Sustaining Livelihoods: Adapting to Climate Change

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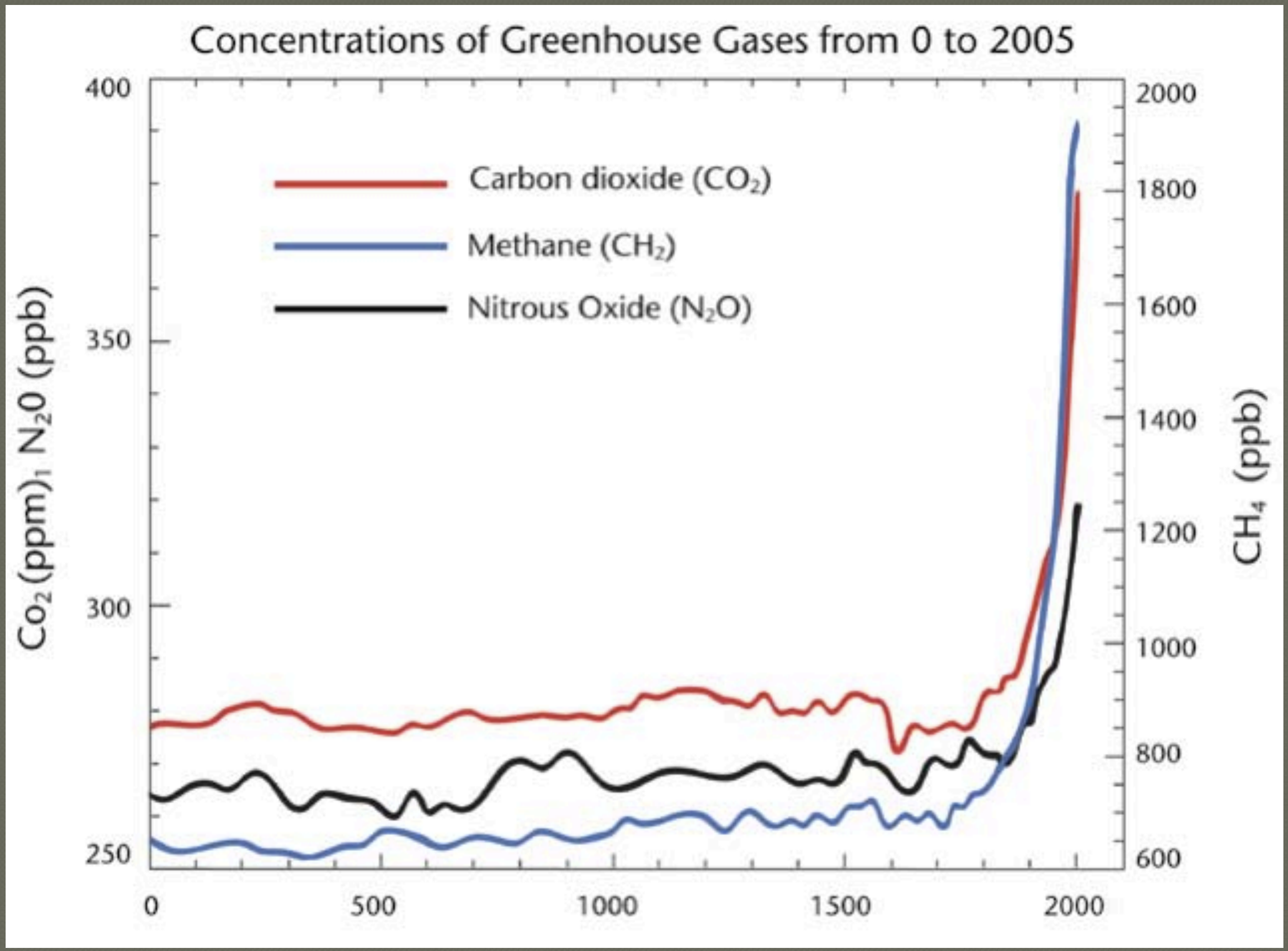
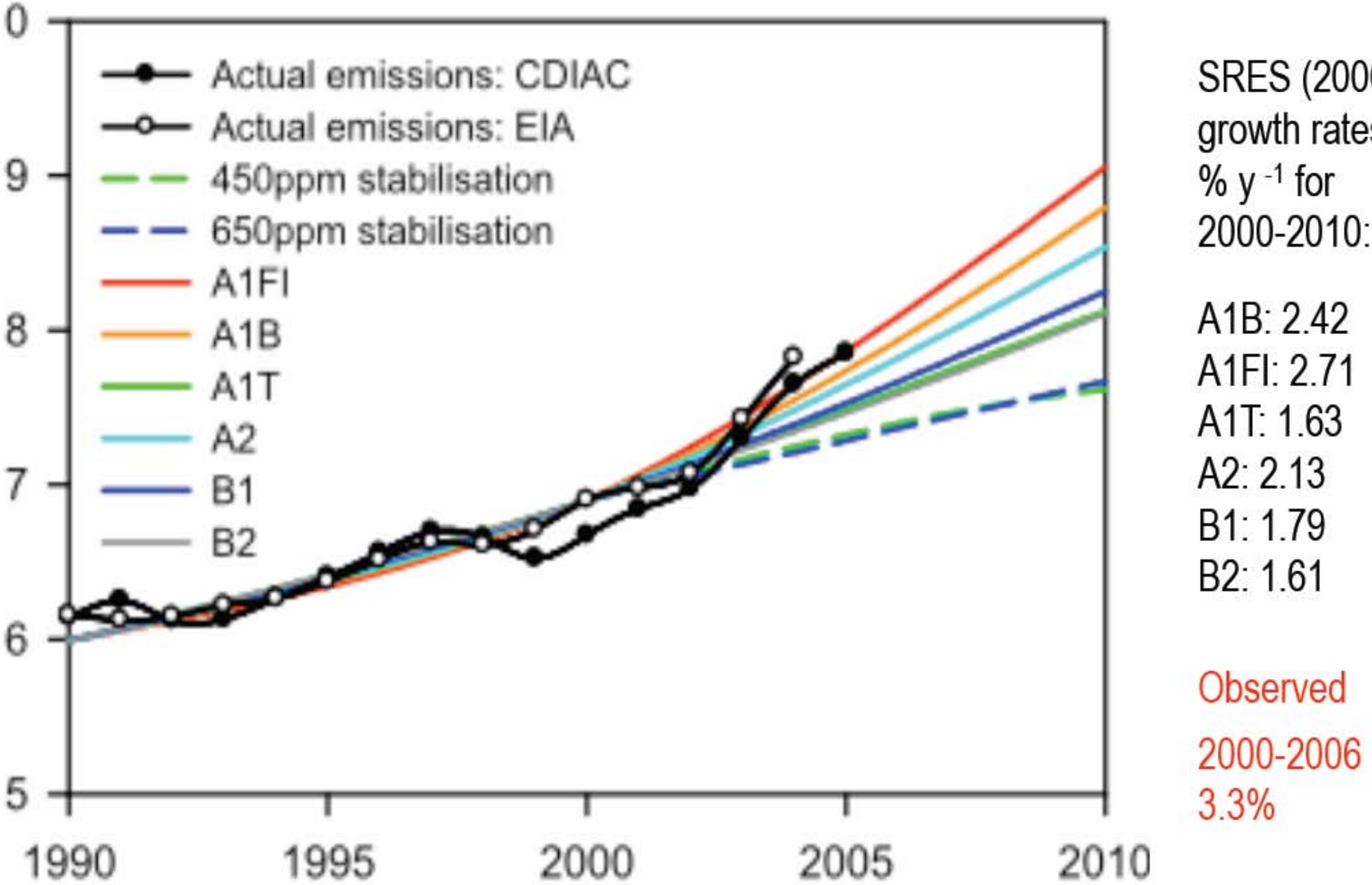
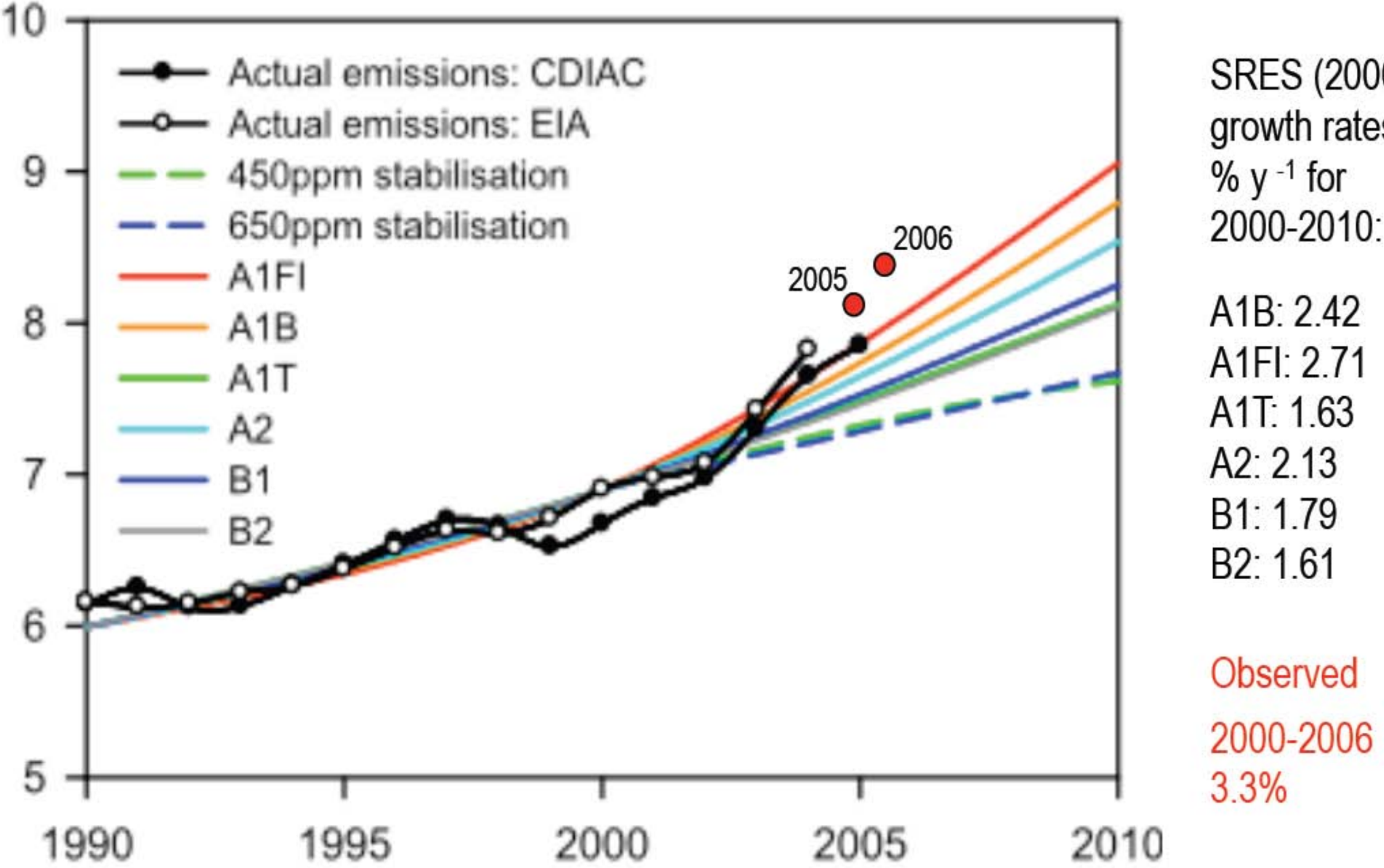


Atmospheric concentrations of important long-lived greenhouse gases over the last 2,000 years. Concentration units are parts per billion (ppb). Originally from Forster et al. 2007.

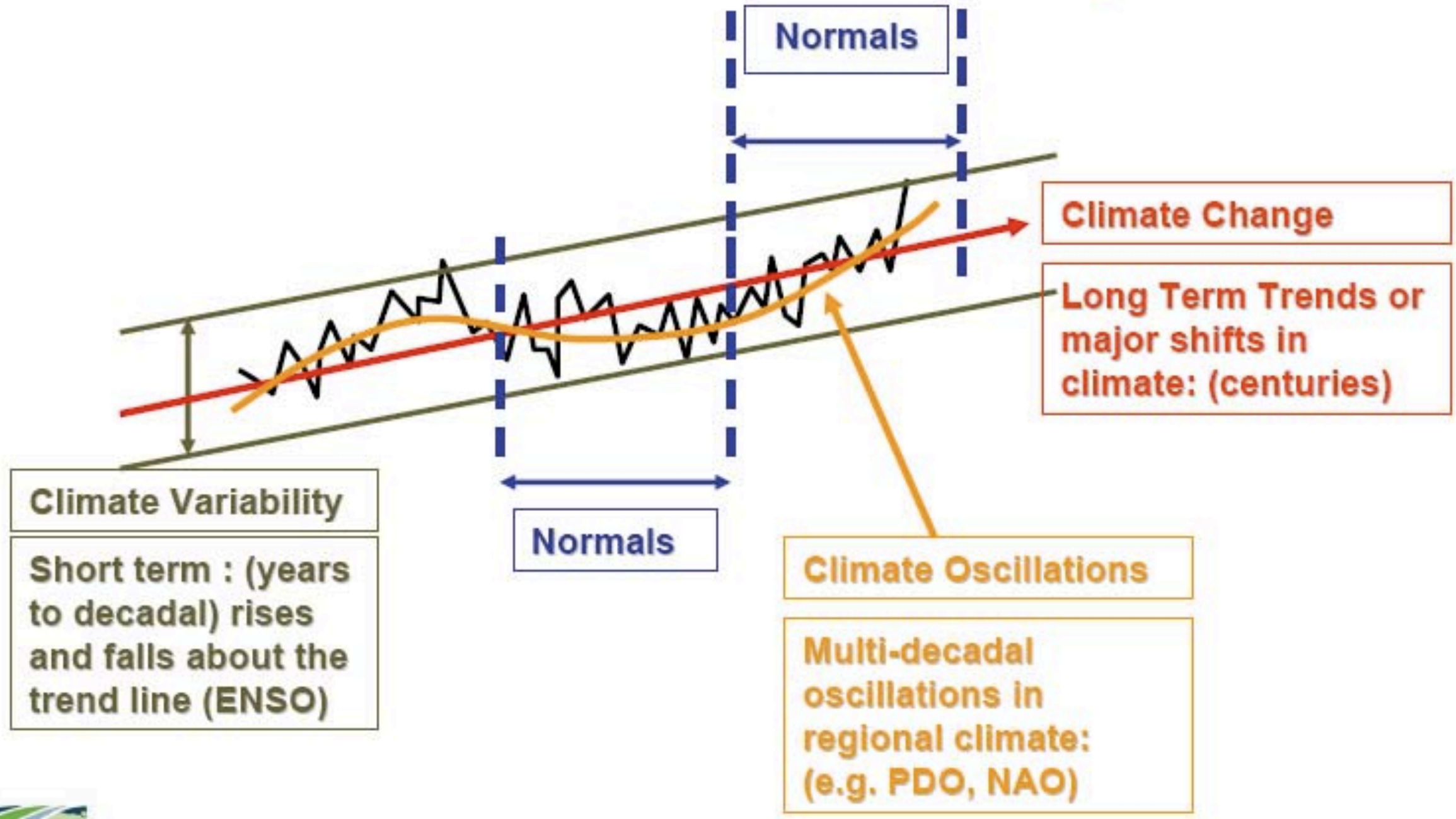


Raupach et al. 2007, PNAS



Raupach et al. 2007, PNAS

Climate Variability & Climate Change



PACIFIC CLIMATE IMPACTS CONSORTIUM

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

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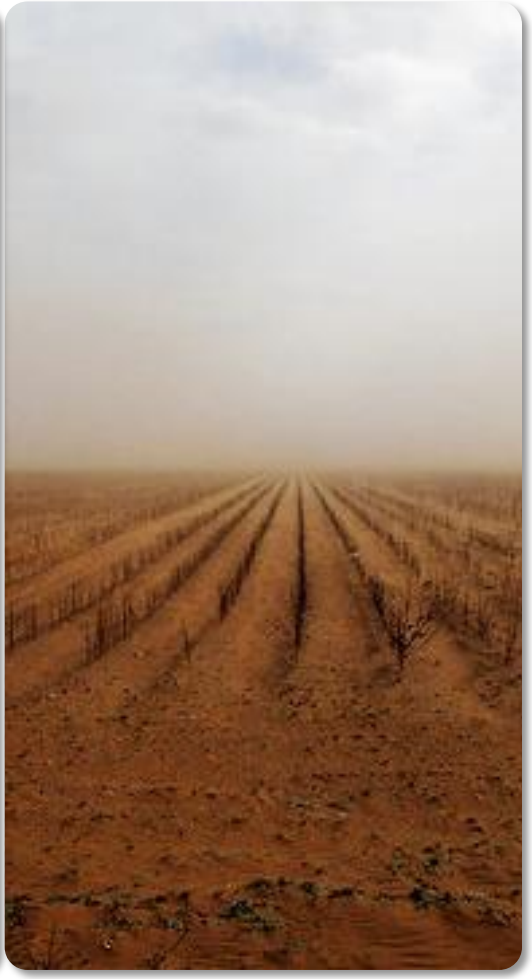
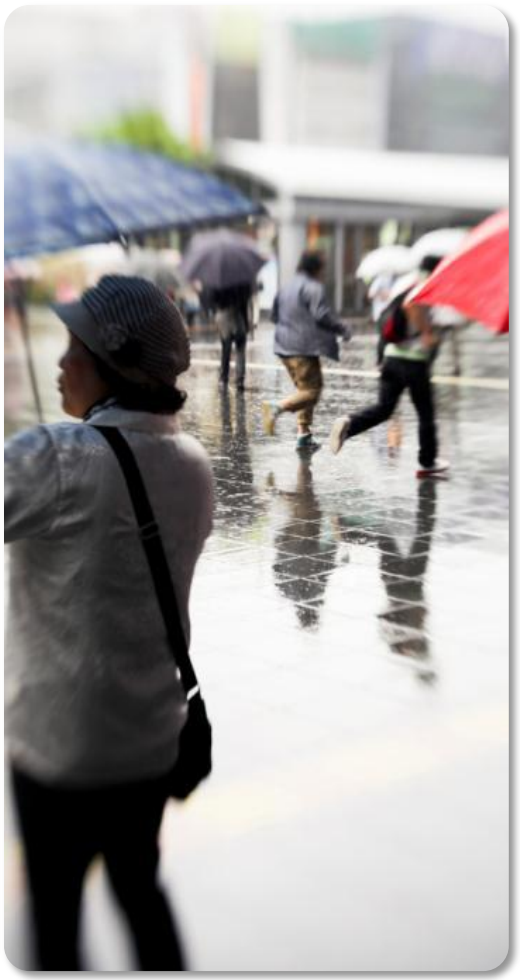
INTERGOVERNMENTAL PANEL ON climate change

A changing climate leads to changes in extreme weather and climate events



Impacts from weather and climate events depend on:

nature and severity of event

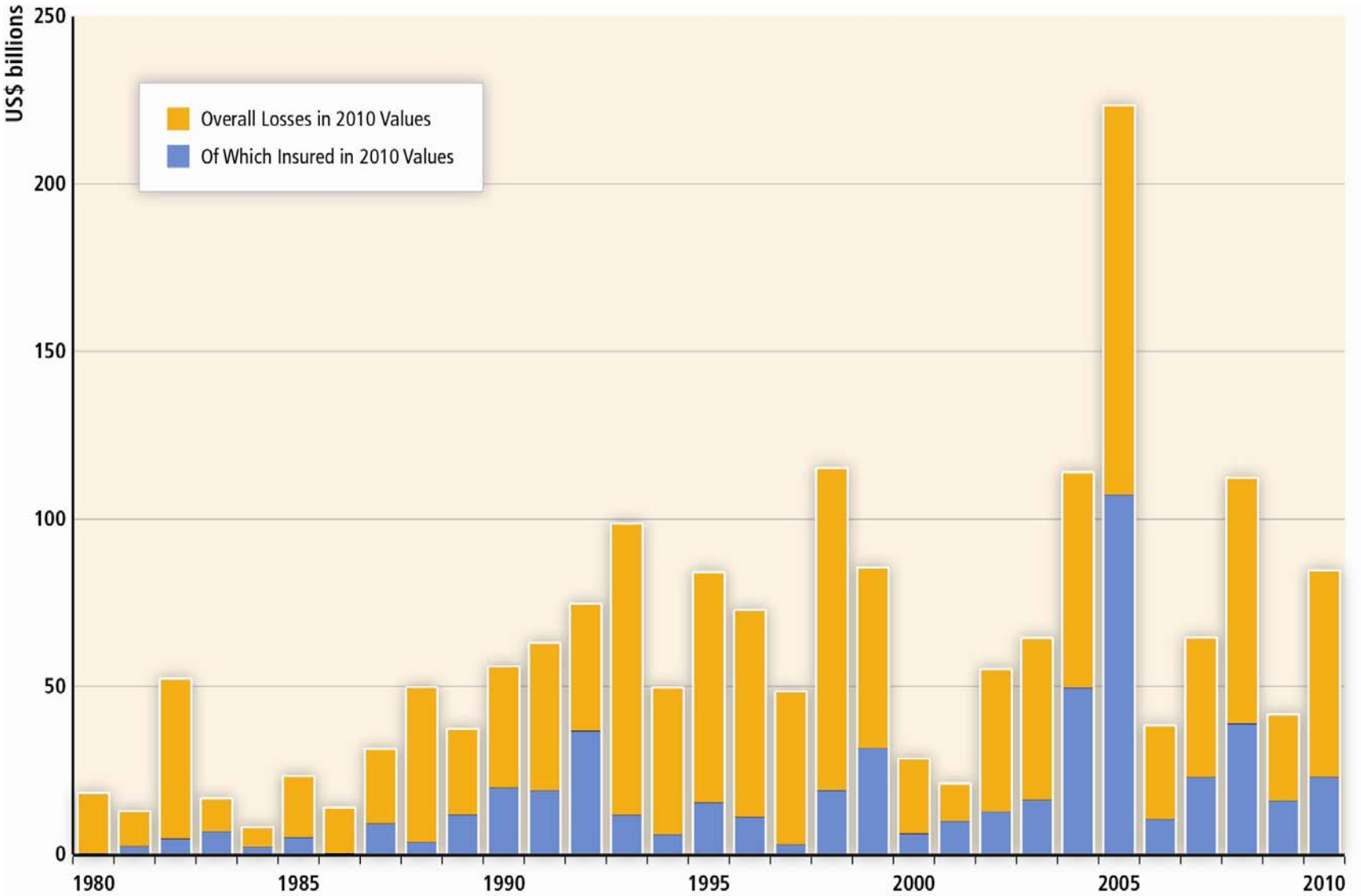
vulnerability

exposure

Impacts of climate extremes can be felt locally or regionally

AGRICULTURE	**"Russia, Crippled by Drought, Bans Grain Exports"** *August 5, 2010,* ***The New York Times***
ENERGY	**"Heatwave hits French power production"** *August 12, 2003,* ***The Guardian***
WATER	**"Lake Mead is at Record Low Levels. Is the Southwest drying up?"'** *August 08, 2010,* ***The Independent***
PUBLIC HEALTH	**"Pakistan floods: Aid trickles in for victims as cholera spreads in Pakistan's worst-ever floods"** *August 14, 2010,* ***The Guardian/Observer***
TOURISM	**"Alpine resorts feel heat during record warm spell"** *December 08, 2006,* ***CNN***
TRANSPORTATION	**"Flash flooding causes train to derail"** *July 30, 2001,* ***Chicago Sun Times***

Economic losses from climate-related disasters have increased, with large spatial and interannual variations



Data from Munich Re, 2011

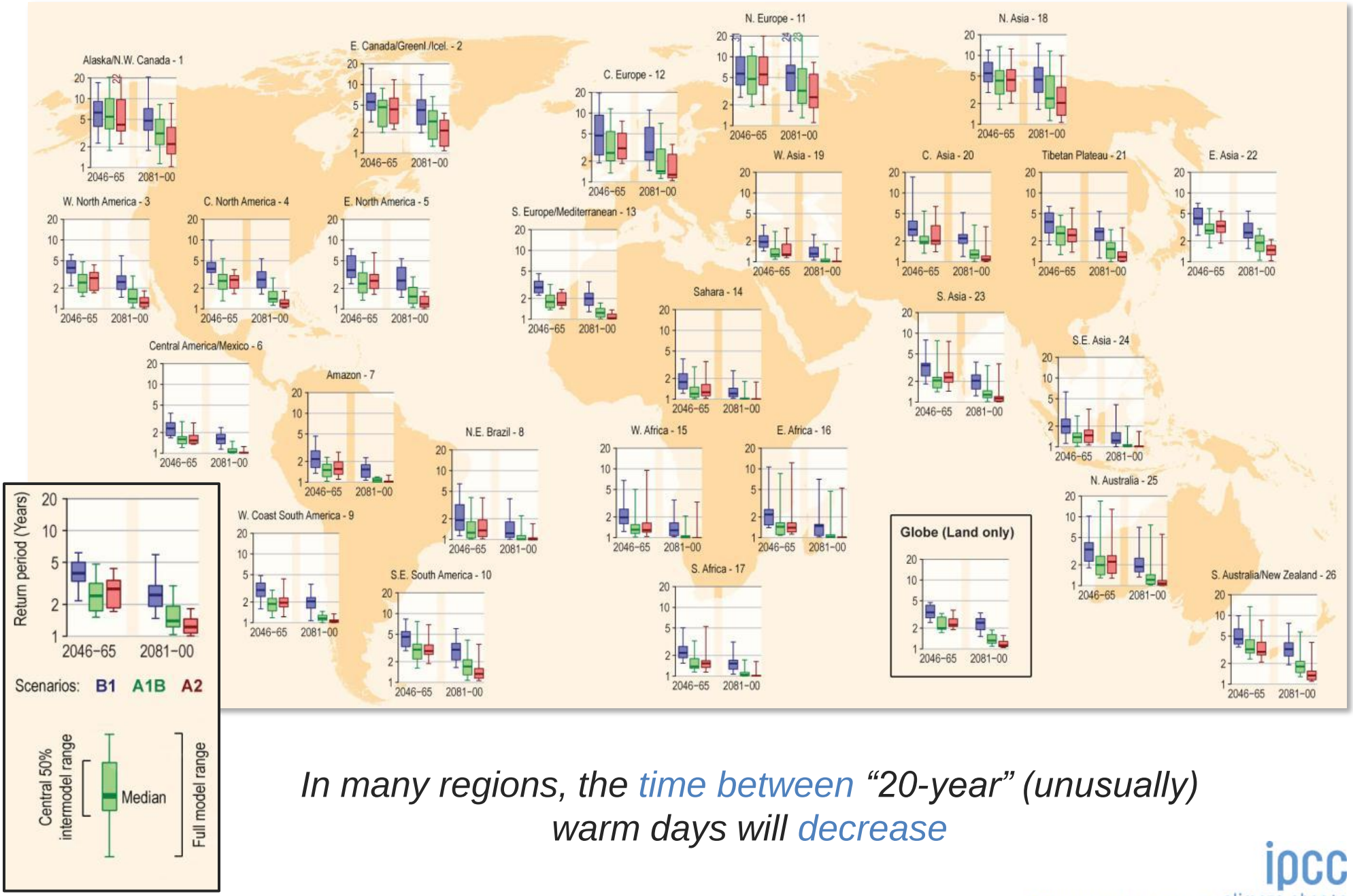
Increasing exposure of people and assets has been the major cause of changes in disaster losses

Economic disaster losses are higher in developed countries

Since 1950, extreme hot days and heavy precipitation have become more common

There is evidence that anthropogenic influences, including increasing atmospheric greenhouse gas concentrations, have changed these extremes

Climate models project more frequent hot days throughout the 21st century



In many regions, the time between "20-year" (unusually) warm days will decrease

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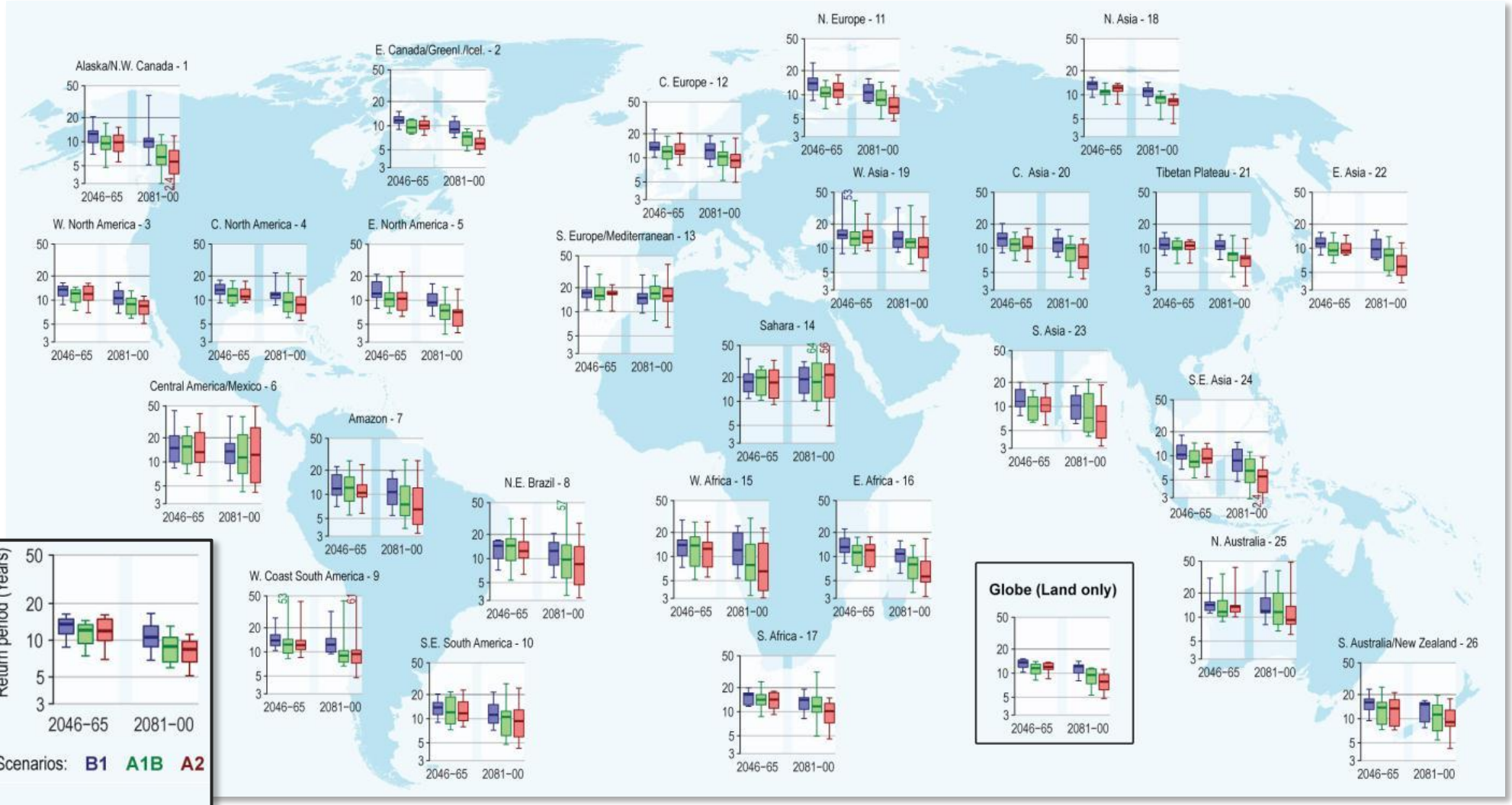
Climate models project there will be more heavy rain events throughout the 21st century



In many regions, the time between "20-year" (unusually intense) rainstorms will decrease

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Short-term actions don’t always provide long term risk reduction

Permafrost thaw

- permafrost requires sub zero temperatures
- melt affects roads, building foundations, airport infrastructure
- infrastructure maintenance needed
- short-term risk reduction won’t eliminate long-term melt risk

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- changes in climate extremes vary across regions
- each region has unique vulnerabilities and exposure to hazards
- effective risk management and adaptation address the factors contributing to exposure and vulnerability

Managing the risks: heat waves in Europe

Risk Factors

- lack of access to cooling
- age
- pre-existing health problems
- poverty and isolation
- infrastructure

France, August 2003 (over 14,000 dead)

Risk Management/ Adaptation

- cooling in public facilities
- warning systems
- social care networks
- urban green space
- changes in urban infrastructure

Projected: *likely* increase heat wave frequency and *very likely* increase in warm days and nights across Europe

Managing the risks: hurricanes in the USA and Caribbean

Risk Factors

- population growth
- increasing property value
- higher storm surge with sea level rise


Hurricane Katrina, 2005

Risk Management/ Adaptation

- better forecasting
- warning systems
- stricter building codes
- regional risk pooling

Projected globally: *likely* increase in average maximum wind speed and associated heavy rainfall (although not in all regions)

Managing the risks: flash floods in Nairobi, Kenya

Risk Factors

- rapid growth of informal settlements
- weak building construction
- settlements built near rivers and blocked drainage areas

Risk Management/ Adaptation

- reduce poverty
- strengthen buildings
- improve drainage and sewage
- early warning systems

Projected: *likely* increase in heavy precipitation in East Africa

Managing the risks: sea level rise in tropical Small Island Developing States

Risk Factors

- shore erosion
- saltwater intrusion
- coastal populations
- tourism economies

Risk Management/ Adaptation

- early warning systems
- maintenance of drainage
- regional risk pooling
- relocation

Projected globally: *very likely* contribution of sea level rise to extreme coastal high water levels (such as storm surges)

Managing the risks: drought in the context of food security in West Africa

Risk Factors

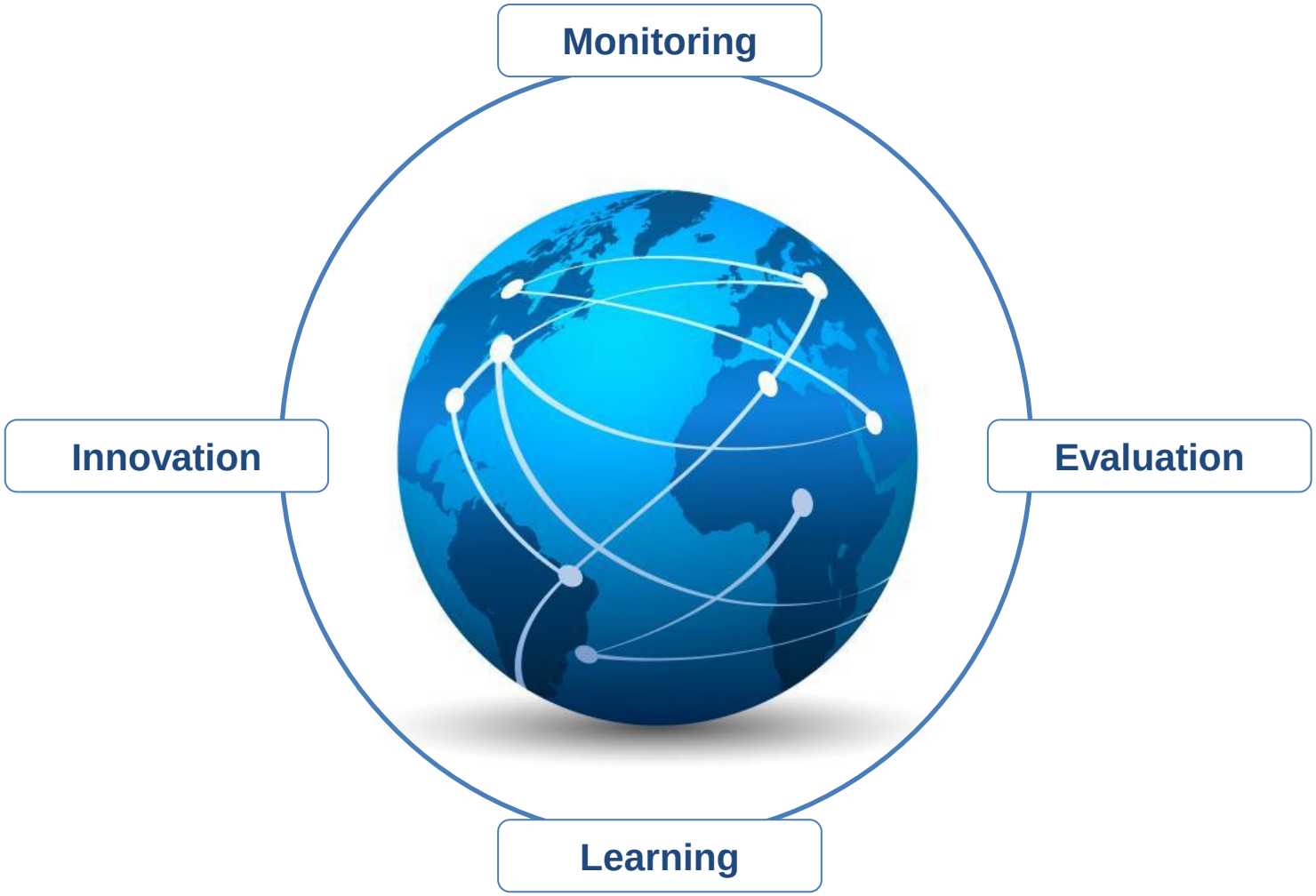
- more variable rain
- population growth
- ecosystem degradation
- poor health and education systems

Risk Management/ Adaptation

- improved water management
- sustainable farming practice
- drought-resistant crops
- drought forecasting

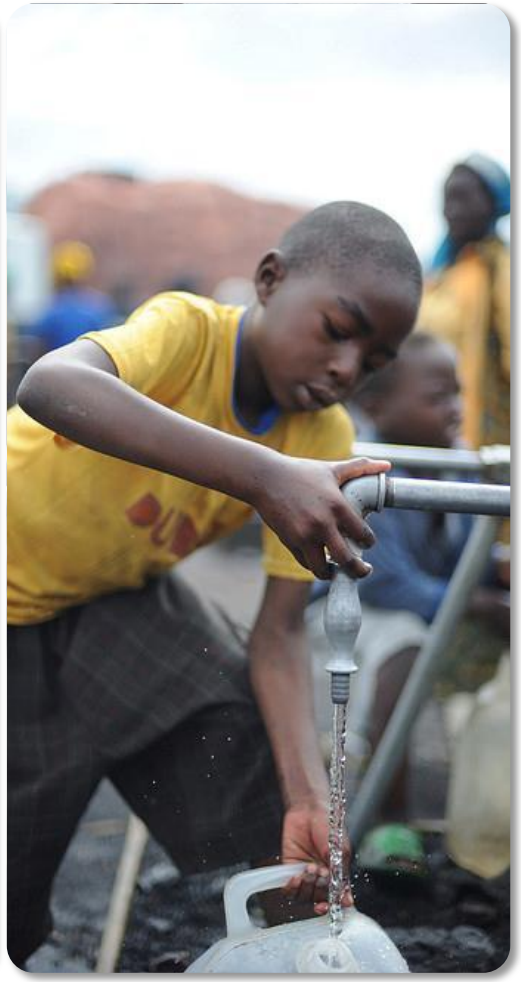
Projected: *low confidence* in drought projections for West Africa

Managing risks of disasters in a changing climate benefits from an iterative process



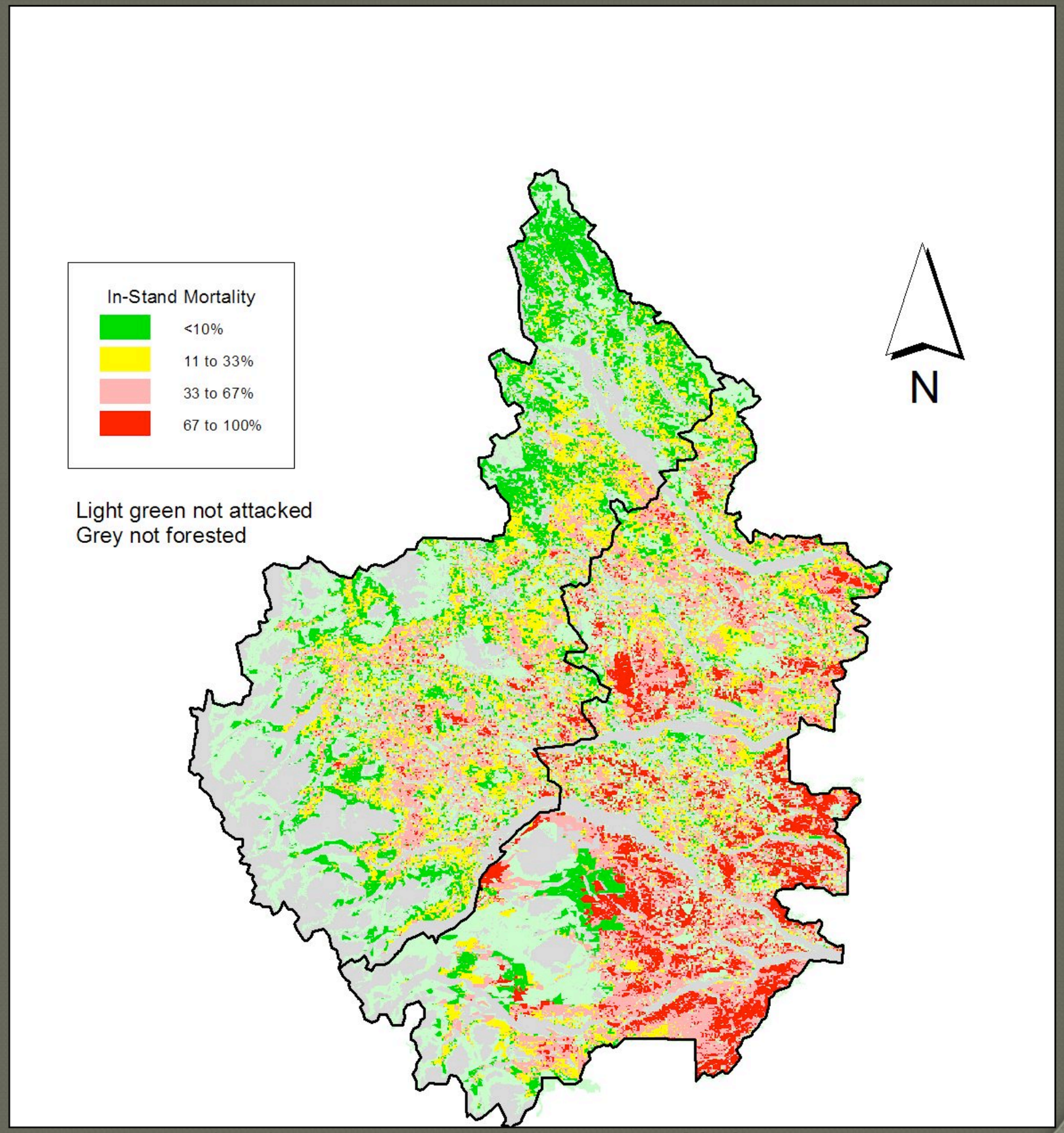
Learning-by-doing and low-regrets actions can help reduce risks now and also promote future adaptation

There are strategies that can help manage disaster risk now and also help improve people's livelihoods and well-being



The most effective strategies offer development benefits in the relatively near term and reduce vulnerability over the longer term

Climate Change in the Bulkley Valley



Mortality level in Nadina forest due to mountain pine beetle (data from Walton 2010).

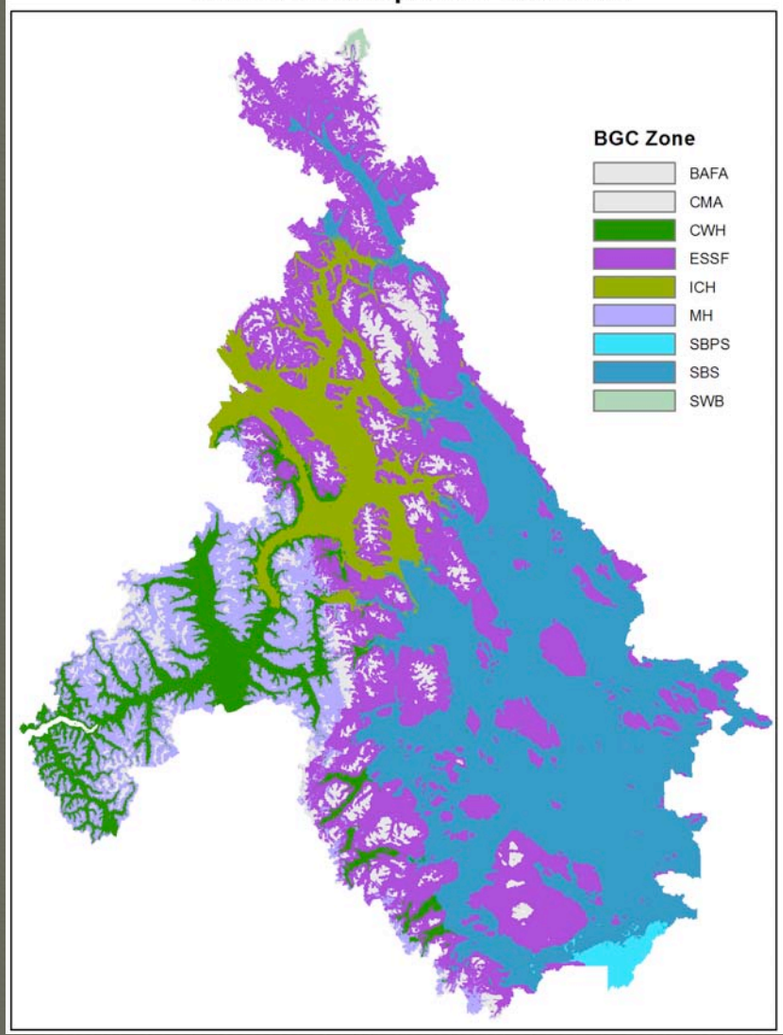
Bulkley Valley Climate Change 2055

Variable	Median Change	Range
Mean temp (annual)	+1.8 °C	+1.3 °C to +2.7 °C
Mean temp (summer)	+1.6 °C	+1.2 °C to +2.8 °C
Mean temp (winter)	+1.8 °C	+0.6 °C to +2.8 °C
Precip (annual)	+9%	+2 to +16%
Precip (summer)*	+2%	-7 to +11%
Precip (winter)	+11%	-2 to +21%
Snowfall (winter)	+7%	-4 to + 16%
Snowfall (spring)	-52%	-68 to -10%
Growing degree days	+213 (deg x days)	+127 to 394
Frost free days	+18 days	+11 to +29

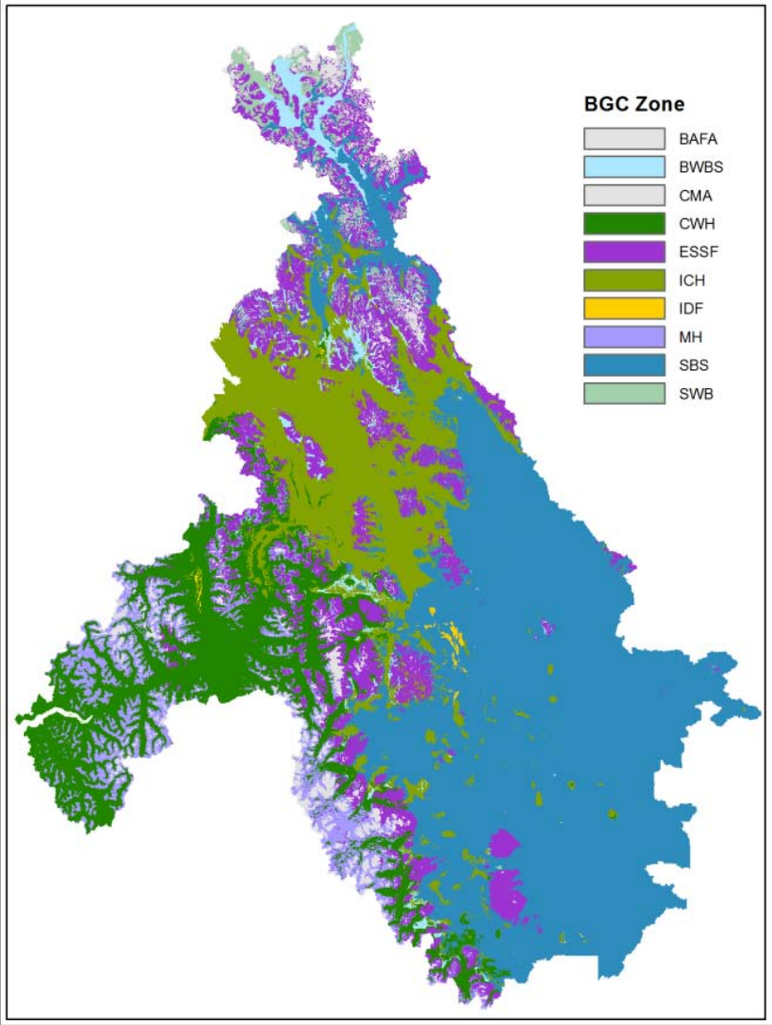
Median and range (90% of outcomes) of climate variables projected for 2055 in the Bulkley-Nechako Regional District from multiple runs of different climate models using different emissions scenarios ("ensemble" runs). Source: http://plan2adapt.ca

CC Skeena 2050

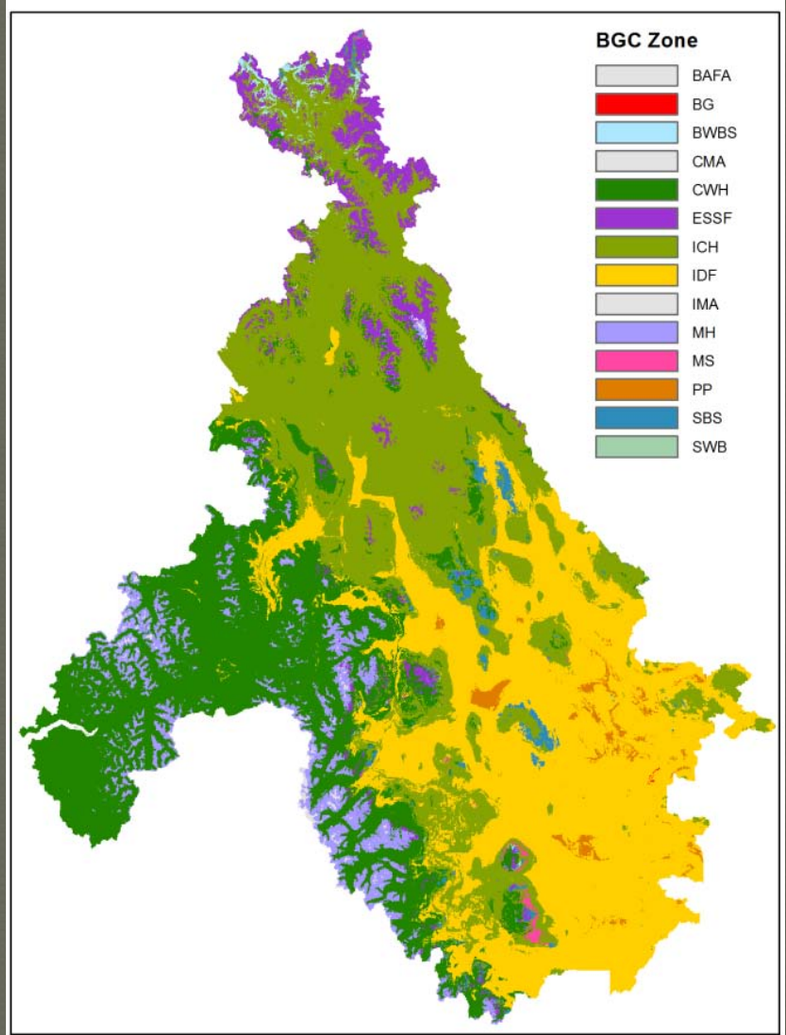
Climate Envelopes for 1961-1990



Climate Envelopes for HadCM3 B1 run1 2050s



Climate Envelopes for HadGEM1 A1B run1 2050s

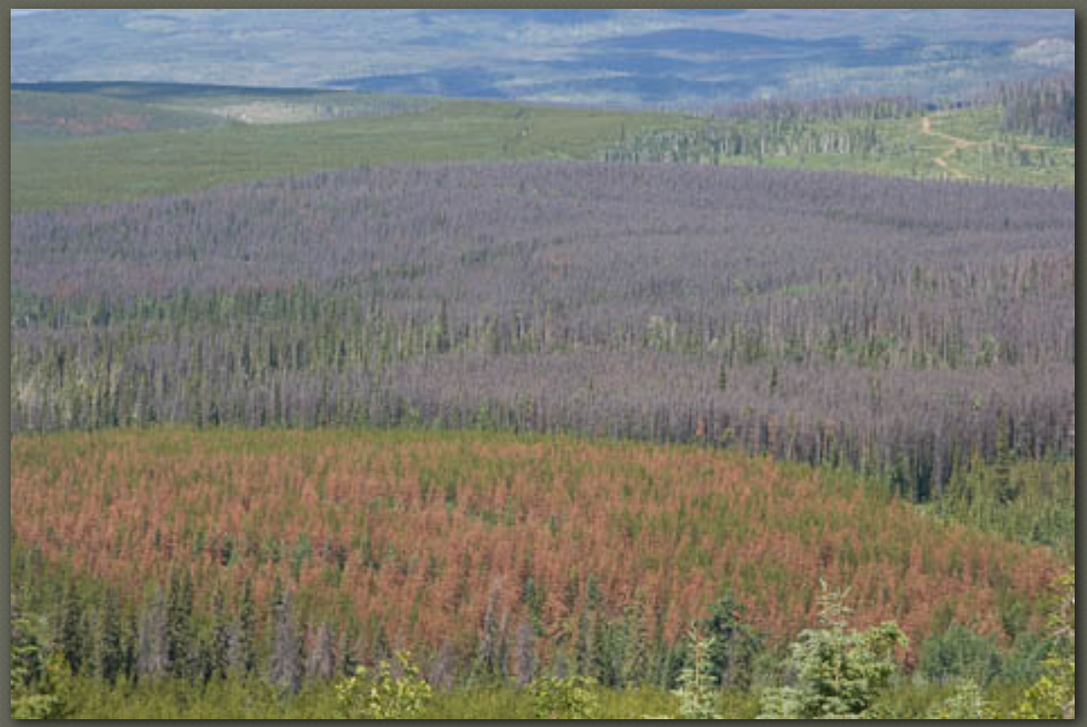


Impacts in the Bulkley Valley

Natural Disturbance Regimes

Pest-host interactions

Alien Species



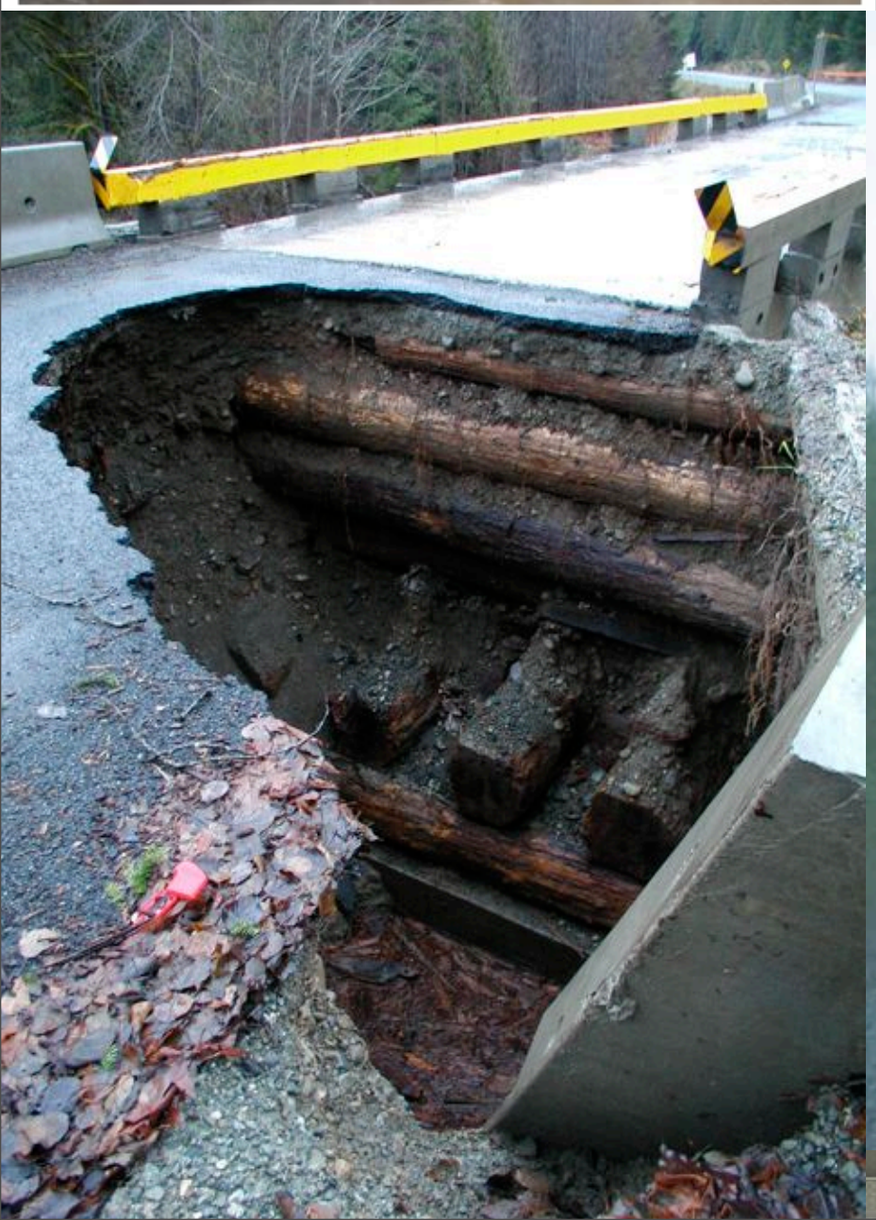
Increased risk of pest outbreaks

Extreme events

Pollination success

Incidence cold damage

Changes to phenology and reproductive success

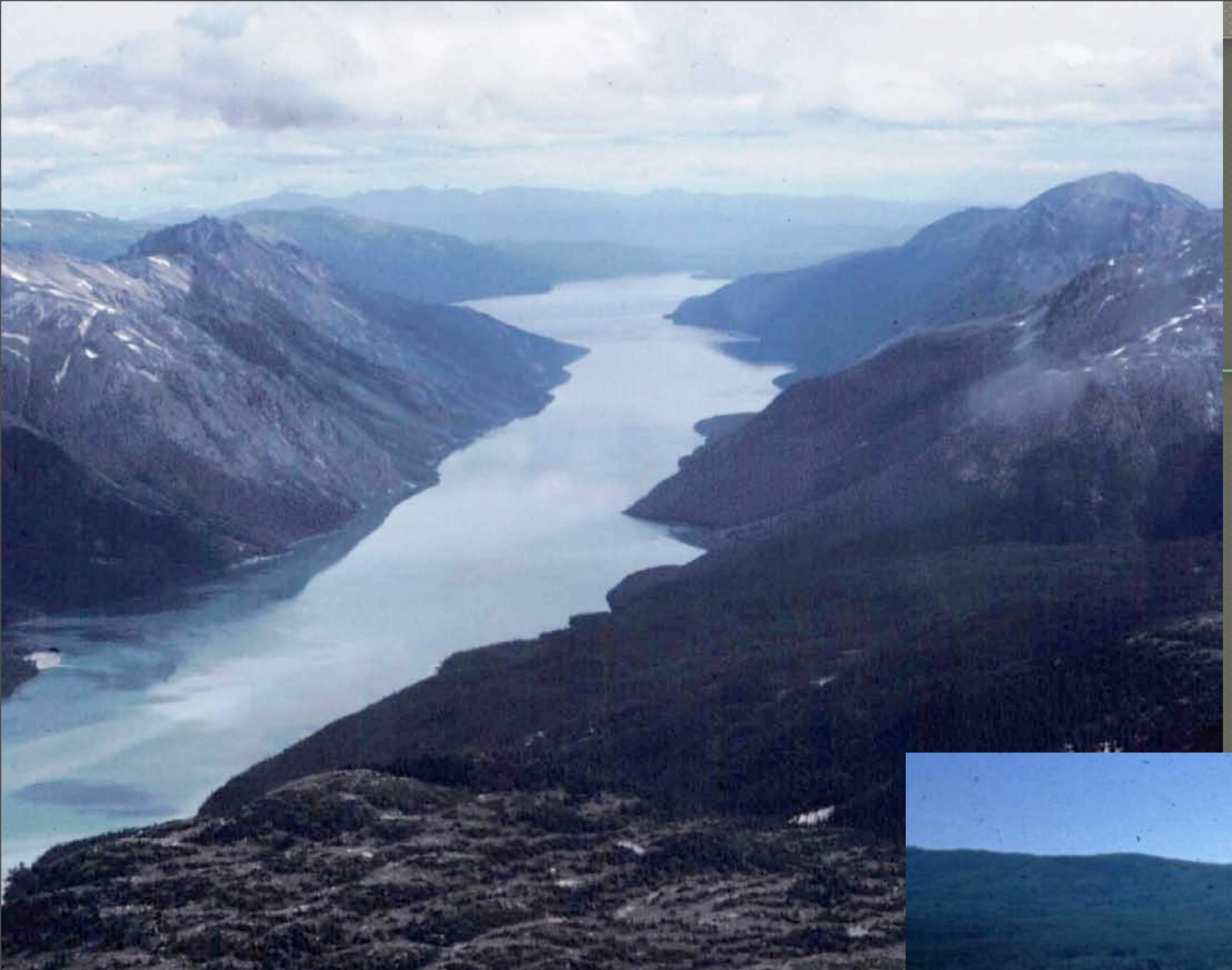


Hydrological Change

- ↑ Warmer water in rivers, lakes & ocean
- Cold-water fish decline
- Less snow, more rain (shoulder seasons) >>changes streamflow ---volume & timing

Skeena near Temlaham J. Pojar

Glacial Retreat



Salmon Streams

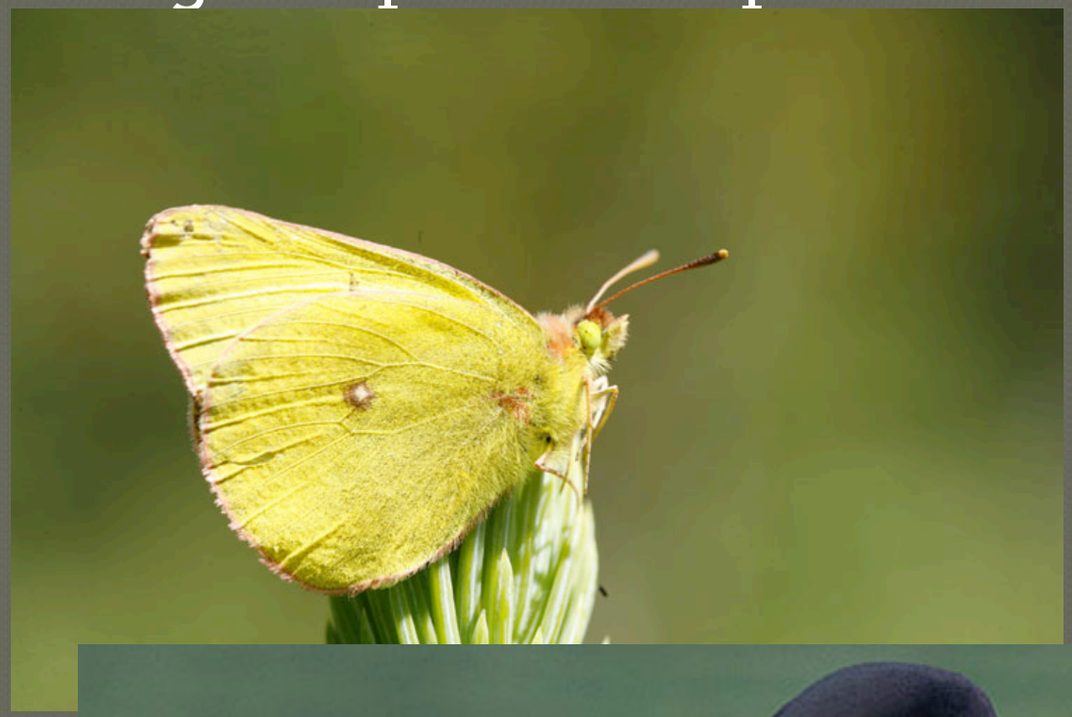
- Two of B.C.'s largest rivers
- Large populations of spawning salmonids + steelhead
- Lake-headed salmon streams
- Water T of small lakes & streams such as Nadina, Maxan??

Morice Lake J. Pojar

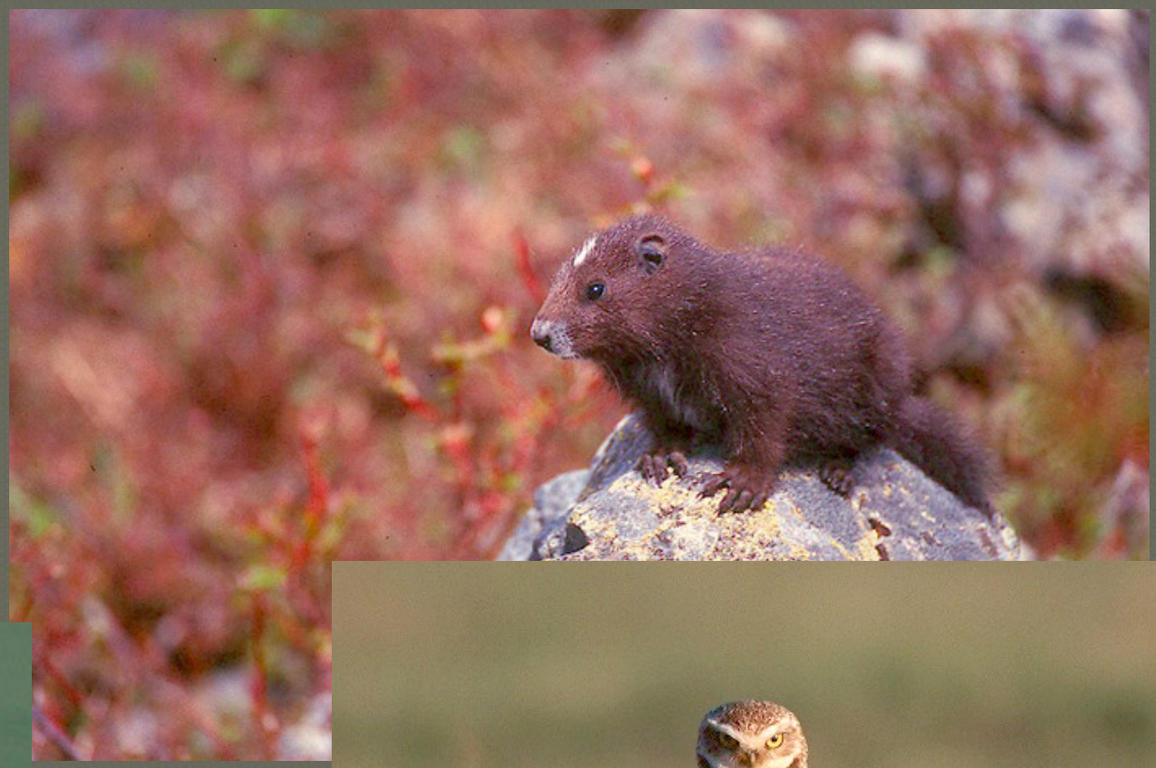
Babine Lake, SE arm J. Pojar

Climate Change Effects on Wildlife

Changes in pollination patterns



Changes in hibernation patterns



Changes in migration patterns

Reduced & Fragmented Habitat

Big threat not cc acting in isolation; combination cc & other human footprints.

Red Chris exploration camp

Ecosystem responses complex & difficult to predict; reflect combined and synergistic effects of Δs climate, natural disturbances, land & resource uses, and invasive species.

Haida Gwaii

Finlay clearcut W. Sawchuk

Acknowledgements

Bulkley Valley Research Centre

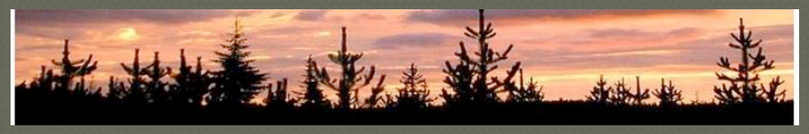
Ministry of Forests and Range (FLNRO)

Ministry of Environment

Future Forest Ecosystem Initiative:
http://www.for.gov.bc.ca/hts/Future_Forests/

Dr. Jim Pojar

Dave Daust



IPCC Special Report

- *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*
- *IPCC Video*