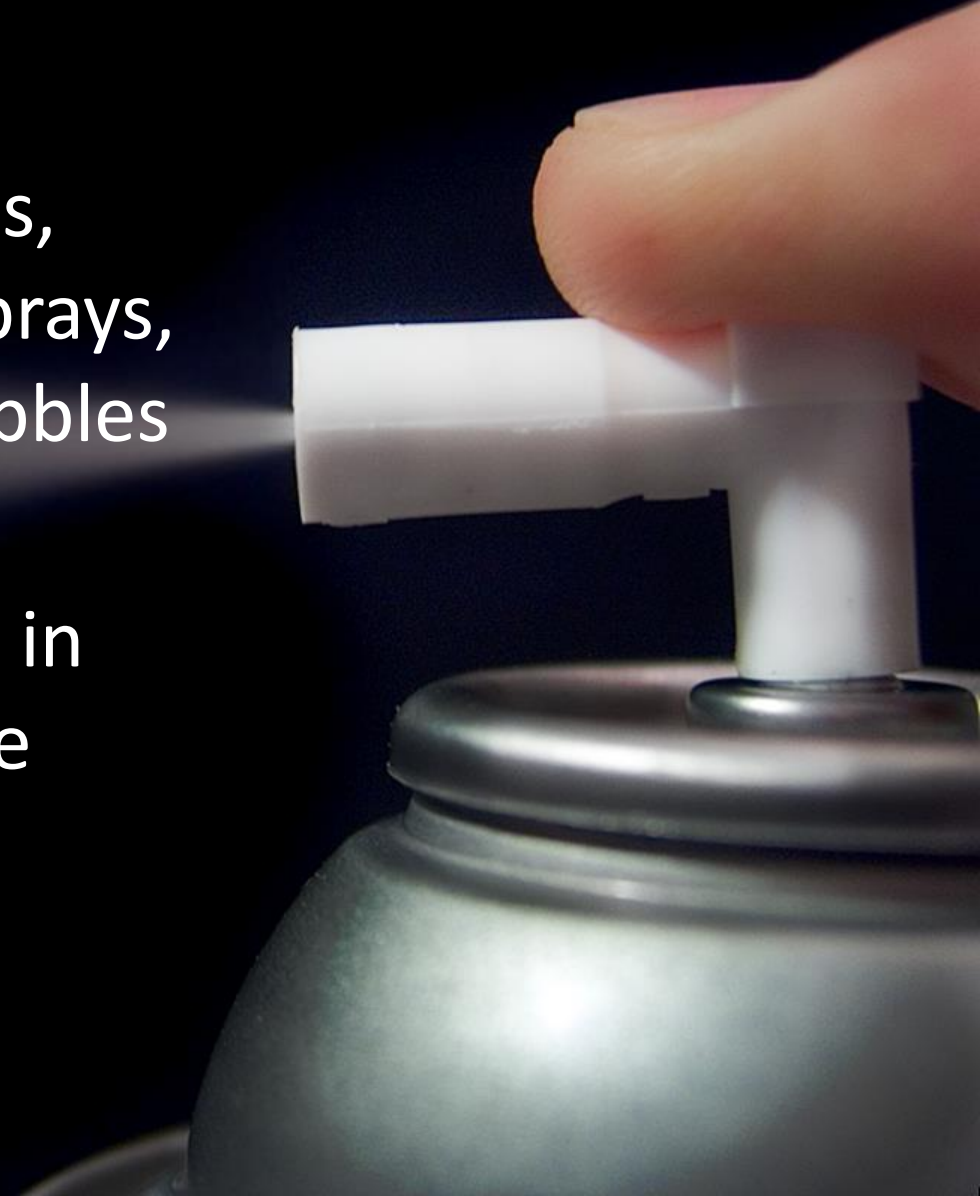
King Tides in SF



“We have places around the periphery of the bay that are very close to mean high tide so, even if it only goes a few inches above, these places get some flooding.”

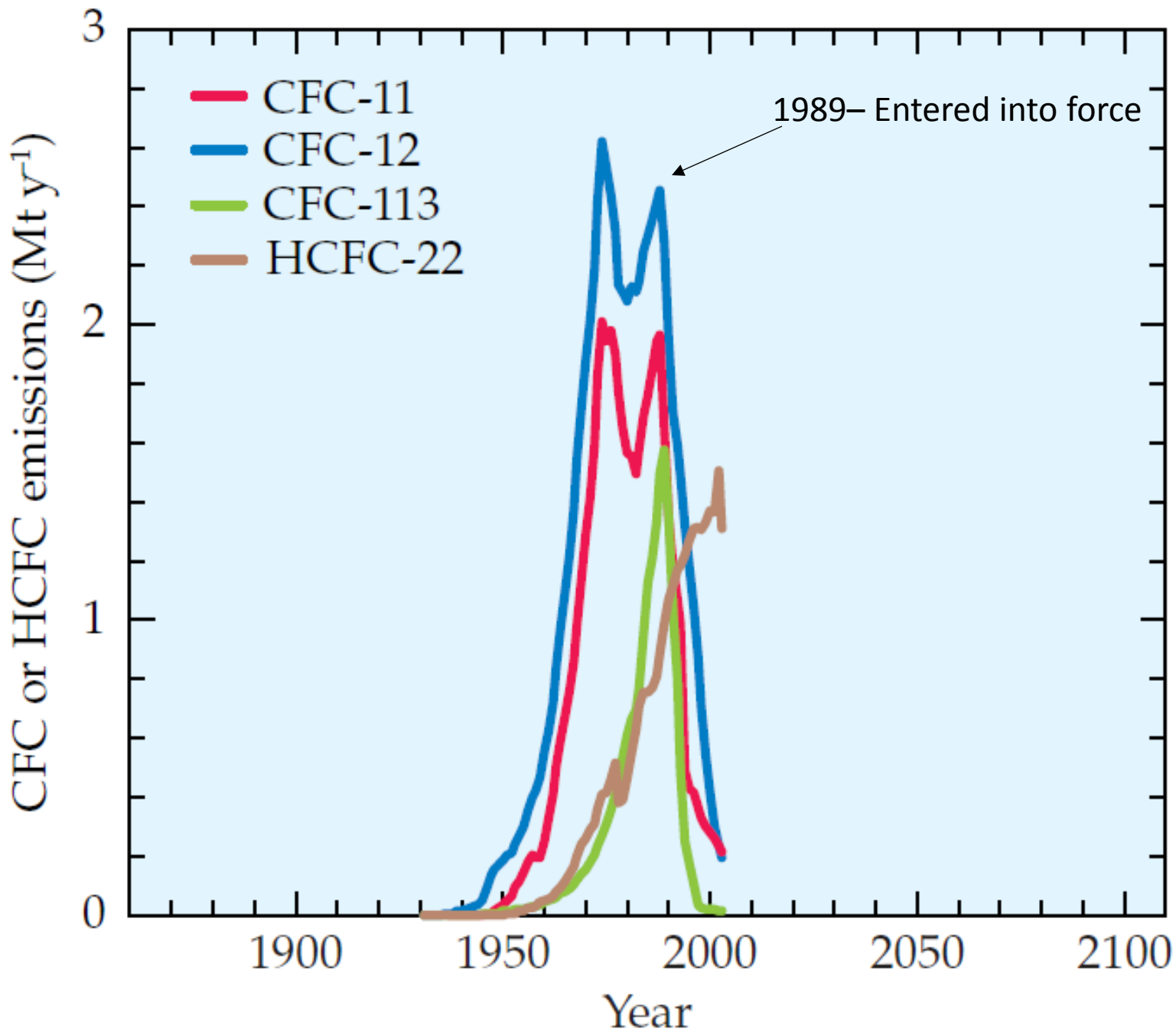
Montreal Protocol

- CFCs: used to be main ingredients of refrigerants, propellants for aerosol sprays, cleaning solvents and bubbles injected into foams
- Depleted the ozone layer in Earth's upper atmosphere
- Also very strong GHGs



Montreal Protocol

- 1985: 28 states, including most of the major producers of CFCs negotiated the Vienna Convention on Protection of the Ozone Layer
- 1987: Montreal Protocol on Substances that Deplete the Ozone Layer
 - A treaty with a timetable to phase out and eliminate the production and consumption of those chemicals
- 1989: Entered into force
- By 2008, 193 sovereign states (all but Andorra, San Marino, and Timor-Leste) had ratified





The Kyoto Protocol

1988: Establishment of the Intergovernmental Panel on Climate Change (IPCC)

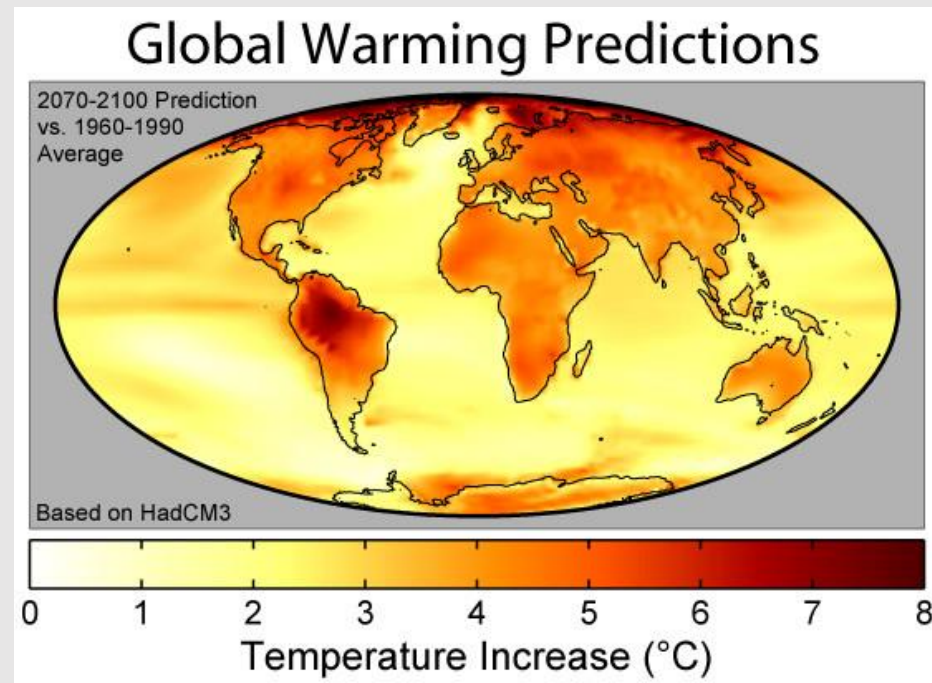
- International group of scientists and other experts
- assess the causes of climate change, potential environmental and socioeconomic consequences, and adaptation and mitigation options



IPCC

1990: First assessment report

- “Emissions from human activities are substantially increasing the atmospheric concentrations of GHGs and this will enhance the greenhouse effect and result in additional warming of the Earth’s surface.”





UNFCCC

- 1992: Drafting of the UN Framework **Convention** on Climate Change (UNFCCC)
 - Encourages voluntary measures
 - Obligates signatories to develop, update, and publish a national inventory of human sources and sinks of GHGs
- Only 4 states failed to ratify (Andorra, the Vatican, Iraq and Somalia)

UNFCCC

Designated sovereign states as:

- **Developing** – no immediate limits to GHG emissions but may receive funds and technologies from Annex II states to help mitigation
- **Annex I Industrialized States** – objective of limiting GHG emissions to some percentage of 1990 levels
- **Annex II Developed States** - Annex I objective with added responsibility of providing funds/technologies to developing states for mitigation and adapting to adverse effects of climate change

The Kyoto Protocol

- 1997: Drafted in Kyoto Japan
 - Set legally binding commitments for the UN Framework Convention on Climate Change
- 2005: Entered into force
- 192 states have ratified it
 - But not the United States. We signed it but did not ratify it



Kyoto Protocol

Annex I requirements:

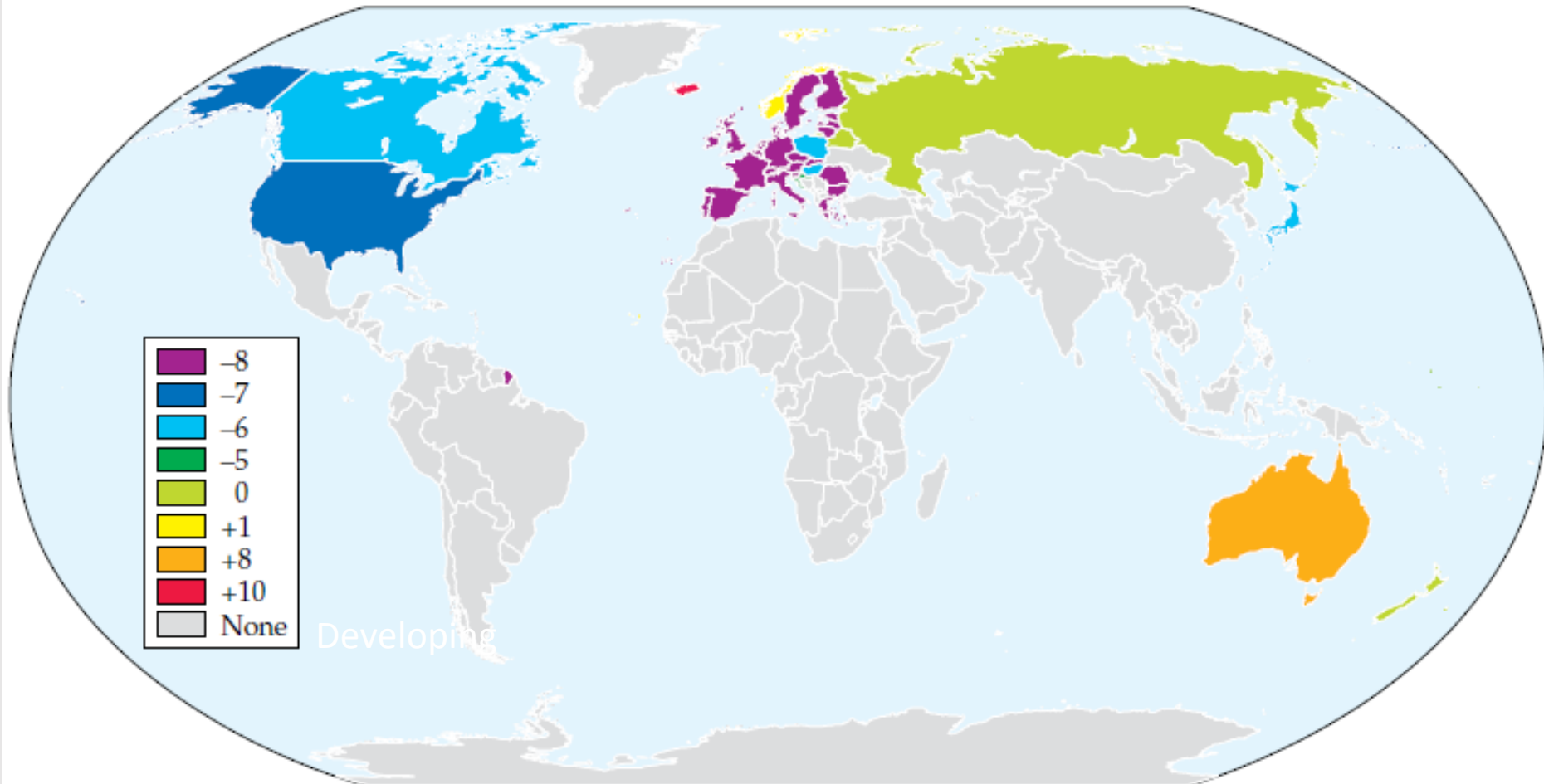
- Provide detailed inventories of current GHG emissions and 1990 emissions
- **By 2008-2012, achieve 92 – 110% of 1990 emissions**
- 1990 bad year for US, low emissions
- 1990 good year for other countries
 - Before German reunification
 - Before Soviet Union dissolved

Kyoto Protocol

Annex II countries and their emission targets

Country	Target
EU-15*, Bulgaria, Czech Rep., Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0%
Norway	+1%
Australia	+8%
Iceland	+10%

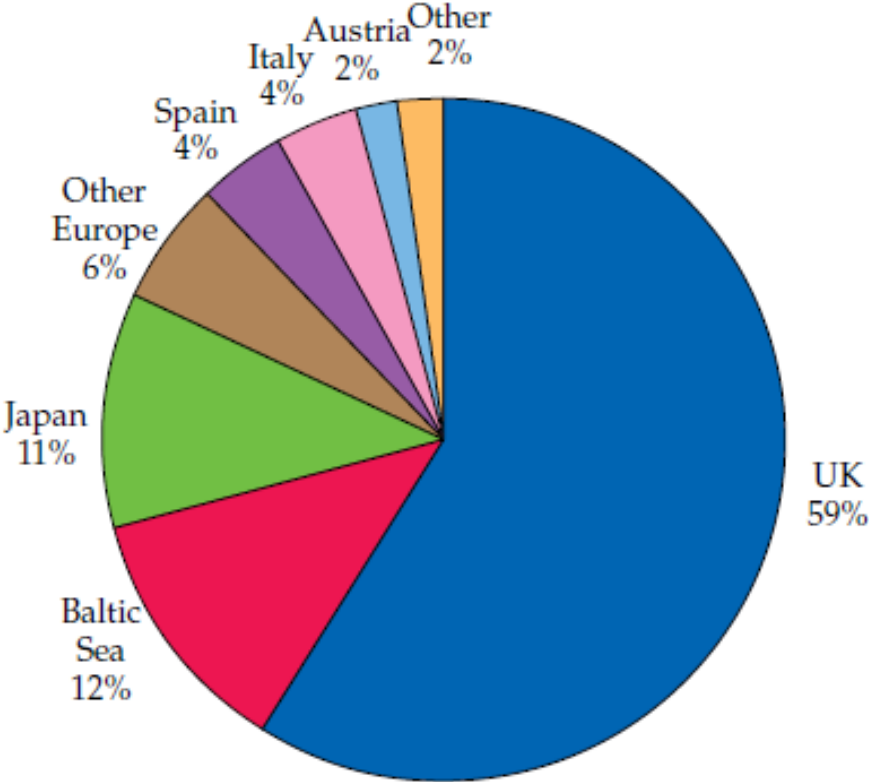
Emission targets



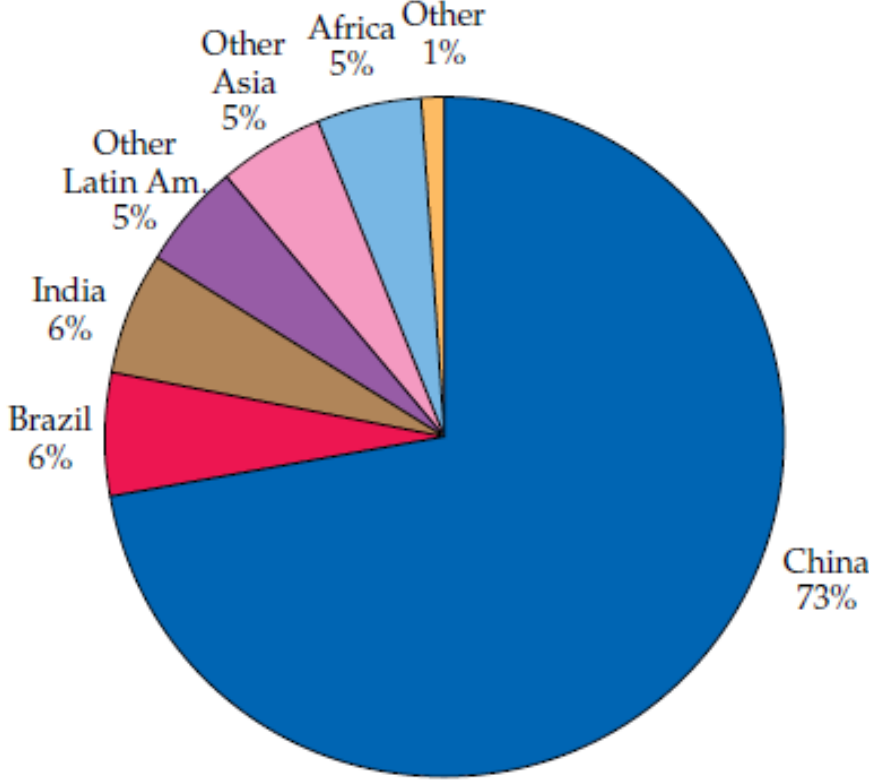
Carbon Credits

- Earn some quantity of credits (that is, additional allowances) for forestry and agricultural projects that sequester carbon
- Receive credits by financing emissions reducing projects in **other Developed countries** through a process called Joint Implementation
- Receive credits by financing projects in **Developing countries** through another process known as the Clean Development Mechanism
- Buy, sell, or trade emissions allowances to undetermined extent

Buyers and Suppliers of Carbon Emission Credits in 2007



Buyers



Suppliers

Kyoto Protocol

- 1990-2005, many Annex I parties met their GHG emission reduction targets
- Total emissions during that period still grew 24%
- Developing countries:
 - Turkey increased by 76%
 - China increased by 65%
 - India increased by 54%

Kyoto Protocol

Annex I countries in non-compliance: 1990-2005

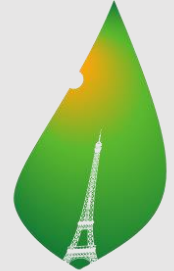
- Spain emissions increased 60%
- Canada emissions increased 54%
- Portugal emissions increased 40%
- Greece emissions increased 25%
- Ireland emissions increased 25%
- New Zealand emissions increased 23%

No major sanctions imposed yet for noncompliance

USA and Kyoto

- Kyoto's lack of regulations for emissions from developing states
 - China, India, South Korea, Brazil. Emissions increasing so fast they would soon surpass the total emissions from Annex I states
- Kyoto's cap and trade system for emissions
 - Would seriously impair US economy. Alternative measures for mitigation would achieve higher benefits at lower costs
- Kyoto's choice of 1990 as the baseline year
 - Easy target for Germany and Russia, difficult for US. Lobbied for 1995 as a baseline year

Paris Agreement 2015



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

- 11th session of the Meeting of the Parties to the Kyoto Protocol
- 195 nations adopted the agreement
- Will not enter into force until at least 55 countries that produce at least 55% of the world's GHG emissions ratify
- United States plans to sign this year

The Paris Agreement

- Hold the increase in global average temp to well below 2°C, pursue efforts to limit temp increase to 1.5°C above pre-industrial levels
- 186 of the 195 signatory countries have published plans to cut/limit the growth of their GHG emissions
- Developed/developing countries – shared responsibility
- Each party must set new reduction targets for emissions every five years
- Regular transparent reporting for all countries

“Under US insistence, the 31-page agreement was explicitly crafted to **exclude emissions reductions targets and finance from the legally binding parts** of the deal. Other areas of the deal, including five-year review cycles, do carry legal force. **That would free Obama from having to submit the deal to Congress.**”

The other exclusion was any clause in the agreement that would expose the US to liability and compensation claims for causing climate change.

The Marshall Islands likely won't exist if we warm the planet by 2 degrees

<http://www.cnn.com/interactive/2015/06/opinions/sutter-two-degrees-marshall-islands/>





two°

**You're making
this island disappear.**

[CNN.com/2](https://www.cnn.com/2015/06/26/asia/pacific-islands/index.html)

The Marshall Islands is home to about
70,000



Short Answers to Hard Questions About Climate Change

<http://www.nytimes.com/interactive/2015/11/28/science/what-is-climate-change.html? r=1> Thanks Kamyar!

- 1) How much is the planet heating up?
- 2) How much trouble are we in?
- 3) Is there anything I can do?
- 4) What's the optimistic scenario?
- 5) Will reducing meat in my diet help the climate?
- 6) What's the worst-case scenario?
- 7) Will a tech breakthrough help us?
- 8) How much will the sea rise?
- 9) Are the predictions reliable?
- 10) Why do people question climate change?
- 11) Is crazy weather tied to climate change?
- 12) Will anyone benefit from global warming?
- 13) Is there any reason for hope?
- 14) How does agriculture affect climate change?
- 15) Will the seas rise evenly across the planet?
- 16) Is it really all about carbon?

Warren Buffet's Annual Letter

<http://www.bloomberg.com/news/articles/2016-02-29/buffett-s-take-on-climate-change-it-s-a-problem-but-not-his>

- Thanks Yumi!
- There's no such thing as certainty: "It would be foolish, however, for me or anyone to demand 100 percent proof of huge forthcoming damage to the world if that outcome seemed at all possible and if prompt action had even a small chance of thwarting the danger."
- Science is based on uncertainty. It's no wonder that climate change is an intractable political problem in America: **How can politicians, who so frequently deal only in absolutes, embrace science, wherein "100 percent" is a philosophical impossibility**

The question then is, **if climate change should be addressed**, as he suggests—and it's not him (or someone like him) who should address it—then **who?** The whole eight-paragraph episode is, perhaps inadvertently, a **presentation of the climate conundrum in a nutshell: Sure seems like this is a problem; but it's not anybody's responsibility to solve everybody's problem.**

