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MALAYSIA IMPROVING FOREST GOVERNANCE COURSE

Introduction to Climate Change

UNIVERSITY OF WOLVERHAMPTON
KNOWLEDGE • INNOVATION • ENTERPRISE

In this session

1) **Why** is the climate changing?
2) What are the **impacts** of climate change?
3) What is **Climate Vulnerability?**
4) What is the relationship between **Forests and Climate Change** related?
5) How can we **respond** to climate change?
6) How can **REDD+** contribute to respond to Climate change?

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What is Climate Change?

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Weather or climate?

Weather: Short Timescales
"hours, days"

Climate: Long Timescales
"average over the past 30 years"

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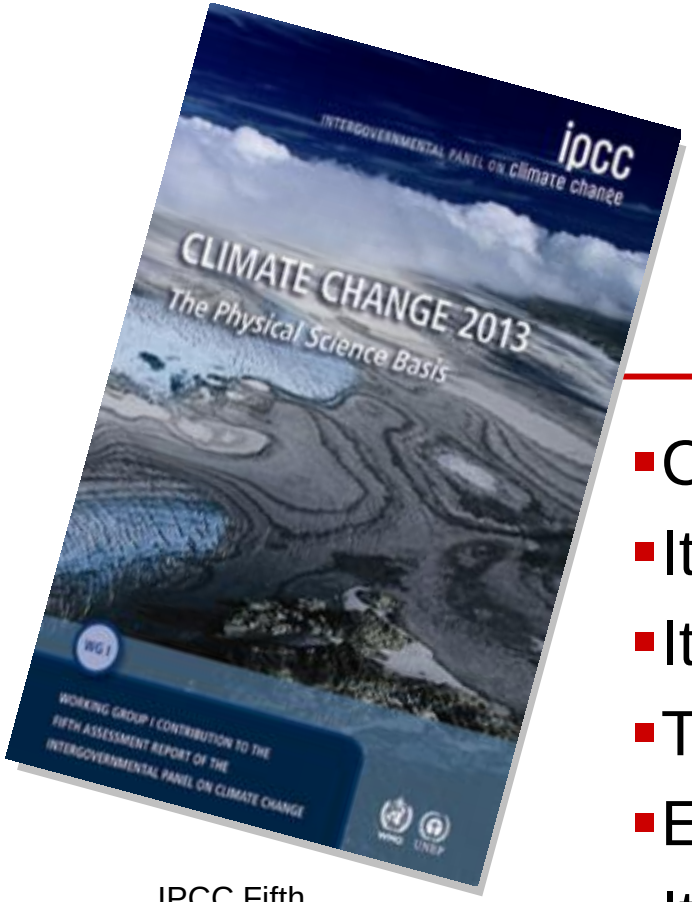
IPCC – the ‘key reference’ on climate change



IPCC Fifth Assessment Report, 2013

Main findings

- Climate change is already happening
- It is mostly caused by man
- It will continue
- The rate of change is alarming
- Extreme weather is getting more frequent
- It is urgent to stop further warming

First question: Why is it getting warmer?

Answer: The rapid global warming of the past 100 years is caused mostly by human activity, mainly:

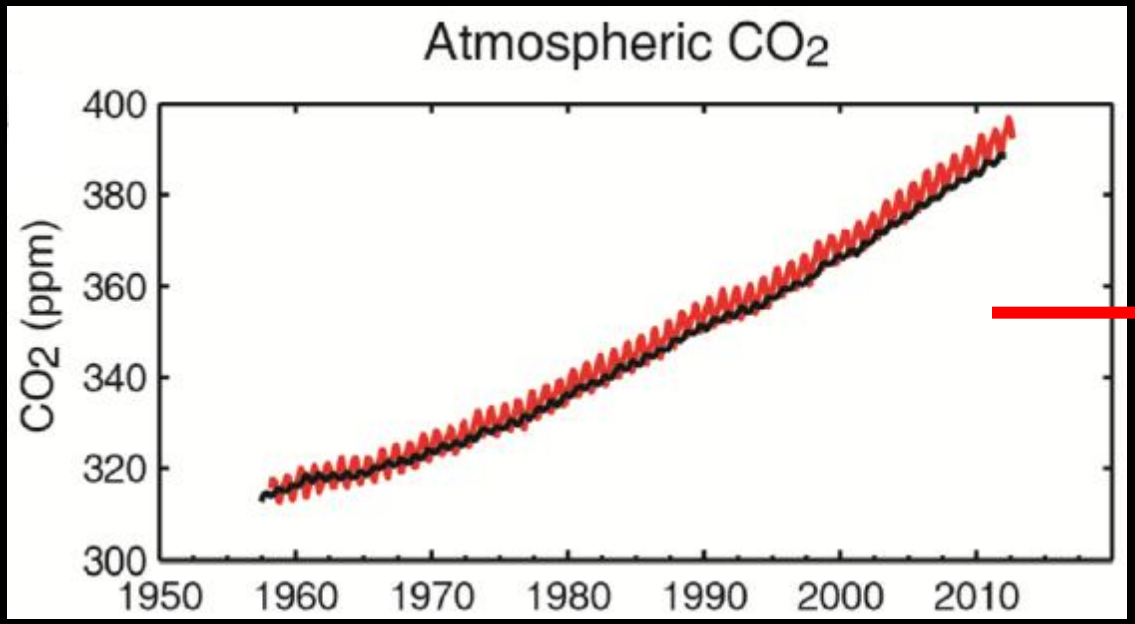
Burning fossil fuels (e.g. coal, oil, natural gas) at unprecedented rates, sending “greenhouse gases” into the atmosphere

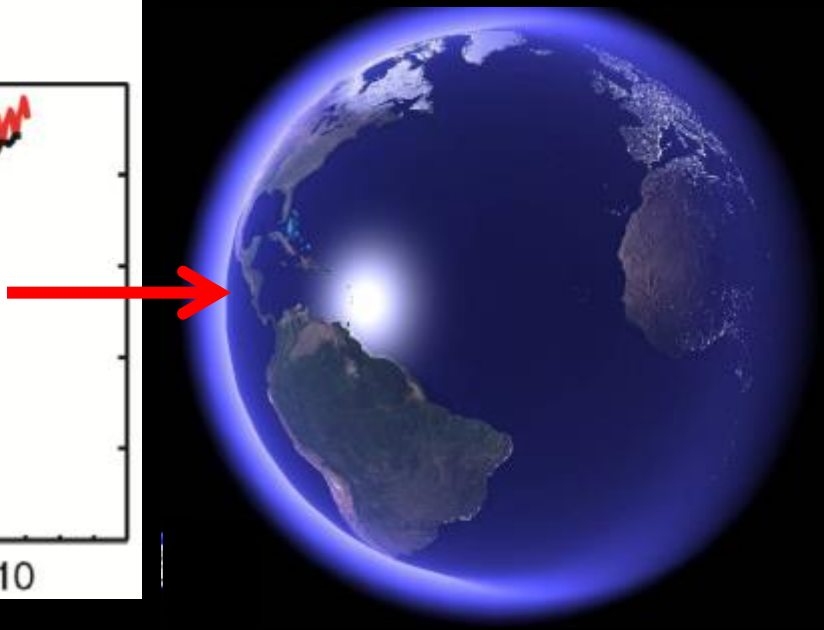
Widespread deforestation (trees contain a lot of carbon, and when burnt CO_2 is released)

Changing agricultural and land-use practices (agriculture releases other GHGs, CH_4 and NO_2)

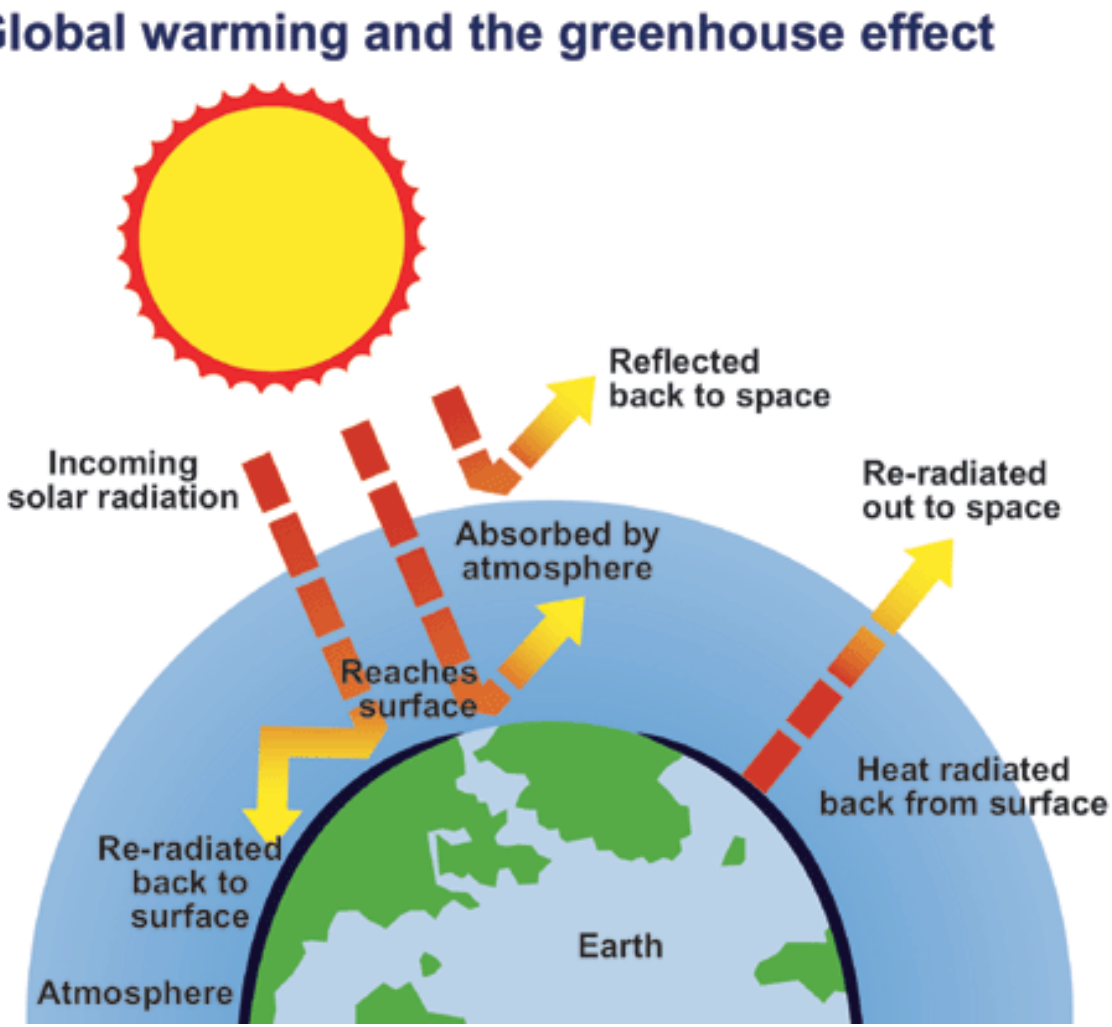
First question: *Why is it getting warmer?*

Greenhouse gases are acting as a blanket around the earth





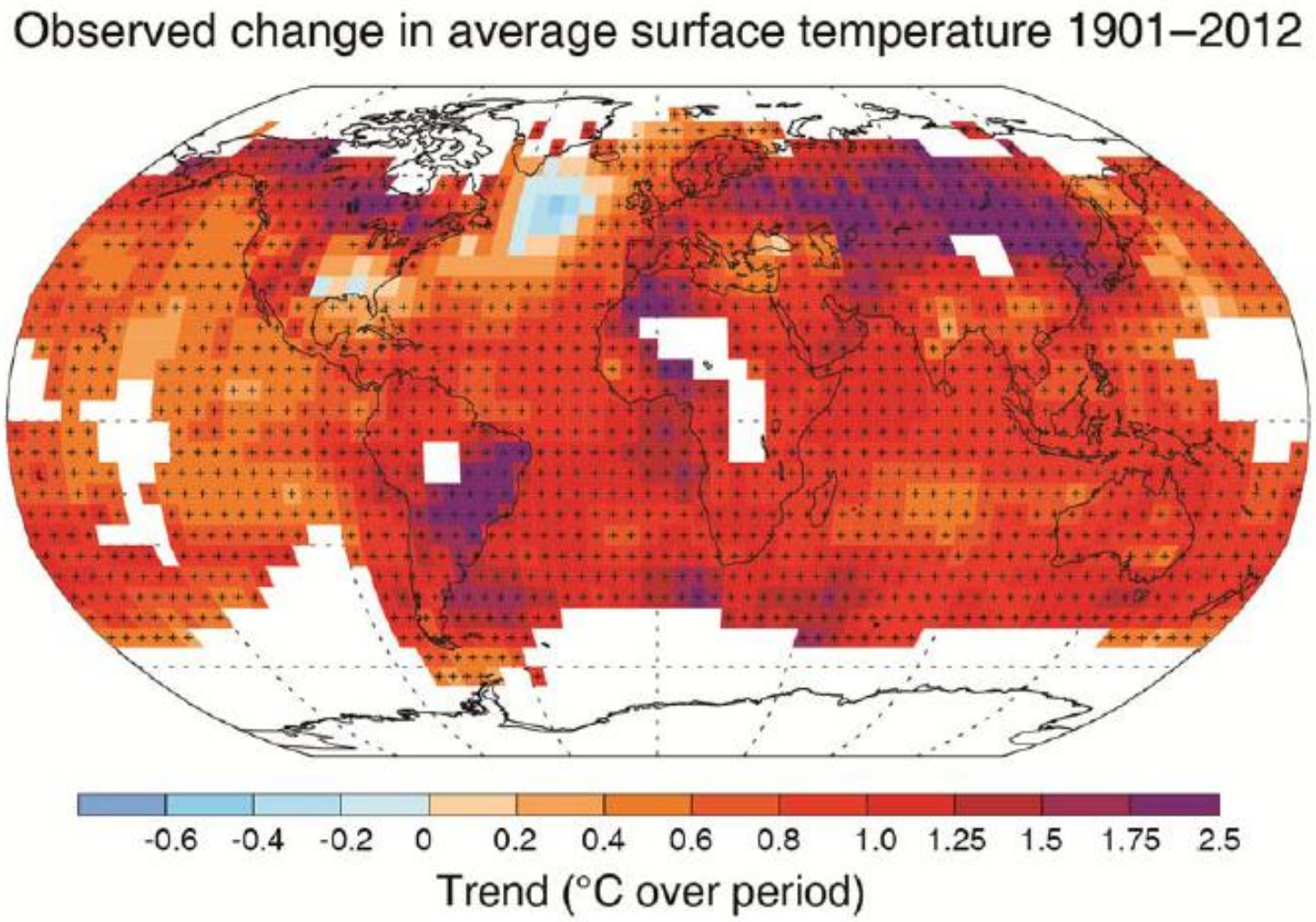
The Greenhouse Effect



Second Question: Along with the *GHG the earth is getting warmer – what does that mean?*

Rising temperatures, heat waves

It’s getting hotter…



Second Question: Along with the *GHG the earth is getting warmer – what does that mean?*

Rising temperatures, heat waves

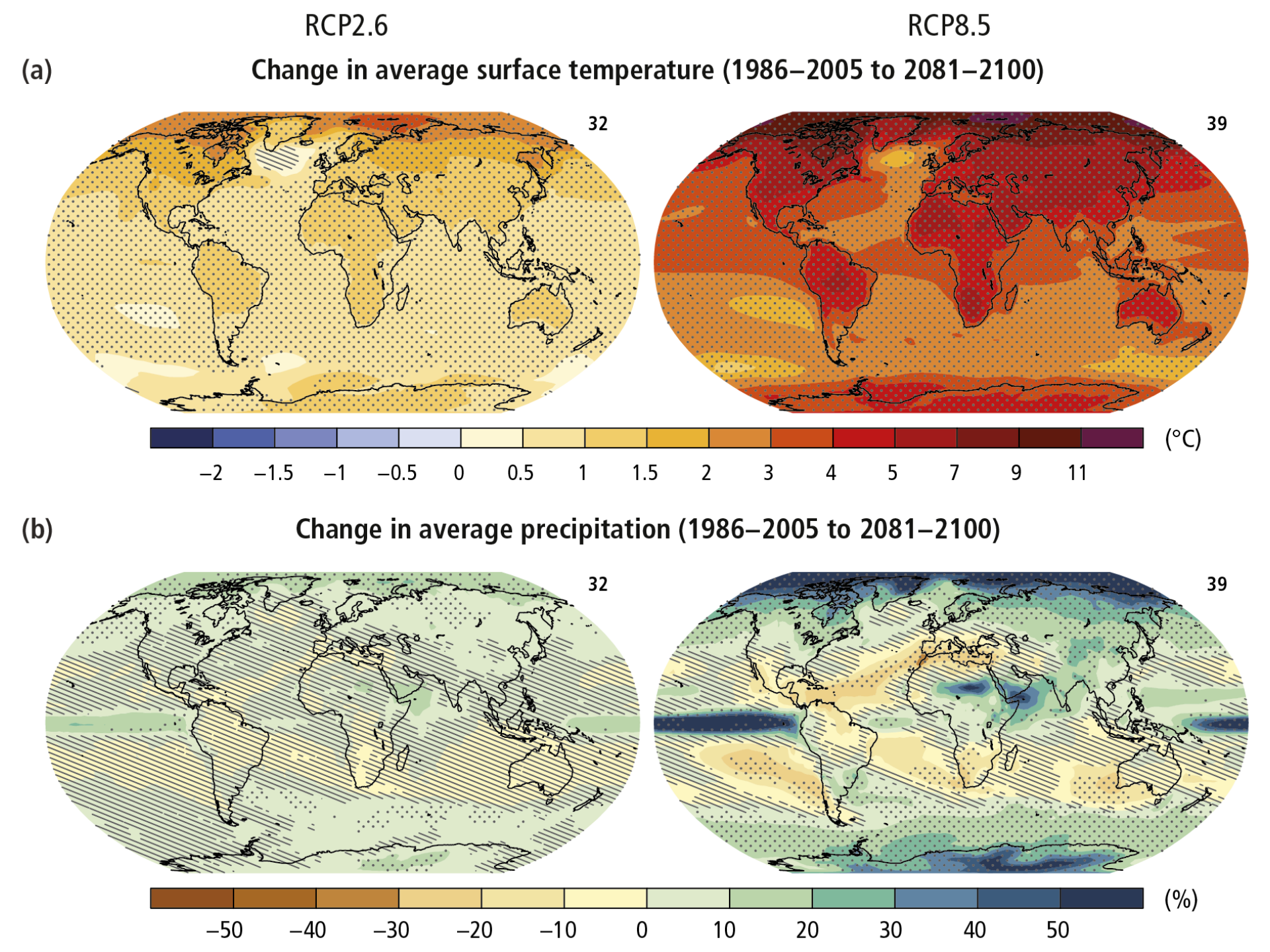
Sea level rise

Melting ice

Ocean acidification

Changing rainfall patterns

Changes in extreme events


RCP2.6
RCP8.5
(a)
Change in average surface temperature (1986–2005 to 2081–2100)
32
39
(°C)
–2 –1.5 –1 –0.5 0 0.5 1 1.5 2 3 4 5 7 9 11
(b)
Change in average precipitation (1986–2005 to 2081–2100)
32
39
(%)
–50 –40 –30 –20 –10 0 10 20 30 40 50

Second Question: Along with the *GHG the earth is getting warmer – what does that mean?*

Rising temperatures, heat waves

Sea level rise

Melting ice

Ocean acidification

Scientists very sure

Changing rainfall patterns

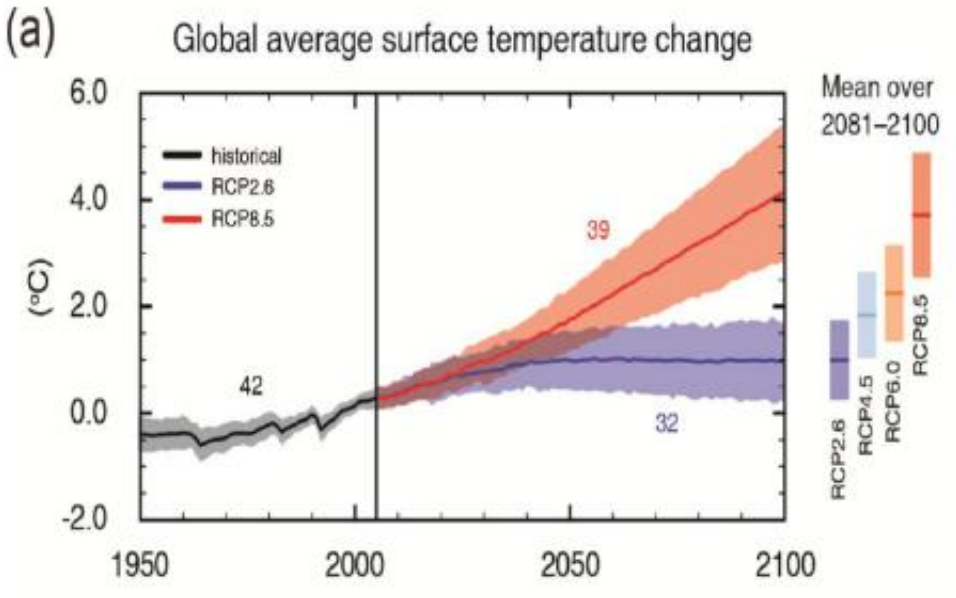
Changes in extreme events

Less clear, and regional differences

What do you think would happen if we stopped emitting CO_2 today?

Warming will continue, but how much is our choice

In the next few decades, temperatures will continue to rise, even if we almost completely stop emissions of GHGs today (blue line)



This is because GHGs, especially CO_2, stay in the atmosphere for a long time

Therefore, we have further climate change “in the pipeline” because of the emissions already in the atmosphere

Ocean acidification will not be reversed in short term, and will still affect marine ecosystems

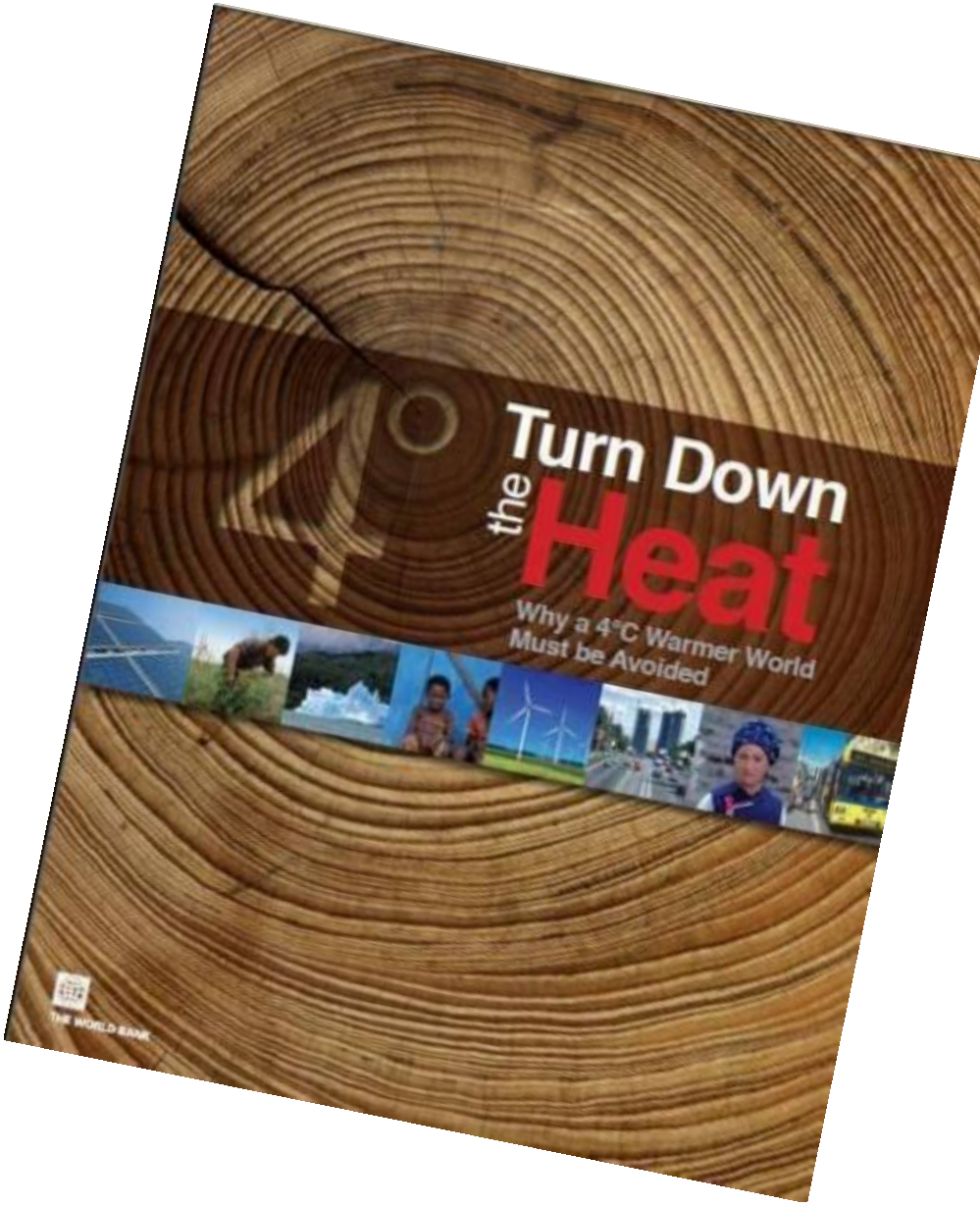
Sea level will continue for a long period due to the melting of the Greenland ice.

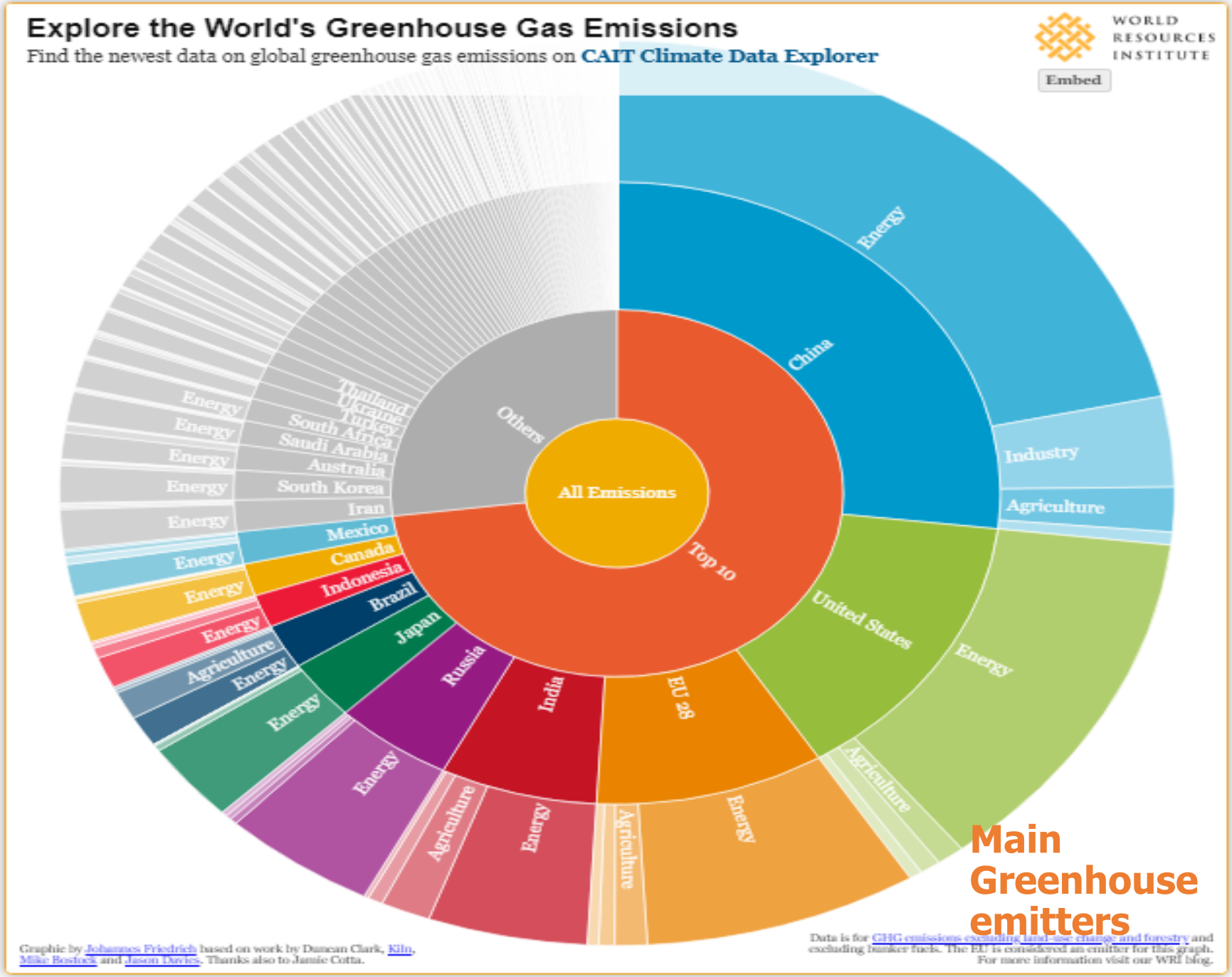
Scientist warnings are clear:

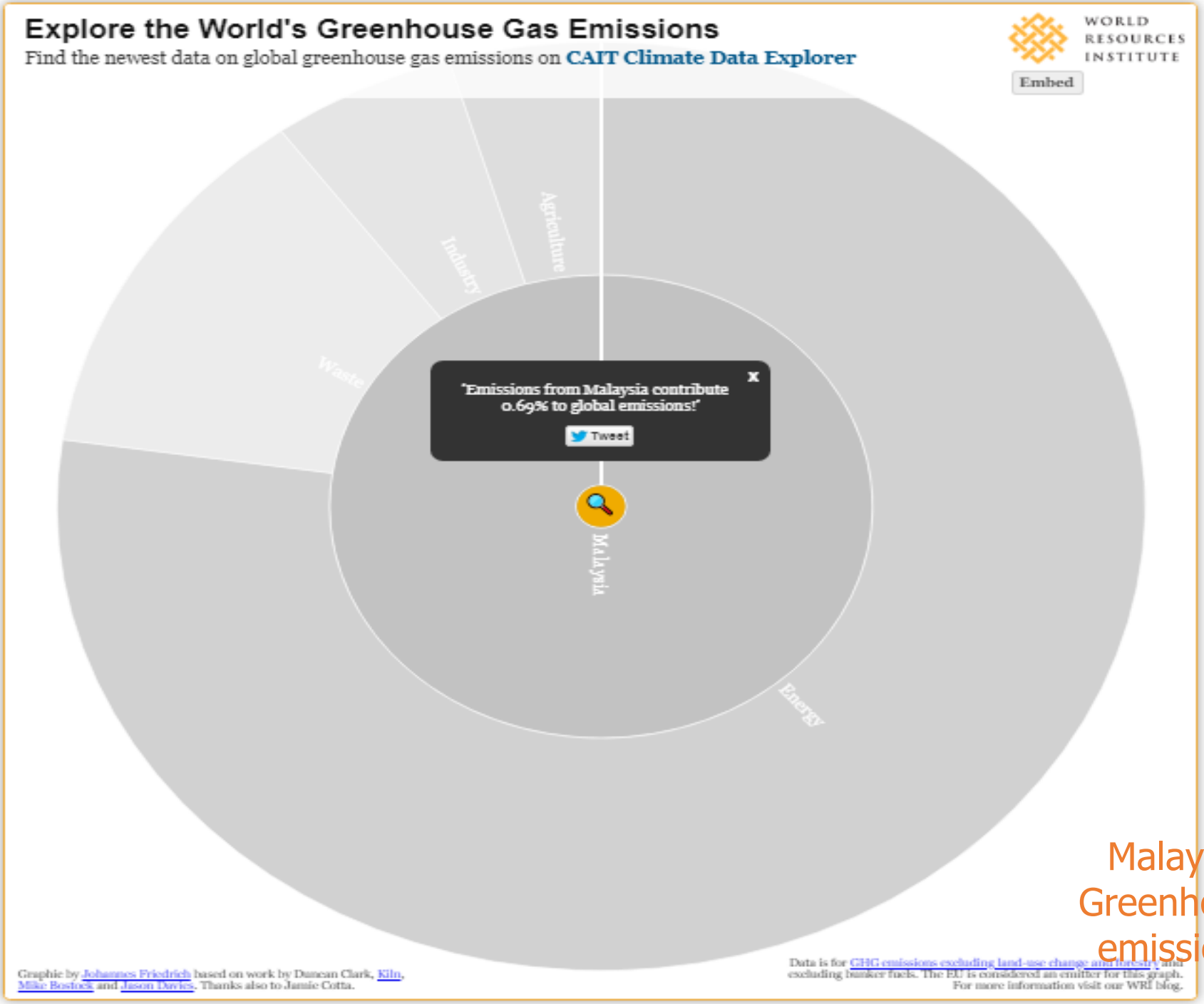
We should **avoid** more than a 2°Celsius **temperature rise** in the coming century

A 2012 World Bank report summarizes the potential effects of a 4° warmer world: **it's urgent** to limit GHG emissions

The **more we limit** GHG emissions now, the **less need for adaption** to a future wilder weather




Explore the World's Greenhouse Gas Emissions
Find the newest data on global greenhouse gas emissions on CAIT Climate Data Explorer
WORLD RESOURCES INSTITUTE
Embed
All Emissions
Top 10
Others
China
United States
EU 28
India
Russia
Japan
Brazil
Indonesia
Canada
Mexico
Iran
South Korea
Australia
Saudi Arabia
South Africa
Turkey
Ukraine
Thailand
Energy
Industry
Agriculture
Main Greenhouse emitters
Graphic by Johannes Friedrich based on work by Duncan Clark, Kiln, Mike Bostock and Jason Davies. Thanks also to Jamie Cotta.
Data is for GHG emissions excluding land-use change and forestry and excluding bunker fuels. The EU is considered an emitter for this graph.
For more information visit our WRI blog.

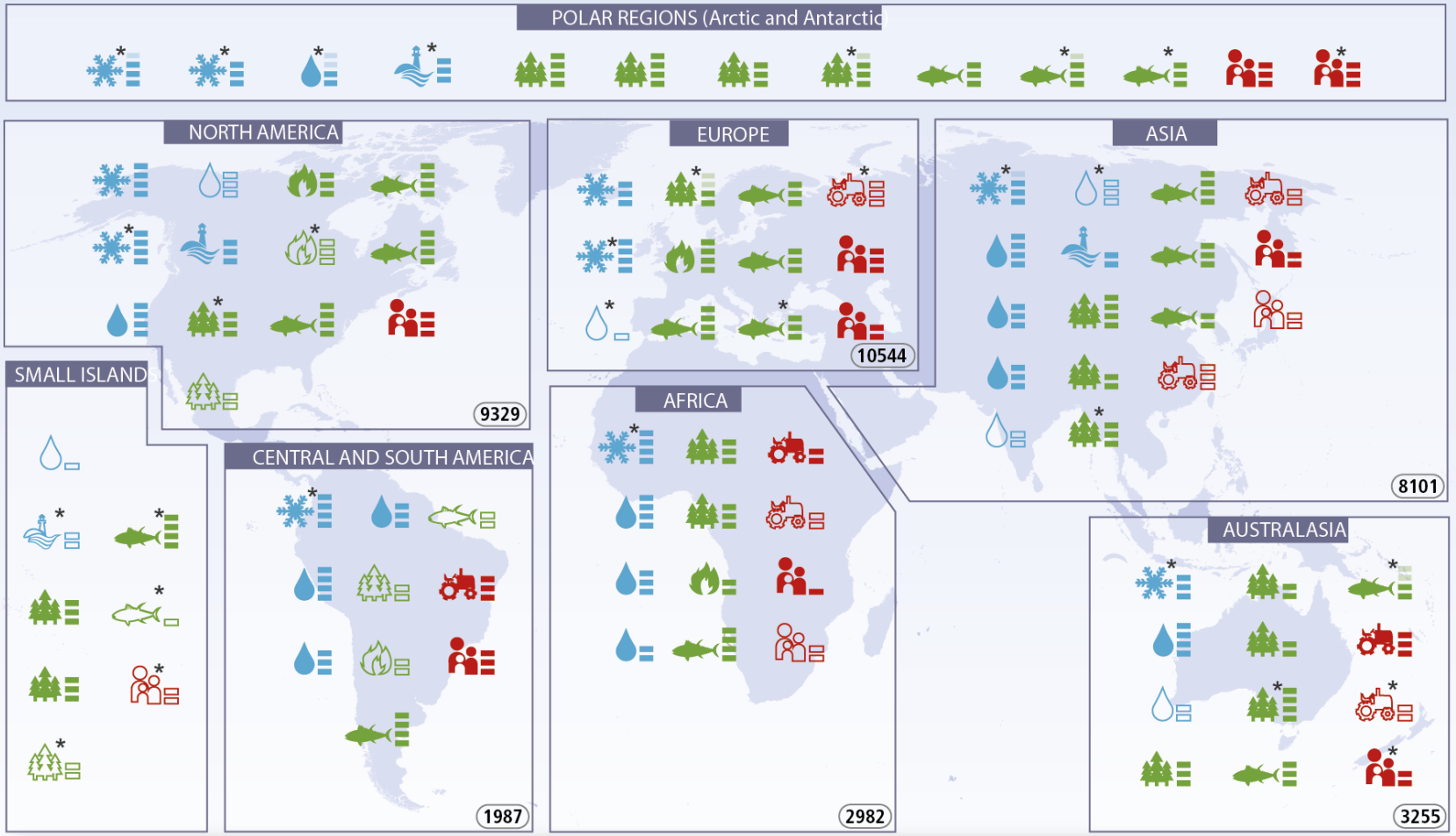


Malaysia Greenhouse emissions

https://www.youtube.com/watch?v=CQbOlI0YQNs

Impacts of Climate Change

Widespread impacts attributed to climate change based on the available scientific literature since the AR4



Confidence in attribution to climate change

very low | low | med | high | very high

⌋ indicates confidence range

Observed impacts attributed to climate change for

Physical systems
- Glaciers, snow, ice and/or permafrost
- Rivers, lakes, floods and/or drought
- Coastal erosion and/or sea level effects

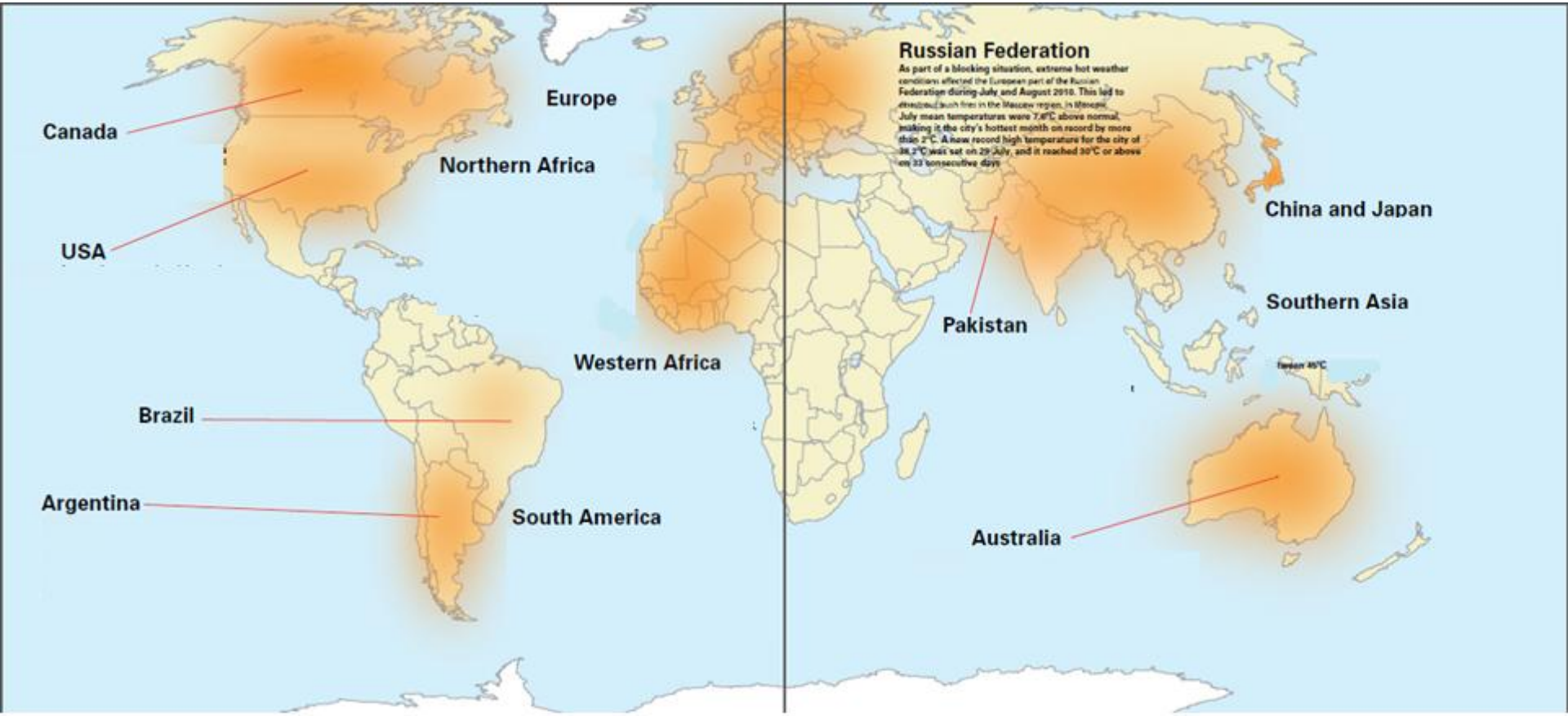
Biological systems
- Terrestrial ecosystems
- Wildfire
- Marine ecosystems

Human and managed systems
- Food production
- Livelihoods, health and/or economics

* Impacts identified based on availability of studies across a region

Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

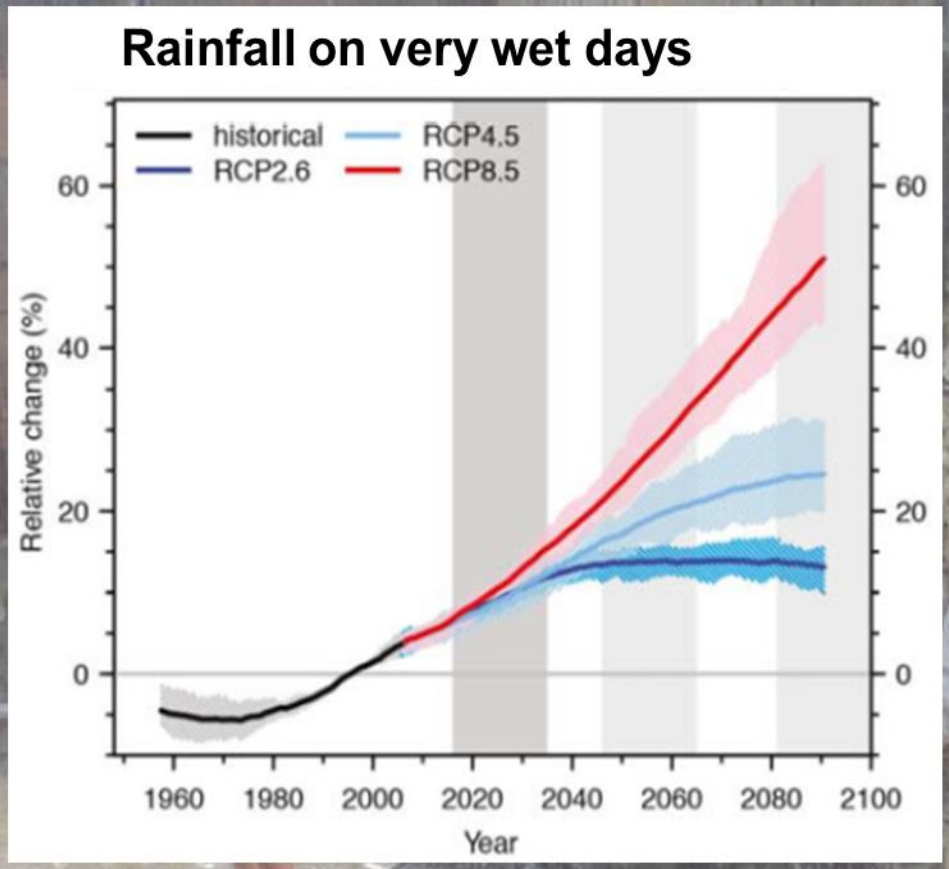
Potential impact: Rising temperatures



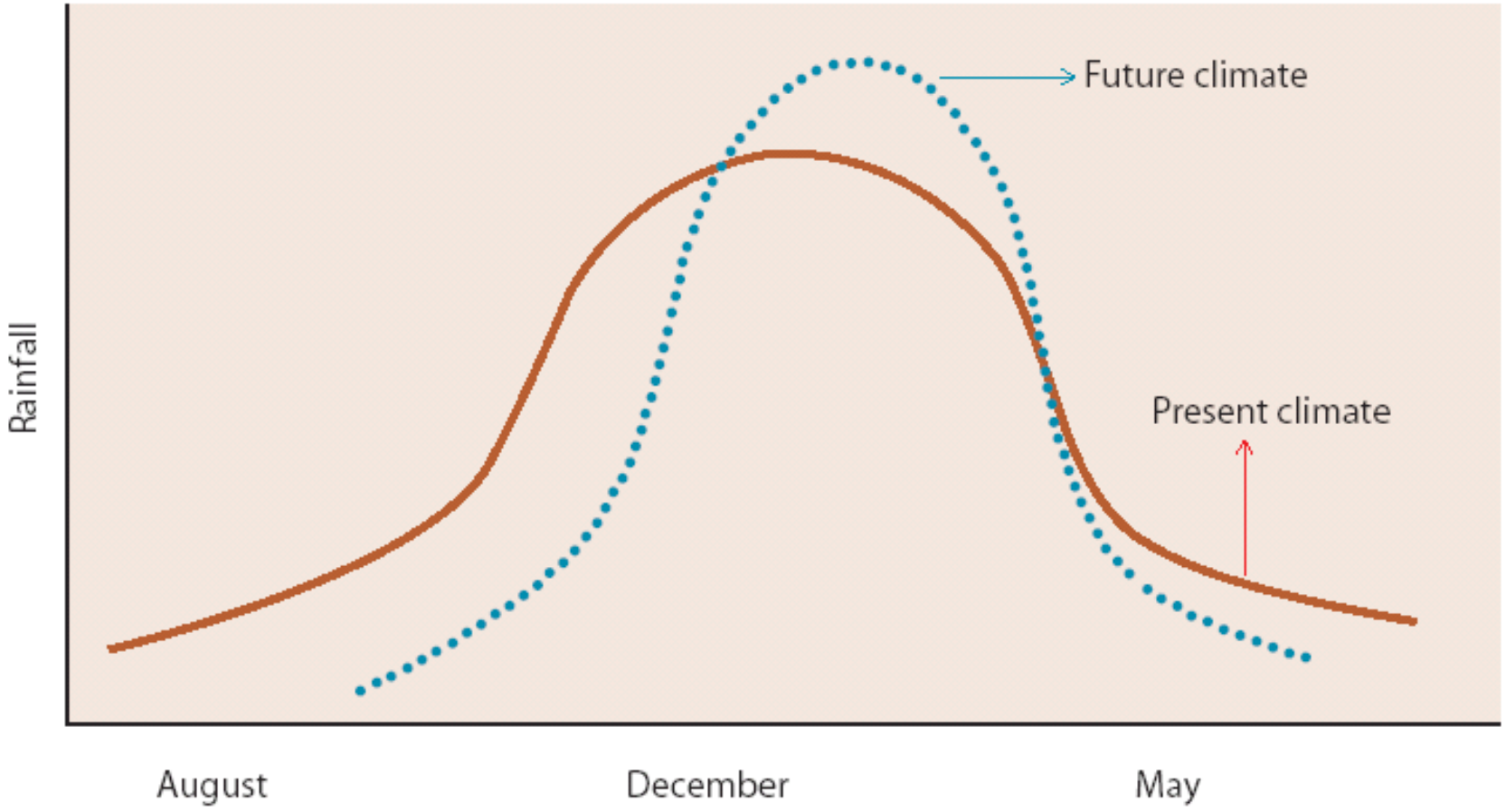
Heat waves: Rising temperatures lead not only to changes of **average temperature** but also to **weather extremes.**

Potential impact: Changing rainfall patterns

- Rainfall seasons around the world might shift → **major implications for global agriculture**
- Amount of rainfall in each region might change
- Number of extremely rainy events might increase in many places → **changes in floods and water flows**
- Other places could see an increased number/duration of dry spells → **water stress for vulnerable populations**



Shift in *seasonality* as important as *amount*



Potential impact: Floods

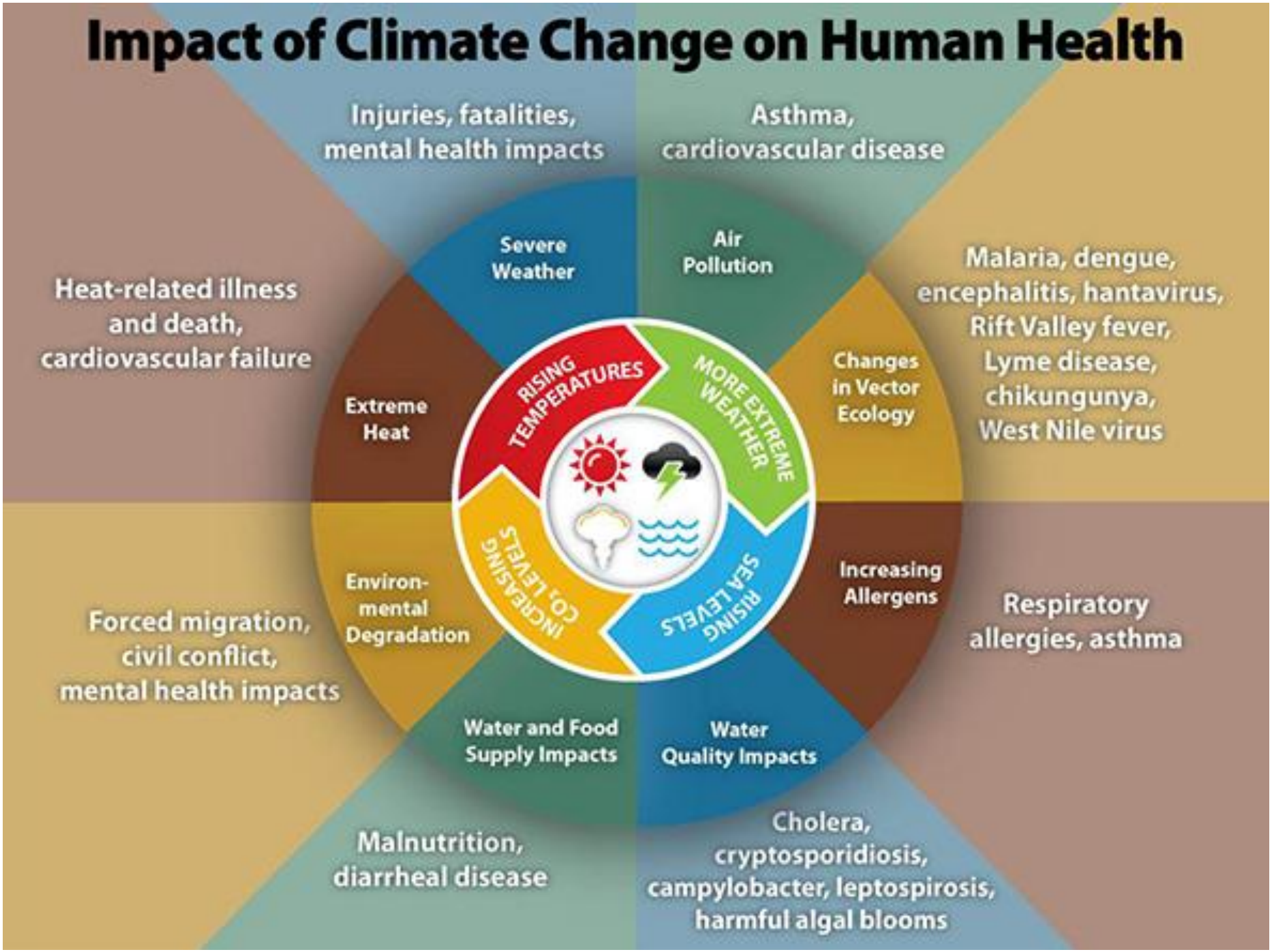
- Difficult to measure the frequency and intensity of floods, but generally there has been an increasing trend
- Changes in rainfall patterns and precipitation intensity could put more people at risk from flooding

Potential impact: Coastal erosion, coastal flooding and salt water intrusion

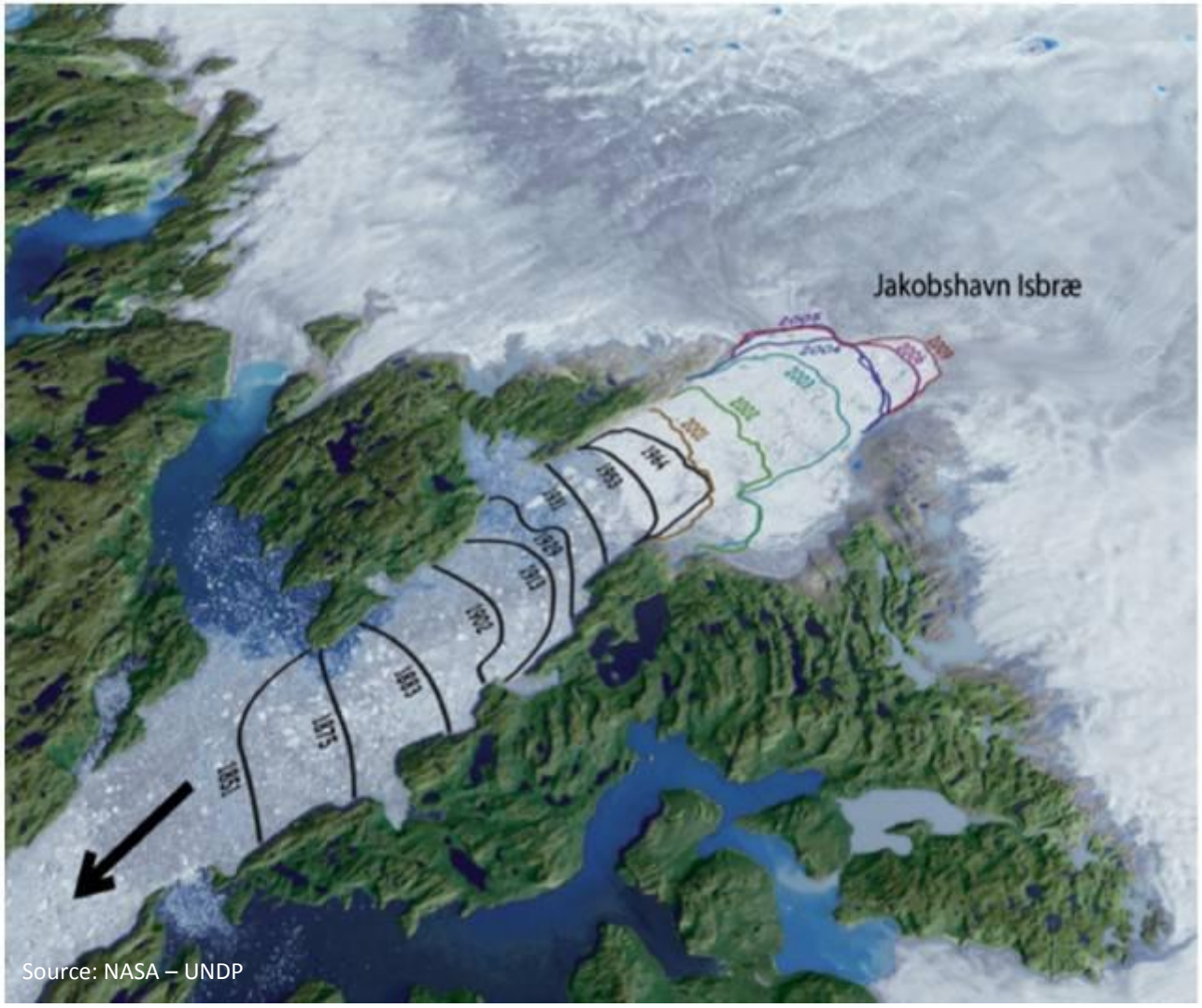
Potential impact: Drought

Possible impact: Increased food insecurity

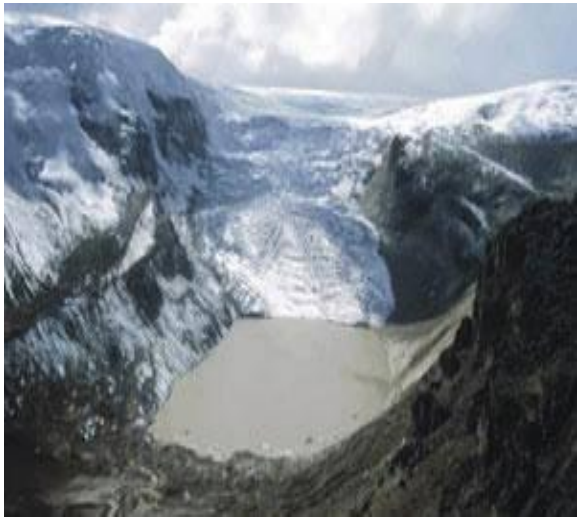
Impact of Climate Change on Human Health



Potential impact: Melting ice

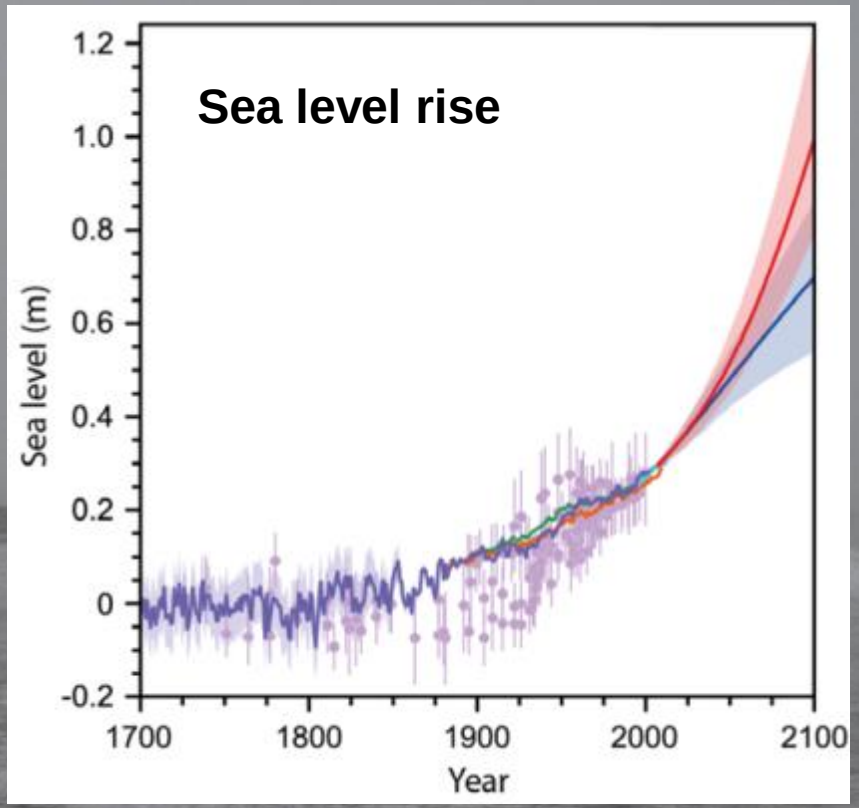


Source: NASA – UNDP



Potential impacts: Oceanic changes

- Sea levels are rising – at a faster rate
- Ice on land melts



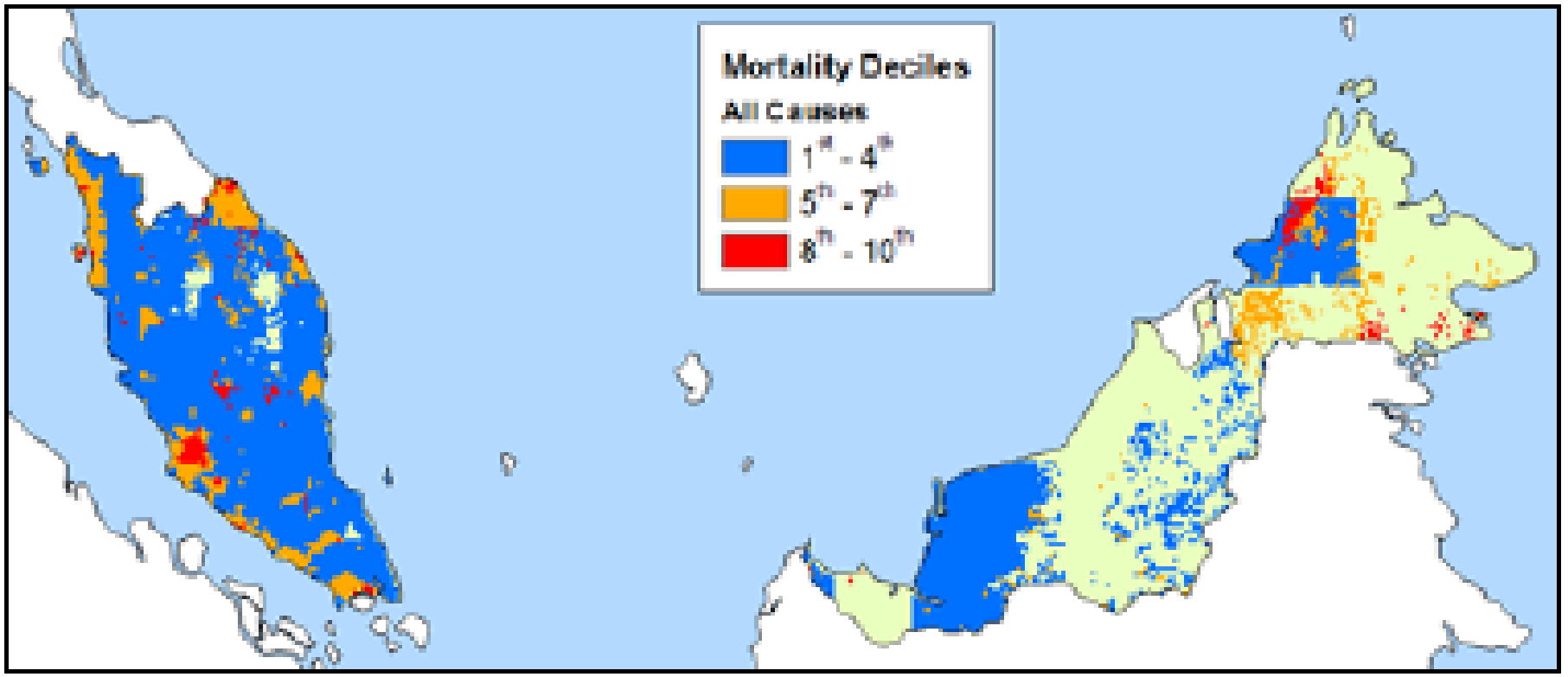
Potential impacts: Oceanic changes

... and fish stocks decline, eroding livelihoods for millions of people

Ocean acidification damages coral reefs – reducing their coastal protection effects

Potential impact: tropical cyclones impacts

- Possibly an increase in the intensity of tropical cyclone activity (hurricanes/typhoons), coupled with higher storm surges due to sea level rise
- → economic/human losses are expected to increase



EM-DAT Information (1965-2004):

Disaster	*# of Events*	*Total Killed*	*Avg. # Killed*	*Total Affected*	*Avg. # Affected*
Cyclone	*6*	*294*	*49*	*55,805*	*9,301*
Drought	*1*	*0*	*0*	*5,000*	*5,000*
Earthquake	-	-	-	-	-
Flood	*24*	*243*	*10*	*899,620*	*37,484*
Volcano	-	-	-	-	-

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Vulnerability

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Vulnerability

Vulnerability is ‘the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

Vulnerability is determined by the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system

Components of Vulnerability

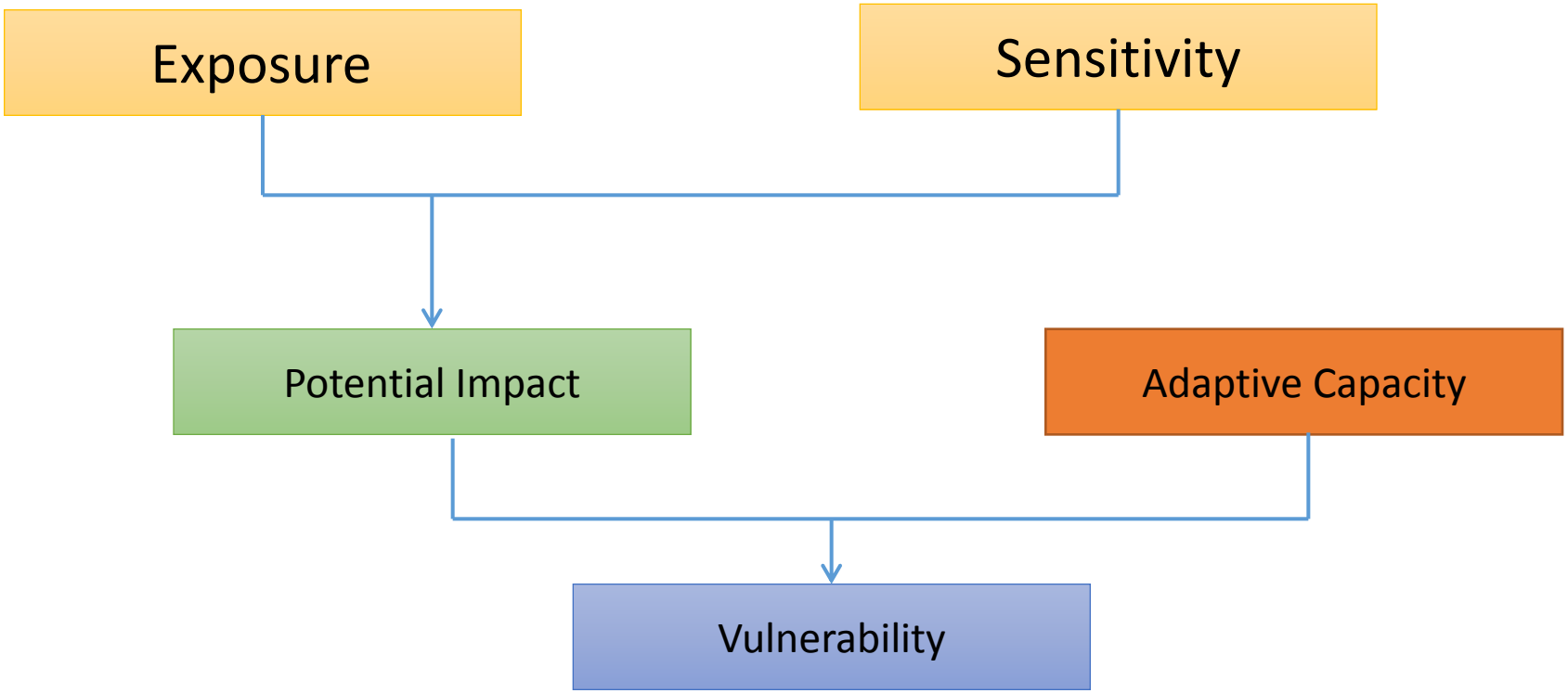
The IPCC identifies three components of vulnerability:

Exposure: refers to 'the nature and degree to which a system is exposed to significant climatic variations'.

Sensitivity: refers 'to the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea-level rise)'.

Adaptive Capacity: Adaptive capacity refers to 'the ability of a system to adjust to climate change – including climate variability and extremes – to moderate potential damages, to take advantage of opportunities, or to cope with the consequences'.

Relationship between the components of Vulnerability



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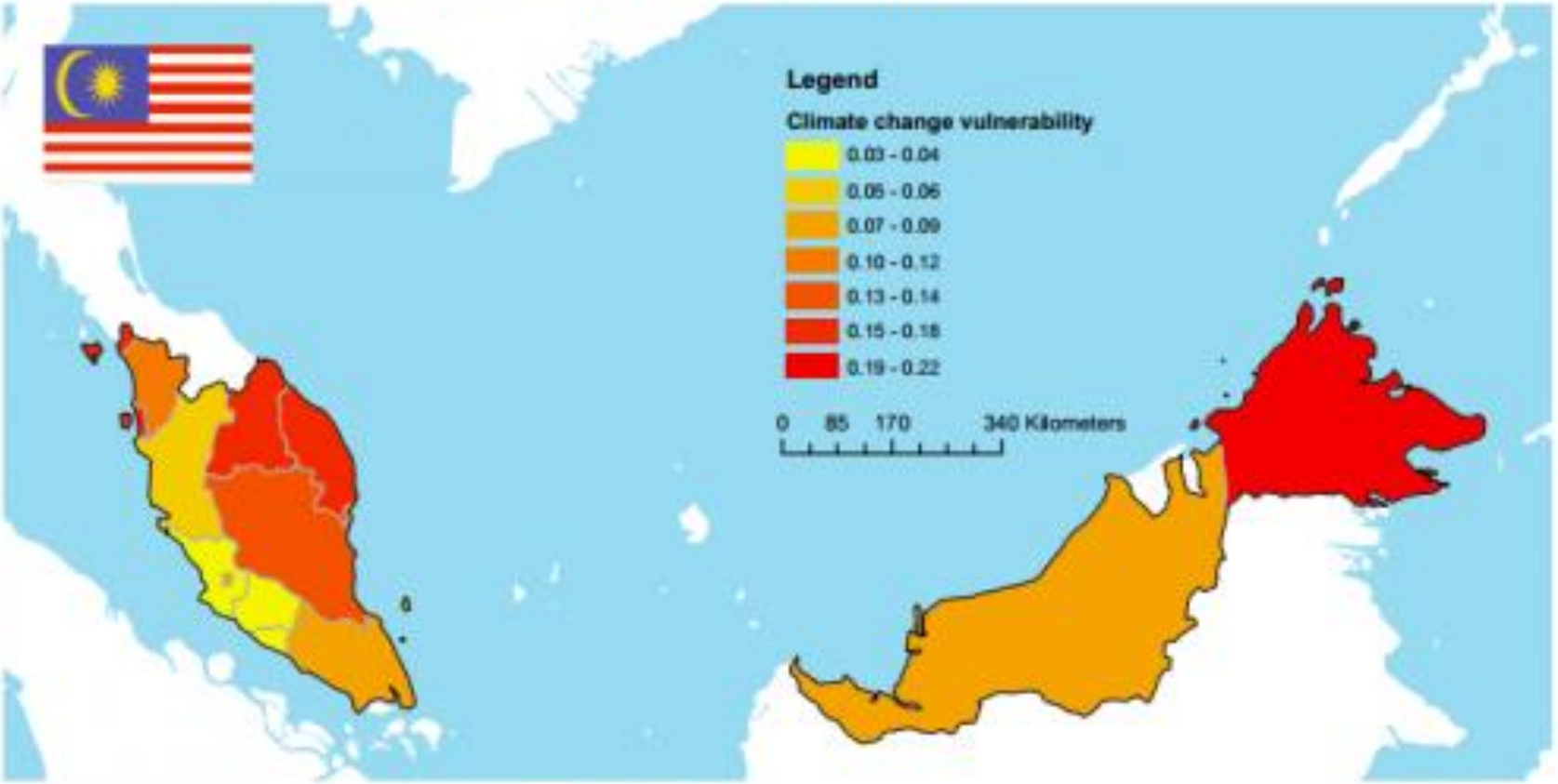
Climate Change Vulnerability Map of Malaysia



The assessment was carried out for each of the 14 states of Malaysia. The adaptive capacity of the Malaysian states is relatively high compared to the other assessed regions in Southeast Asia. This explains the relatively low vulnerability of Malaysia to climate change hazards.

Nevertheless, the top five states in terms of climate change vulnerability in the country are: Sabah, Pulau Pinang (or Penang), Kelantan, Terengganu, and Perlis. Sabah, Kelantan, and Perlis are exposed to relatively frequent droughts while floods occur relatively frequently in Kelantan and Perlis.

Forests and Climate Change

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Importance of Forests

- Forests play a significant role in improving people's livelihoods directly and indirectly through provision of various ecosystem services
- They stabilize soil, treat waste, provide habitats, and offer opportunity for recreation.
- These benefits are on continuous decrease due to reduction of area under trees
- Importantly, they regulate climate change through carbon sequestration.

How much does deforestation and forest degradation contribute to GHG that drive climate change?

A. 5%

B. 15%

C. 20%

D. 40%

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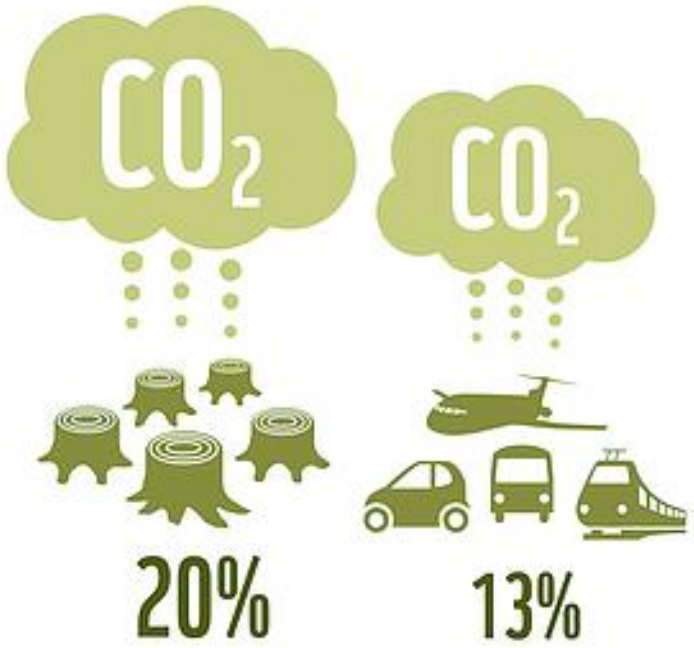
INFOGRAPHIC



DEFORESTATION AND FOREST DEGRADATION REPRESENT UP TO 20% OF GLOBAL ANTHROPOGENIC CO^2 EMISSIONS, MORE THAN THE ENTIRE GLOBAL TRANSPORT SECTOR (WHICH ACCOUNTS FOR 13%).

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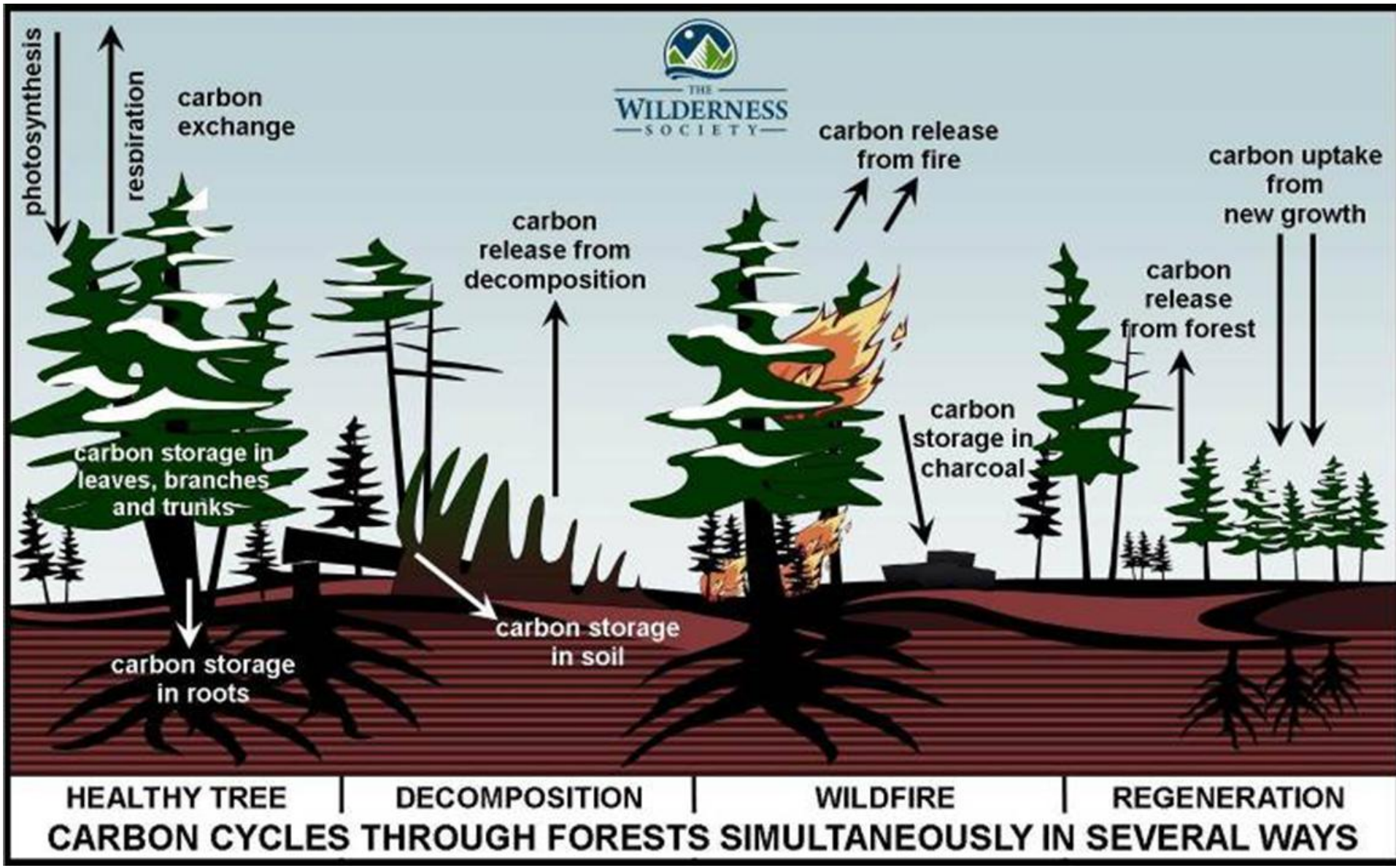
How do forests contribute GHG that drive Climate Change?

Forests and Climate Change



Forests and Climate Change

- Forests take up carbon in new growth
- Forests store carbon in their biomass and soils
- Forests release carbon dioxide through respiration, decay and when they are burned
- Multiple factors determine whether a forest is a net carbon sink or source

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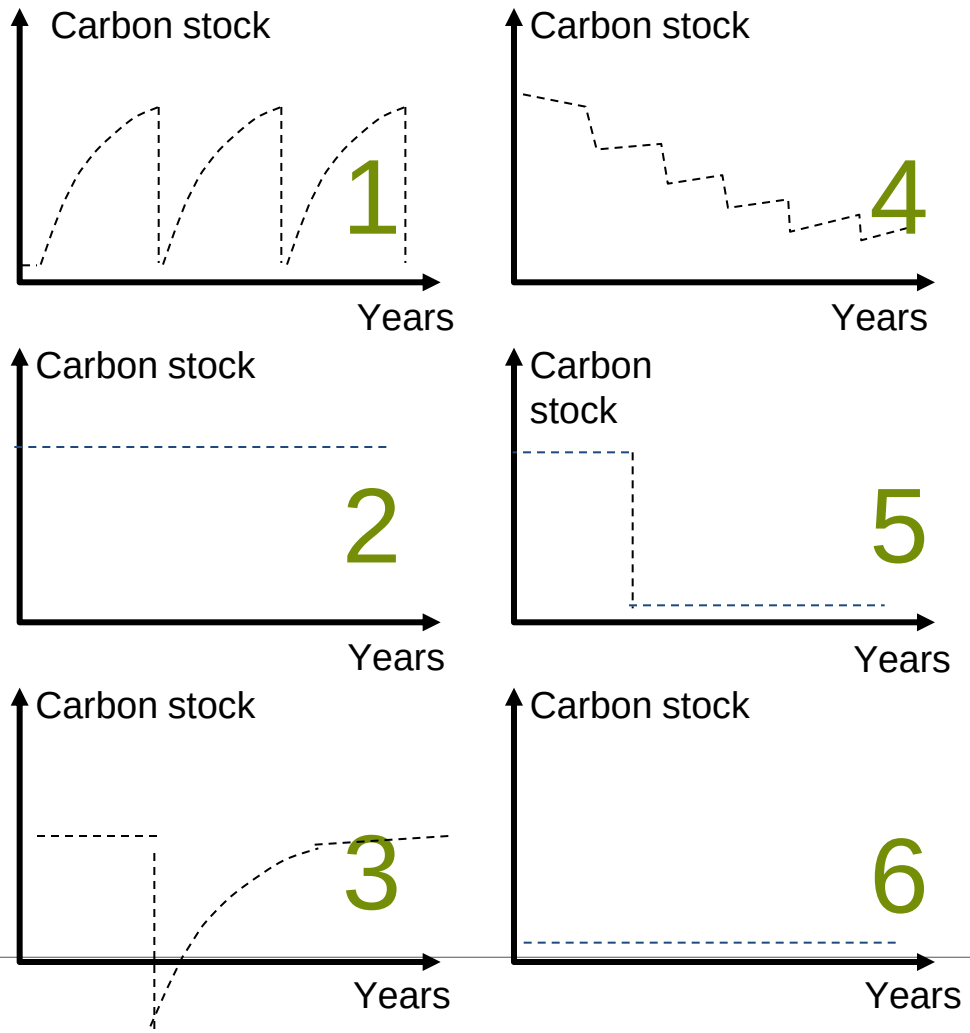
Forests: Sinks / Sources of CO_2

Which figure represents the simplified evolution of above-ground carbon stocks in the following cases?



- Non-forested land
- Forest conversion to non-forested land use
- Unsustainably managed forest
- Plantation established on non-forested land and harvested regularly
- Forest converted to a plantation
- Conserved primary forest

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Forests and Climate Change

- Forests are dynamic systems, responding to environmental changes affecting them
- Increased atmospheric CO_2 stimulates a 'carbon fertilisation' effect whereby the rate of photosynthesis increases
- Tree mortality and associated forest dieback will become apparent in many regions sooner than previously anticipated (medium confidence). (balancing fertilisation effects with projections of increasing tree mortality and forest loss due to, for e.g. fires, drought and pest attacks)
- Forest growth rates have increased during the last decades, but the variability is large, and in some areas production has decreased

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Climate influence the following:

- Geographical distribution
- Composition
- Productivity of forests
- Species populations
- Migration
- Pests and diseases
- Forest regenerations


CLIMATE CHANGE AND WILDFIRES
Stronger winds from bigger storms will mean more fallen branches for wildfires to consume.
Increased extreme wet weather primes forests for fire by growing more fuel.
Climate change will lead to more hot days compared to cold. Higher temps cause fiercer fires.
Drought and warmer springs mean smaller snow packs and drier forest fuel.
CLIMATE DESK

Impacts of CC on forests

- Boreal forests in N. Asia will move further north, displacing the tundra.
- Broad leaved Korean pine forests to decrease by 20% to 35% with a northward shift.
- Beech tree in Japan could disappear by end of century.
- Increasing intensity and spread of fires in N and SE Asia due to rises in temperature and decline in precipitation combined with land use change.

Trees and Mitigation of climate change

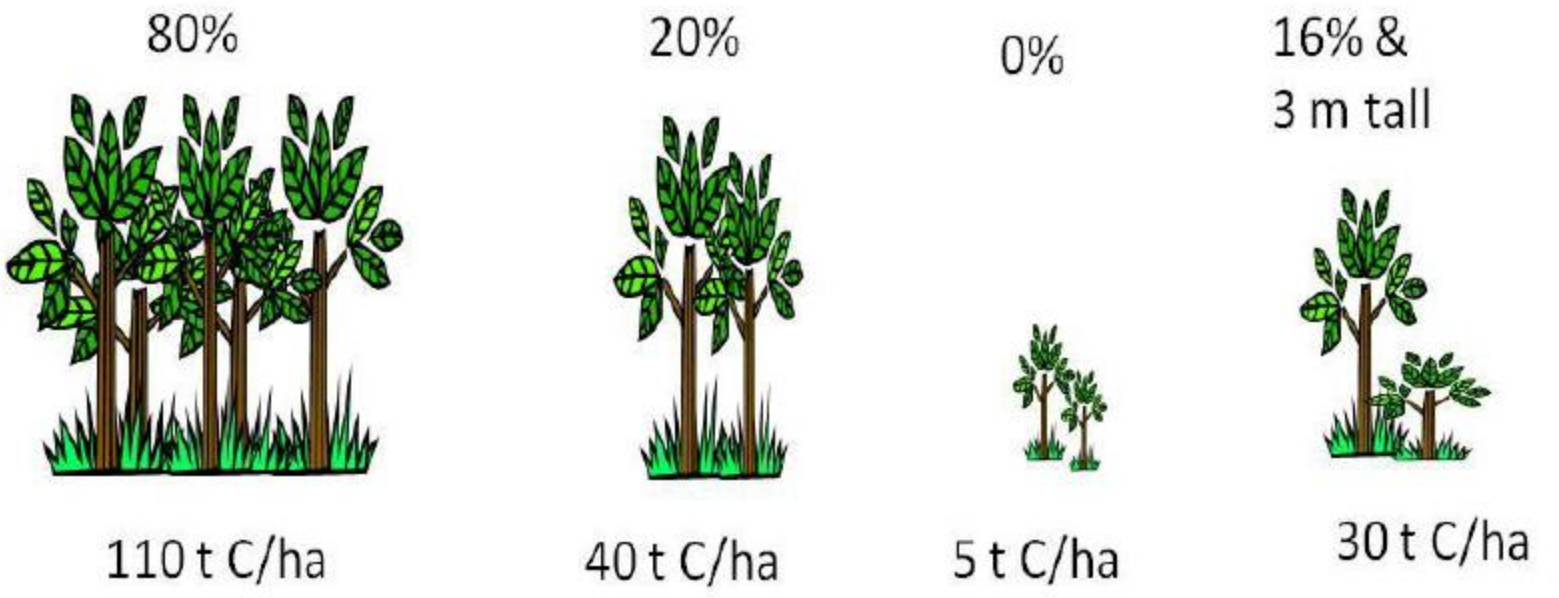

Illustration of various changes in forest cover, and corresponding emissions and removals of carbon

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(Forest) Ecosystem Services

- **An ecosystem** is a biological environment including all of the organisms that live there, and both living and non-living components.

- Ecosystems provide a wide range of goods and services used by society and people. These benefits are known as **ecosystem** (or sometimes environmental**) services**

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(Forest) Ecosystem Services

ECOSYSTEM SERVICES

Supporting Services:

- Nutrient cycling
- Primary production
- Soil formation

Regulating Services:

- Climate regulation
- Water purification
- Flood regulation
- Disease regulation

Provisioning Services:

- Timber
- Fibre
- Food
- Water
- Fuel

Cultural Services:

- Aesthetic
- Landscape
- Historical
- Recreation & Tourism
- Educational
- Spiritual
- Traditional

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Climate Change &(Forest) Ecosystem Services

- Many plant and animal species have moved their ranges…in response to observed climate change… and will continue to do so:
  - community composition will change
  - the seasonal activity of many species will change differentially, disrupting life cycles and interactions between species.
  - modelling of the Amazon region has indicated that 43 per cent of… plant species could become non-viable by the year 2095
- Increases in the frequency or intensity of ecosystem disturbances (droughts, wind storms, fires, and pest outbreaks) will alter the structure, composition, and functioning of ecosystems
- Forests' ability to moderate and regulate water flows are likely to be affected by changes in rainfall and incidences and severity of flooding
- Sea level rise poses a major threat to coastal mangrove forests

- **Forest growth, species and ecosystems will change**

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Responses to Climate Change

Mitigation

- **Mitigation**- consists of activities that aim to reduce GHG emissions, directly or indirectly, by avoiding or capturing GHGs before they are emitted to the atmosphere or sequestering those already in the atmosphere by enhancing "sinks" such as forests. Such activities may entail, for example, changes to behaviour patterns or technology development and diffusion.

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Forests and Mitigation

- Forests absorb the greenhouse gas carbon dioxide, thereby mitigating the effects of climate change,
- Using wood from a sustainably- managed forest as fuel instead of oil, coal and natural gas, can also reduce global warming.
- Changes in global climate are already stressing forests through higher temperatures, altered rain patterns and more frequent and extreme weather.
- The world's forests and forest soils currently store more than one trillion tons of carbon – twice the amount found floating free in the atmosphere
- However, when destroyed or over-harvested and burned, forests can become sources of carbon dioxide.

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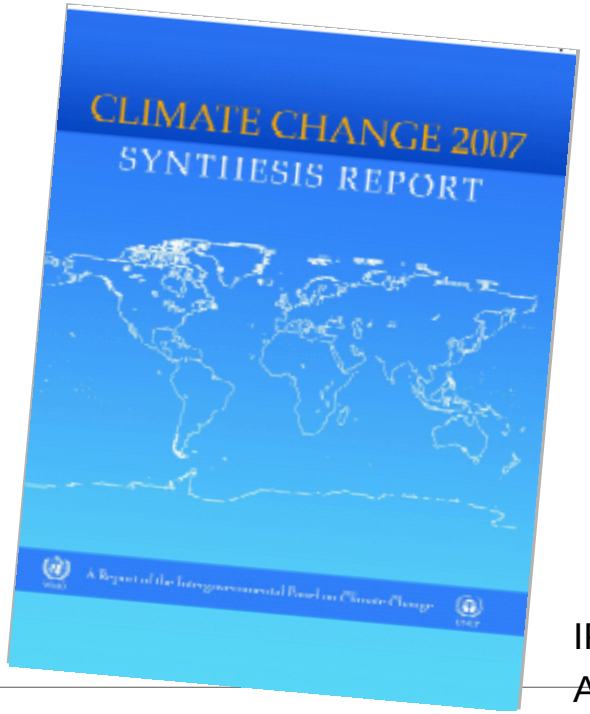
Adaptation

- ***Adaptation*** is defined as adjustments in human and natural systems, in response to actual or expected climate stimuli or their effects, that moderate harm or exploit beneficial opportunities.



IPCC Fourth Assessment Report, 2007

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Forests and Adaptation

- If crops fail due to drought or assets are lost because of floods, communities can sell forest and tree products – timber, fuelwood and NTFPs – for income.
- Fodder from trees can help ensure the survival of livestock for months at a time if drought strikes.
- Crops grown in agroforestry systems are more resilient to drought, excess precipitation, and temperature fluctuations and extremes.
- Forests contribute to regulating river flows – base flows during dry seasons and peak flows during rainfall events – minimising risks related to water scarcity and floods.
- Coastal forests such as mangroves help reduce risks from disasters relating to climate extremes (storms or cyclones) and sea-level rise (coastal flooding).
- Urban forests and trees provide green infrastructure – shade, evaporative cooling, and rainwater interception, storage and infiltration – in cities.

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In your group, identify key mitigation measures at local, state and national levels

In your group, identify key adaptation measures at local, state and national levels

REDD+ as a response to Climate Change

What is REDD+

Reduced

Emissions from

Deforestation and forest

Degradation

\+ Fostering conservation, sustainable management of forests, and enhancement of forest carbon stocks

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REDD+ within the UNFCCC – the WHY

- REDD+ is – an international framework to halt deforestation
- A vehicle to financially reward developing countries for SFM
- REDD+ Mechanism – to help fight poverty while conserving biodiversity and sustaining vital ecosystem services
- Reducing deforestation is the “single largest opportunity for cost-effective and immediate reductions of carbon emissions” (Stern Review)

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How does REDD+ work?

Pay developing countries to keep their forests standing in order to reduce greenhouse gas emissions.

What is positive about REDD+?

- Positive global recognition and support
- The concept of adding a market value to forest preservation creates new incentives for tropical countries in terms of forest usage and appears to be a promising scheme to protect tropical forests.
- However, REDD+ will need more financial support to fully achieve its potential.
- This could be through incorporating it into the Clean Development Mechanism (CDM)
- Despite lobbying proponents such as the World Bank, it is unclear whether or not REDD+ will be recognized as a legitimate CDM activity (Venter and Koh 2012).

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Positive about REDD+

- The international community has a renewed focus on the importance of conservation and restoration of forest ecosystems
- Multilateral institutions dedicated to make countries ready for REDD+ have been established, and private and public actors alike have started many local initiatives and projects" (Pistorius 2012: 643).
- Furthermore, the scheme provided a framework for already existent anti-deforestation and degradation projects, and helped building up strong multilevel and stakeholder networks.
- However, the effectiveness of current REDD+ interventions have been criticised and it will be necessary to find solutions to solve problems in order to fully use the positive capacity of REDD+ to reduce deforestation and forest degradation in the tropics.

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Criticism of REDD+

- Avoiding deforestation in one part of the world makes it likely to happen elsewhere;
- The baseline used for determining emission savings is based on estimates about what might have happened, and therefore likely to be inaccurate
- Permanence- forest carbon is not permanently locked away, it will always return
- It is difficult to measure with certainty forest carbon storage, makes it difficult to compare with countries' reduction in GHG emissions

Criticism of REDD+

- Could encourage shifts to plantation forestry, undermine agricultural production
- There is no globally accepted and applied definition of forest or sustainable forest management. The UNFCCC definition of forest includes a crown cover between 10-30%. Based on this definition countries could degrade forests down to 30% crown cover and a minimum height of two meters, without causing deforestation.
- REDD+ initiative sites should qualify as forest for a minimum of 10 years and may include mature forests, secondary forests, and degraded forests. These definitions leave loop-holes enabling significant forest degradation.

Criticism of REDD+

- Equality issues, and cultural and social barriers- what environmental, social, and development issues should be included; and
- Which are the right indicators and frameworks for measuring these impacts
- High level of corruption, economic instability, social polarization, ethnical conflicts, and extent of state/community/private control over forest resources. All of these influential factors are based on a variety of established cultures often in contrast to the western market-based economy.

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Criticism

- Leakage- defined as “the decrease or increase in GHG benefits outside of an intervention boundary that is either directly or indirectly attributable to the intervention implemented within those boundaries”.
- There is not yet a long-term financial structure for REDD+ interventions and existent projects run on a voluntary basis, which could lead to a lack of financial support. Furthermore, the average time horizon of REDD+ projects is approximately 20 years (Phelps et al. 2011). After this period of time the countries could theoretically restart logging in the protected areas. The problem of released emissions from deforestation would only be procrastinated.

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Priorities and Concerns of IPOs/CSOs

- Access to information and appropriate capacity building to ensure full and effective participation of IPs/LCs and other stakeholders.
- Translation and implementation of international measures related social and environmental safeguards at the national level
- How REDD+ programmes ensure that internationally agreed decisions, guidelines, safeguards, among other concerns will be implemented at national/subnational levels
- Allocation of capacity building funds and engagement of stakeholders especially at subnational/community demo areas for REDD+
- Recognition of customary land tenure rights and resolving conflicts on land tenure

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