

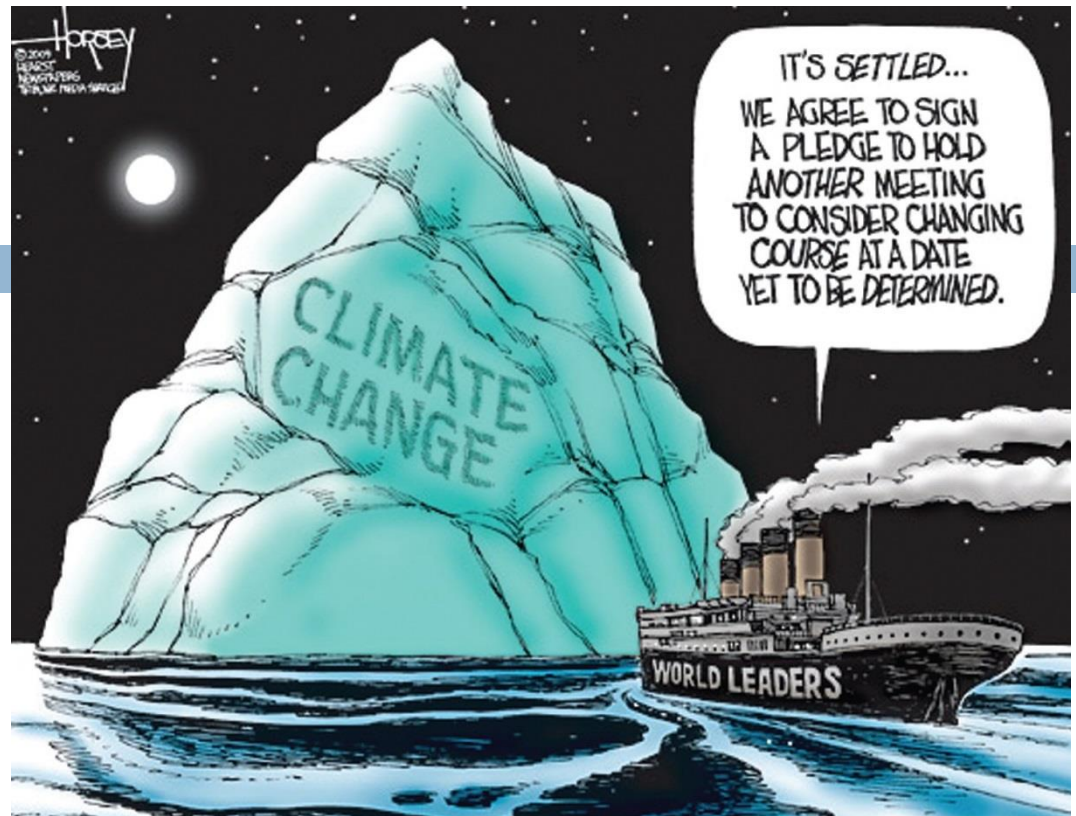
LECTURE 13:  
MAY 28, 2014

# CLIMATE CHANGE

ADAPTATION TO, RESPONSES TO,  
COMMUNICATION ABOUT...

Text Reference: Dearden and Mitchell (2012), Ch. 7, pp. 218-233

# Outline



*From: Dearden and Mitchell (2012)*

- Communications about Climatic Change
- Adaptation to Climate Change:
  - *Case study:* The Maldives and ADAPT-Asia Pacific
- Global & National Responses to Climate Change
  - Kyoto Protocol

# Climate Change Adaptation: Initial Considerations

- **Five types of adaptation** are usually recognized:
  1. Prevent the loss by adopting measures that reduce vulnerability
  2. Tolerate the loss by doing nothing and absorbing the cost of losses when they happen
  3. Spread or share the loss by distributing the costs over a larger population, such as through insurance
  4. Change the affected activity by ceasing to do certain things or by shifting to other activities; and
  5. Change the location of the activity by moving to a less vulnerable location

# Communicating Global Change

- Challenges for communicating information or understanding about global change:
  - Global change is a **complex issue**
  - **Uncertainties exist** regarding almost every aspect of the global change issue
  - The **impacts of global change will be heavier on people in less developed countries and on future generations**
  - The basic causes of global change are embedded in current values and lifestyles



**What was that bump?**



# Adaptation Measures (1 of 3)

- Convenient to discuss adaptation measures in three groups
  1. **Protective Measures** – typically structural measures to protect property, buildings and infrastructure



Hurricane Resistant "Louisiana Lift House"  
Launched 2011

# Adaptation Measures (2 of 3)

2. **Accommodation** – a mix of approaches:
  - ▣ Redesign of structures to reduce vulnerability
  - ▣ Zoning land use so as to direct only low capital investments to vulnerable areas
  - ▣ Rehabilitate natural protective features (like coastal dune systems)

\*\* Cautionary point ... stabilizing natural ecosystems is counter to their being natural and thus variable ... and may cause greater harm than good.



# Adaptation Measures (3 of 3)

- Convenient to discuss adaptation measures in three groups
- 3. **Retreat** – seeks to avoid vulnerability
  - ▣ Relocate buildings and other infrastructure from highly vulnerable areas



North Carolina Homes being taken by the Atlantic Ocean August 2011

# Maldives, Ground Zero for Climate Change Impacts

Posted by [Jon Bowermaster](#) on October 15, 201



## Case Study (Adaptation to CC)

### The Maldives



#### National Adaptation to Climate Change

*A background paper prepared by the  
Ministry of Housing, Transport and Environment  
for the  
Maldives Partnership Forum (MPF)  
to be held in Maldives, 23-24 March 2009*

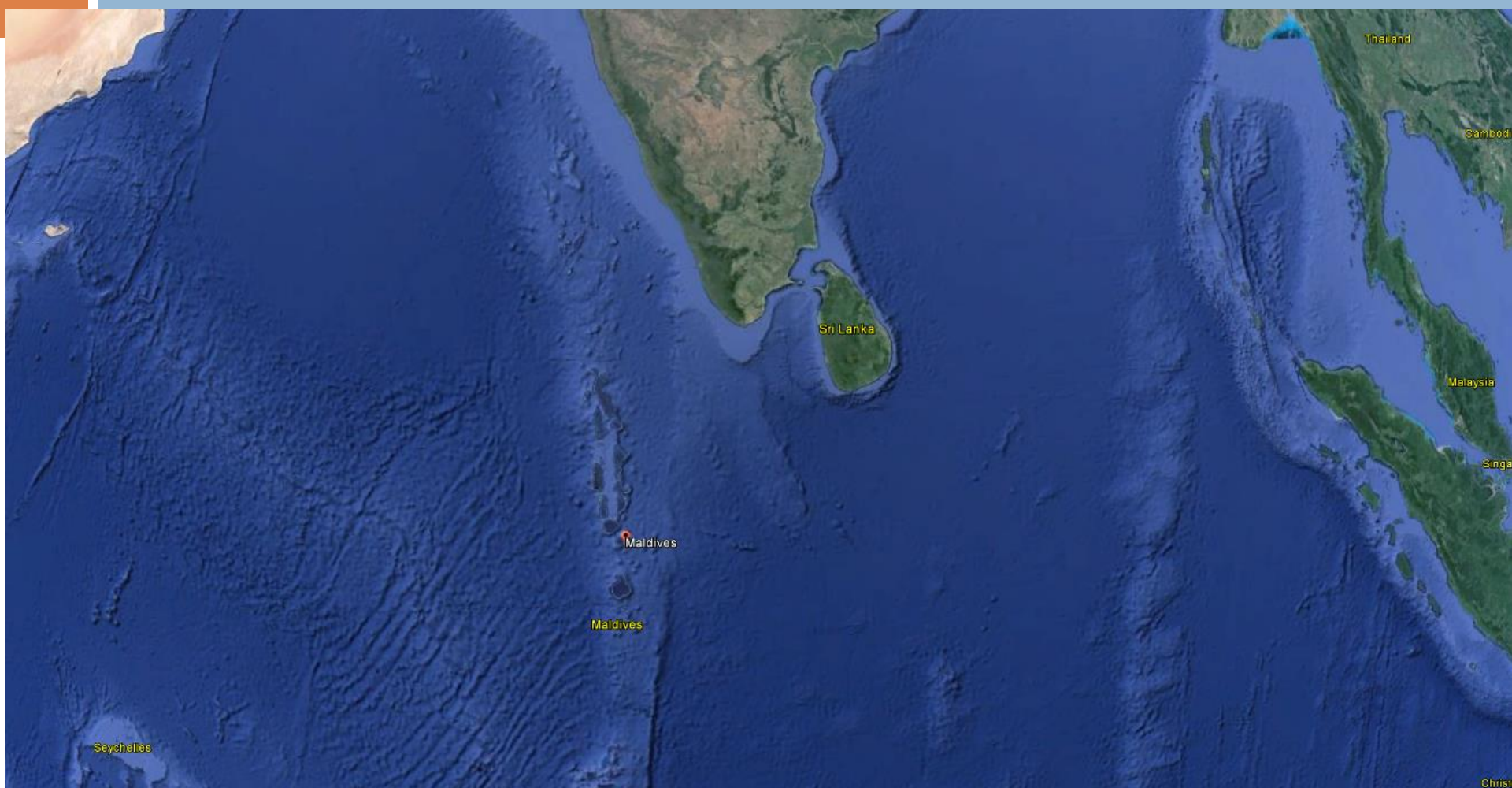
**Government of Maldives (March 2009)**

<http://www.maldivespartnershipforum.gov.mv/pdf/Adaptation%20to%20Climate%20Change.pdf>

*Low-lying island nation in the Indian Ocean (Maldives) is planning to re-locate should predicted sea level rise occur. From: Dearden and Mitchell (2012)*



# Maldives, Indian Ocean



*Google Earth image accessed: January 15, 2014*

# The Maldives

- Population (est. 2012)  
328,536
- A nation of atolls (~1,200 islands, 200 inhabited)
- World's lowest country
  - max natural elevation of only 2.4 m. asl.
  - >80% of land base composed of coral islands that rise less than 1 m. asl.
- Economy
  - Fishing & Tourism
- Third most vulnerable nation to sea level rise



*Google Earth images accessed: January 15, 2014*



# Maldives: Nature of vulnerability

1. (to) Global Sea Level Rise
2. Increase in high intensity rainfall events (expected doubling of their frequency)
3. Projected 1.5°C increase in maximum daily temperature by 2100
4. Increase in the intensity and frequency of cyclonic activity (i.e., hurricanes)

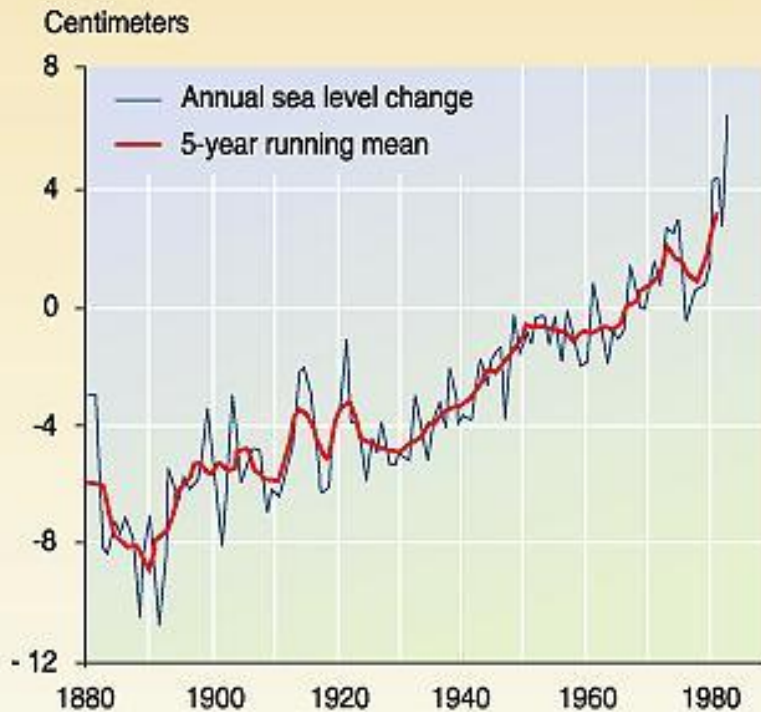
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<http://www.maldivespartnershipforum.gov.mv/pdf/Adaptation%20to%20Climate%20Change.pdf>

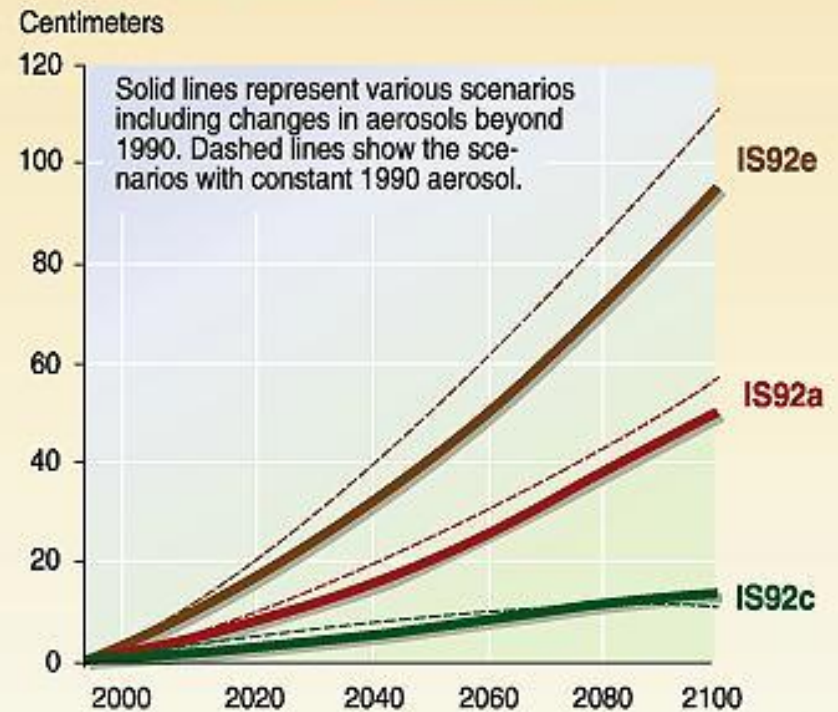
# Sea Level Changes (Observed & Forecast)

## Sea level rise due to global warming

### Sea level rise over the last century



### Sea level rise scenarios for 2100

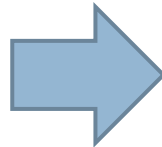


# Sea Level Changes

Predictions of sea level rise in responses to a modeled rise in global temperature by 2100 (compiled by Mallory Carpenter 2009)



IPCC predicts  
9 to 88 cm by  
2100



+  
Storm Surge

Author(s)	Area of Study	Modeled Temp. Change (C)	Minimum Prediction	Maximum Prediction
Alley, R. B. <i>et al.</i> (2005)	Greenland	5°	40 cm	50 cm
Aunap, R. <i>et al.</i> (2001)	Estonia	2.3-4.5°	n/a	100 cm
Begin, Y. and Robichaud, A. (1997)	New Brunswick	n/a	20 cm	40 cm
Bray, M. J. and Hooke, J. M. (1997)	England	n/a	n/a	50 cm
Daniels, R. C. (1992)	South Carolina	1-5°	25 cm	200 cm
Ely, C. and Jorgenson, T. (2000)	Alaska	n/a	10 cm	90 cm
Fitzgerald, D. M. <i>et al.</i> (2008)	Conceptual	n/a	20 cm	60 cm
Harvey, N. and Woodroffe, C. (2008)	South Australia	n/a	33 cm	110 cm
IPCC (2001)	Conceptual	1.8 °	9 cm	88 cm
NRC (2007)	Canada	1.4°	9 cm	88 cm
Nicholls, R. J. (2002)	Global	n/a	23 cm	96 cm
Senior C. A. <i>et al.</i> (2002)	England	n/a	9 cm	88 cm
Shaw, J. <i>et al.</i> (1998)	Canada	2°	n/a	49 cm
Thumerer, T. <i>et al.</i> (2000)	England	1.5°	49 cm	94 cm
USGS (2000)	Eastern USA	n/a	15 cm	95 cm

# The Maldives

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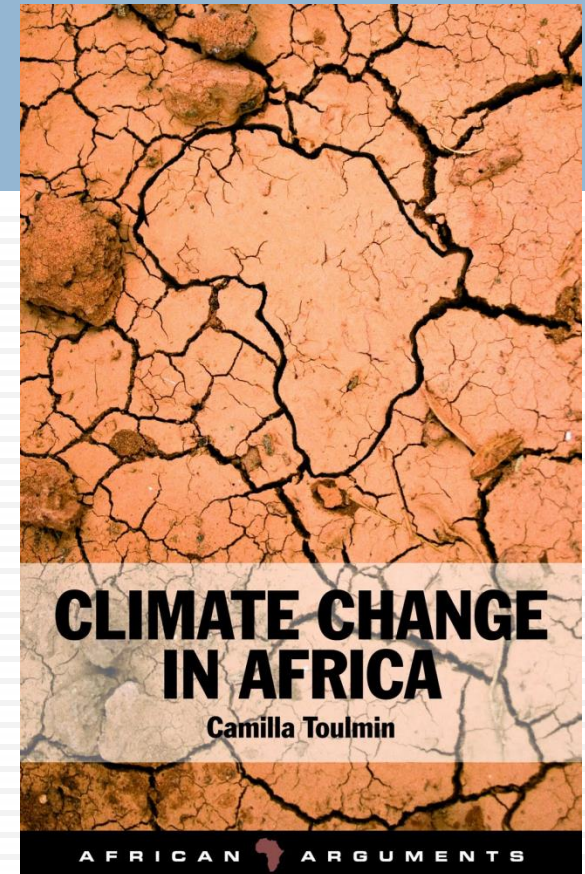
*Google Earth images accessed: January 15, 2014*



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## Case Study:

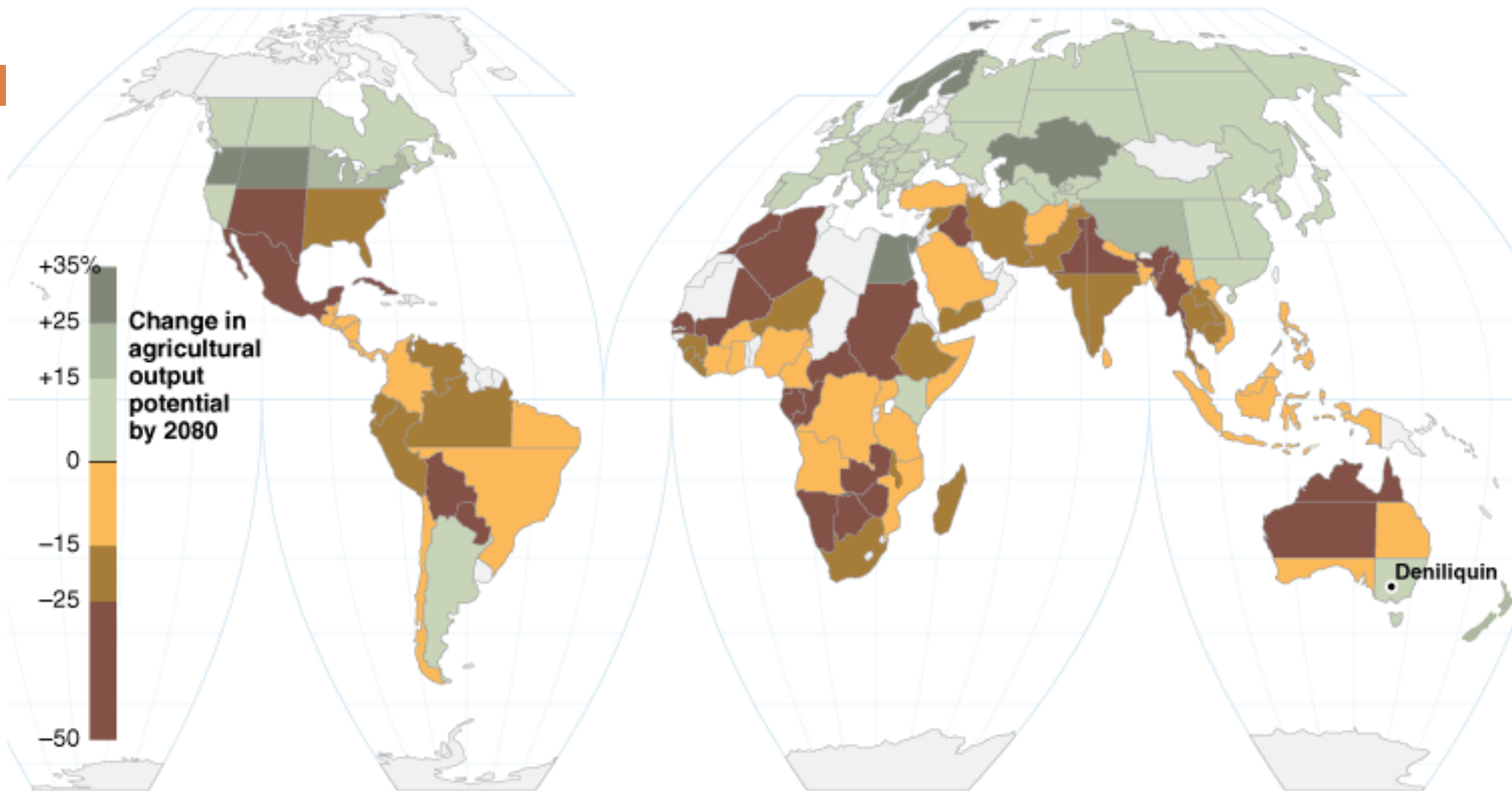
Climate Change Adaptation Needs (Africa with respect to Agriculture)



# Farming in a Warmer World

Crop forecasts show that some countries farther from the Equator could benefit from a warmer world, but others would be worse off by 2080 if global warming were to proceed unchecked. Long-range forecasts vary widely; the following is a synthesis of available forecasts by country or region.

16

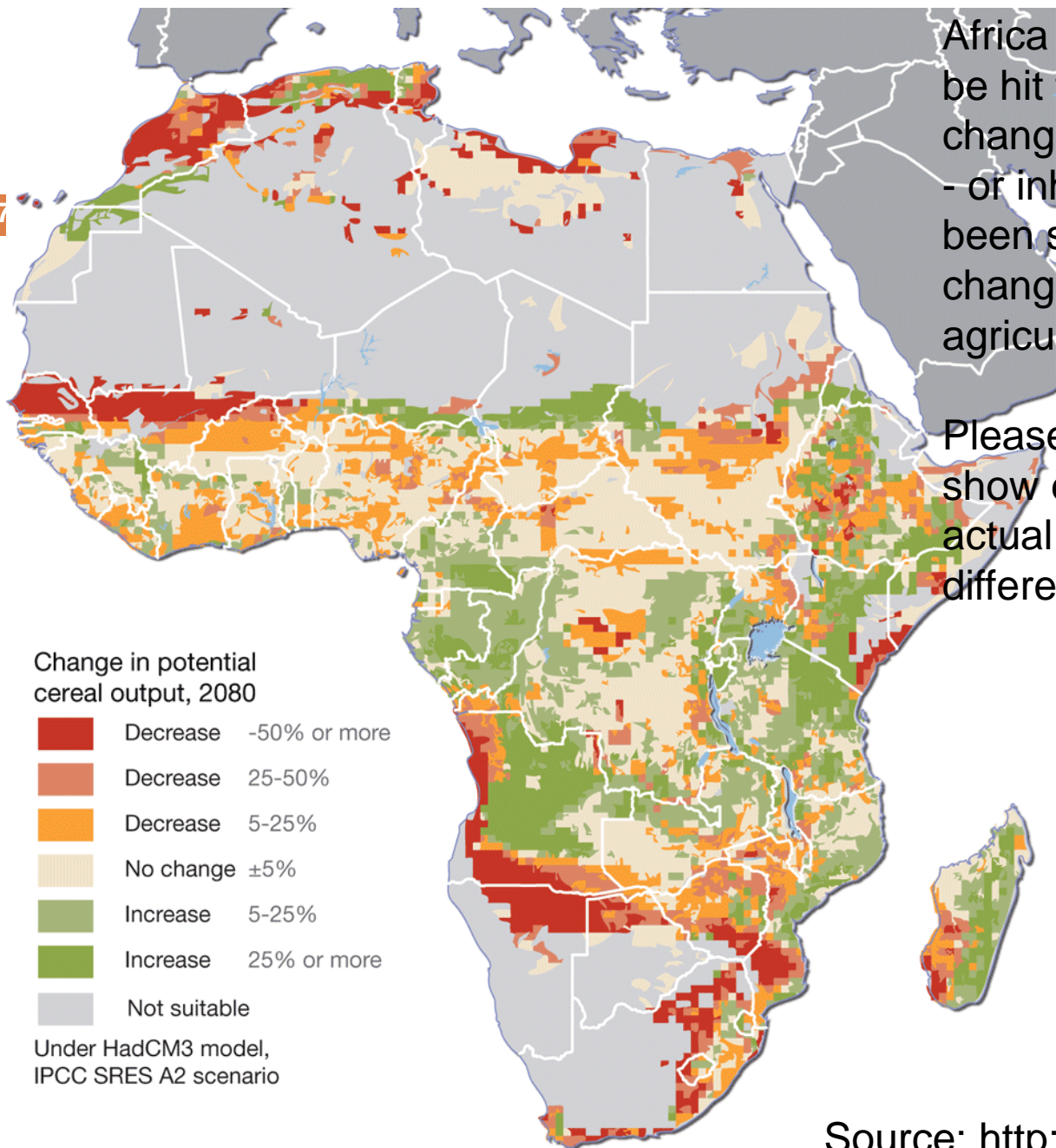


Note: These figures assume that crops grow faster because of higher levels of carbon dioxide in the air. But some scientists say that the actual effects of global warming could be worse than shown here, because the benefits of extra carbon dioxide may not appear if crops lack proper rainfall, proper soil and clean air.

Source: "Global Warming and Agriculture: Impact Estimates by Country," by William R. Cline, Peterson Institute, 2007.

<http://globalfoodpolitics.wordpress.com/2012/08/05/climate-change-and-global-food-availability/>





Africa is one of the regions that will be hit the hardest by climate change, and it will likely slow down - or inhibit - the progress we have been seeing. The projected changes for possible changes in agriculture are not very clear.

Please note that this map does not show existing agricultural land, actual current land use might be different.

Change in potential cereal output, 2080

- Decrease -50% or more
- Decrease 25-50%
- Decrease 5-25%
- No change ±5%
- Increase 5-25%
- Increase 25% or more
- Not suitable

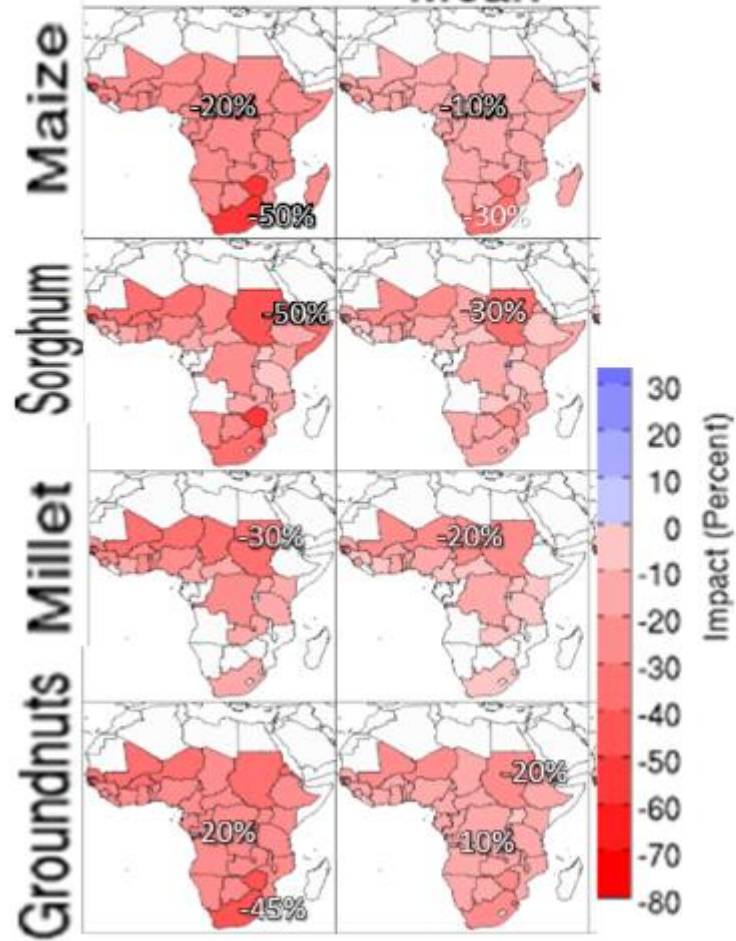
Under HadCM3 model, IPCC SRES A2 scenario

## Robust negative impacts of climate change on African agriculture W. Schlenker, D. Lobell 2010

Figure 6. Distribution of impacts from climate change

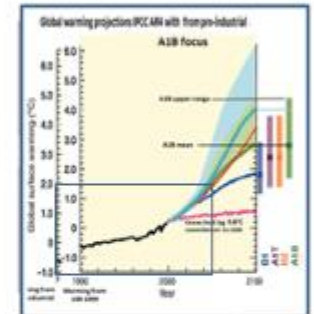
Top risk range of crop decline

5 Percentile Mean



changes under the A1b scenario for mid-century (2046–2065) from 1961–2000

= 2.0°C from pre-industrial



2.0°C

Agriculture: Roughly 17% of GDP in Sub-Saharan Africa in 2005,

# Global Responses to CC

Kyoto

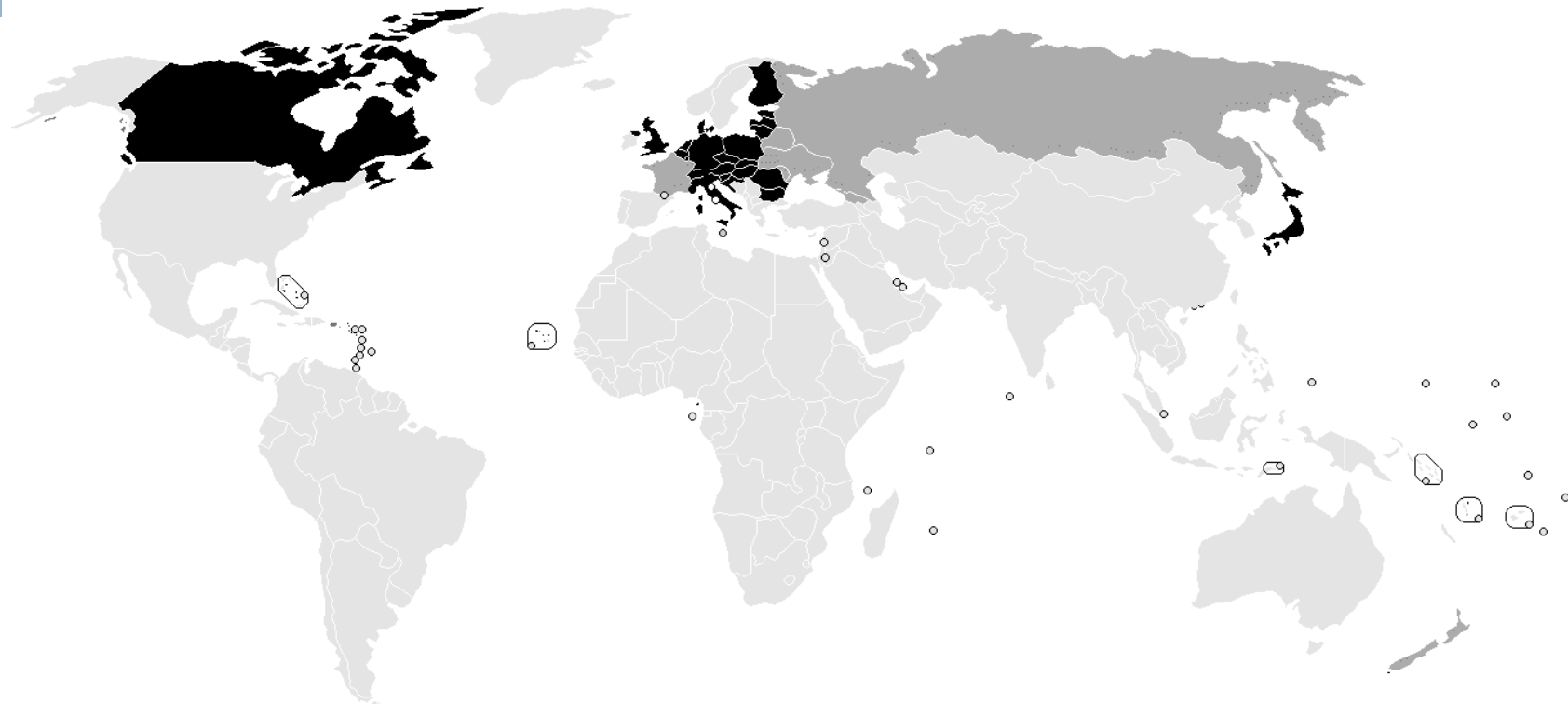
International Climate Change Adaptation  
Funds

# Kyoto Protocol

## Specific Features of the Kyoto Protocol

- **Legal Basis**
  - ▣ Commitments are legally binding on nations under international law
- **Assigned Amounts**
  - ▣ For 2008–12, overall average emissions are to be 94.8 per cent relative to 1990 levels
- **Greenhouse Gases**
  - ▣ The protocol identifies six greenhouse gases

# Initial Kyoto Protocol participation map (commitment period 2008-2012)



**Dark grey (black)** = Annex I Parties who have agreed to reduce their GHG emissions below their individual base year levels

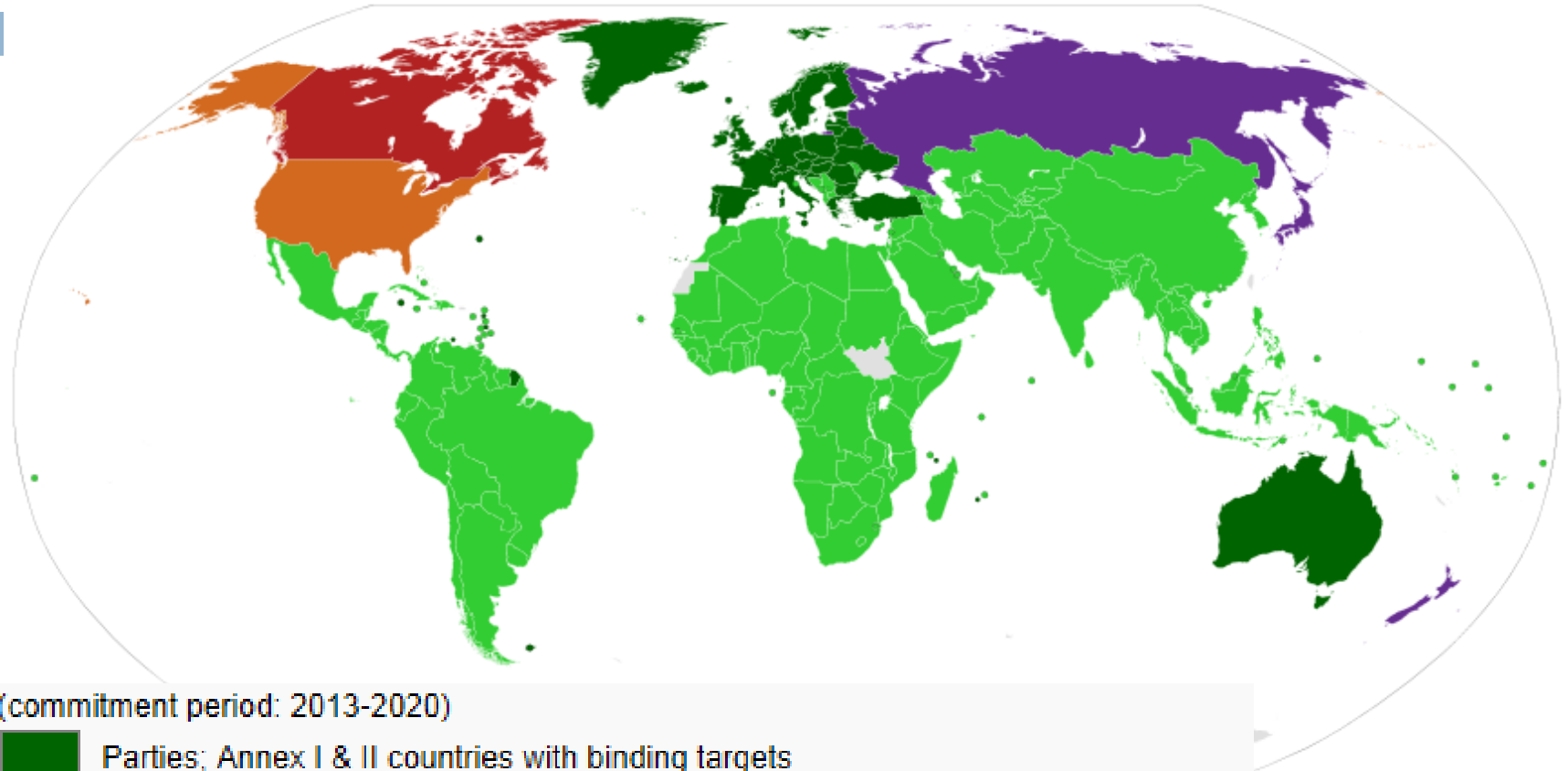
**Grey** = Annex I Parties who have agreed to cap their GHG emissions at their base year levels

**Pale grey** = Non-Annex I Parties who are not obligated by caps or Annex I Parties with an emissions cap that allows their emissions to expand above their base year levels or countries that have not ratified the Kyoto Protocol







# Kyoto Protocol

- an **international agreement** reached in Kyoto, Japan, in 1997 that targets 38 developed nations as well as the European Community to ensure that their **emissions of six (6) greenhouse gases** (GHGs) do not exceed their assigned amounts
- These GHGs are: Carbon dioxide (CO<sub>2</sub>); Methane (CH<sub>4</sub>); Nitrous oxide (N<sub>2</sub>O); Hydrofluorocarbons (HFCs); Perfluorocarbons (PFCs); and Sulphur hexafluoride (SF<sub>6</sub>)
- came into effect in 2004 when **55 countries accounting for 55%** of 1990 global carbon dioxide emissions ratified it
- As of 2013, 191 countries have ratified Kyoto.
- Who did not ratify Kyoto?

# Kyoto Protocol participation map (commitment period 2013-2020)



(commitment period: 2013-2020)

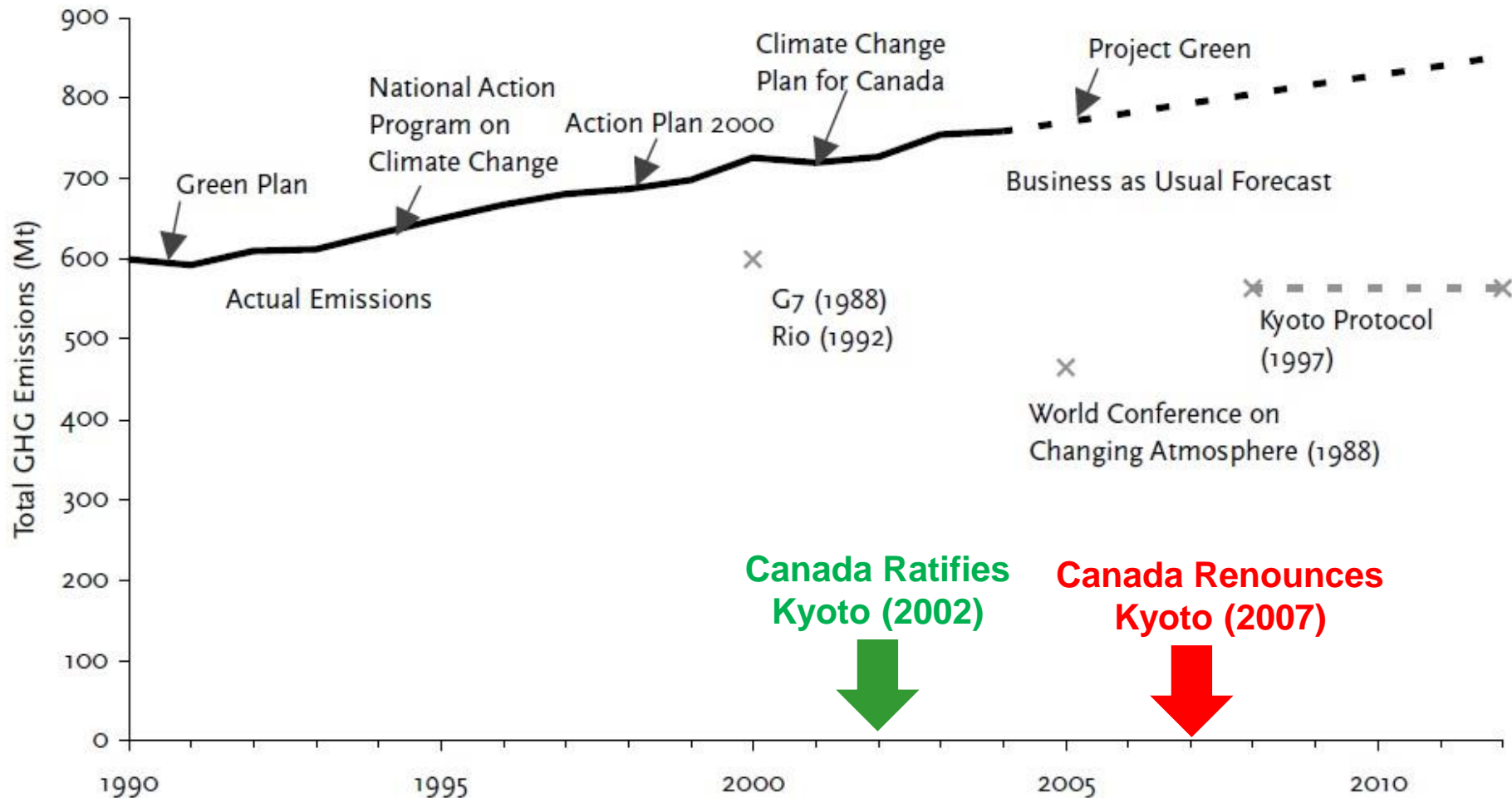
-  Parties; Annex I & II countries with binding targets
-  Parties; Developing countries without binding targets
-  States not Party to the Protocol
-  Signatory country with no intention to ratify the treaty, with no binding targets
-  Countries that have renounced the Protocol, with no binding targets
-  Parties with no binding targets in the second period, which previously had targets

# Kyoto Protocol – Canada's approach to ...

- **Canada ratified** the Kyoto Protocol in **2002** without a clear plan on how it would be implemented in Canada, under *then*-Prime minister Jean Chrétien
- By 2004, it became clear that Canada would not meet its commitments under Kyoto
- In 2007, the **Harper government rejected the Kyoto Protocol**, instead preferring the **voluntary approach** to emissions endorsed by the AP6 (Asia-Pacific Partnership on Clean Development and Climate)



# Greenhouse Gas Emissions in Canada, 1990–2004, and International Commitments to Reduce Greenhouse Gas Emissions



From an essay by : Mark Jaccard, circa 2007. **Canada's Kyoto Delusion: the evidence is finally forcing us to admit we have done nothing.** (M.J. is Professor of Resource and Environmental Management at Simon Fraser University)



**USAID**  
FROM THE AMERICAN PEOPLE

**ADAPT**  
ASIA-PACIFIC

## EU pledges further €4million for climate change adaptation in the Maldives

Release date: Dec 5 2013

The European Union has today revealed it is to release an additional €4 million to address climate change in the Maldives.

## World Bank Supports Building Resilient Coastal Communities in Samoa

Release date: Dec 27 2013

... a US\$14.6 million grant to help 45,000 Samoans who live in coastal communities adapt to climate change and climate variability. The **Enhancing the Climate Resilience of Coastal Resources and Communities Project** will develop and implement immediate adaptation activities to protect the lives and livelihoods of the people; protect infrastructure and environment; and increase awareness of climate change impacts and adaptation activities among communities, civil society and government.

<http://www.adaptasiapacific.org/content/about-adapt-asia-pacific>



**USAID**  
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**ADAPT**  
ASIA-PACIFIC

- With funding through USAID's Regional Development Mission for Asia (RDMA)
- Purpose:
  - to help nations in Asia and the Pacific obtain financing from international climate change adaptation funds
  - designed to share information and best practices about climate fund requirements



**USAID**  
FROM THE AMERICAN PEOPLE

**ADAPT**  
ASIA-PACIFIC



**Maldives**

<http://www.adaptasiapacific.org/content/about-adapt-asia-pacific>

# Looking Ahead to the next lectures

**May 29 & June 2: Forests**

Read ahead (Chpt. 9, pp. 282 →)

# References

- Dearden, P and Mitchell, B. 2012. *Environmental Change and Challenge*, Fourth Edition, Don Mills, Ontario: Oxford University Press {chapter 7 'Climate Change'}
- Mark Jaccard, circa 2007. **Canada's Kyoto Delusion: the evidence is finally forcing us to admit we have done nothing.** (M.J. is Professor of Resource and Environmental Management at Simon Fraser University)
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- Natural Resources Canada 2007. "Towards Adaptation: Case Studies in British Columbia" (date accessed January 14, 2014) <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/ch8/10393>