Nature based solutions in urban areas to support Climate Change adaptation

CLEARINGHOUSE
中欧城市森林应对方案

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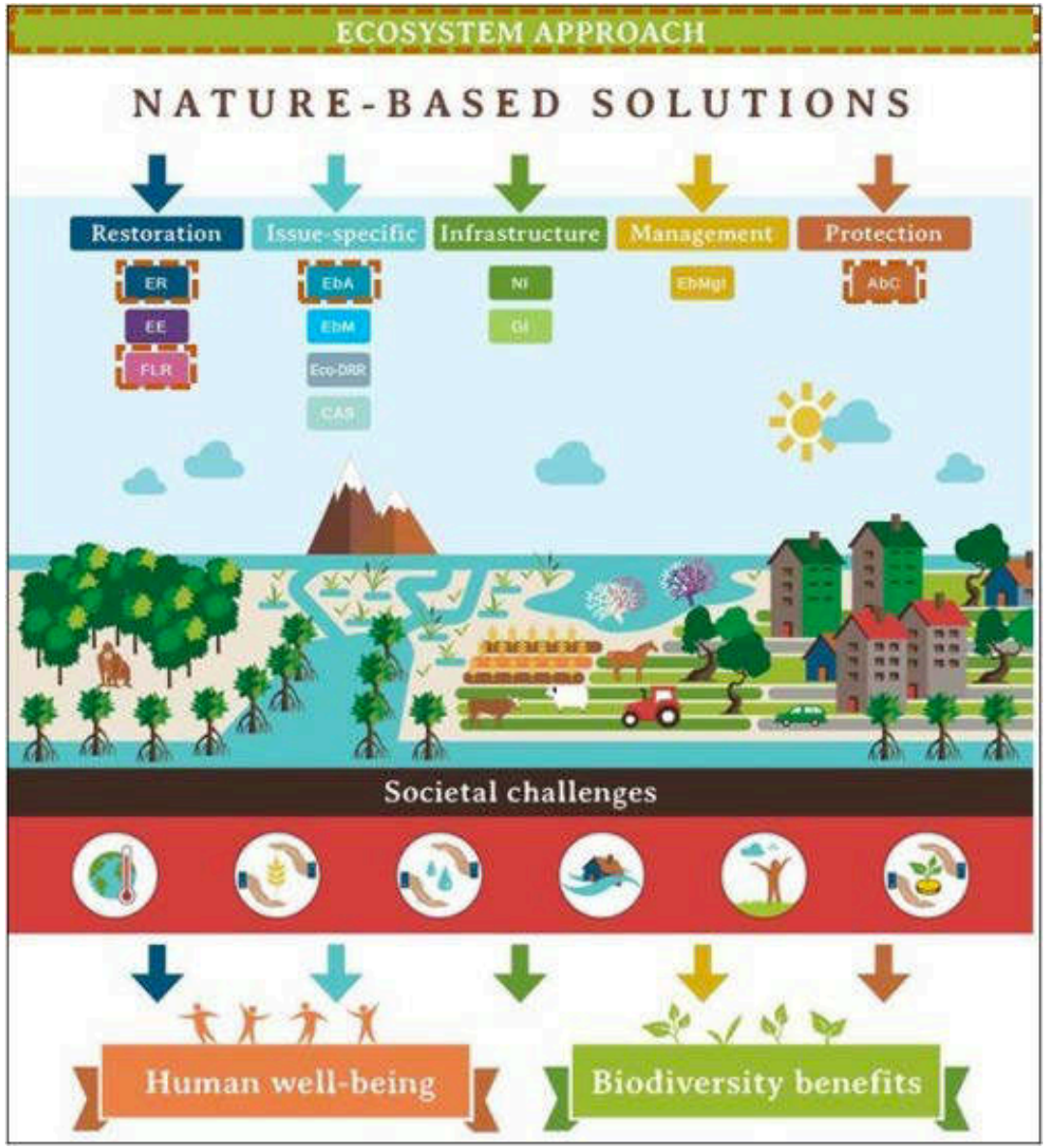

Credit: ScienceDirect Core principles for successfully implementing and upscaling Nature-based Solutions; Emmanuelle Cohen-Shacham et al.

CLEARING HOUSE Case studies in EU and CN

EUROPE	CHINA
Brussels	Beijing
Leipzig-Halle	Guangzhou+Shenzhen
Krakow	Hangzhou
Gelsenkirchen	Huaibei
Barcelona	Xiamen

- Inner-city afforestation
- Urban-rural linkages
- Air purification
- Heat wave mitigation
- Outdoor recreation
- River catchment restoration
- Increasing attracativeness & aesthetics
- Restoring former industrial sites
- Urban regeneration

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Part 1

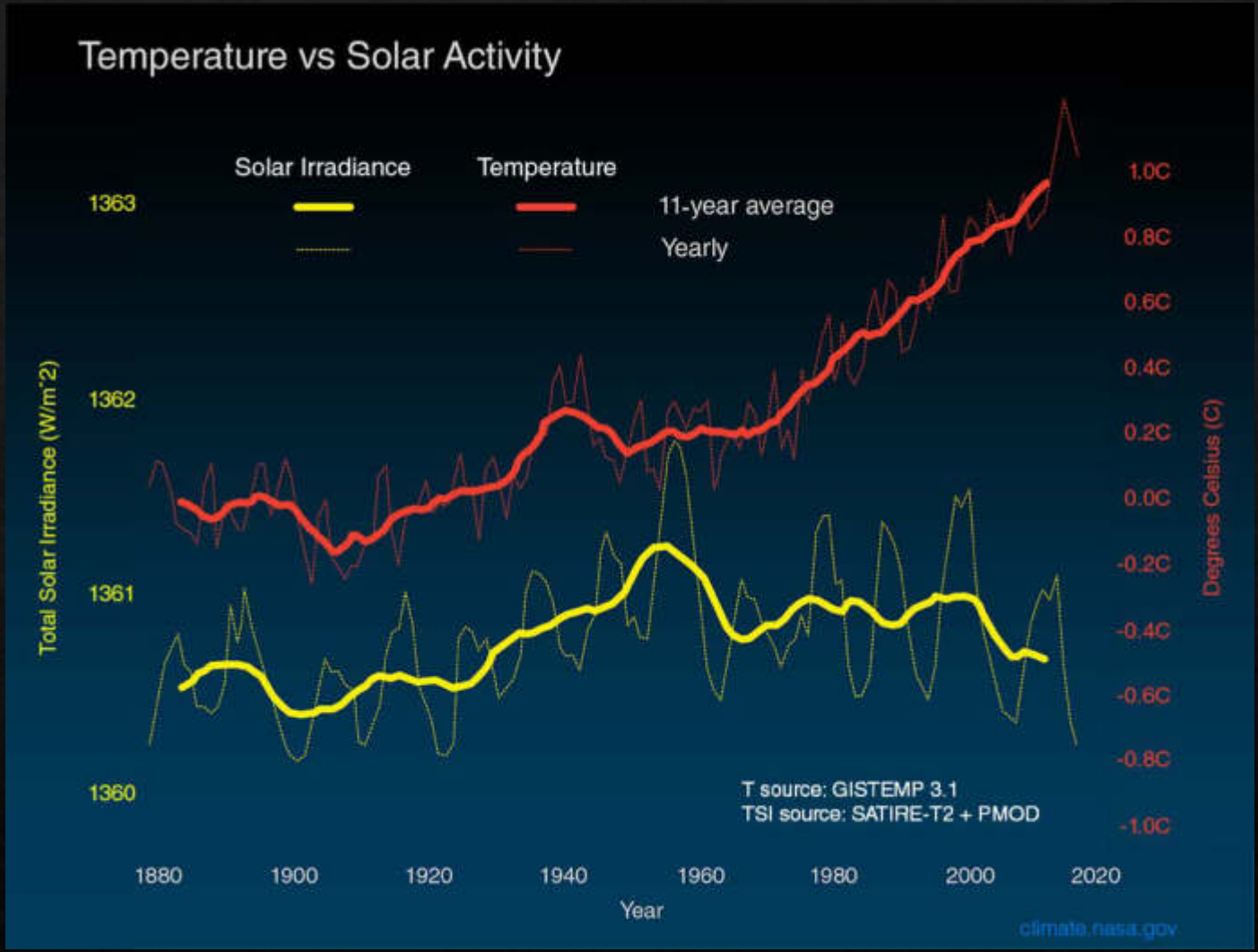
We have a problem

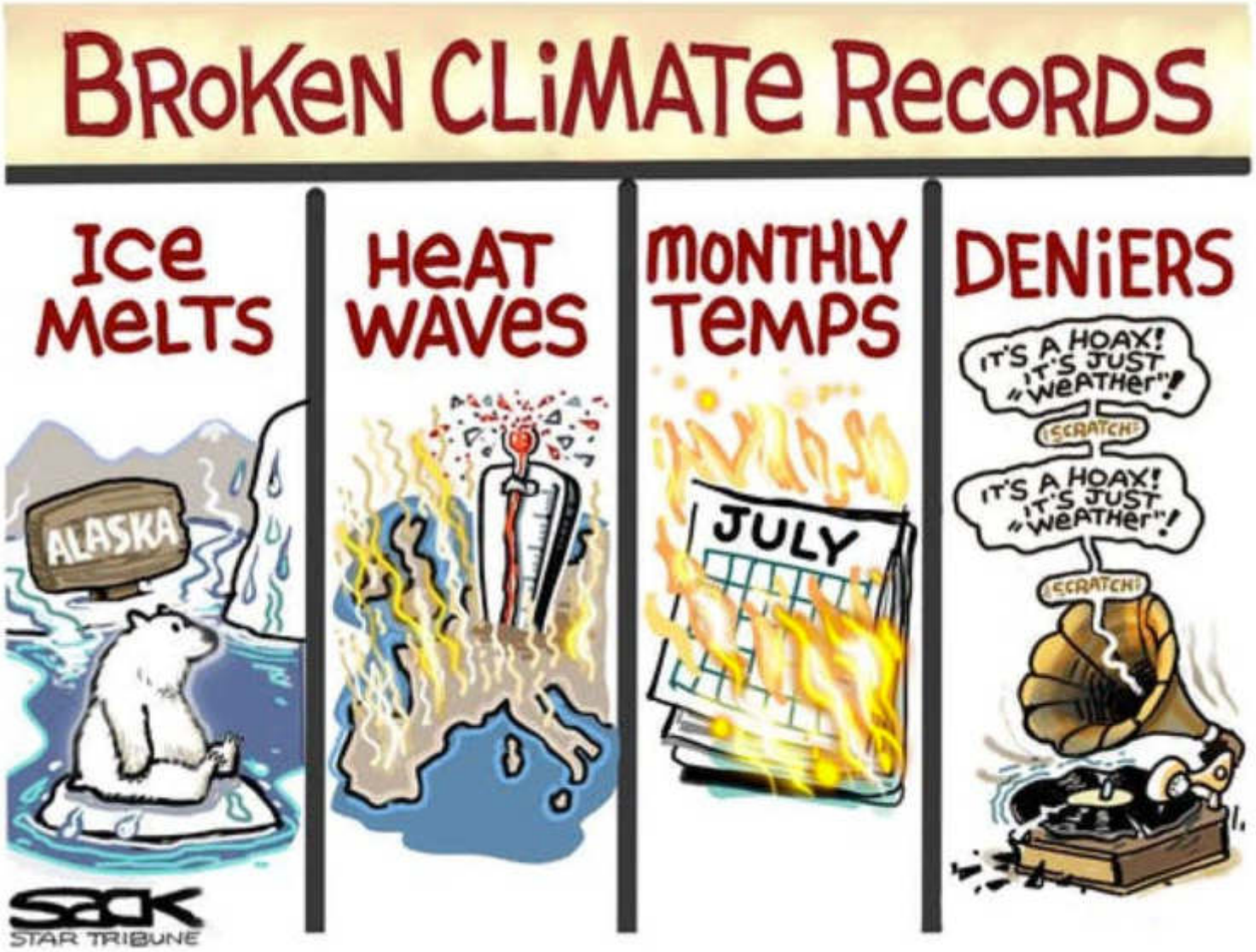
Photo: Greenpeace

Are we? and how bad can it get?

ask NASA Climate

The warming seen over the last few decades is too large to be caused by changes in solar activity. Here's how we know.



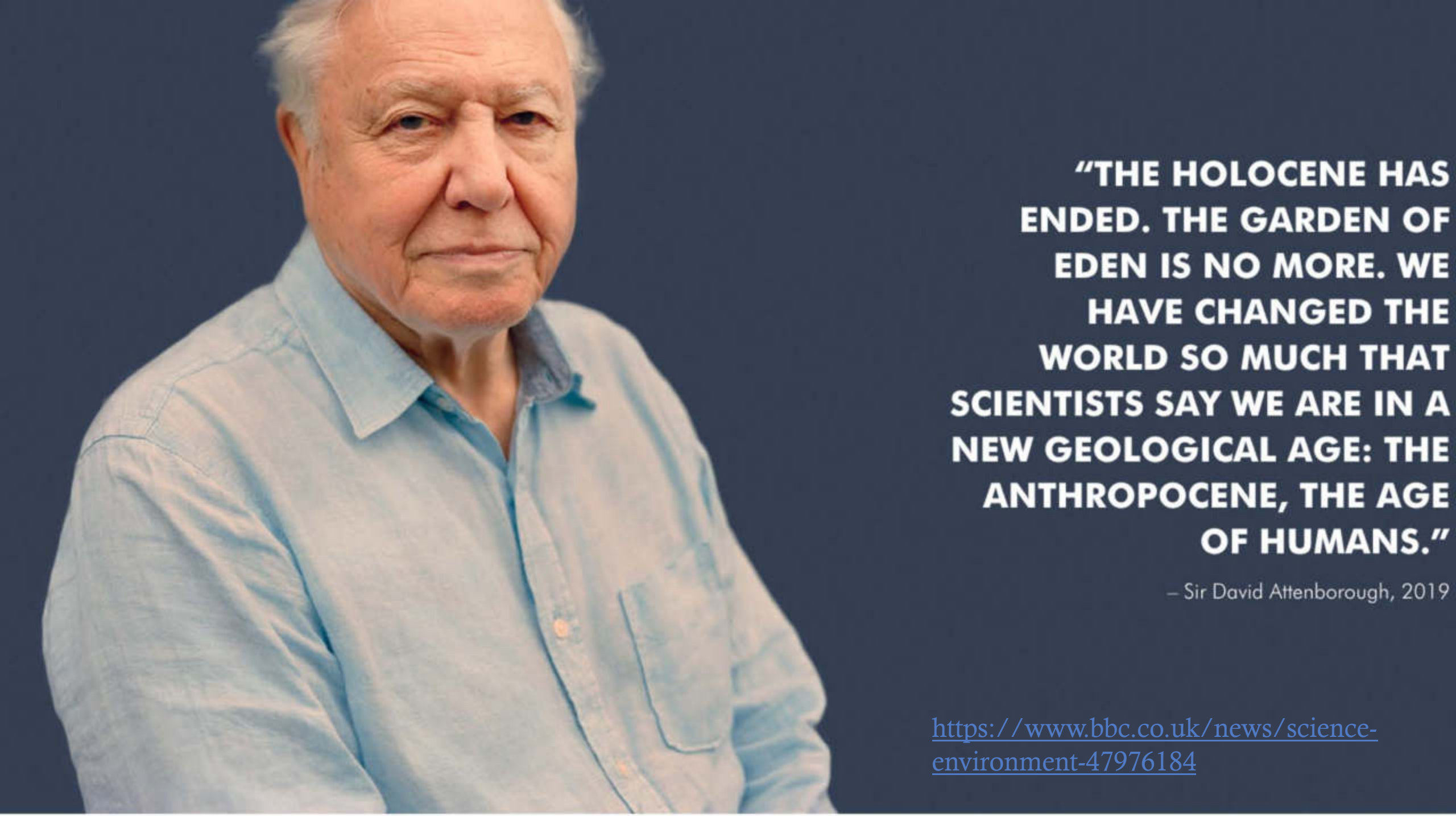

BROKEN CLIMATE RECORDS
ICE MELTS
ALASKA
HEAT WAVES
MONTHLY TEMPS
JULY
DENIERS
IT'S A HOAX! IT'S JUST "WEATHER"!
SCRATCH!
IT'S A HOAX! IT'S JUST "WEATHER"!
SCRATCH!
SACK
STAR TRIBUNE

No climate emergency

https://www.youtube.com/watch?v=GpVBH-HY5Ow

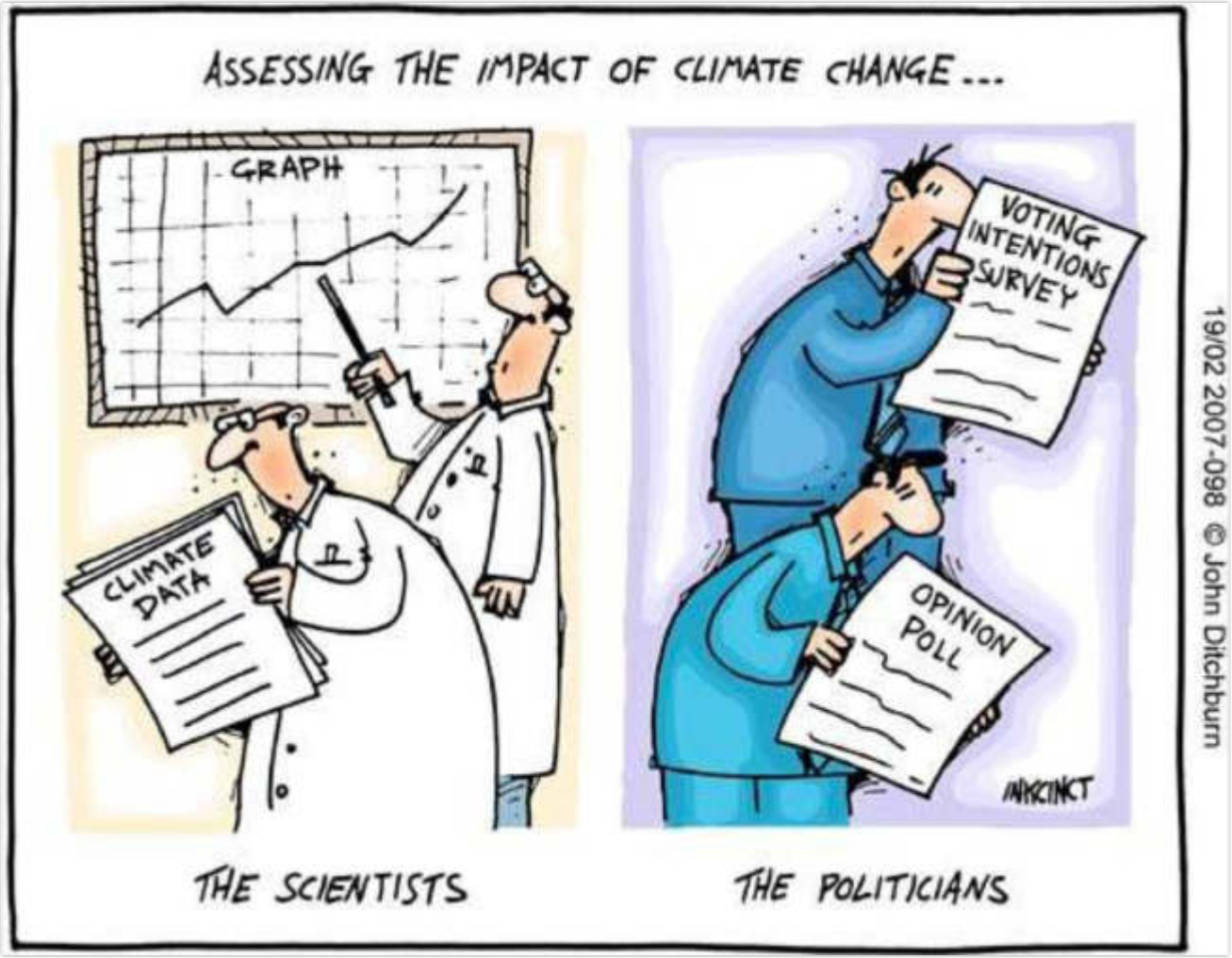
Save the scientific method from Big Green propaganda and faulty science.

Carbon Dioxide has nominal impact on temperature.



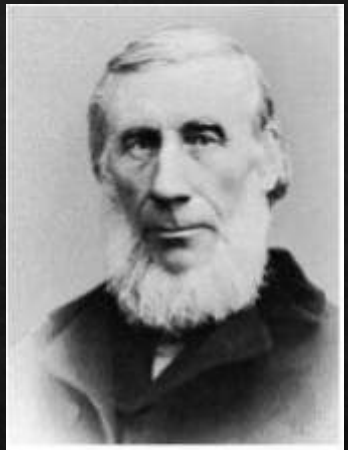
https://www.bbc.co.uk/news/science-environment-47976184

Okay - lets do some climate science



Sound science

the scientific basis for climate change has a long history …



Experiment

John Tyndall

1820-1893

Calculation

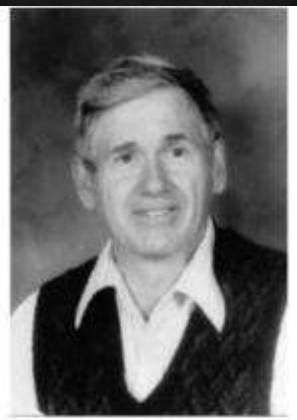
Svente Arrhenius

1859-1927

Observation

Guy Callendar

1897-1964



Measurement

Charles Keeling

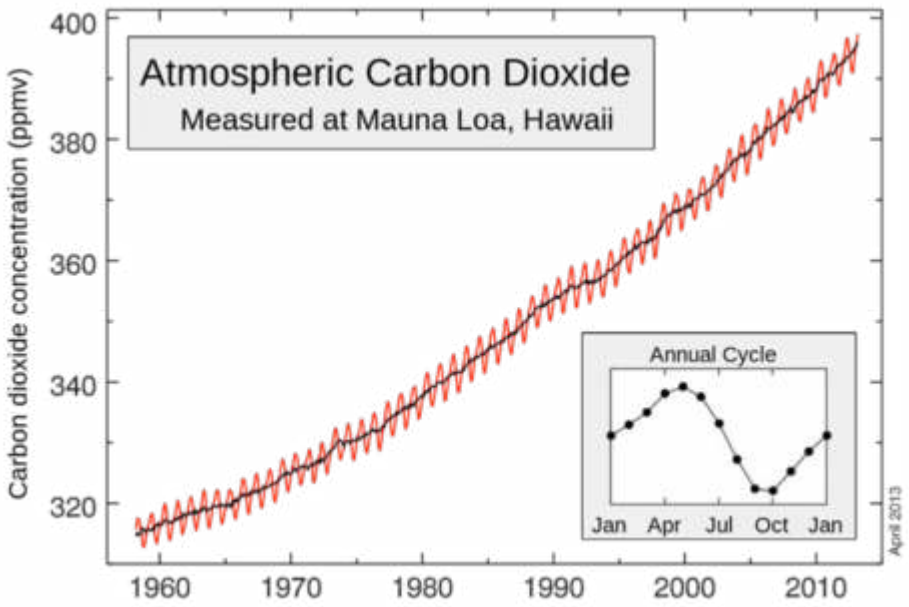
1928-2005

Prediction

Syukuro Manabe

1935-

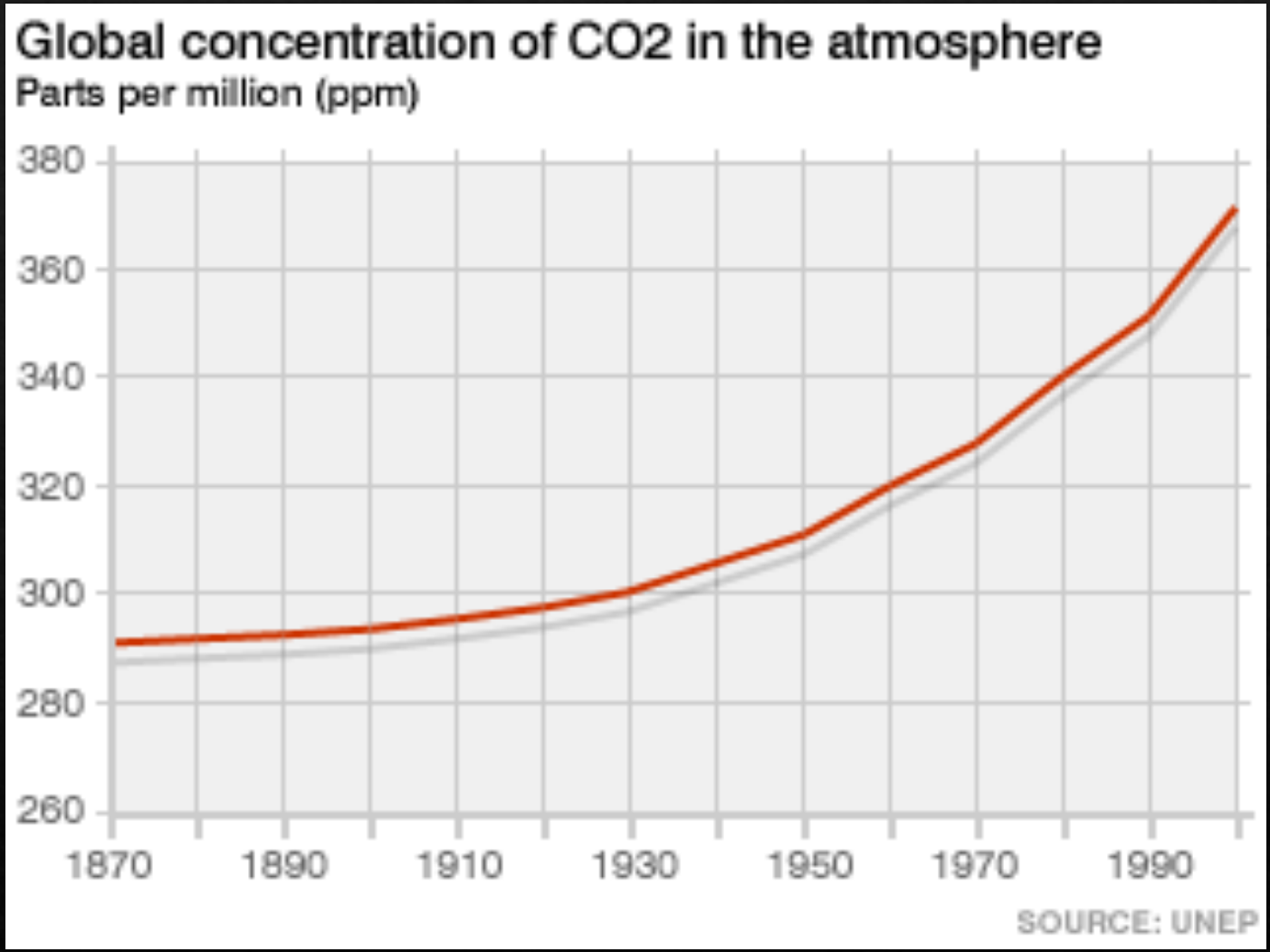
Keeling Curve



Rising level of atmospheric CO2 concentration

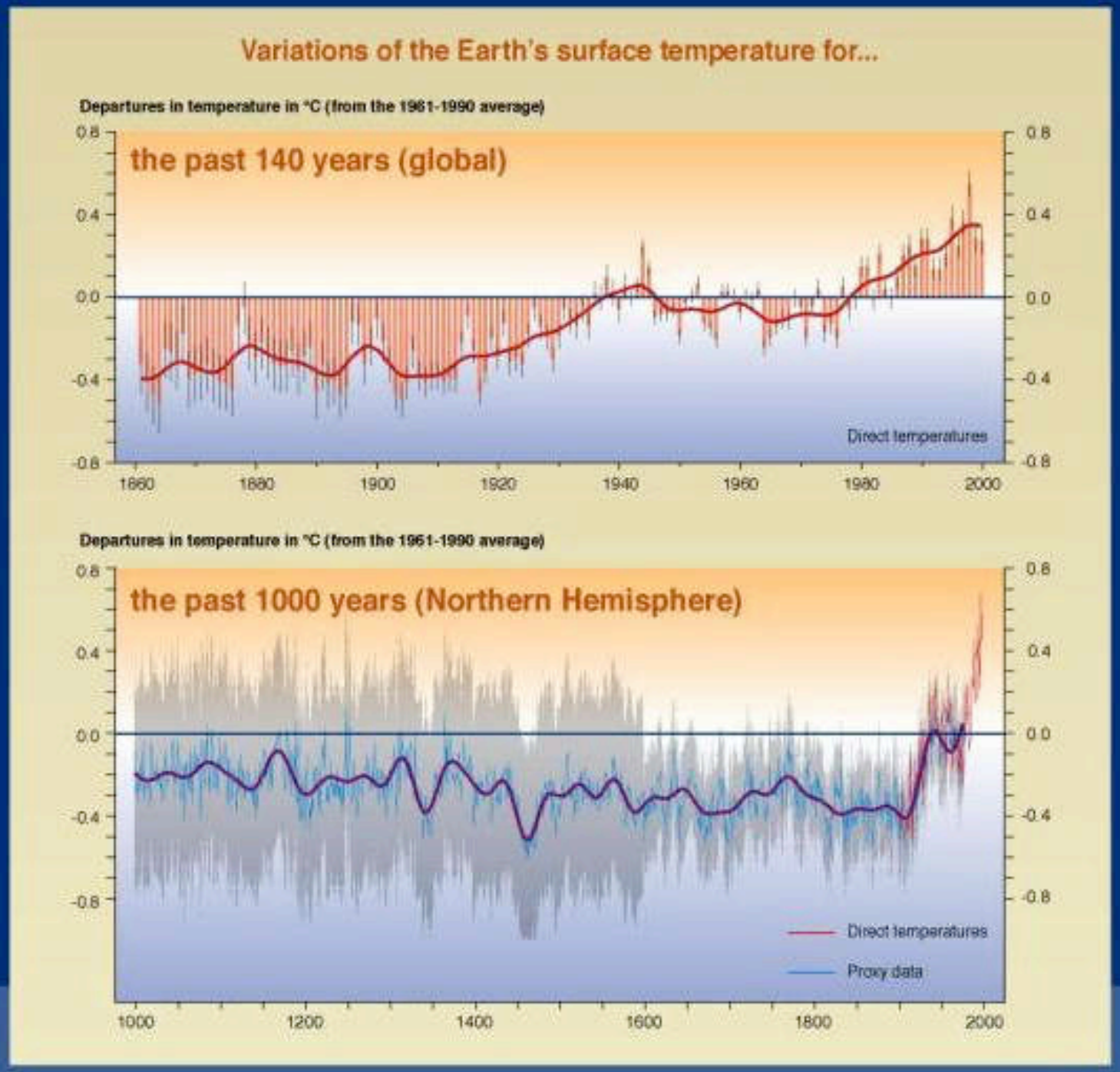
- Mean global atmospheric CO2 concentration has increased from 280ppm in 1700s to **390ppm in 2011**

- This is 40% more than before the industrial revolution



Emissions cause global warming

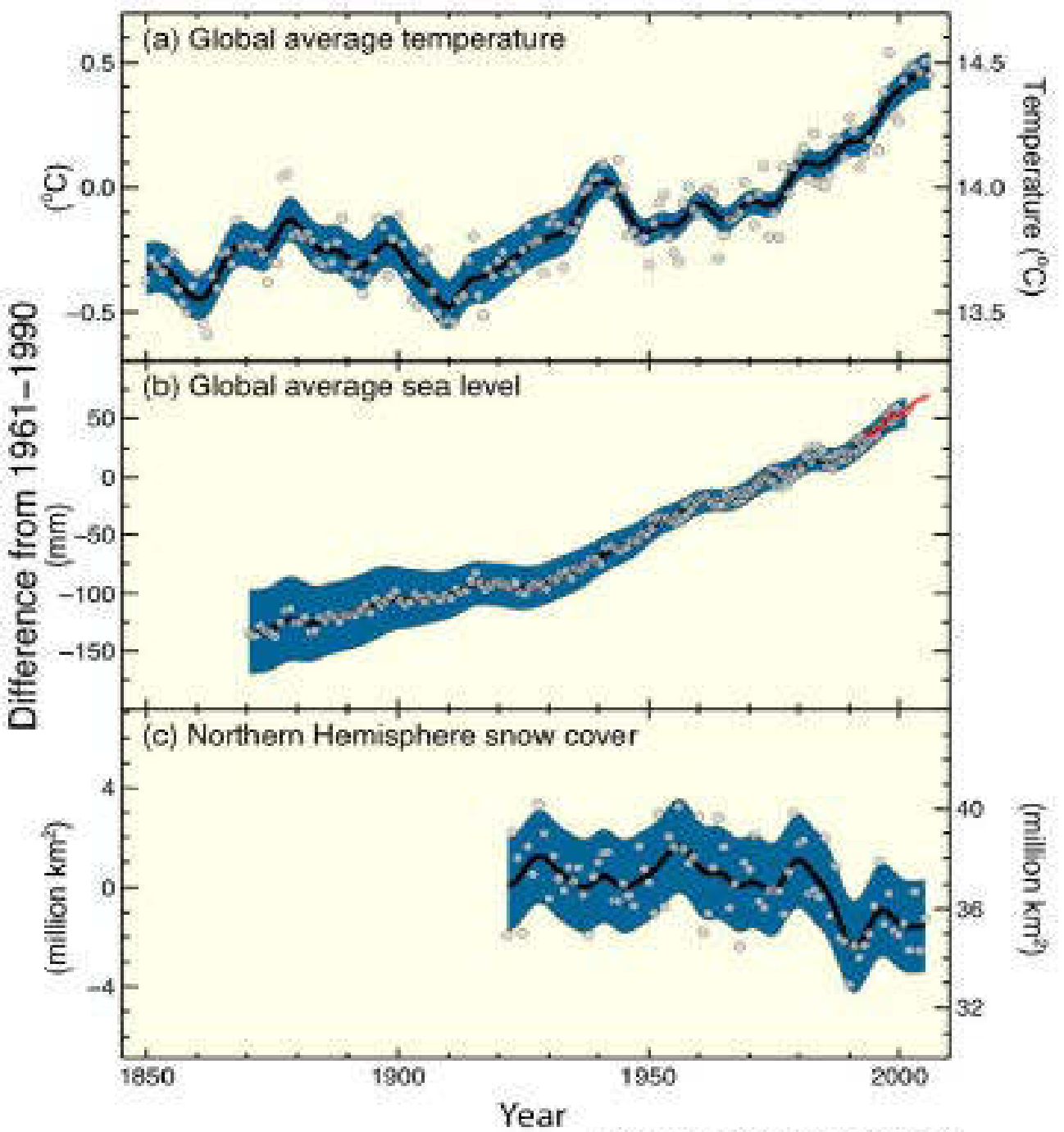
The rate of increase in global average temperature is accelerating from about 0.07 C per decade over the past 100 years to 0.17 ° C per decade over the past 10 years or so.



Observed changes in global average temp (IPCC, 3rd Report, 2001, Fig 2.3)

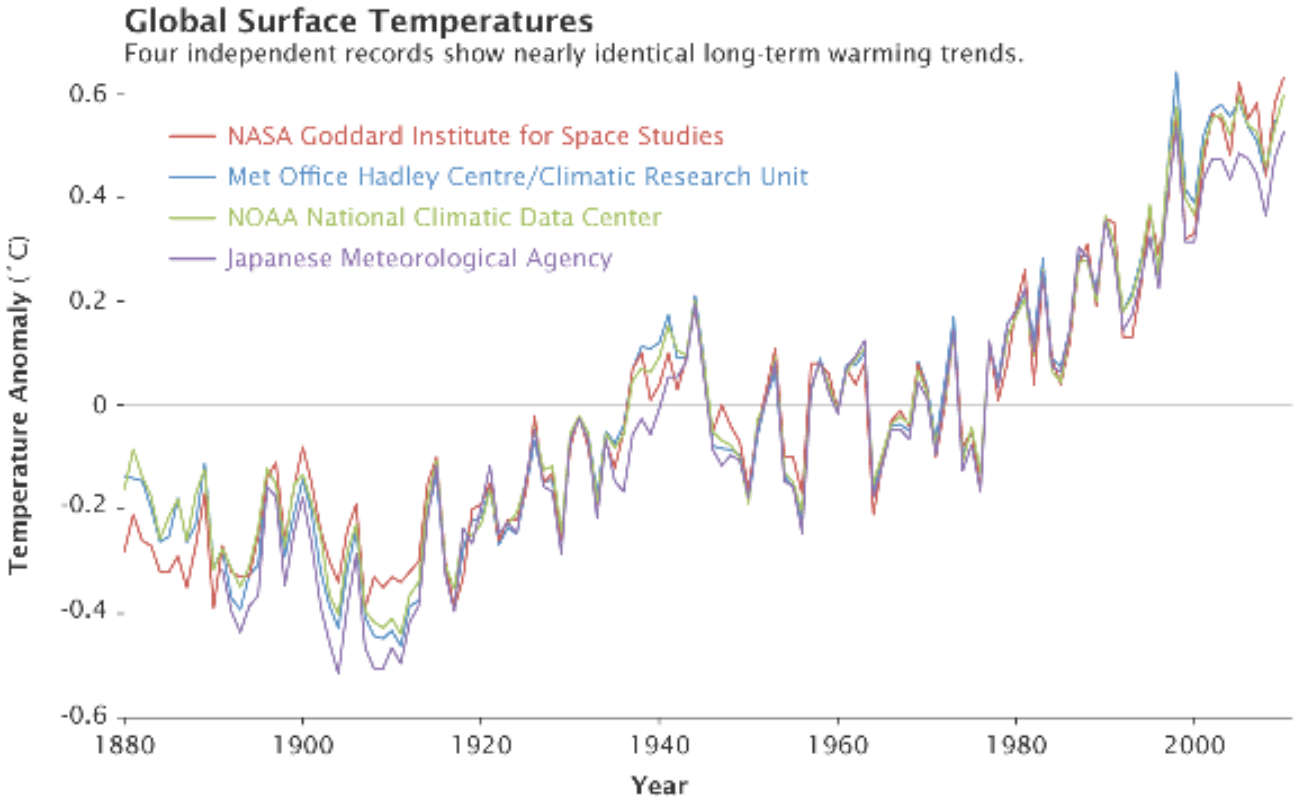
Scientific evidence

- Rise in global average temperature
- Rise in global mean sea level
- Melting of glaciers
- Disappearance of snow caps and ice sheets
- Extreme events



(IPCC, 2007, Fig. SPM-3)

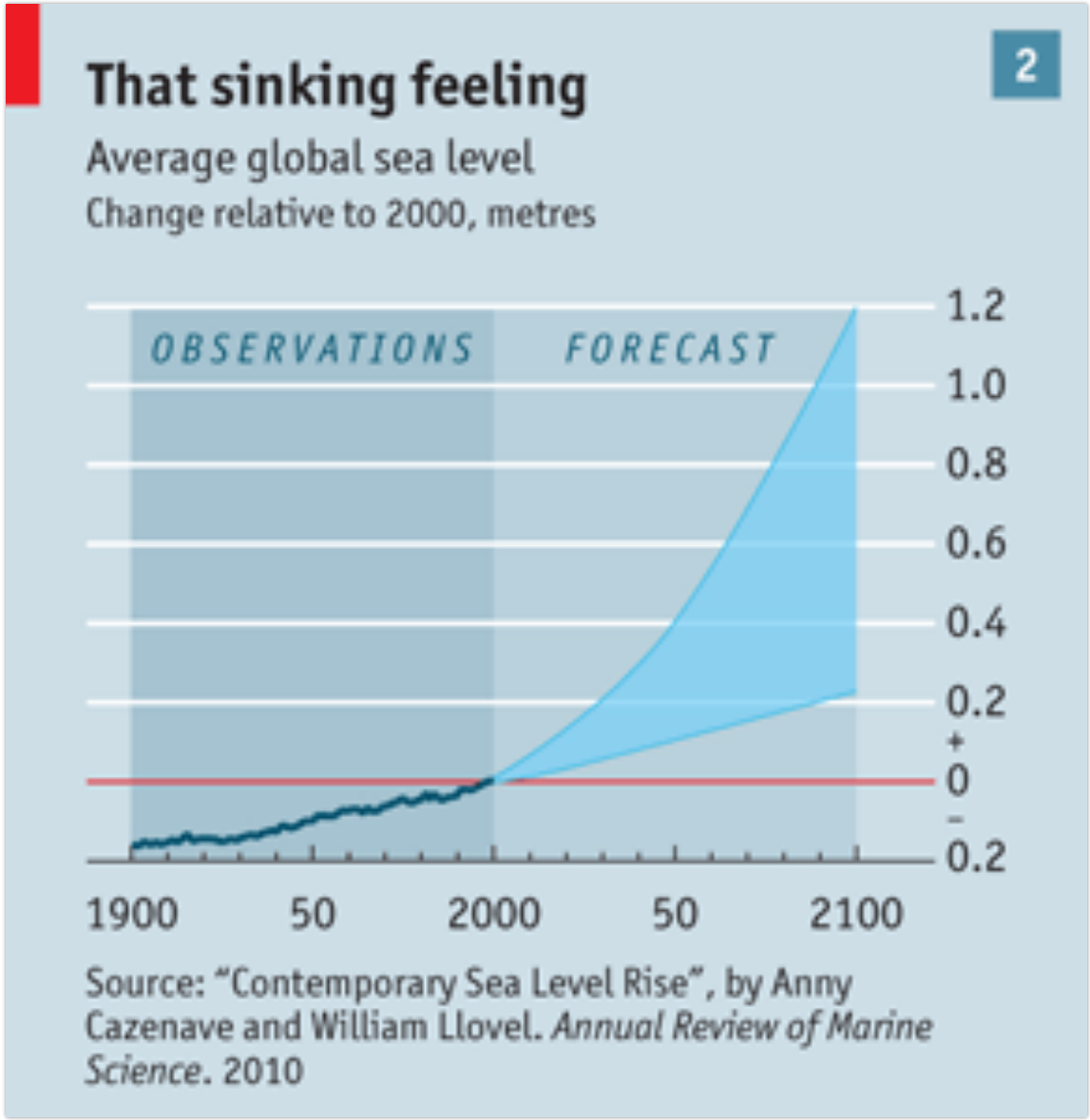
Different data sets produce similar results



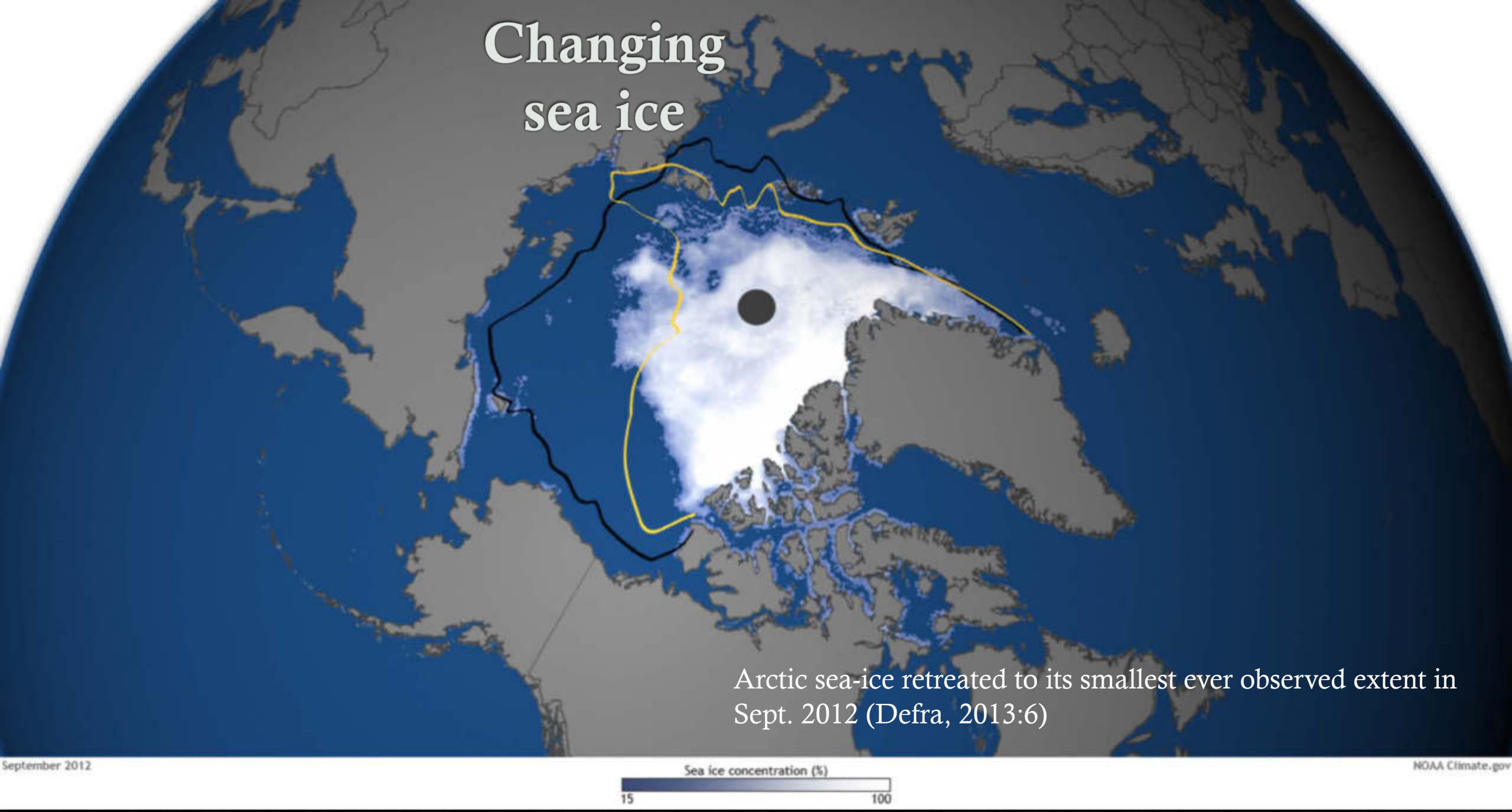
Sea level rise

Satellite measures show global mean sea level is rising by over 3 millimetres per year and accelerating

A sea level rise of up to 1.2m above the 1990 level is expected by 2100.



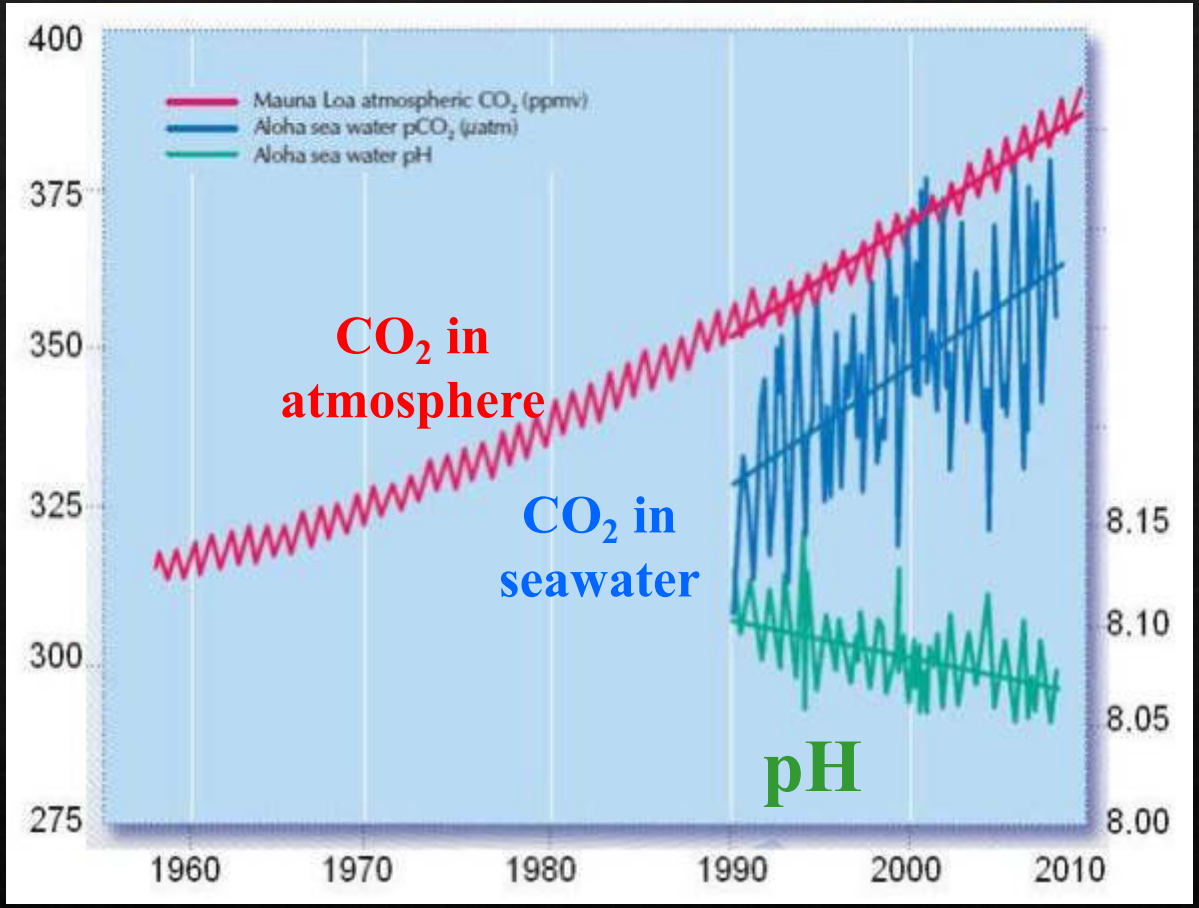
Changing sea ice



Arctic sea-ice retreated to its smallest ever observed extent in Sept. 2012 (Defra, 2013:6)

Ocean acidification

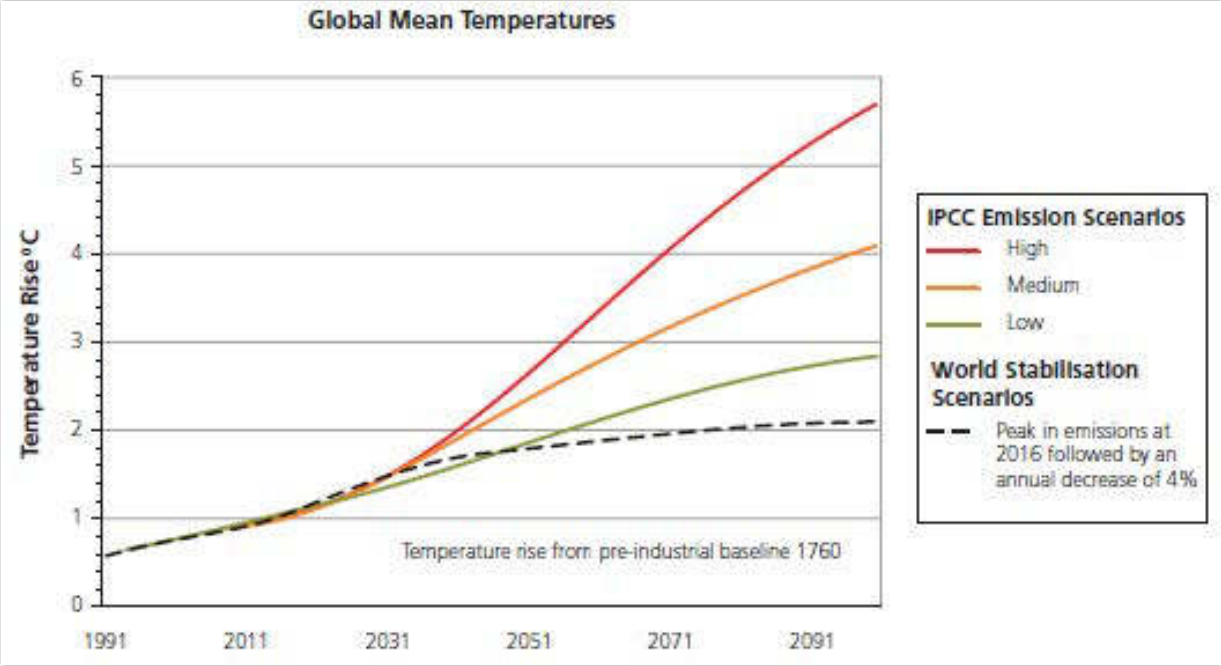
CO_2 levels ppm



pH

- A decrease in surface ocean pH by an average of **0.1 units since 1750**.
- Observations of pH for the last 20 years show trends of decreasing pH at a rate of **0.02 pH units per decade**.

Projected rise in global mean temperatures by 2100: 1.5 to 4.5 °C above the level in 1850-1900



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Part 2

Adapt or mitigate

Stabilizing emissions and avoiding a 2C temperature rise

for… **we need to…** **this means…**

Mitigation, avoiding the unmanageable

Adaptation, managing the unavoidable

The '2C' mitigation challenge!

Requires **fundamental changes** to the ways in which energy is produced and used

"Two degrees is a wishful dream" (Bob Watson, former UK head of IPCC and DEFRA's former Chief Scientist)

Mitigation mechanisms

- Intervention to reduce emissions of GHG to the atmosphere by:
  - Reducing GHG sources and emissions
  - enhancing GHG sinks (trees, soil)

- Mitigating by managing supply and demand for energy:
  - Carbon capture
  - Renewable energy (wind, wave, sun)
  - Energy efficiency measures
  - New technologies

Case Study – The Thames Estuary 2100 Project

The need for adaptation

"Adaptation will be crucial in reducing vulnerability to climate change and is the only way to cope with the impacts that are inevitable over the next few decades…"

(Stern Review, 2006)

Types of adaptation

"Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." (IPCC)

Anticipatory adaptation or proactive adaptation:

adaptation that takes place before impacts of CC are observed

Autonomous adaptation or spontaneous adaptation:

adaptation that does not constitute a conscious response to climate change but is triggered by ecological changes in natural systems and by changes in human systems

Planned adaptation

the result of a deliberate policy decision, and most likely include action that is required to return to, maintain, or achieve, a desired state.

Maladaptation

Any changes in natural or human systems which inadvertently increase vulnerability to the hazards of climate change

An adaptation that does not reduce vulnerability and may increase them

Spending a disproportionate amount of effort and investment on adaptation beyond what is required

Vs

No regret adaptation

Activities which would provide immediate economic and environmental benefits and continue to be worthwhile regardless of future climate.

Activities that would be justified under all plausible future scenarios, including without climate change.

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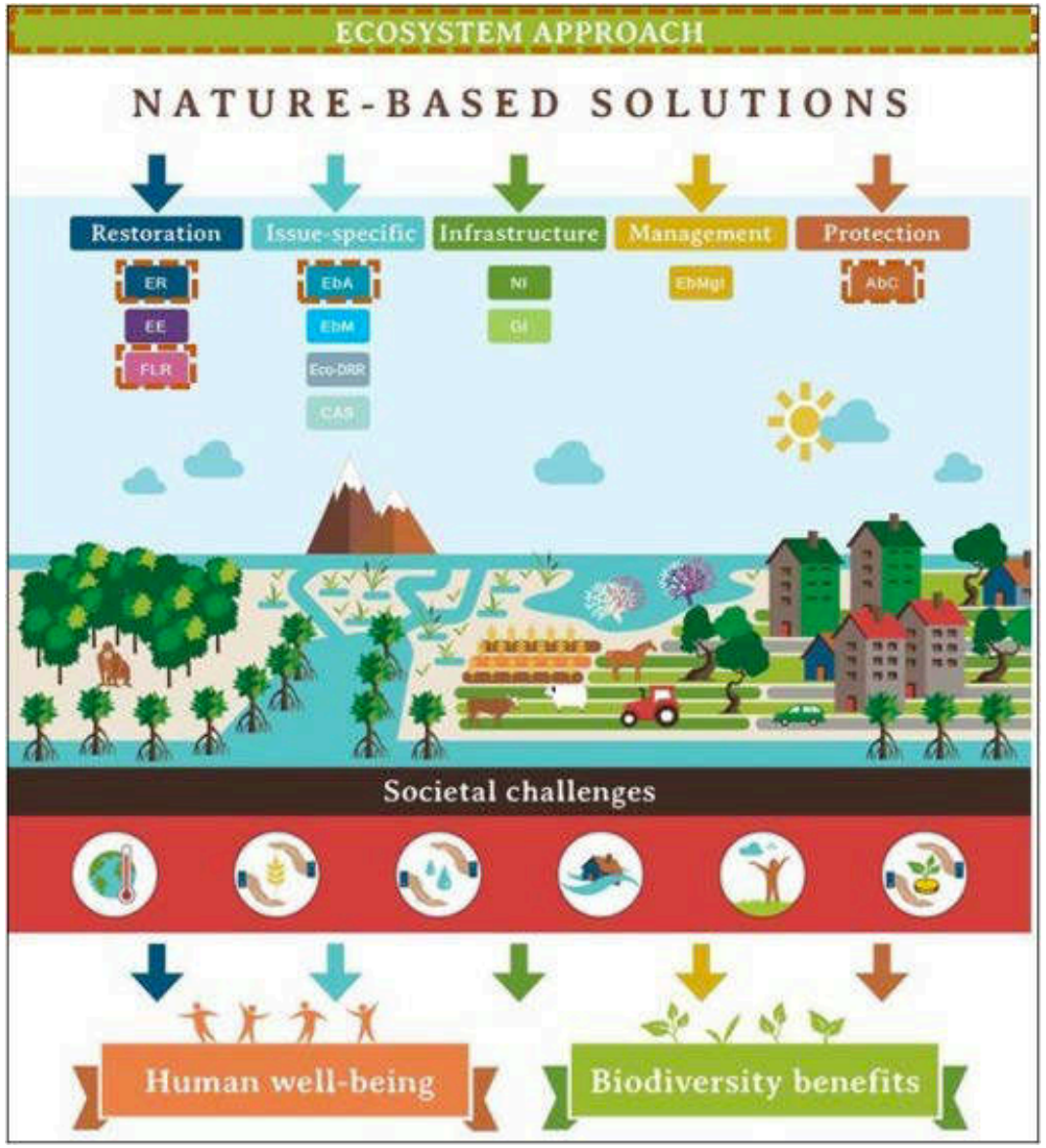
Part 3

What are nature based solutions


ECOSYSTEM APPROACH
NATURE-BASED SOLUTIONS
Restoration
Issue-specific
Infrastructure
Management
Protection
ER
EE
FLR
EbA
EbM
Eco-DRR
CAS
NI
GI
EbMgt
AbG
Societal challenges
Human well-being
Biodiversity benefits

- **Nature-based Solutions** (NbS) are defined by IUCN as "actions to protect, sustainably manage, and restore **natural** or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

The ideal NBS

- Should be a ‘no regret’ adaptation
- Should fit one or more of these criteria
  - **Anticipatory**
  - **Proactive**
  - **Planned**

Part 4

Five Nature based solutions that meet the criteria

Adaptation actions that have consequences for mitigation	Mitigation actions that have consequences for adaptation
•Individual responses to climatic hazards that increase or decrease GHG emissions •More efficient use of water, land, forests •Natural resources managed to sustain livelihoods •Tourism use of energy and water, with outcomes for incomes and emissions •Resources used in adaptation, e.g. large-scale infrastructure, increase emissions	•More efficient energy use and renewable sources that promote local development •Projects on land use or energy use that support local economies and livelihoods •Health benefits of mitigation through reduced environmental stresses •Afforestation, leading to depleted water resources and other ecosystem effects, with consequences for livelihoods
Decisions that include trade-offs or synergies between adaptation and mitigation	**Processes that have consequences for both adaptation and mitigation**
•Public sector funding and budgetary processes that allocate funding to both adaptation and mitigation •Strategic planning related to development pathways (scenarios) to mainstream climate responses •Stabilisation target that include limits to adaptation	•Cultural values that promote both adaptation and mitigation, e.g. culturally valued forests •Management of socio-ecological systems to promote resilience •Ecological impacts, with some human element, drive further releases of GHGs •Legal implications of liability for climate impacts motivates mitigation

Klein, Huq et al. 2007, p.762

Mitigation Adaptation	Actions decreasing GHG emissions, enhancing sinks, protecting carbon stocks	Actions enhancing GHG emissions, reducing sinks, destroying carbon stocks
Actions decreasing exposure and sensitivity to climate change	***Synergies (SD goals)*** •Increase energy efficiency/reduce energy dependency •Increase water use efficiency/reduce water consumption •Protect soils, plant trees, develop agro-forestry (carbon storage) •Enhance ecosystem resilience by reduced air pollution •Design appropriate building codes / standards	***Trade-offs of adaptation (adaptive emissions)*** •Use fossil-based electricity for air-conditioning, cooling of buildings and water supply •Strengthen coastal protection infrastructure •Expand fossil-fuel energised irrigation of lands •Adapting temperate farmers competing with tropical farmers •Expand crop area/number of annual crops to capture benefits of warming in relevant areas
Actions increasing exposure and sensitivity to climate change	***Trade-offs of mitigation (new vulnerabilities)*** •Building low-emissions facilities in vulnerable areas •Implement mitigation policies with costs that affect income of the vulnerable poor •Establish large-scale biofuel production driving locals to vulnerable areas •Include adaptation in development aid or research at expense of mitigation	***Actions contributing to unsustainable development*** •Destroy forests, emitting carbon and increasing vulnerability to drought •Develop urban areas in low-lying areas with little natural cooling or long travel distances, and high vulnerability to flooding

Swart and Raes, 2007

Sustainable urban drainage

Renaturing cities

Urban forestry

Green infrastructures

Ecosystem restoration

Thank you

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