MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Environmental Studies - Introduction

An Update on Major Environmental Issues, and an Introduction to Environmental Science and Sustainability

Definition : It deals with every aspect that affects a living organism. It is essentially a Multidisciplinary approach that bring about an appreciation of our natural world and human impact on its integrity.

Objectives of EVS

- Awareness
- Knowledge
- Attitude
- Skill
- Participation

Importance of EVS

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- EVS enlighten us about the importance of protection and conservation of our environment.
- EVS has become significant for the following reasons:
- Environmental issues being of international importance.
- Problems cropped in the wake of development.
- Explosive increase in pollution.
- Need for an alternative solution.
- Need to save humanity from extinction.
- Need for wise planning of development

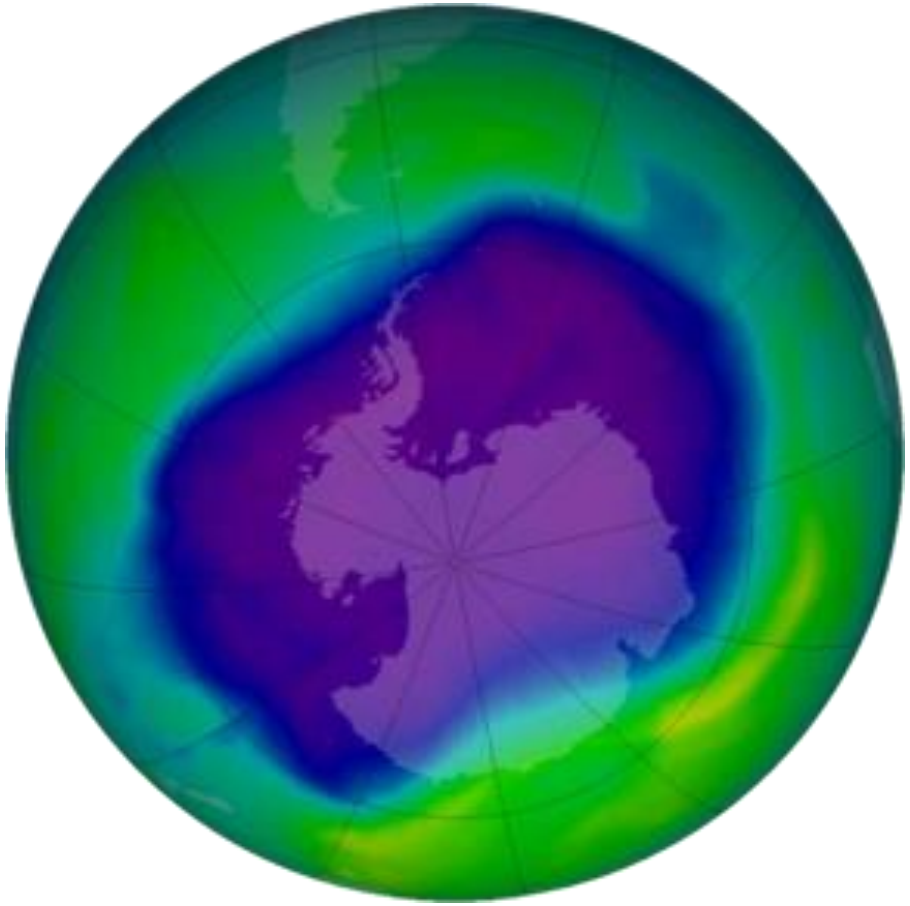
Benefits of EVS

- Conservation of energy and fast depleting natural resources.
- Increase in economic productivity.
- Imparting knowledge about waste management, treatment and disposal.
- Develop social responsibility towards environment protection.
- Creating awareness to control population.
- Inculcating attitude and values towards understanding interdependence of nature, man and work towards sustainable development.

Major Environmental Issues

- Ozone Layer Depletion
- Pollution
- Extinction
- Global Warming
- Resource Depletion

Ozone Layer Depletion



Source: wikimedia

Ozone Layer Depletion- Solved!

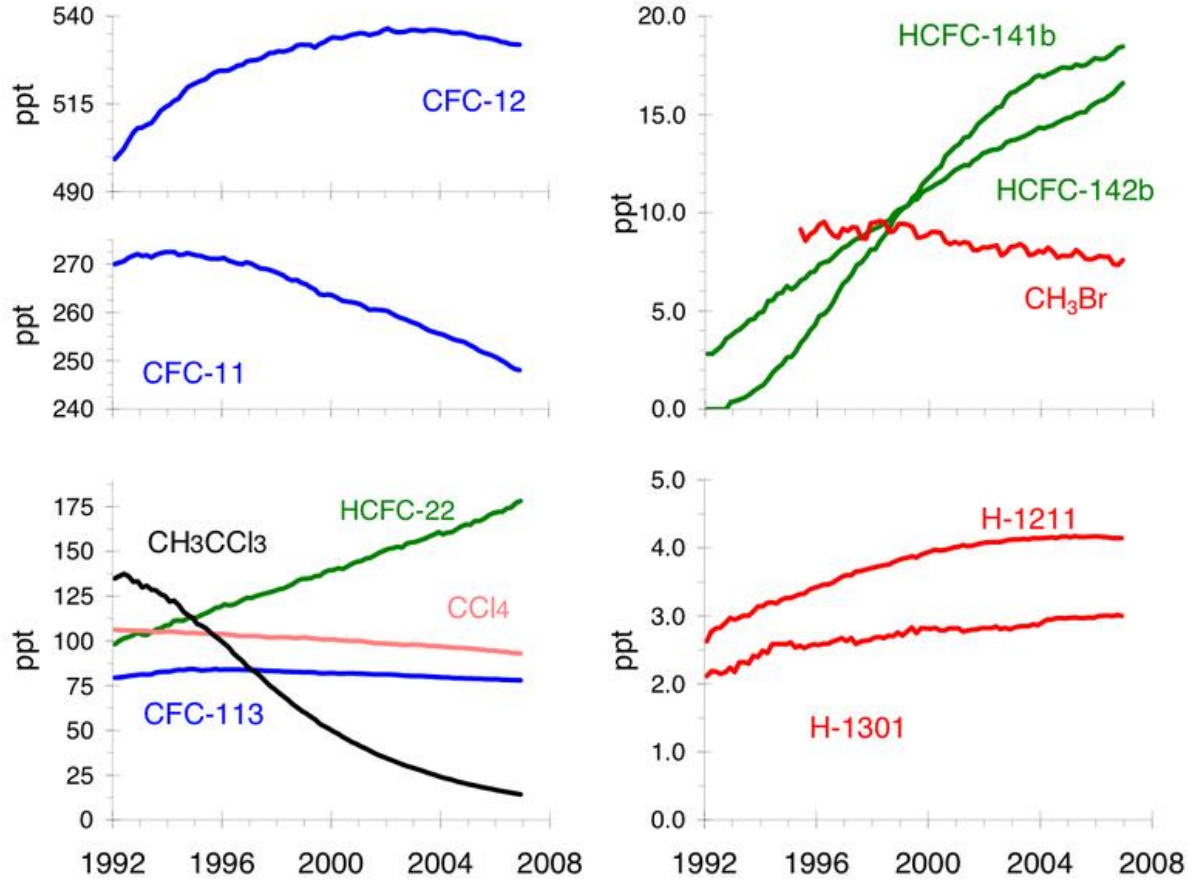
WIRED Technology | Science | Culture | Gear | Business | Politics | More

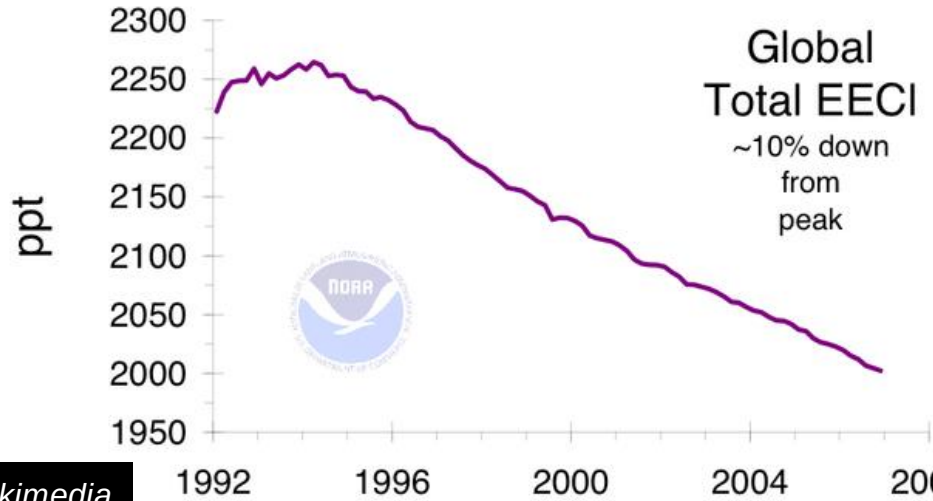
Hole in the ozone layer 'solved' reports Nasa

By MICHAEL RUNDLE

Thursday 7 May 2015

Trends of various Ozone-depleting gases like HCFC,CFC, Bromomethane, carbon tetrachloride





Source: wikimedia

Major Environmental Issues

~~Ozone layer Depletion~~

Pollution

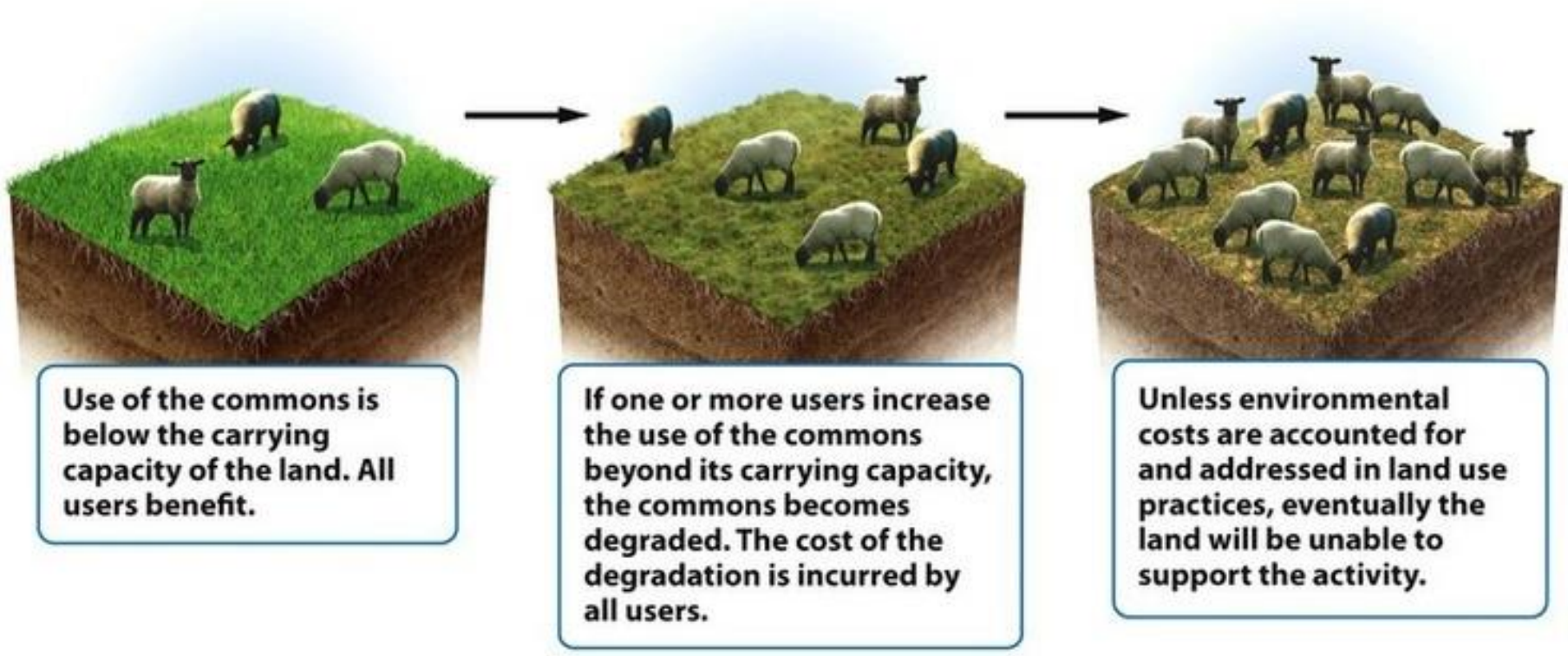
Extinction

Global Warming

Resource Depletion

Tragedy of the Commons

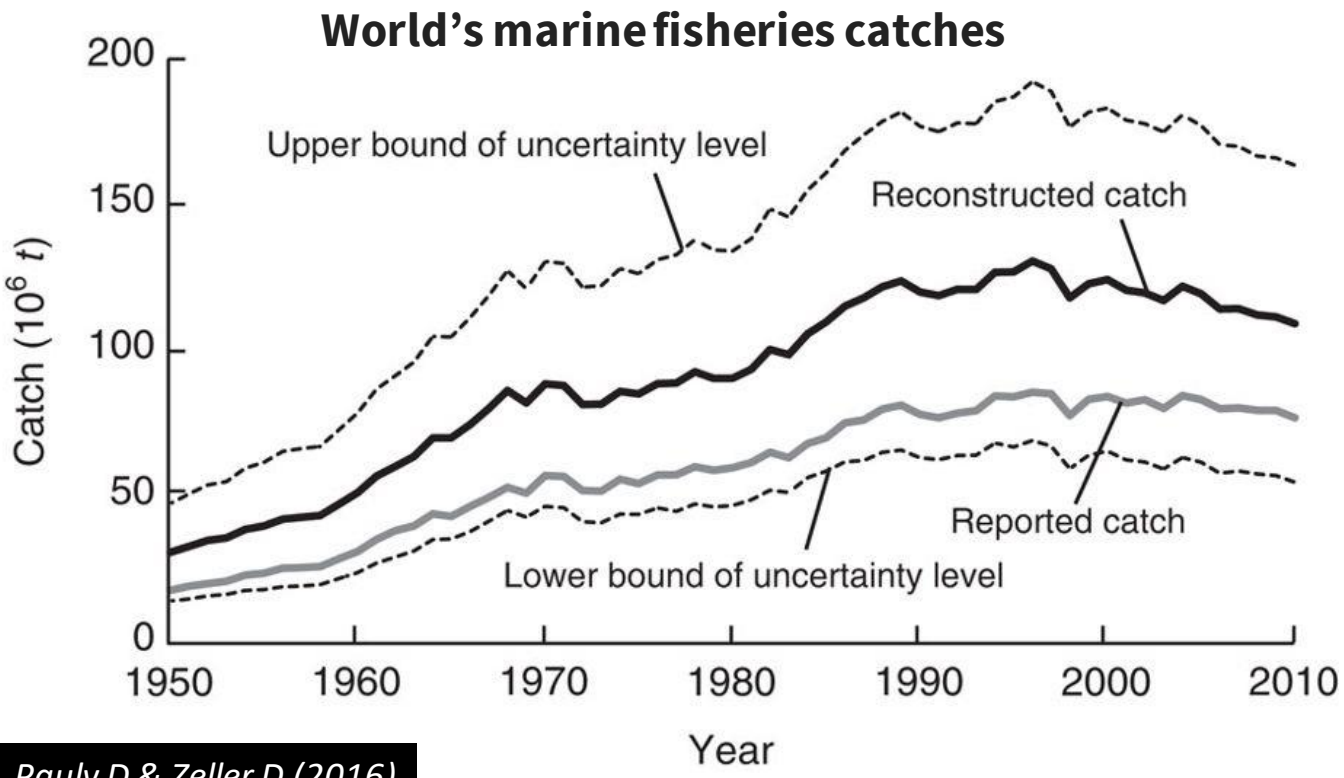
Tragedy of the Commons



Source: NTU

Examples of Tragedy of the Commons

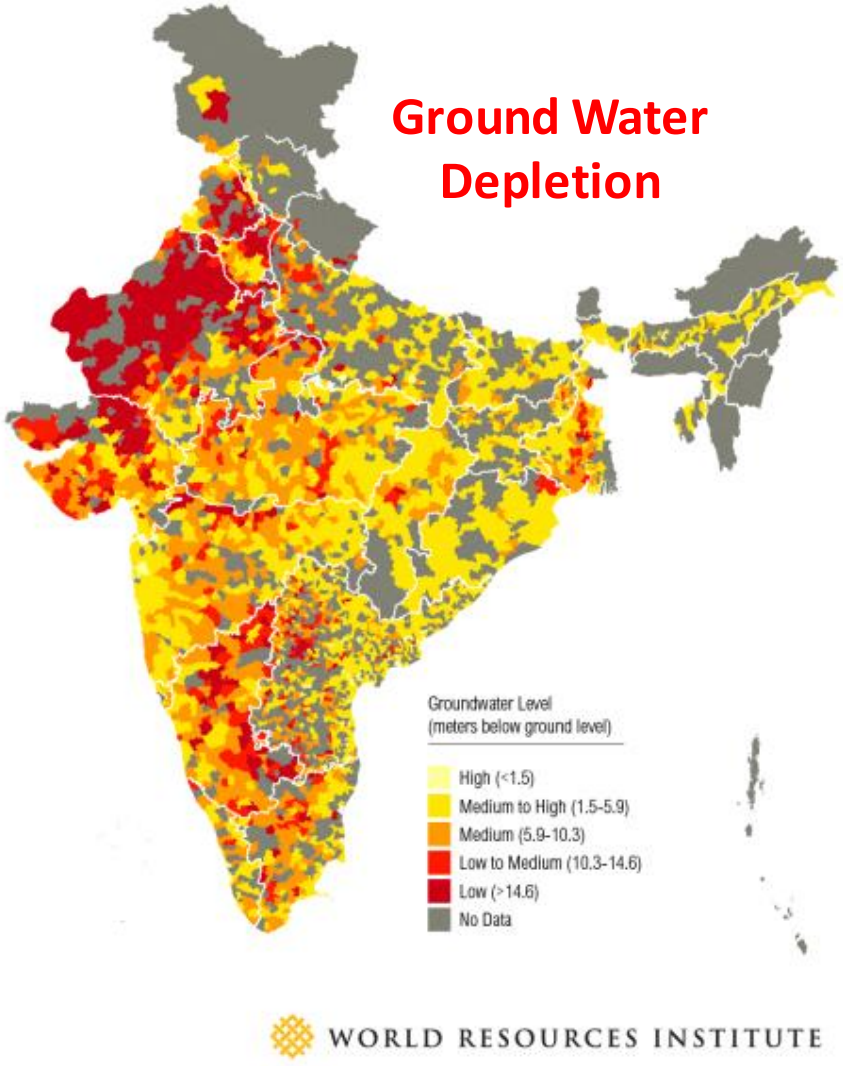
Overfishing



Pauly D & Zeller D (2016)

54% of India's Ground-water Wells Are Decreasing

Ground Water Depletion



www.indiawatertool.in

WORLD RESOURCES INSTITUTE

Solutions?

- Government Intervention?
- Privatization?
- Local Management?
- Is there a technological solution?

There is no definite solution

The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2009

Elinor Ostrom, Oliver E. Williamson

Elinor Ostrom - Facts

Photo: U. Montan

Elinor Ostrom

Born: 7 August 1933, Los Angeles, CA, USA

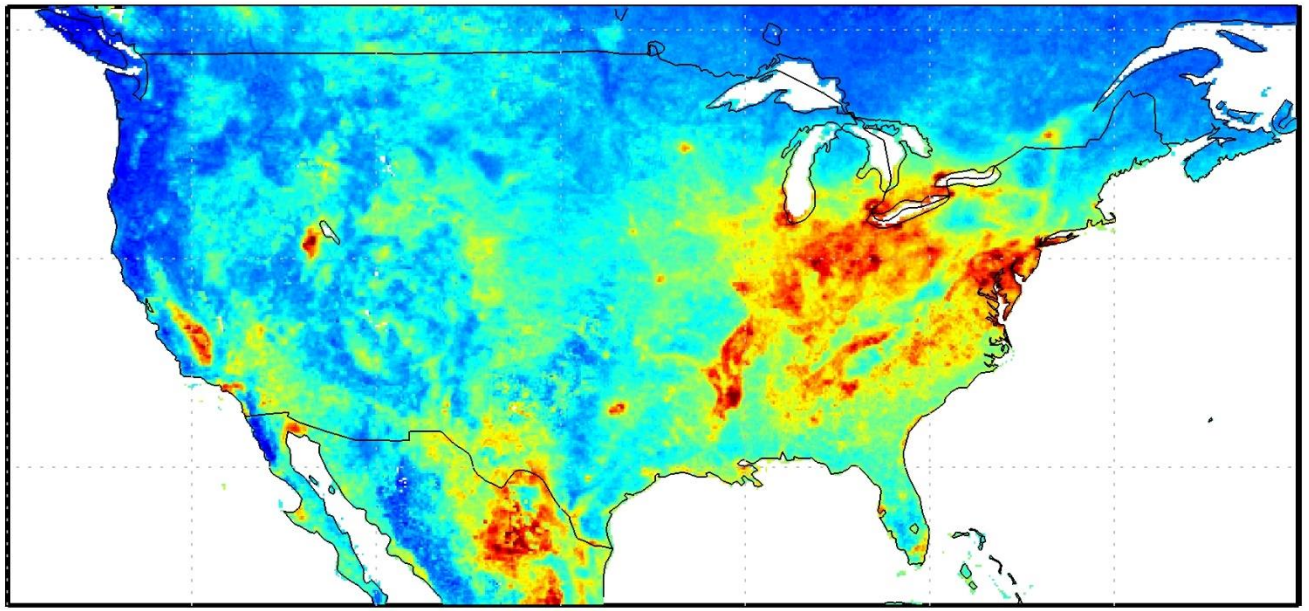
Died: 12 June 2012, Bloomington, IN, USA

Affiliation at the time of the award: Indiana University, Bloomington, IN, USA, Arizona State University, Tempe, AZ, USA

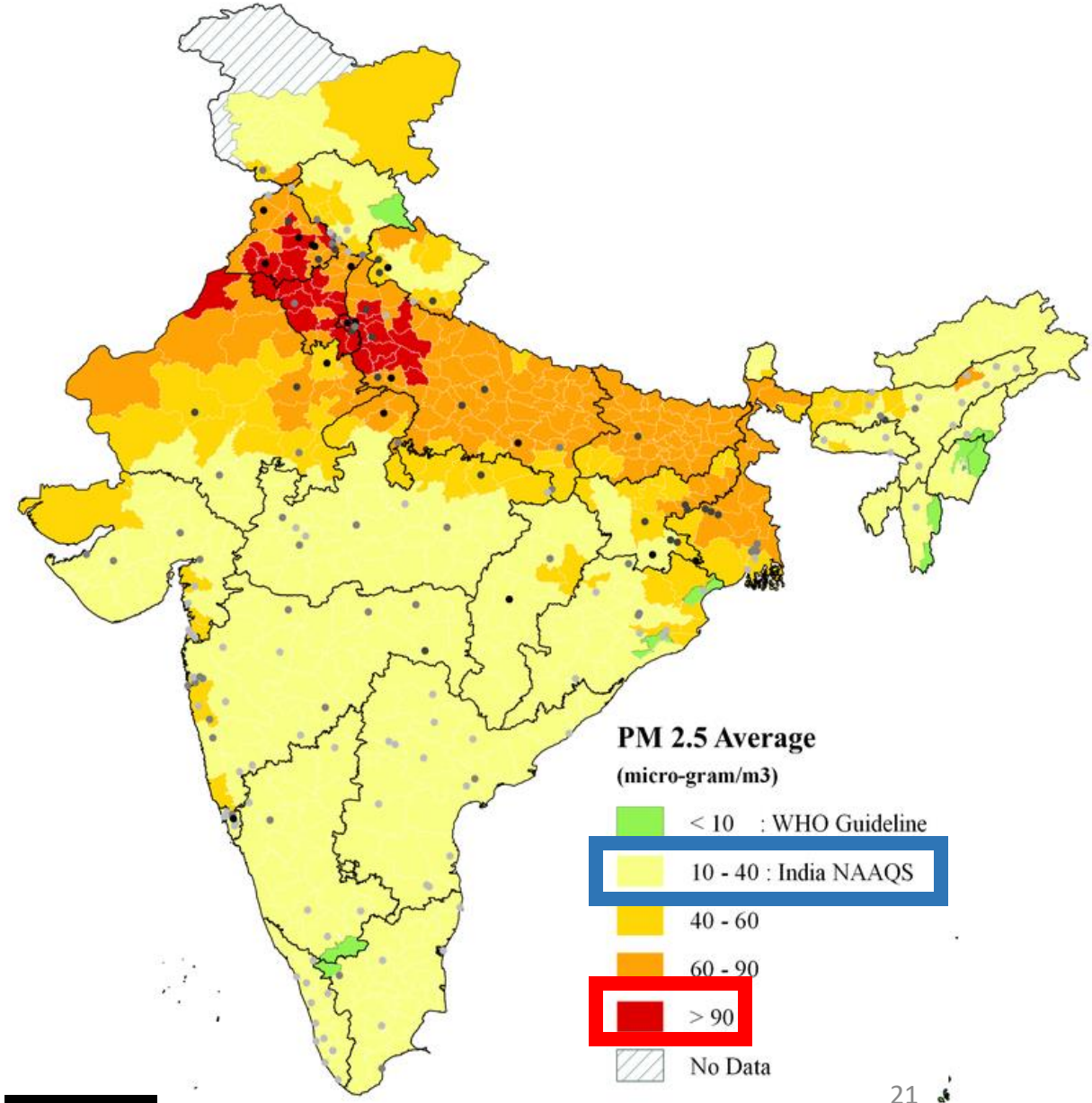
Prize motivation: "for her analysis of economic governance, especially the commons"

Field: economic governance

Contribution: Challenged the conventional wisdom by demonstrating how local property can be successfully managed by local commons without any regulation by central authorities or privatization.



NASA



vox.com

Pollution

Cutting Through India's Smog

By THE EDITORIAL BOARD FEB. 23, 2015

Proof of the grave air pollution problem confronting India is seen not just in the suffocating smog that on many days crowds out the sun in New Delhi, the world's most polluted city. It can be measured as well in the fact that the country has the world's highest death rate from chronic respiratory diseases, which kill an estimated 1.5 million Indians every year. A 2014 World Health Organization report concluded of the 20 most polluted cities in the world, India has 13.

New Delhi Tsering Topgyal/Associated Press

After years of denial and indifference, ordinary Indians appear to be waking up to the dangers of relying on some of the dirtiest energy sources on the planet, including coal, diesel oil and burning garbage, to sustain economic growth and an exploding population. Yet the government has failed to address with any urgency what is

nytimes.com

Extinction

The Telegraph

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Earth has entered sixth mass extinction, warn scientists

Humans are responsible for so many species dying out that we are now in a sixth mass extinction, Stanford University has warned

The last mass extinction saw the dinosaurs wiped out Photo: Alamy

By Sarah Knapton, Science Editor

7:00PM BST 19 Jun 2015

Earth has entered its sixth mass extinction with animals now dying out at

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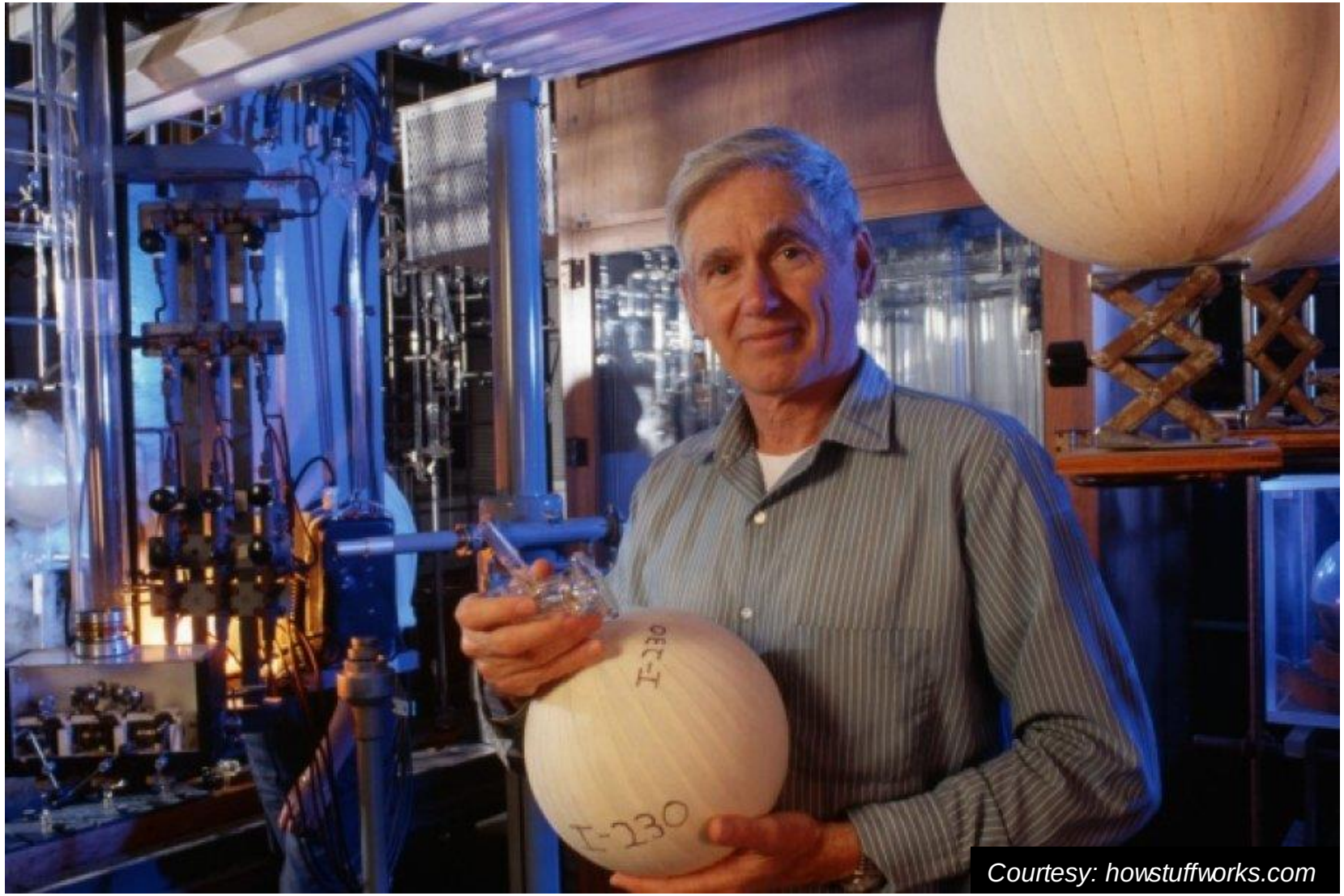
Bin Laden relatives killed in Hampshire plane crash

RAF intercept 10 Russian jets in single patrol

BBC reporter uses invisible iPad in bizarre bulletin sign-off

Migrants break through police line in Calais



Courtesy: howstuffworks.com

Charles David Keeling

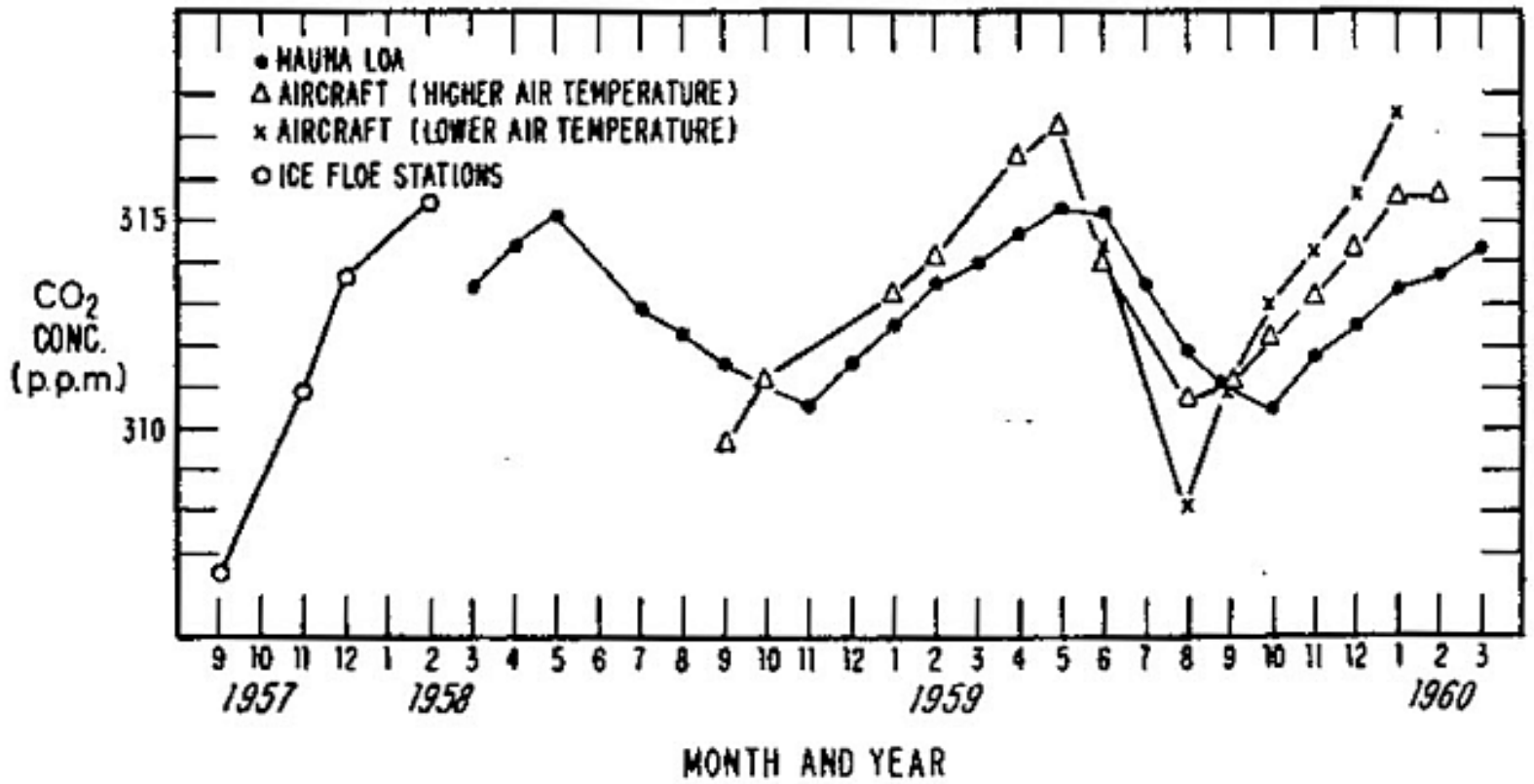
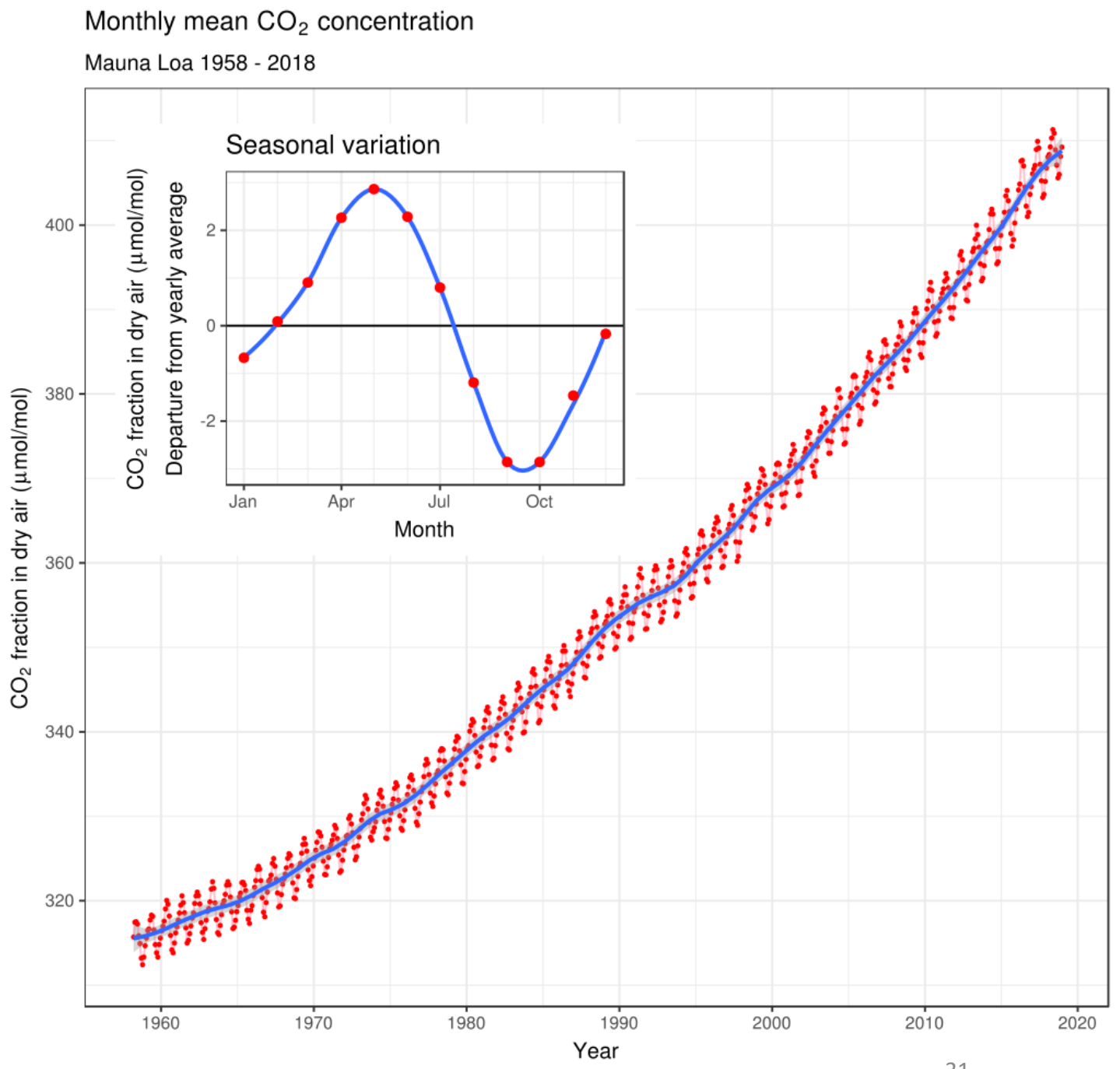


Fig. 1. Variation in concentration of atmospheric carbon dioxide in the Northern Hemisphere.

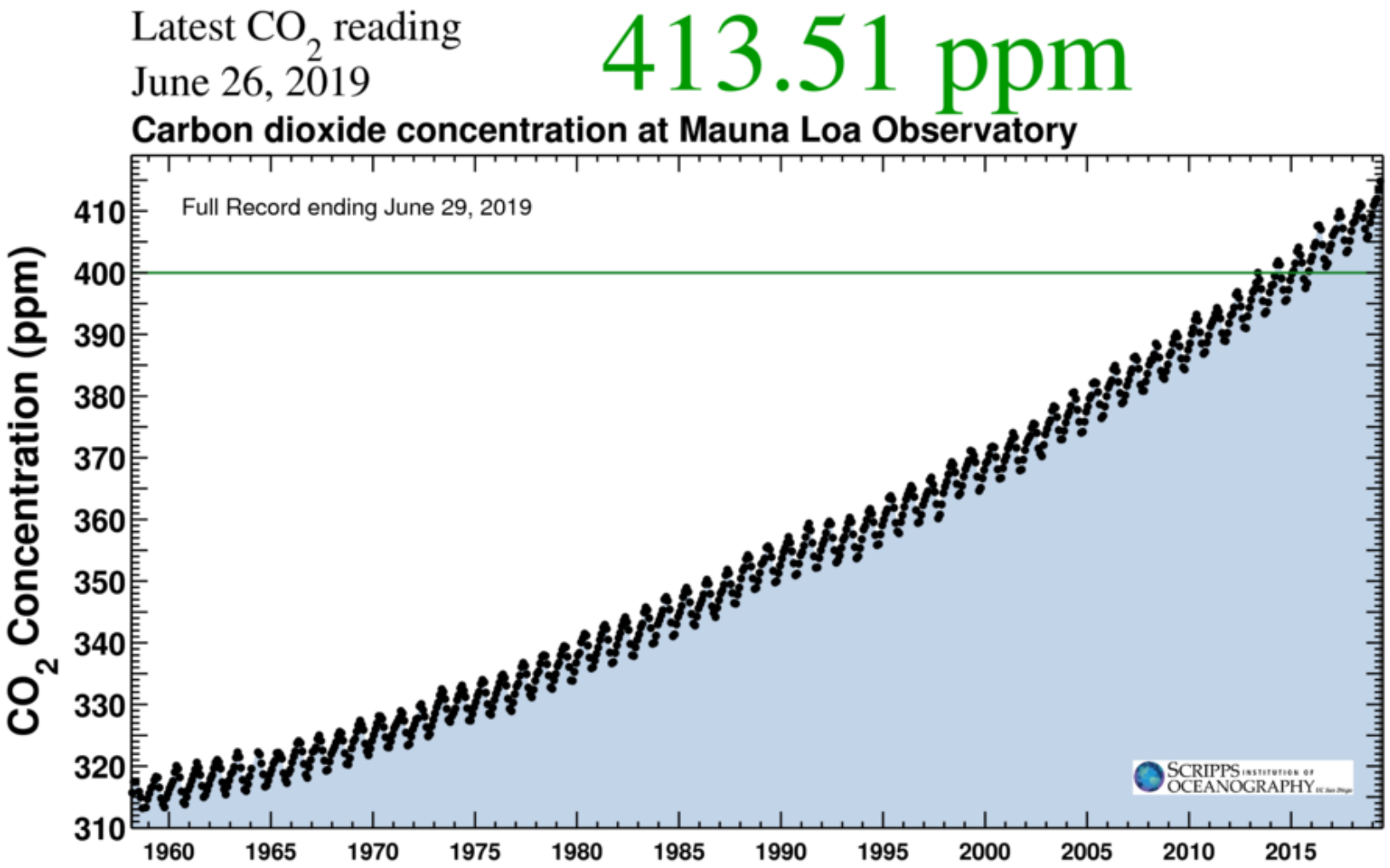
Tellus XII (1960), 2

The Keeling Curve



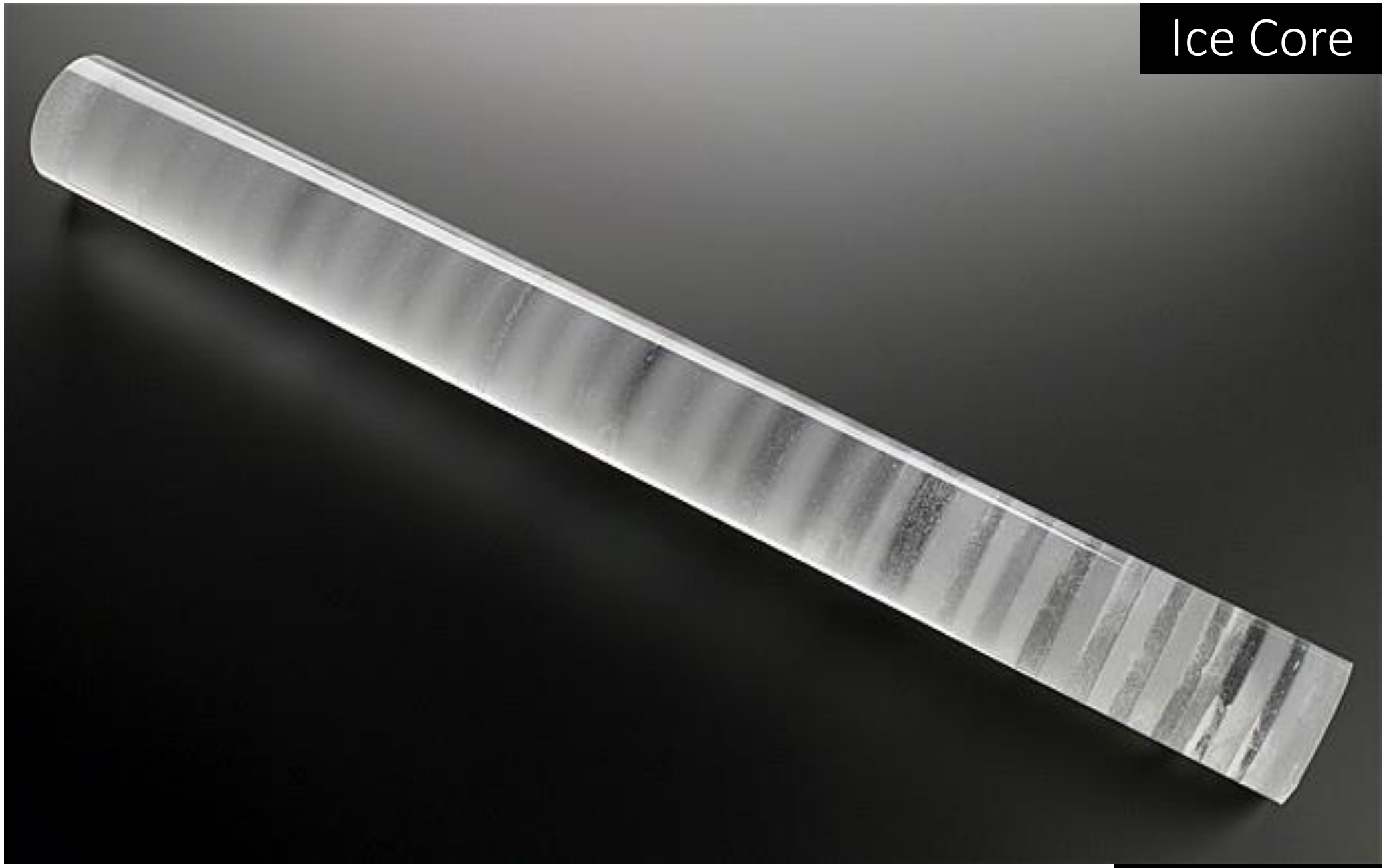
Data : R. F. Keeling, S. J. Walker, S. C. Piper and A. F. Bollenbacher
Scripps CO2 Program (http://scrippsco2.ucsd.edu). Accessed 2019-01-06

So what?



The Keeling Curve

Ice Core



Courtesy: The Telegraph

Ice Core Drilling

Courtesy: Frontier Scientists

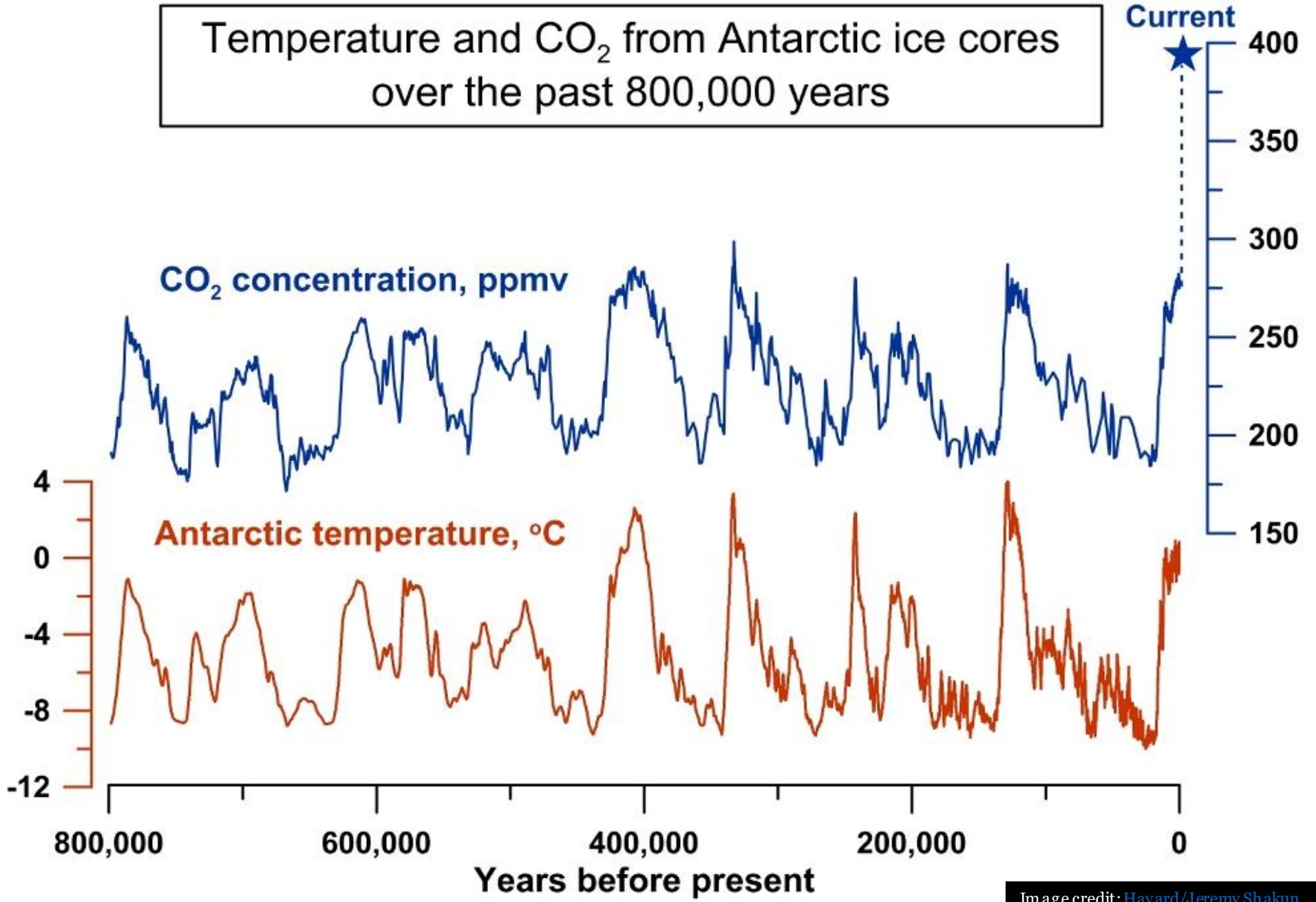
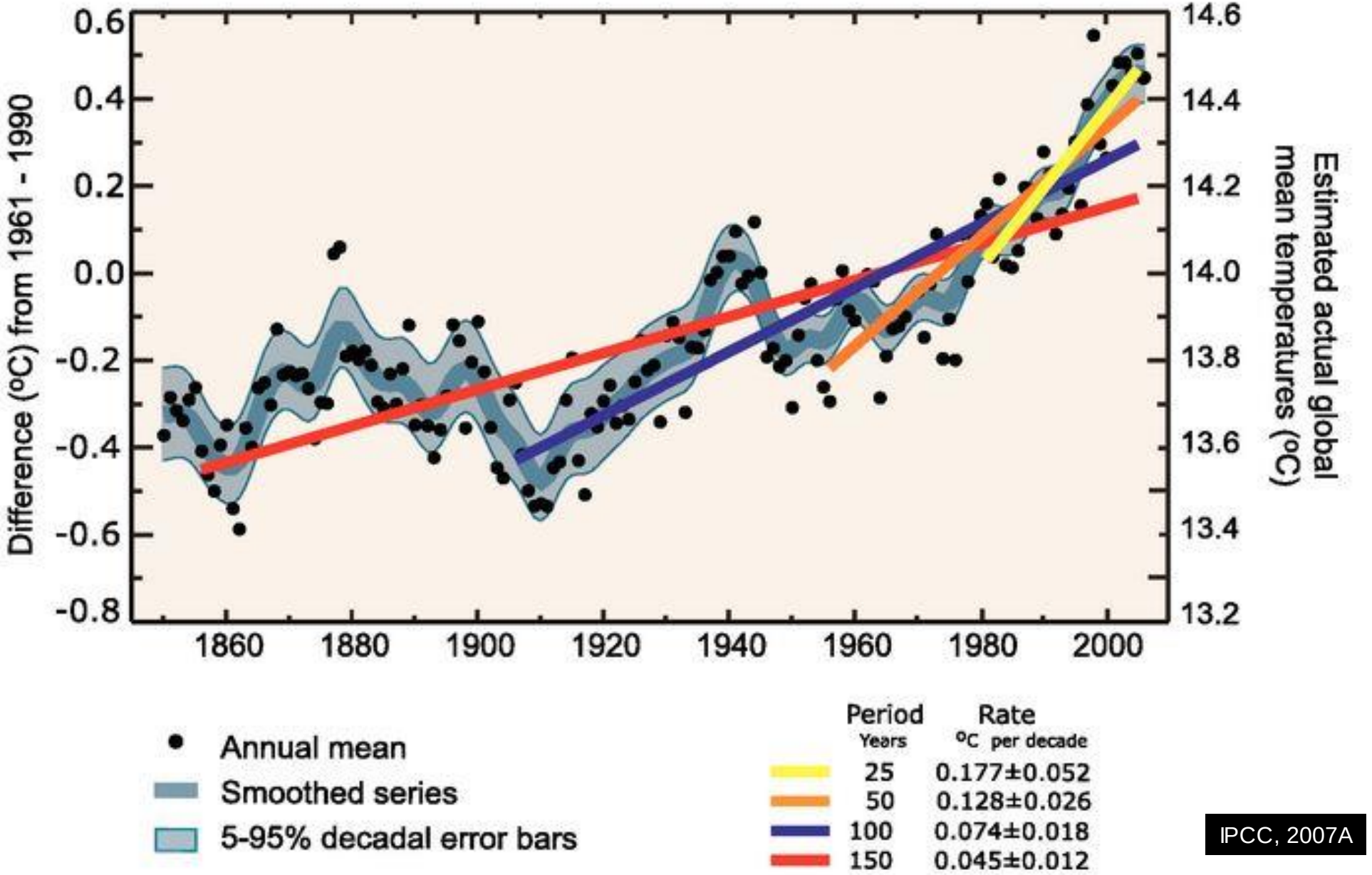
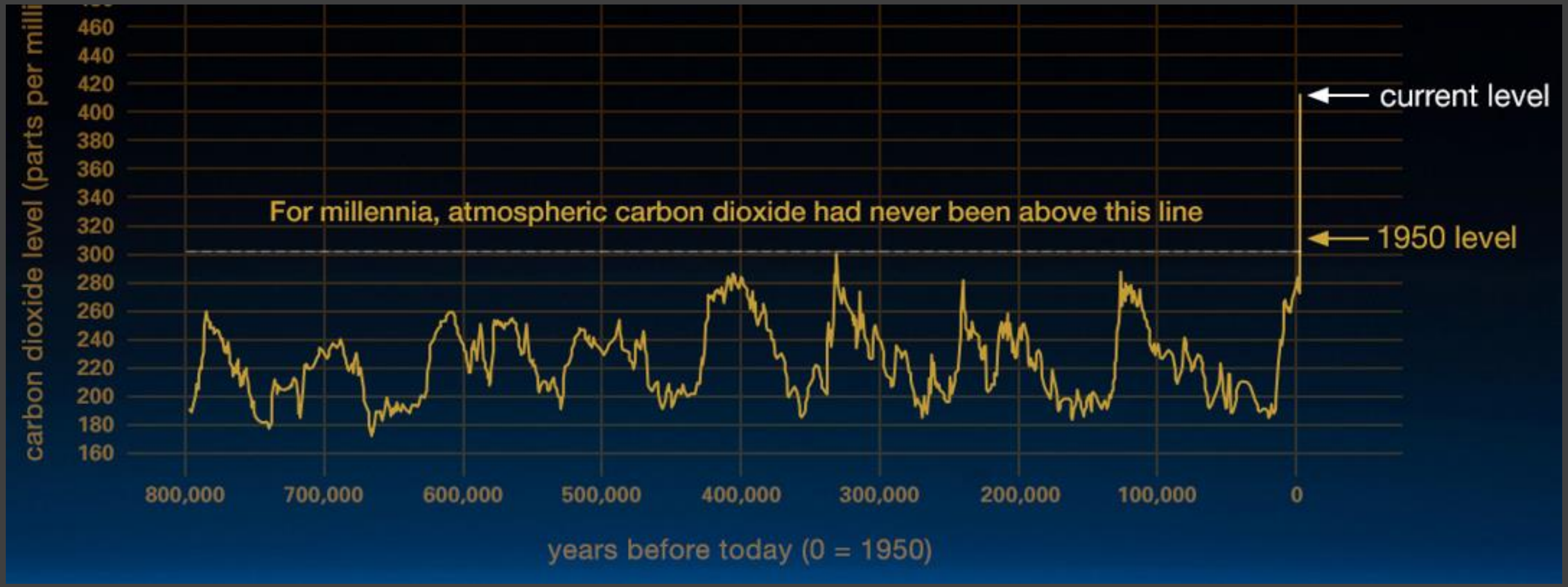


Image credit: Havard/Jeremy Shakun


Difference (°C) from 1961 - 1990
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
1860
1880
1900
1920
1940
1960
1980
2000
Estimated actual global mean temperatures (°C)
14.6
14.4
14.2
14.0
13.8
13.6
13.4
13.2
Annual mean
Smoothed series
5-95% decadal error bars
Period Years
Rate °C per decade
25 0.177±0.052
50 0.128±0.026
100 0.074±0.018
150 0.045±0.012

IPCC, 2007A



This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution. (Credit: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO_2 record.)

Evidences

1.Shrinking ice sheets : The Greenland and Antarctic ice sheets have decreased in mass. Data from NASA's Gravity Recovery and Climate Experiment show Greenland lost an average of 286 billion tons of ice per year between 1993 and 2016, while Antarctica lost about 127 billion tons of ice per year during the same time period.

2.Declining Arctic sea ice : Both the extent and thickness of Arctic sea ice has declined rapidly over the last several decades. (Image: Visualization of the 2012 Arctic sea ice minimum, the lowest on record)

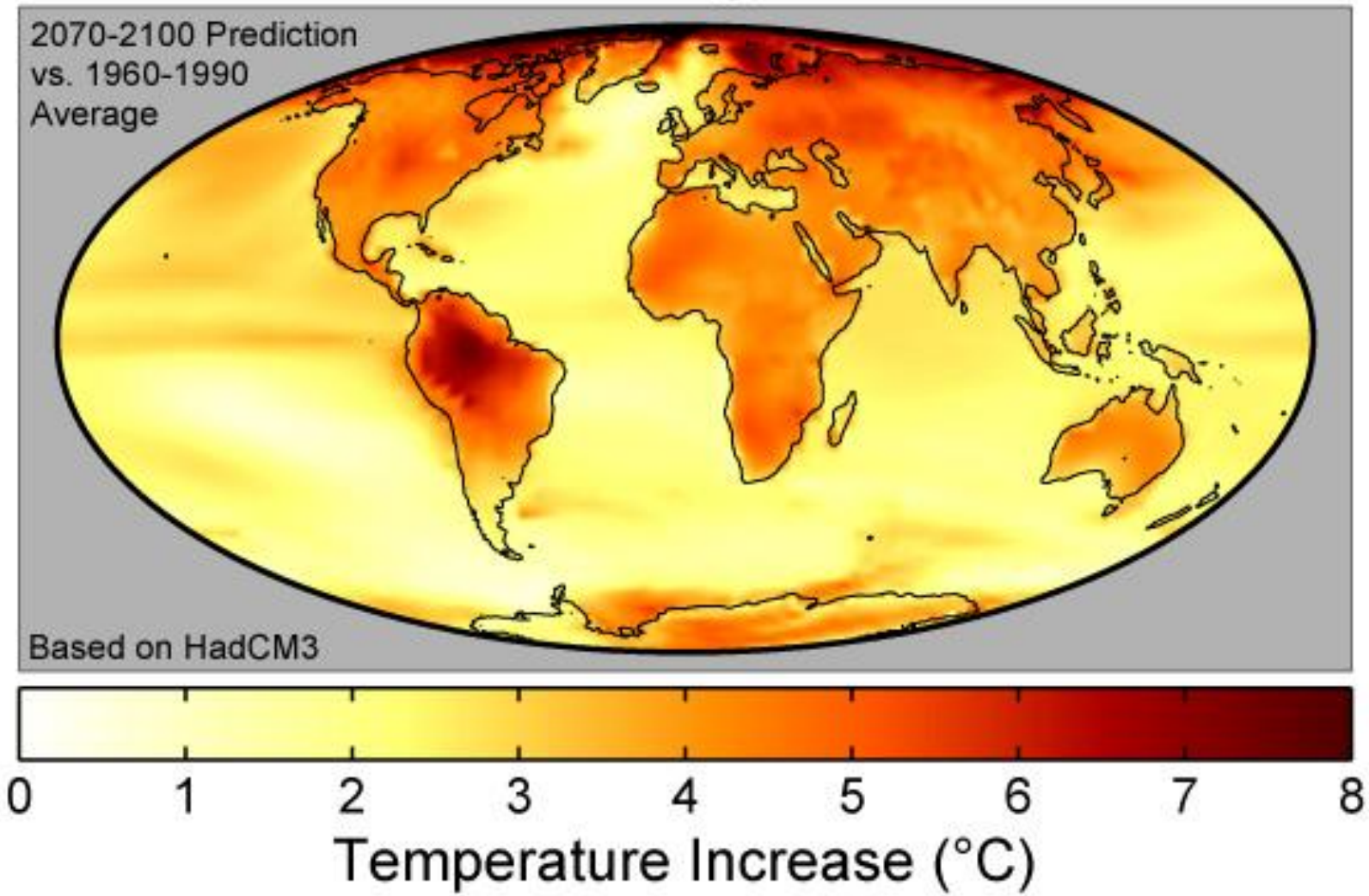
Source : UCAR centre for science education

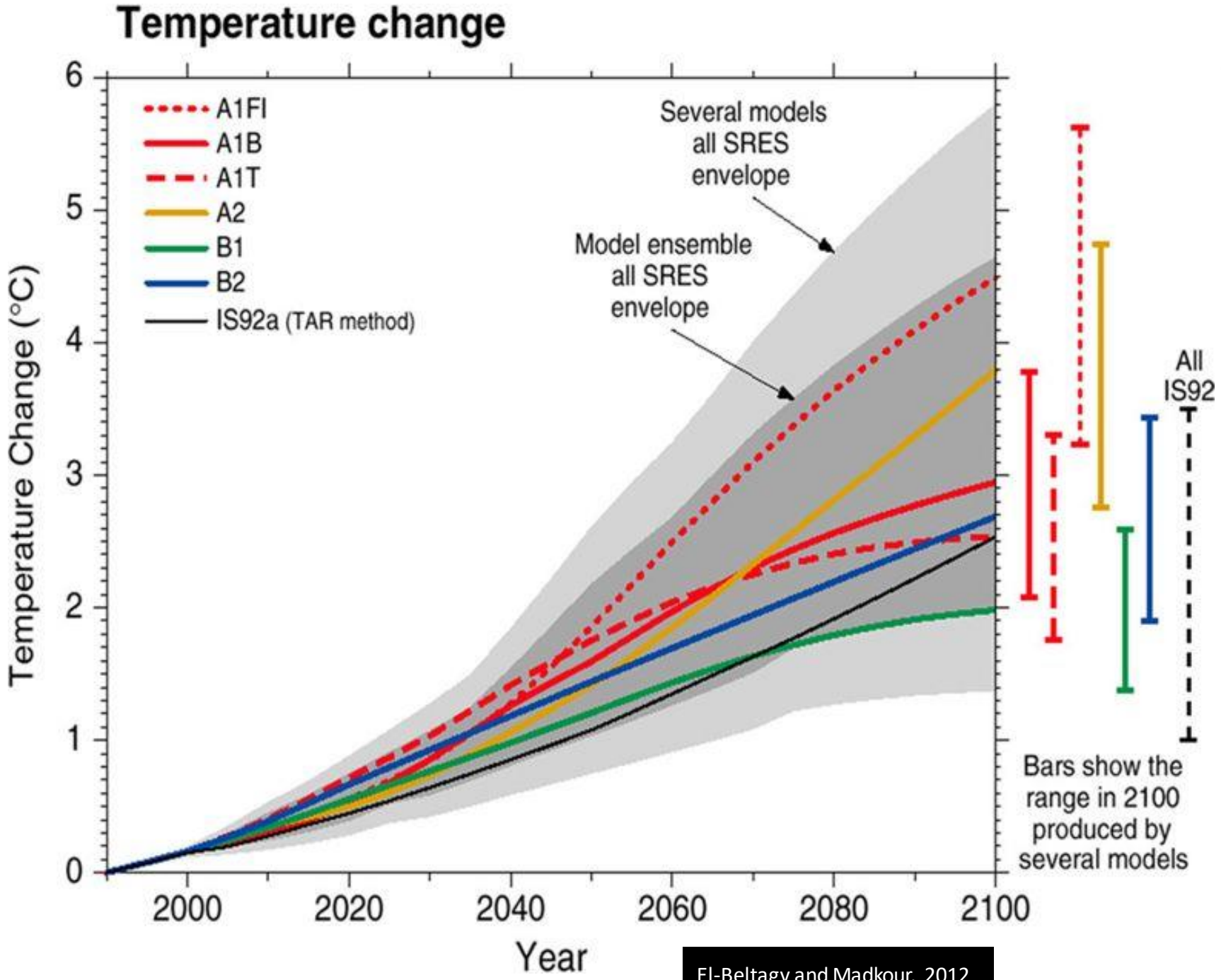
3.Extreme events : The number of record high temperature events in the United States has been increasing, while the number of record low temperature events has been decreasing, since 1950. The U.S. has also witnessed increasing numbers of intense rainfall events.

4.Ocean acidification : Since the beginning of the Industrial Revolution, the acidity of surface ocean waters has increased by about 30 percent. This increase is the result of humans emitting more carbon dioxide into the atmosphere and hence more being absorbed into the oceans. The amount of carbon dioxide absorbed by the upper layer of the oceans is increasing by about 2 billion tons per year.

Source : UCAR centre for science education

Global Warming Predictions





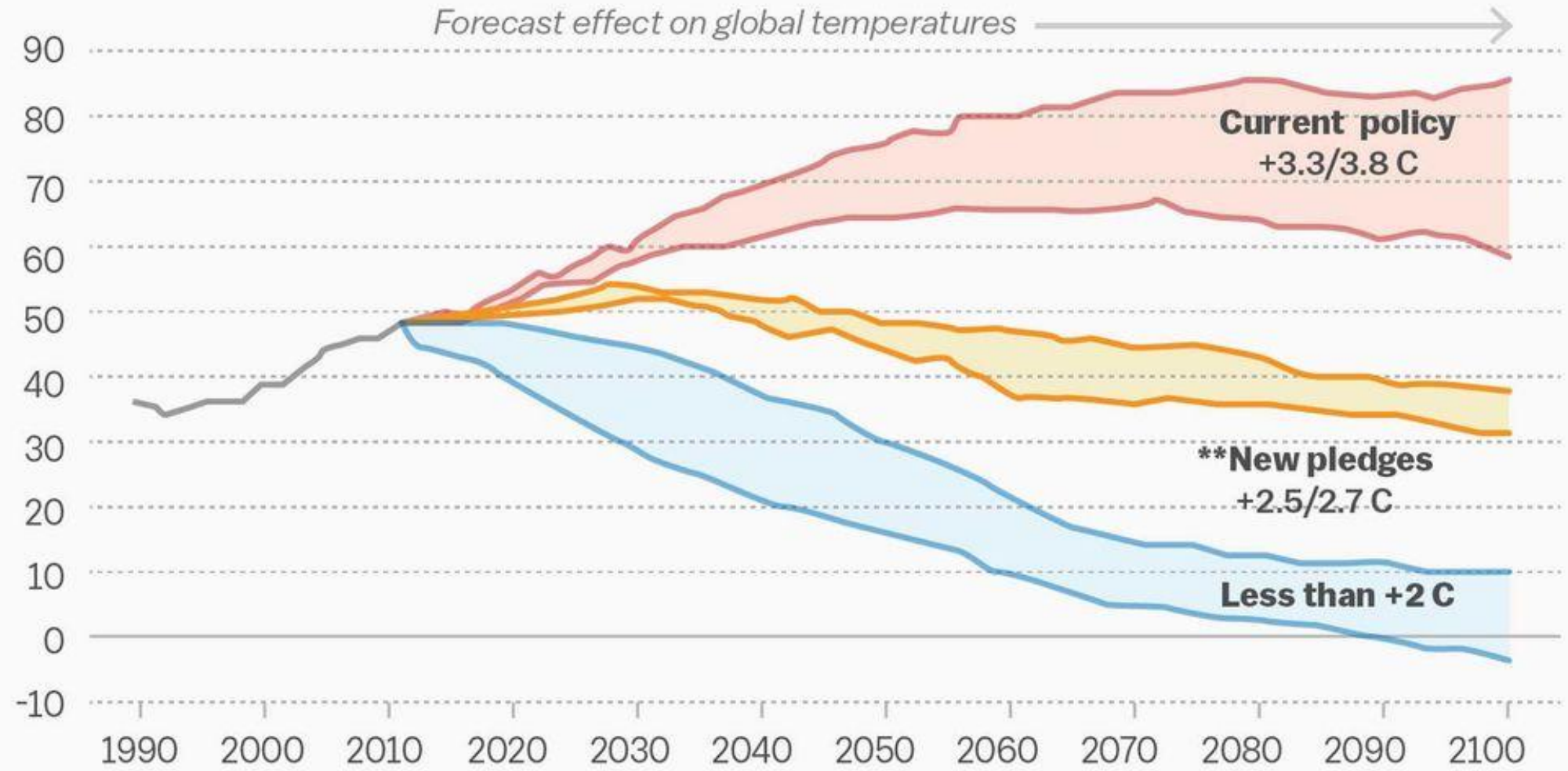
El-Beltagy and Madkour, 2012

Temperature change under different scenarios

Image Credit: Friendsofe

Estimated global greenhouse gas emissions

In gigatons, CO2 equivalent



*Expected temperature change by 2100, versus period before Industrial Revolution

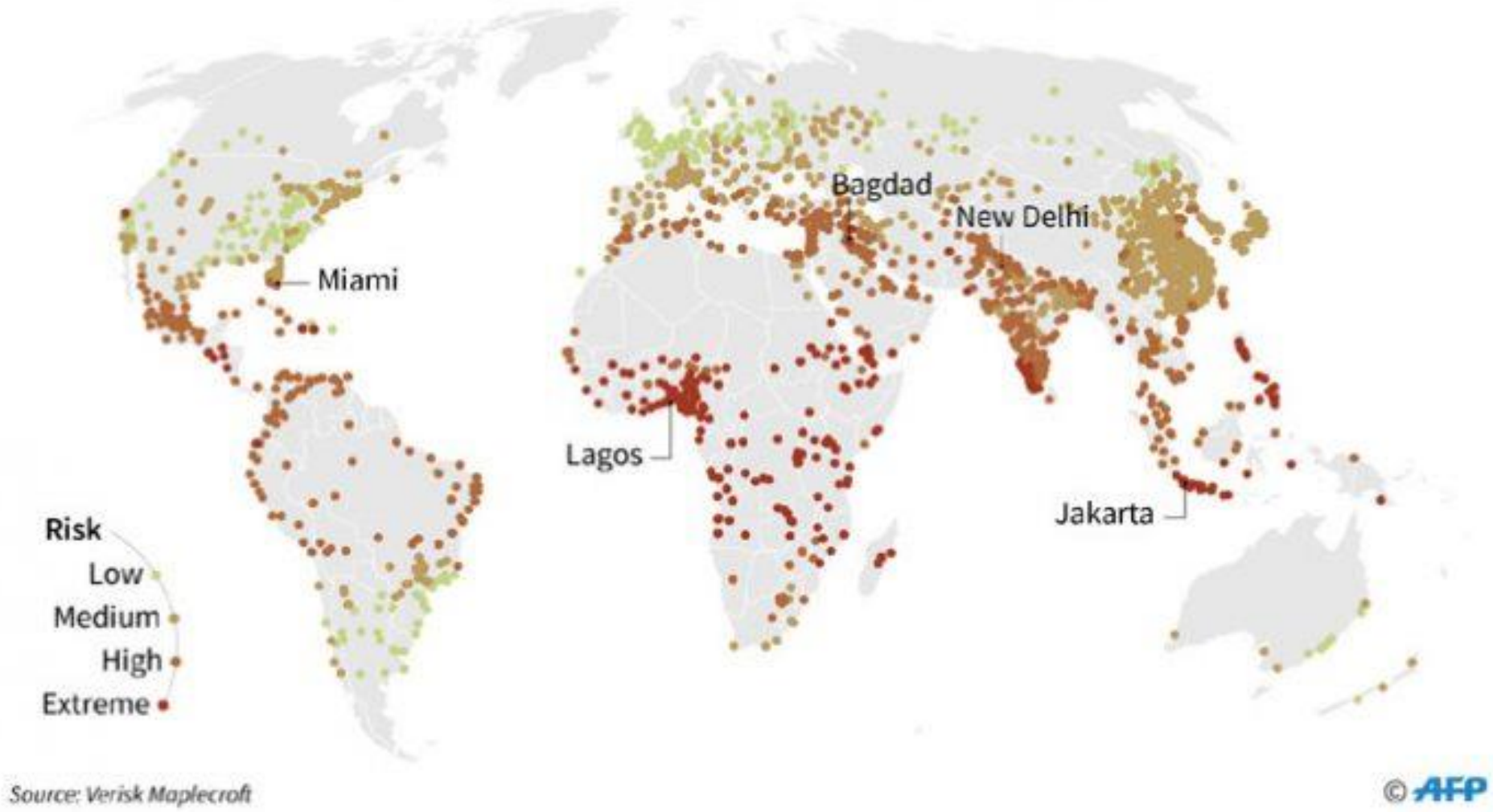
** Based on intended nationally determined contributions submitted to UNFCCC by Oct. 1

SOURCE: Climate Action Tracker

Vox

Cities at risk from climate change

Estimates of the vulnerability of large cities



Sustainable Development

Sustainable Development (SD)

"Development that meets the needs of the present without compromising the ability of future generation to meet their own needs"

1987 report of the World Commission on Environment and Development (WCED).

What is Sustainable about Development?

- What is development?
- How do you measure sustainability in the current paradigm of development?
- Is your definition of sustainability in line with environmental sustainability?

What is development?

Definition of Development:

Gross Domestic Product (GDP)

"GDP measures the monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time"- IMF

Measurement of throughput of natural resources

Challenges to Sustainable Development

- Rising income inequality (Economical Kuznets curve)
- Environmental degradation (Environmental Kuznets curve)

Economical Kuznets curve : Refers to relating growth and income redistribution.

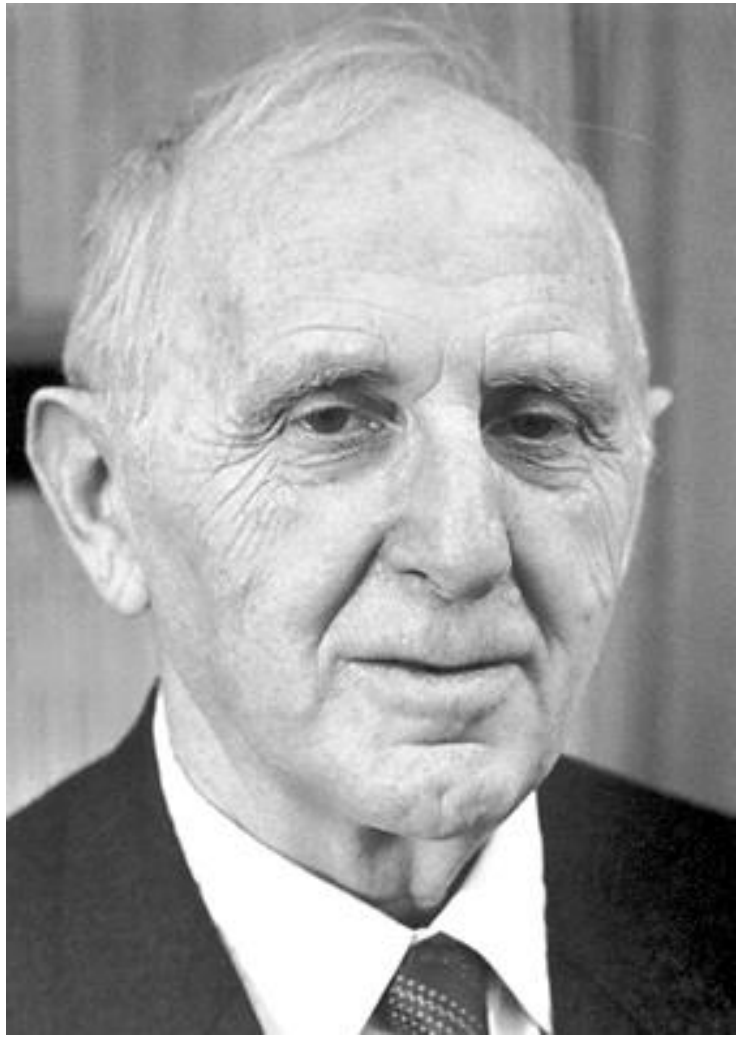
Environmental Kuznets curve : Refers to relating growth and environment.

How to measure sustainability?

- For the case of development- Sustainable growth
- For the case of the environment- Environmental sustainability
- Environmental sustainability requires that we don't consume nonrenewable resources. In such a scenario, GDP should be close to zero.

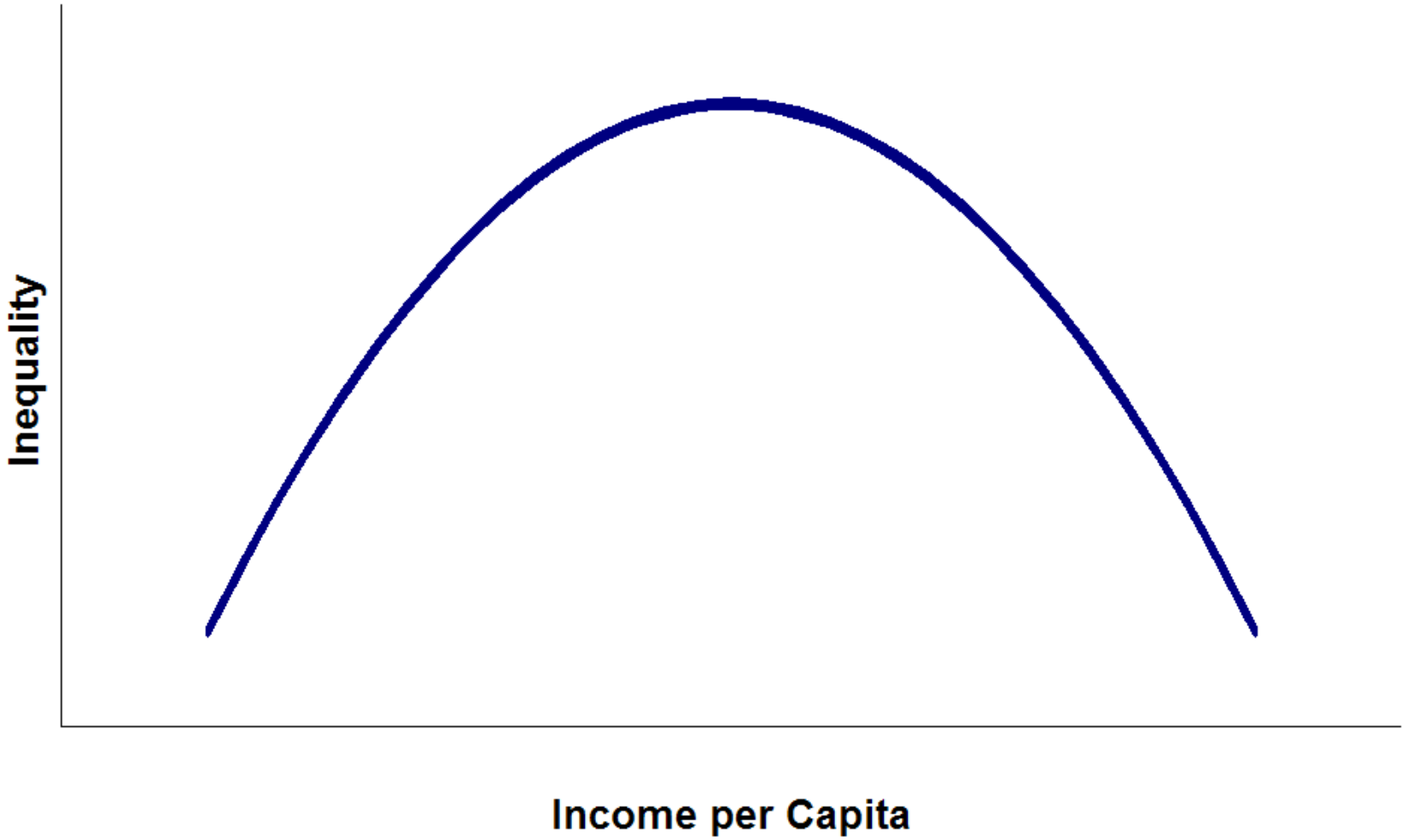
Sustainable Growth ≠ Environmental Sustainability

Why do we use GDP as a metric for overall improvement in human life?



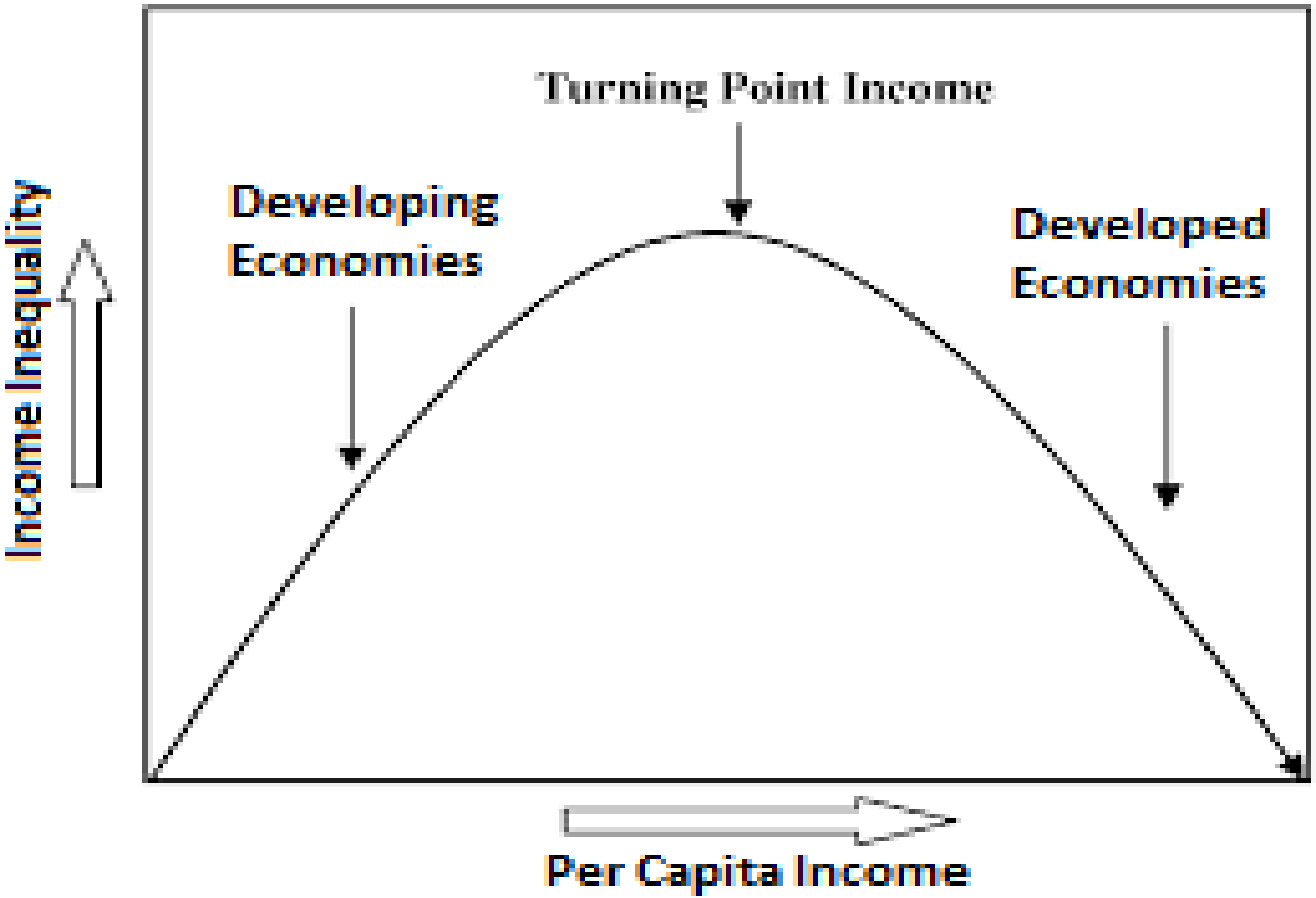
Simon Kuznets

Kuznets Curve

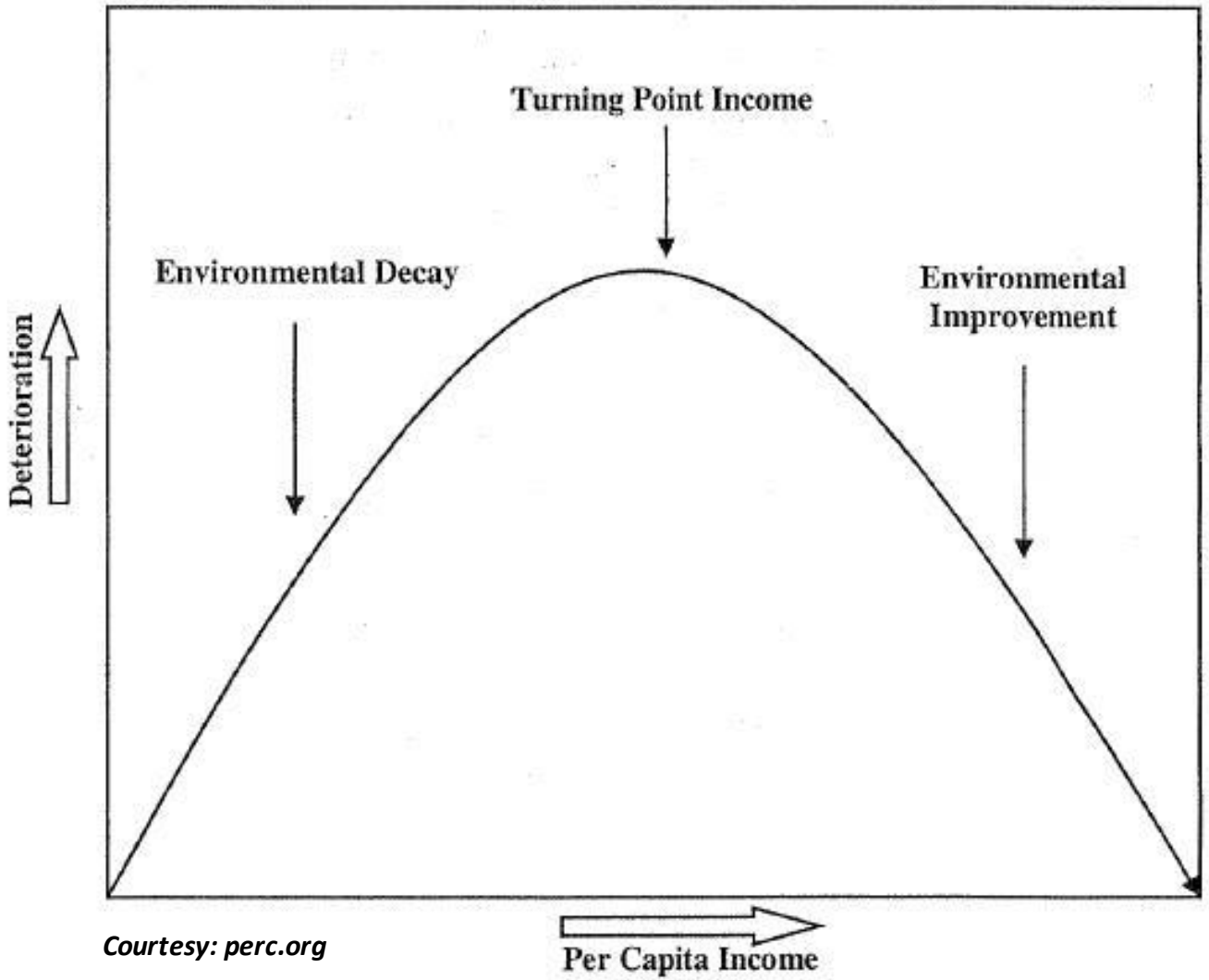


Wikipedia.org

KUZNETS CURVE



Environmental Kuznets Curve (EKC)

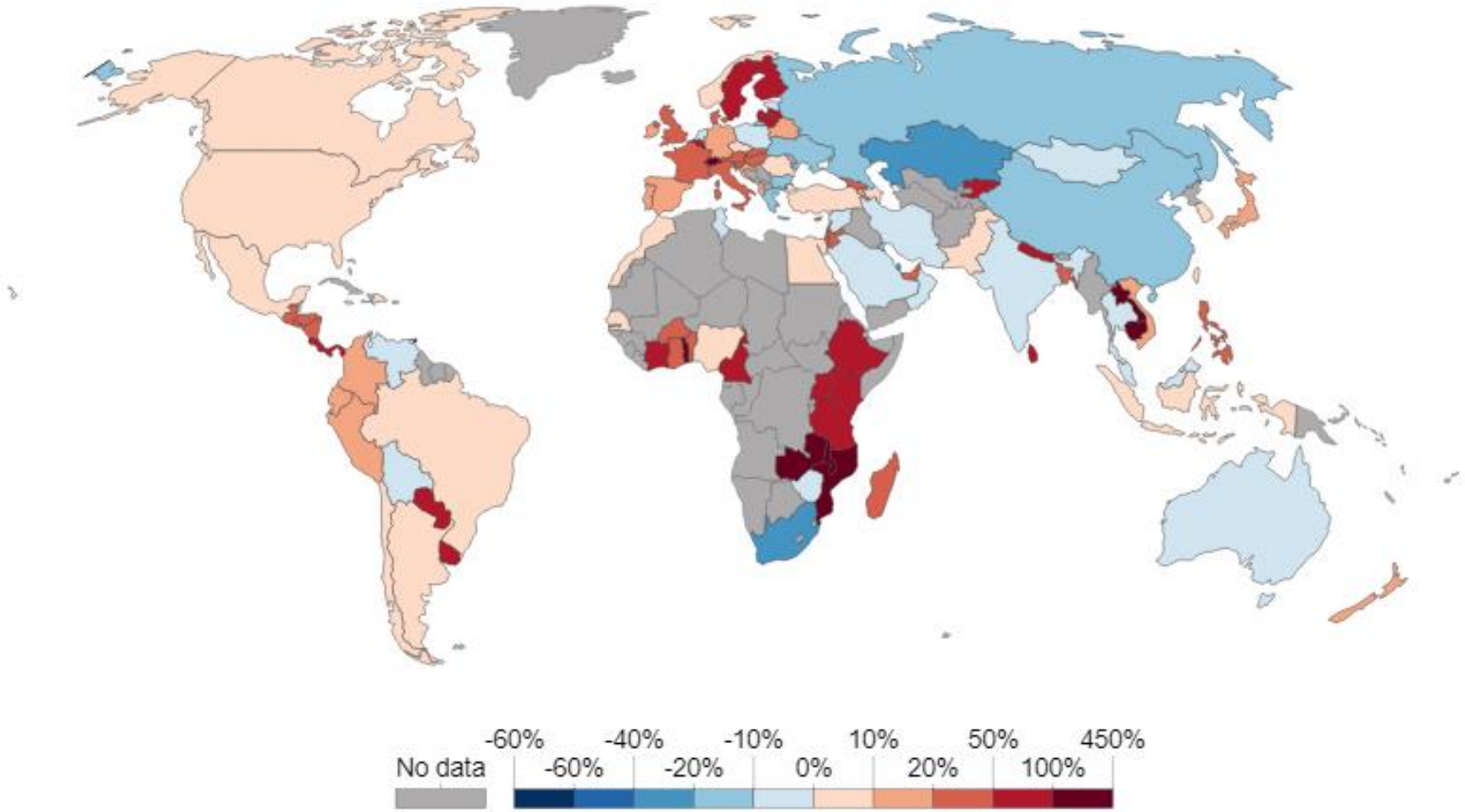


Courtesy: perc.org

CO_2 emissions in imported goods as a share of domestic emissions, 2014

Share of carbon dioxide (CO_2) emissions embedded in trade, measured as emissions exported or imported as the percentage of domestic production emissions. Positive values (red) represent net importers of CO_2 (i.e. "20%" would mean a country imported emissions equivalent to 20% of its domestic emissions). Negative values (blue) represent net exporters of CO_2.

Our World in Data



Source: Peters et al. (2012 updated); Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY-SA

Thank you