ADB

• Ulaanbaatar, Mon: 7 Sept
•Astana, KAZ: 10 Sept
•Baku, Azerbaijan: 13 Sept

ADB CAREC Workshop: Finding Mitigation and Adaptation Opportunity In A Climate Changing World

Peter Hayes
Senior Climate Change Specialist
Central and West Asia Department
Asian Development Bank, Metro Manila Philippines

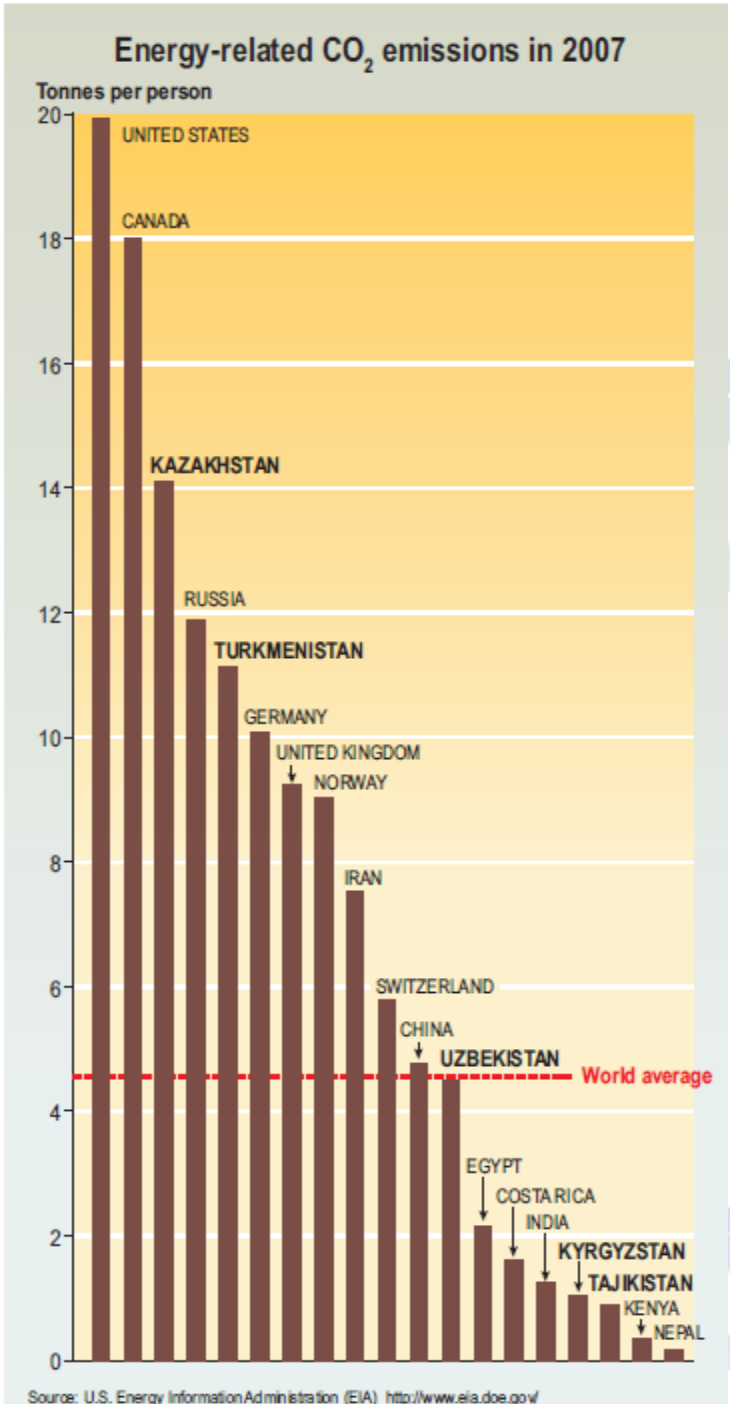
ADB

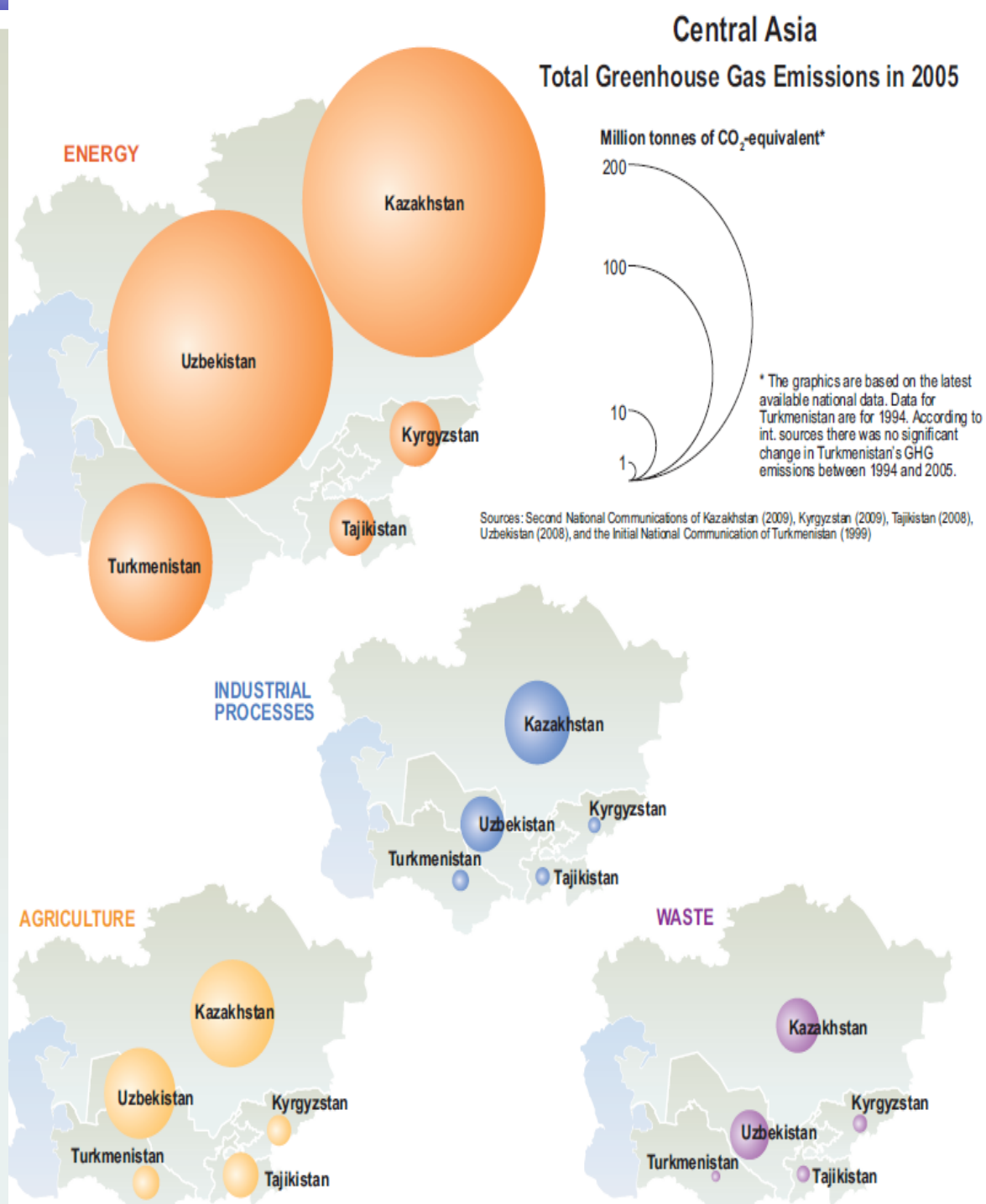
ADB

Outline of Presentation

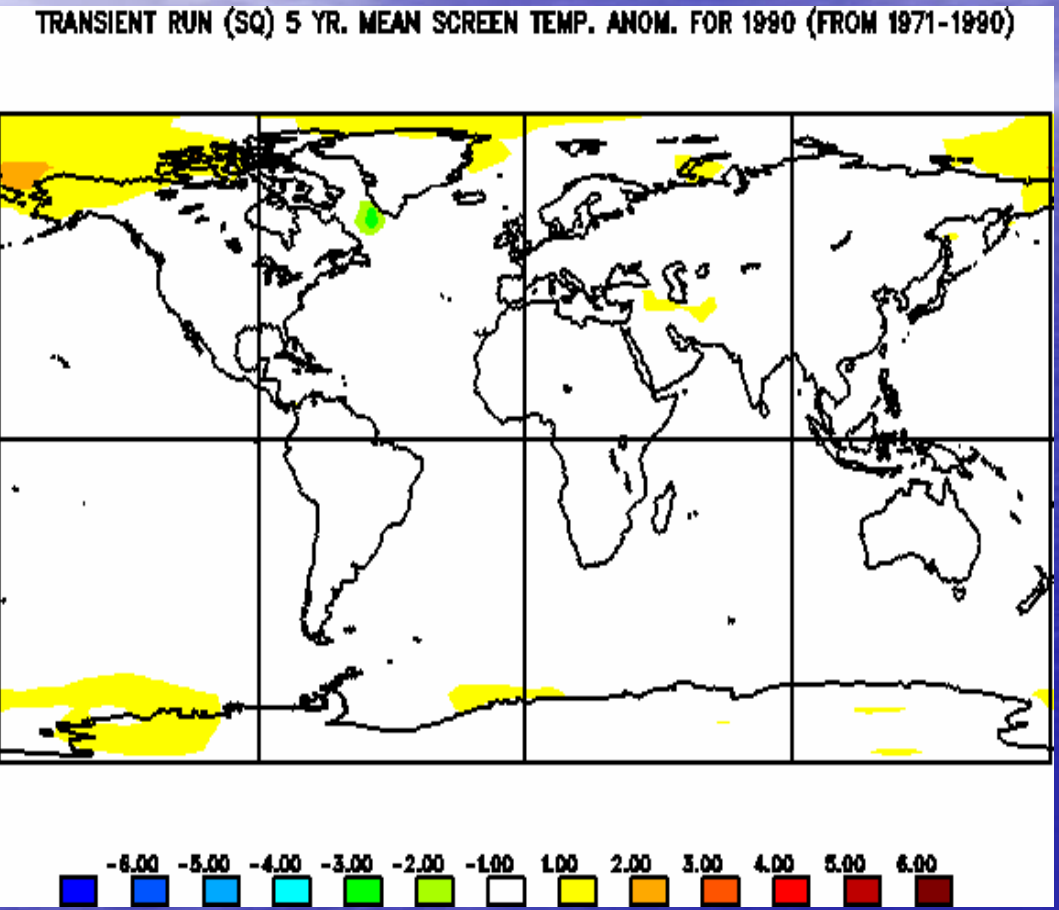
- GHGs, Global Warming, & The Science of Climate Change
- Global Impacts of Climate Change
- Economic Impacts of Climate Change
- Country-Level Climate Impacts
- Climate Impacts on Transportation
- Some Adaptation Actions

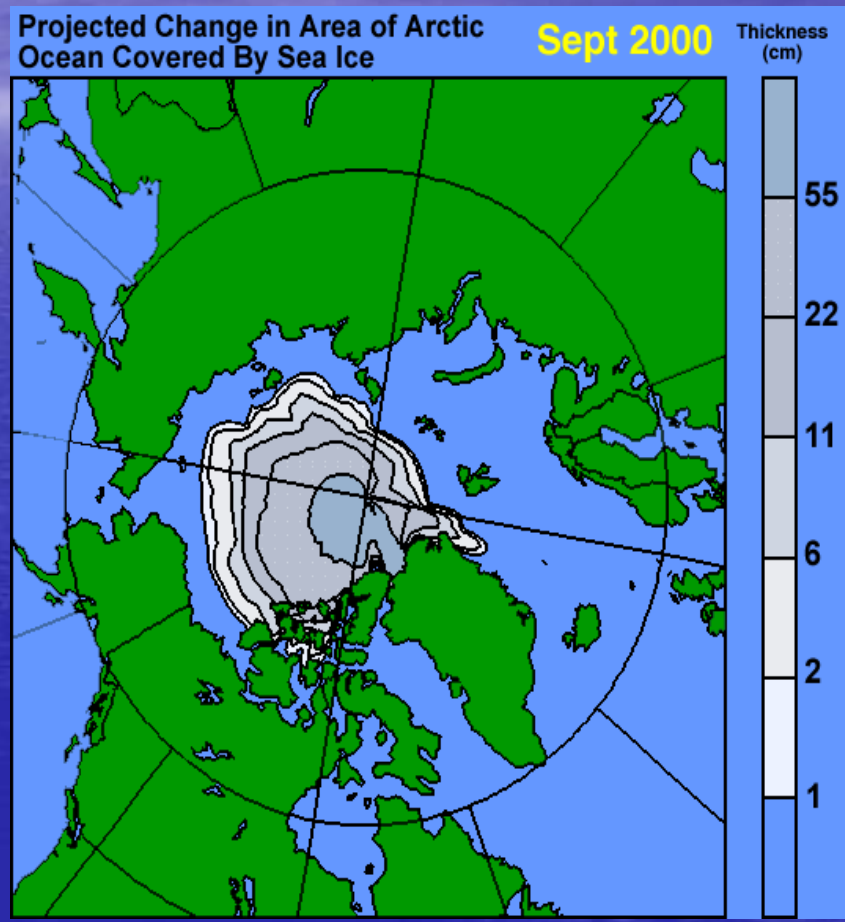
ADB

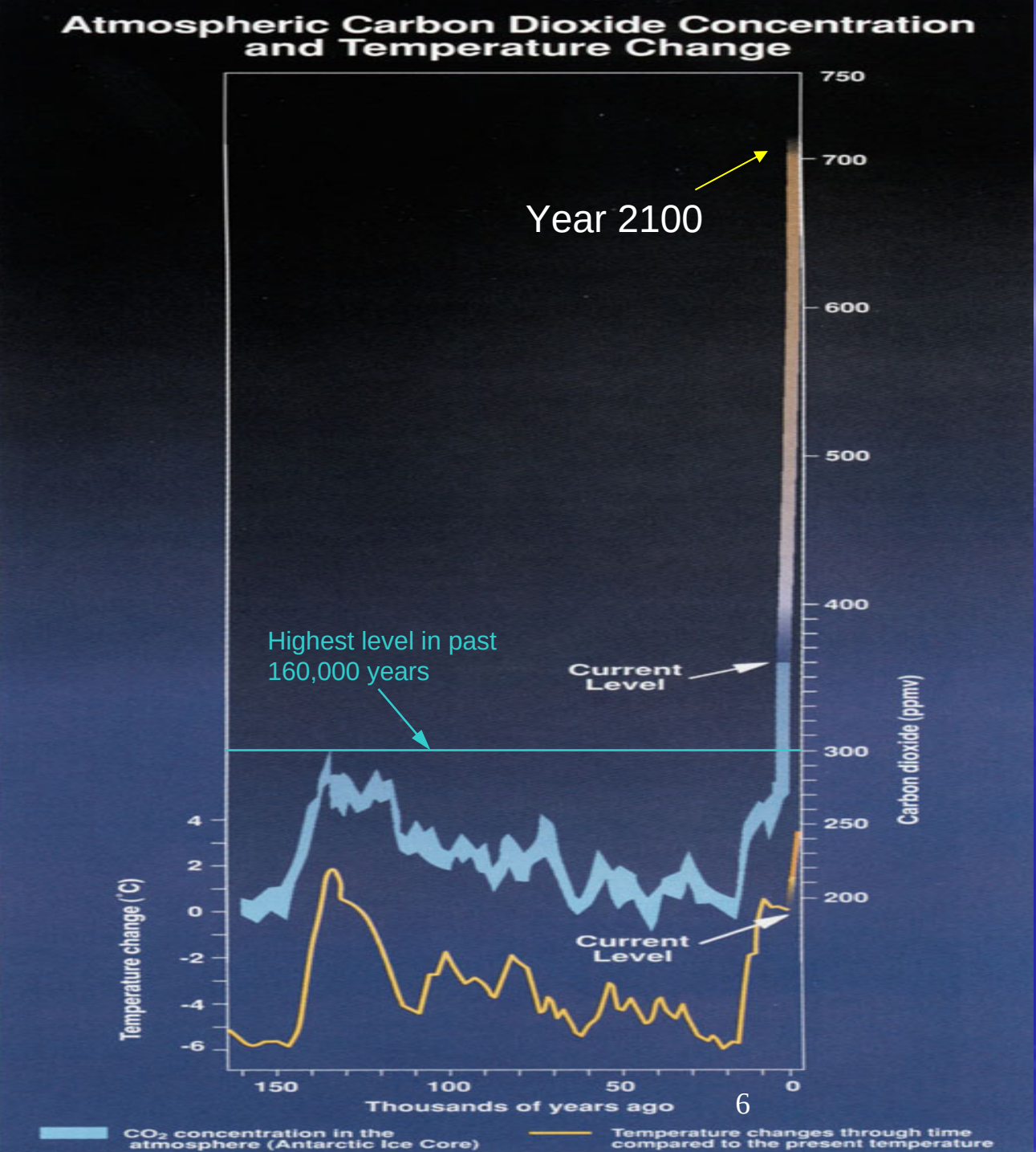

Energy-related CO_2 emissions in 2007
Tonnes per person
20
18
16
14
12
10
8
6
4
2
0
UNITED STATES
CANADA
KAZAKHSTAN
RUSSIA
TURKMENISTAN
GERMANY
UNITED KINGDOM
NORWAY
IRAN
SWITZERLAND
CHINA
UZBEKISTAN
World average
EGYPT
COSTA RICA
INDIA
KYRGYZSTAN
TAJIKISTAN
KENYA
NEPAL
Source: U.S. Energy Information Administration (EIA) http://www.eia.doe.gov/


Central Asia
Total Greenhouse Gas Emissions in 2005
ENERGY
Kazakhstan
Uzbekistan
Kyrgyzstan
Tajikistan
Turkmenistan
Million tonnes of CO_2-equivalent*
200
100
10
1
* The graphics are based on the latest available national data. Data for Turkmenistan are for 1994. According to int. sources there was no significant change in Turkmenistan's GHG emissions between 1994 and 2005.
Sources: Second National Communications of Kazakhstan (2009), Kyrgyzstan (2009), Tajikistan (2008), Uzbekistan (2008), and the Initial National Communication of Turkmenistan (1999)
INDUSTRIAL PROCESSES
Kazakhstan
Uzbekistan
Kyrgyzstan
Turkmenistan
Tajikistan
AGRICULTURE
Kazakhstan
Uzbekistan
Kyrgyzstan
Turkmenistan
Tajikistan
WASTE
Kazakhstan
Kyrgyzstan
Uzbekistan
Turkmenistan
Tajikistan

Projected GHG Emissions & Temperature Rise/Polar Glacial Melt







Before

Pre-industrial CO_2 was 280ppm

Now (2005)

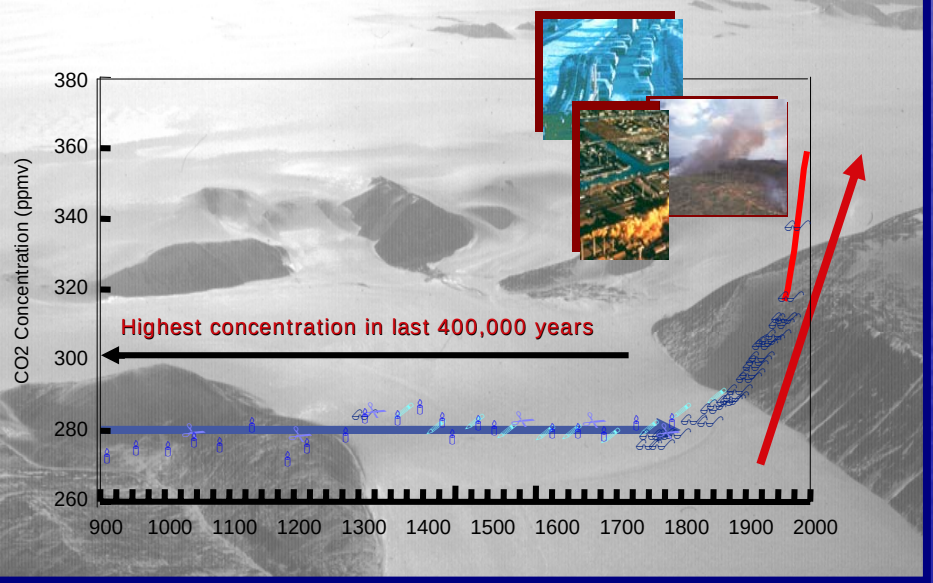
379 ppm

By 2100

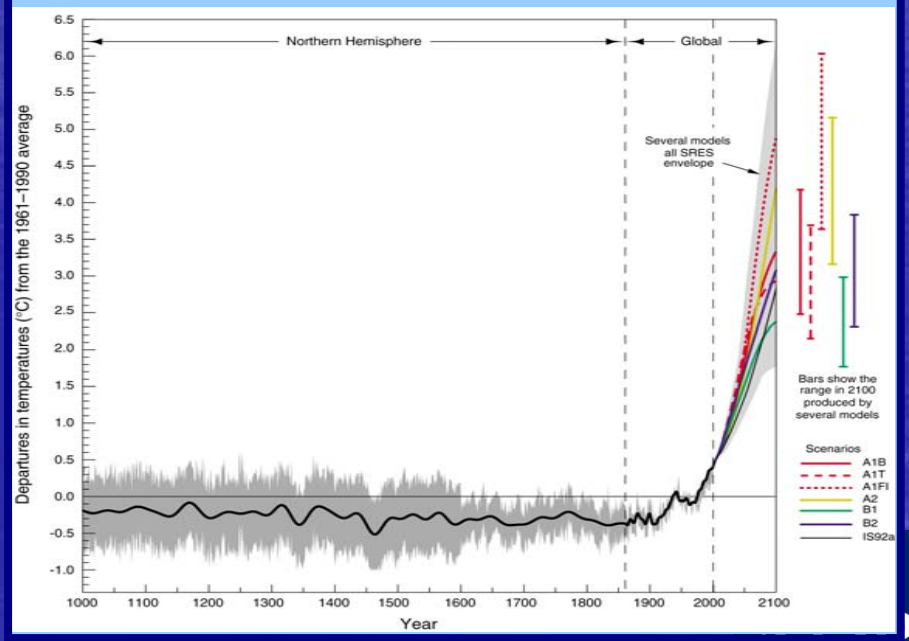
- **Concentrations of CO_2 expected to exceed 700 ppm**
- **Global average temperatures projected to increase between 1.4 – 5.8 ºC**

Fossil Fuel & Green House Effect

CO2 concentrations are now unprecedented in at least the past 400,000 years

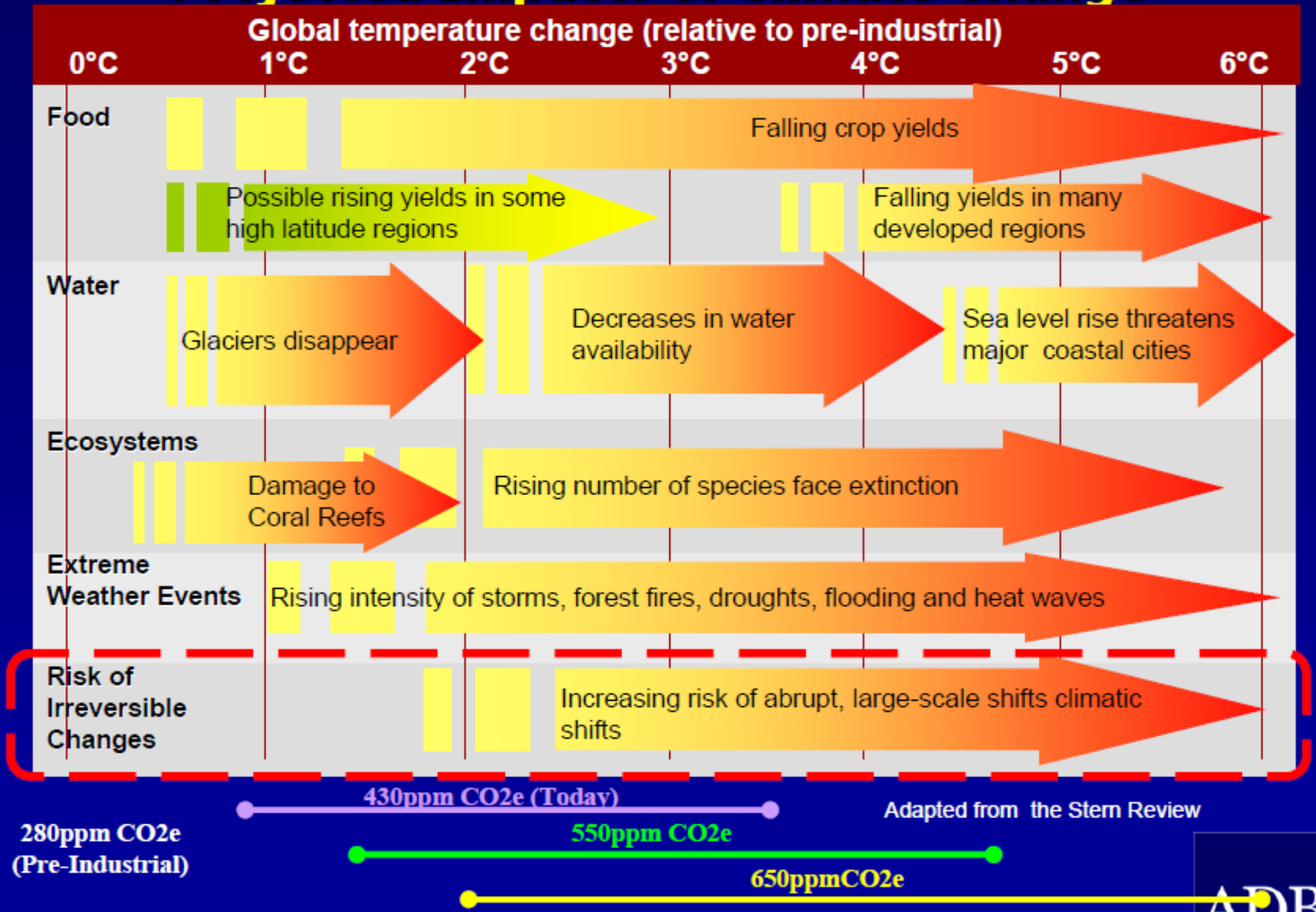


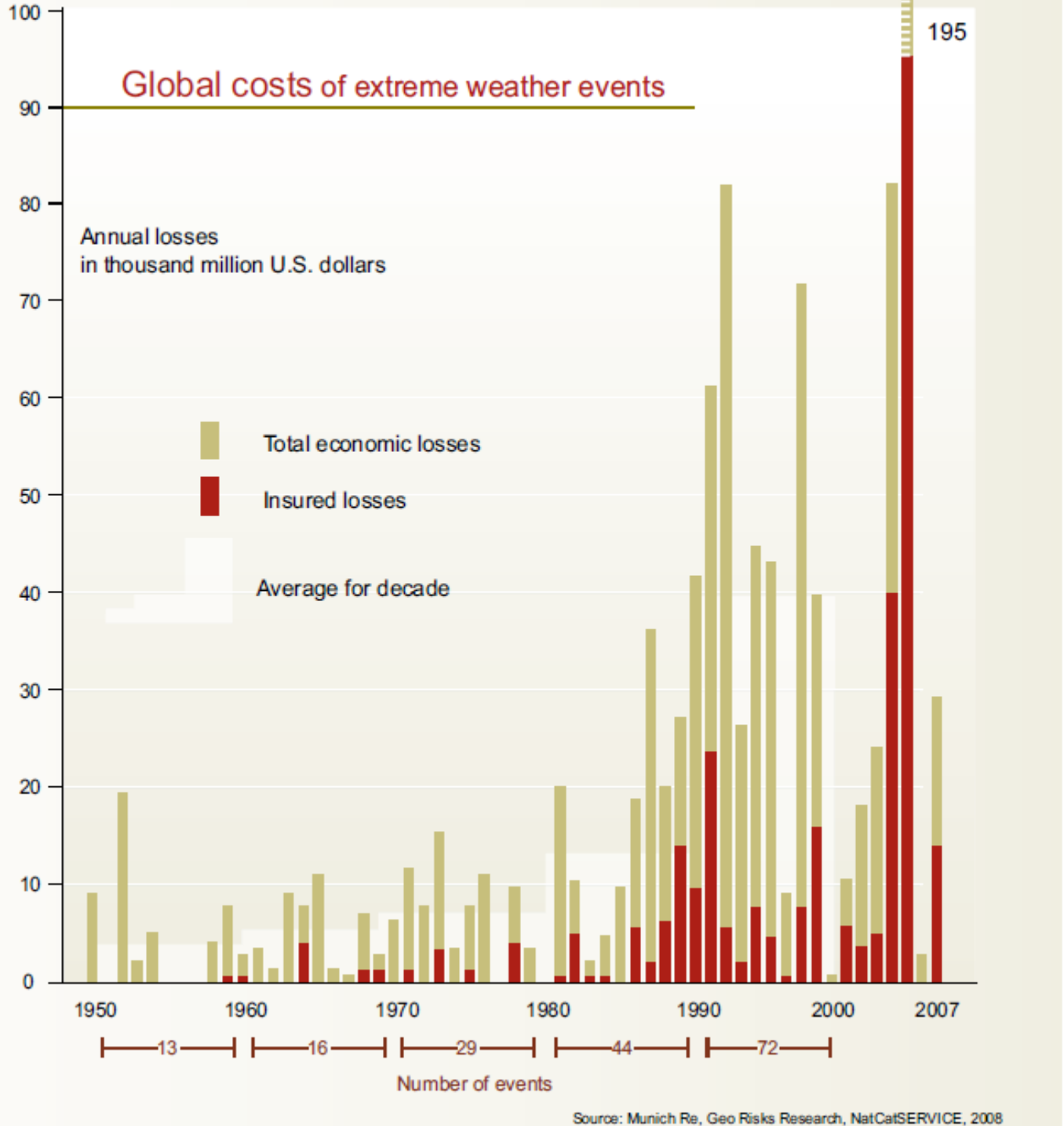
The world will become MUCH, MUCH warmer than during the past millennium



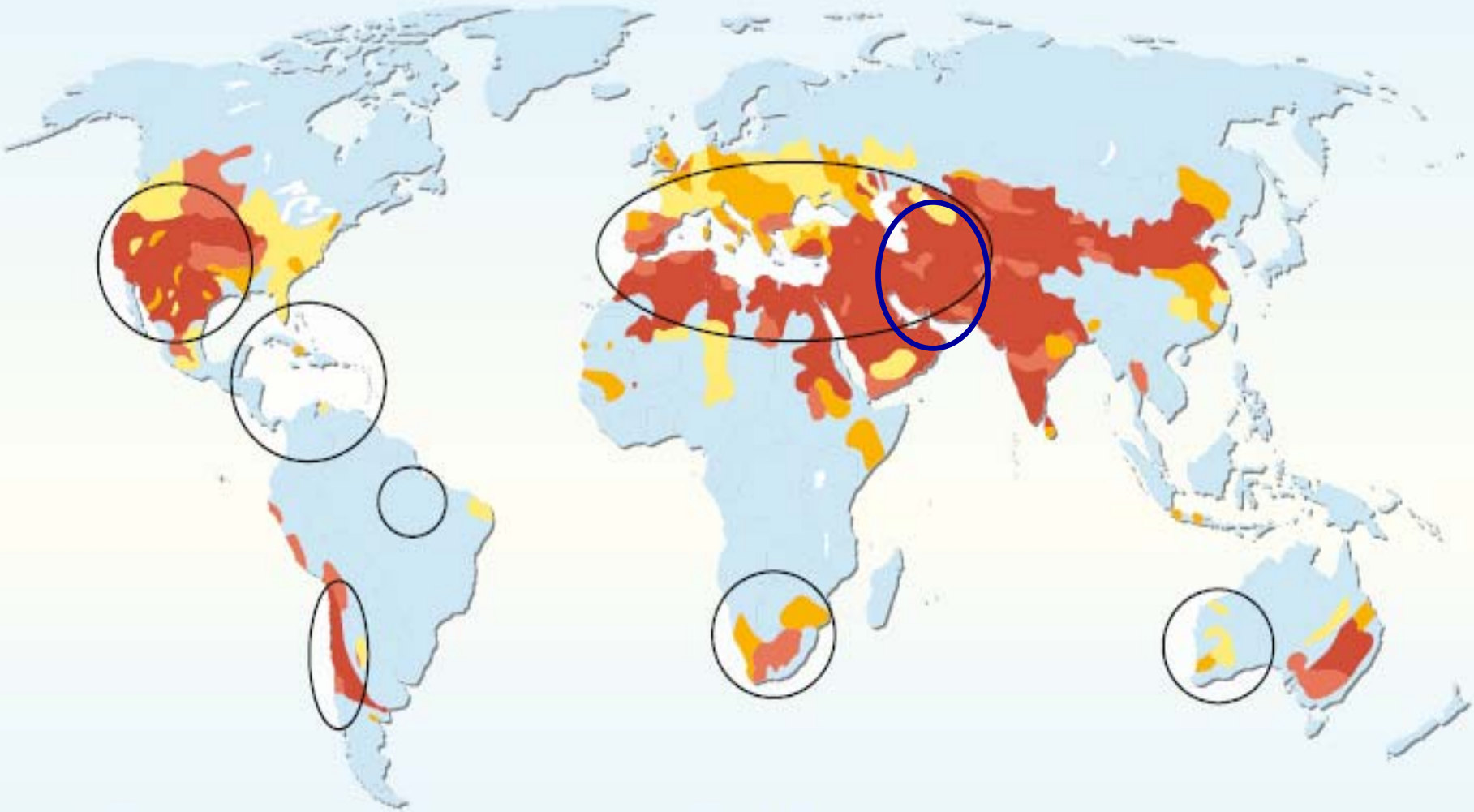
Global Climate Impacts

Projected Impacts of Climate Change




Global costs of extreme weather events
Annual losses
in thousand million U.S. dollars
195
100
90
80
70
60
50
40
30
20
10
0
Total economic losses
Insured losses
Average for decade
1950
1960
1970
1980
1990
2000
2007
13
16
29
44
72
Number of events
Source: Munich Re, Geo Risks Research, NatCatSERVICE, 2008

Water stress and climate change



Water stress: ratio between withdrawal and availability (in 2000)

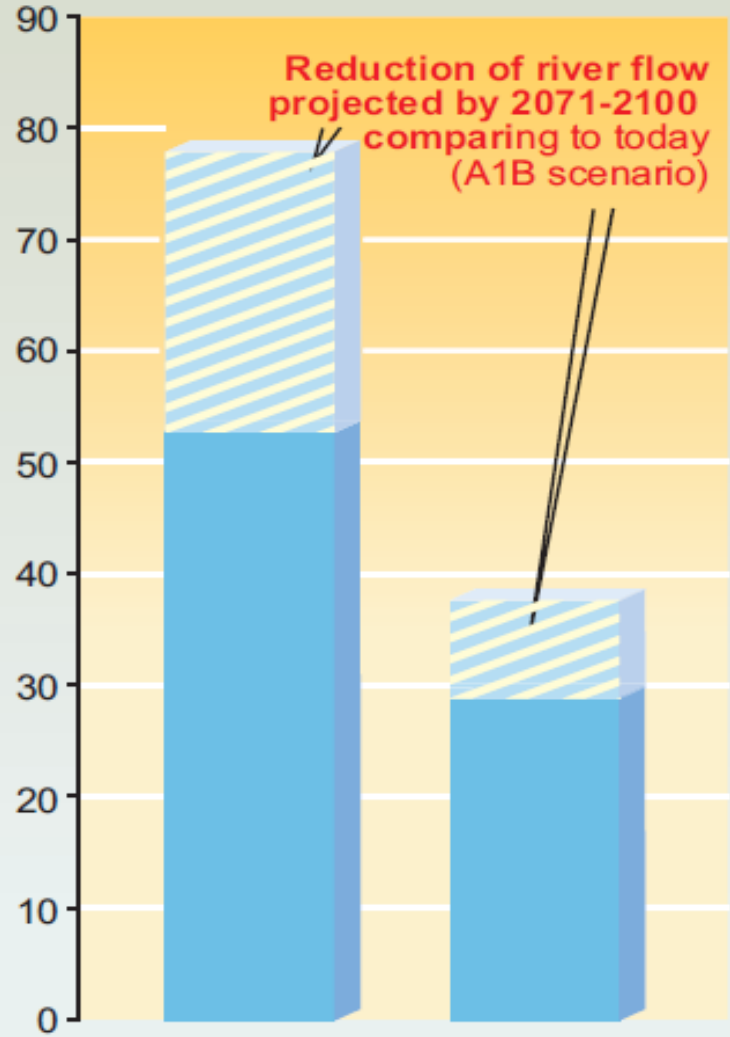
no stress	low	moderate	high	very high
0	0.1	0.2	0.4	0.8

Global regions where climate change is projected to decrease annual runoff and water availability

Source: IPCC, 2007.

Climate Impacts - Water

Climate change impact on flow of large rivers



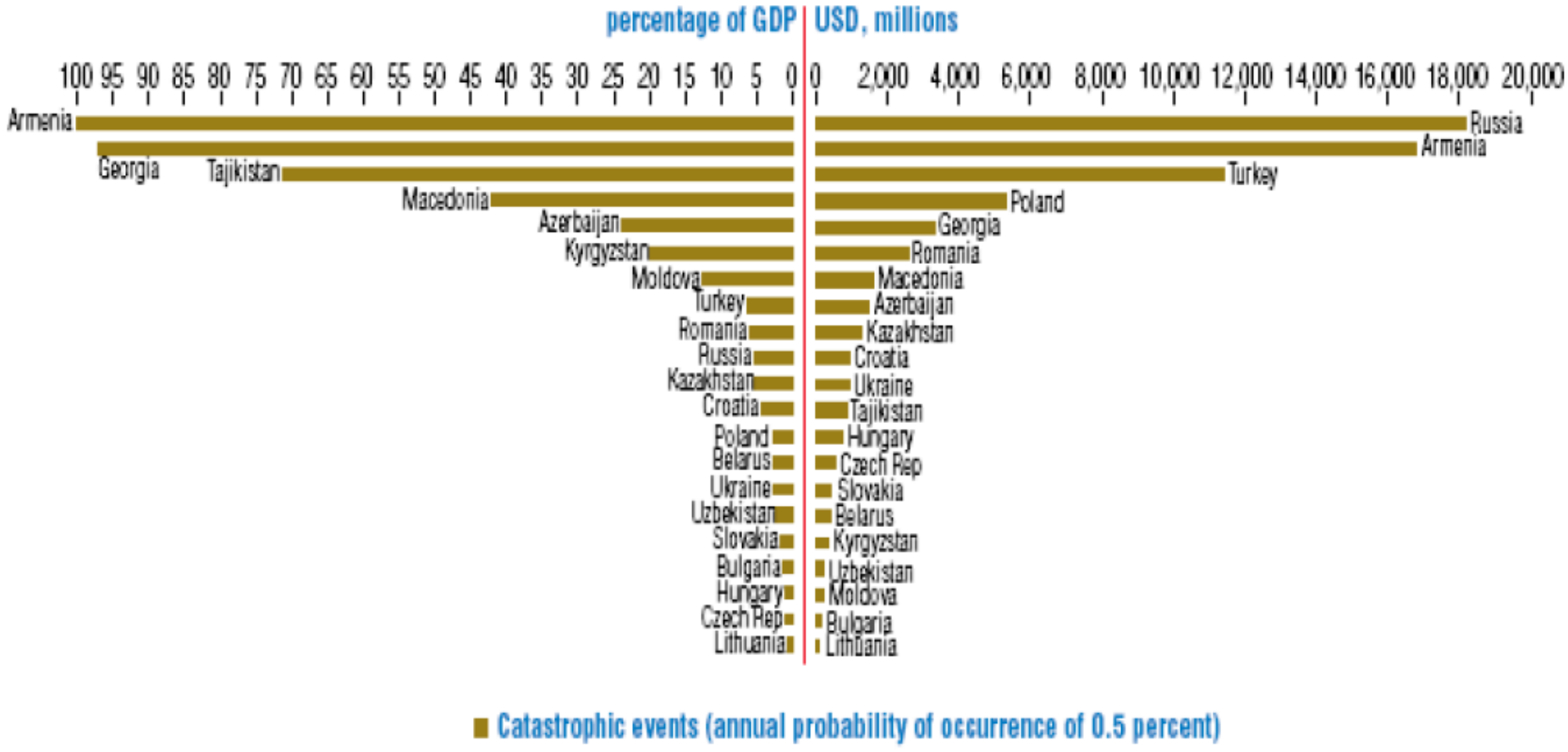
Sources: Uzbekistan's Second National Communication, 2008;, Kyrgyzstan's Second National Communication, 2009; Shiklomanov, 2009

ADB

Economic Impacts of Climate Change

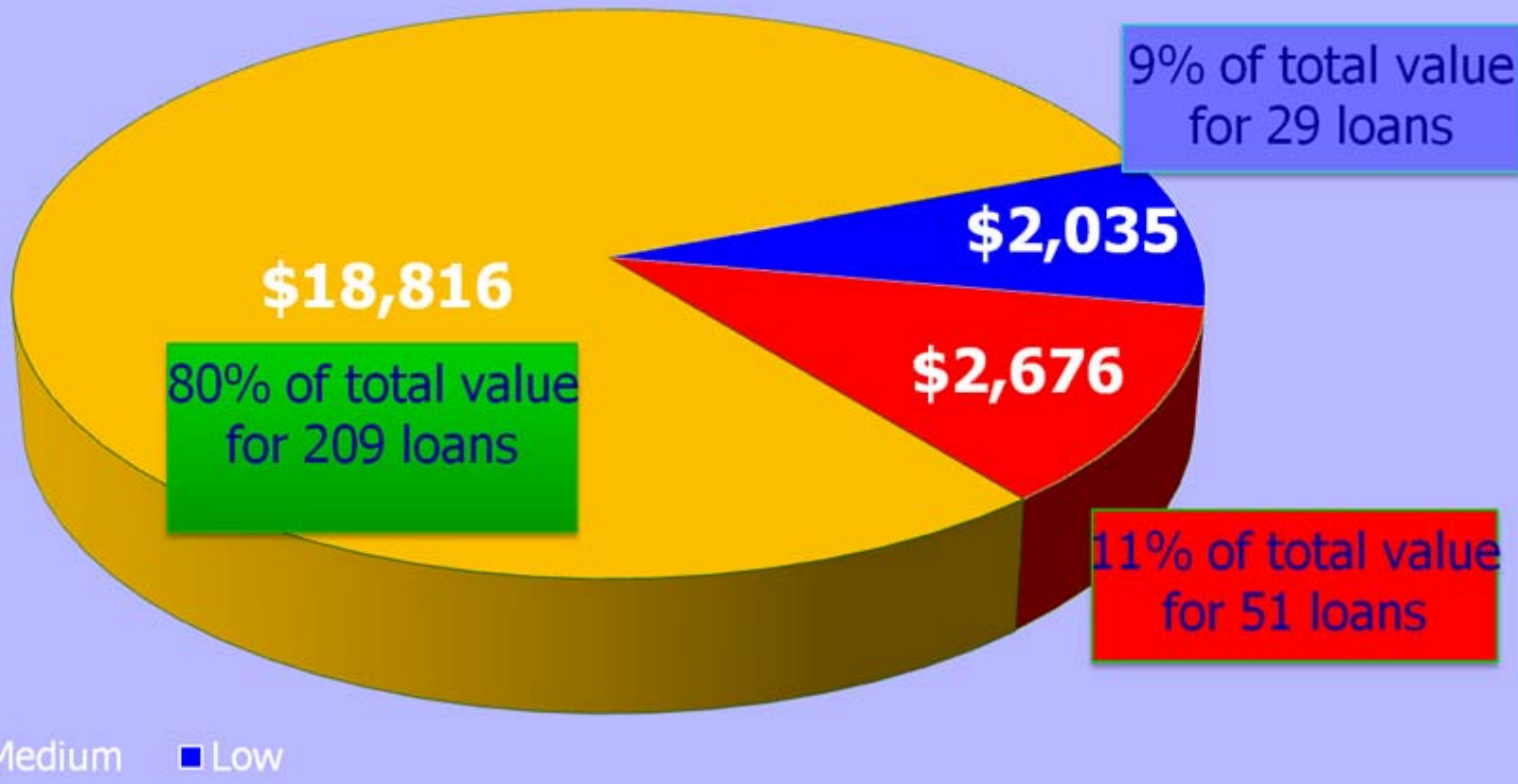
ADB

FIGURE 7.1 ECONOMIC LOSS POTENTIAL OF CATASTROPHIC EVENTS FOR ECA COUNTRIES



Source: Pusch 2004. *Notes:* Does not include drought, forest fire, or industrial accident hazards.

ADB's Screened Loan Portfolio, By Risk Values (US$Mn)



Country-Level Climate Impacts

Mongolia: Observed Changes (1940 – 2007)

- Annual mean air temperature increase 2.1 C
- Average annual precip. decreased: 7%
- Increased incidence and severity of droughts

Projected Changes:

- Increase by 5C & 4% decrease precip.
- Increase in climate-induced permafrost and glacial melt; extreme weather

ADB

Mongolia: Climate Impacts

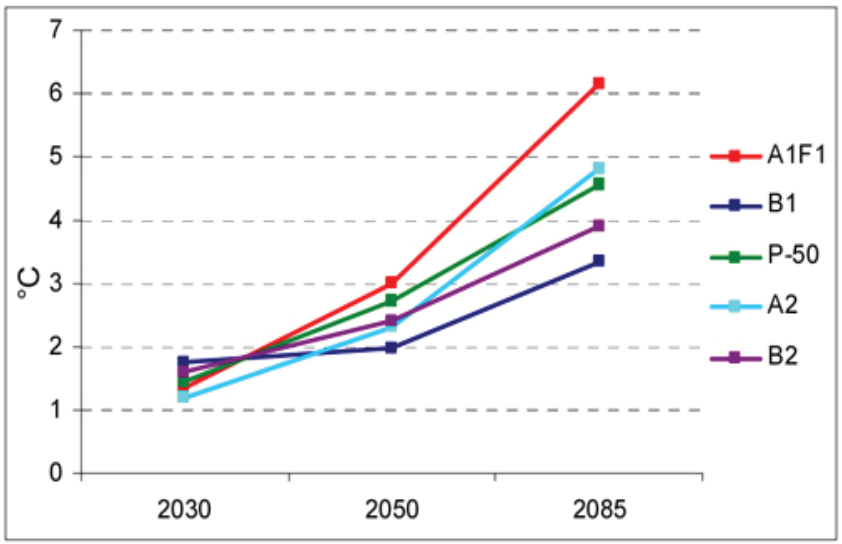
- Increase in desertification & expansion of Gobi desert
- Decrease in grassland productivity
- Decrease in pasture biomass resulting in livestock vulnerability
- Decline in the availability of water from increased surface evaporation rates

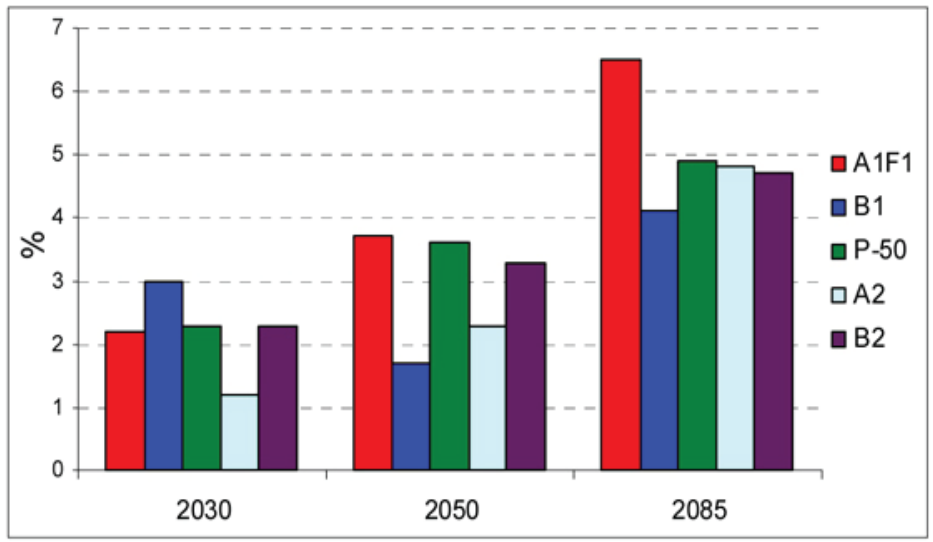
ADB

Kazakhstan: Observed Changes (1936 – 2005)

- Average annual air temperature increased by 0.31 °C for every 10 years
- Significant increase of the number of extremely warm days/ extremely warm nights
- Un-defined trend in annual & seasonal precipitation
- Degradation of glaciers

Projected to 2085:





Kazakhstan: Climate Impacts

- Increase in water scarcity
- Increase in rainfall and glacial mudflows

- Spring wheat productivity decrease in all scenarios
- Pasture productivity likely to increase in spring & decrease during rest of year

ADB

Azerbaijan: Projected Impacts by mid Century

- Increase in average temperature
- Increase in sea level by 150 cm: flooding of 88,000 hectares of coastal areas
- Increase in frequency of droughts; extension of semi-deserts and dry steppes

ADB

Azerbaijan: Climate Impacts by mid Century

Topography

Lowlands and piedmont

Mountains

Impacts on water resources and hydrology

Precipitation and moisture availability decrease and increase in temperatures: more frequent drought, impact on food production and health.

Maximum extent of sea ice (present and future)

River flow increase, earlier onset of spring waters, reduced peak flood

River flow and water availability decrease

Sea level fluctuations (flooding of ecosystems, agriculture lands and human infrastructure, settlements, oil fields)

Impacts on terrestrial ecosystems

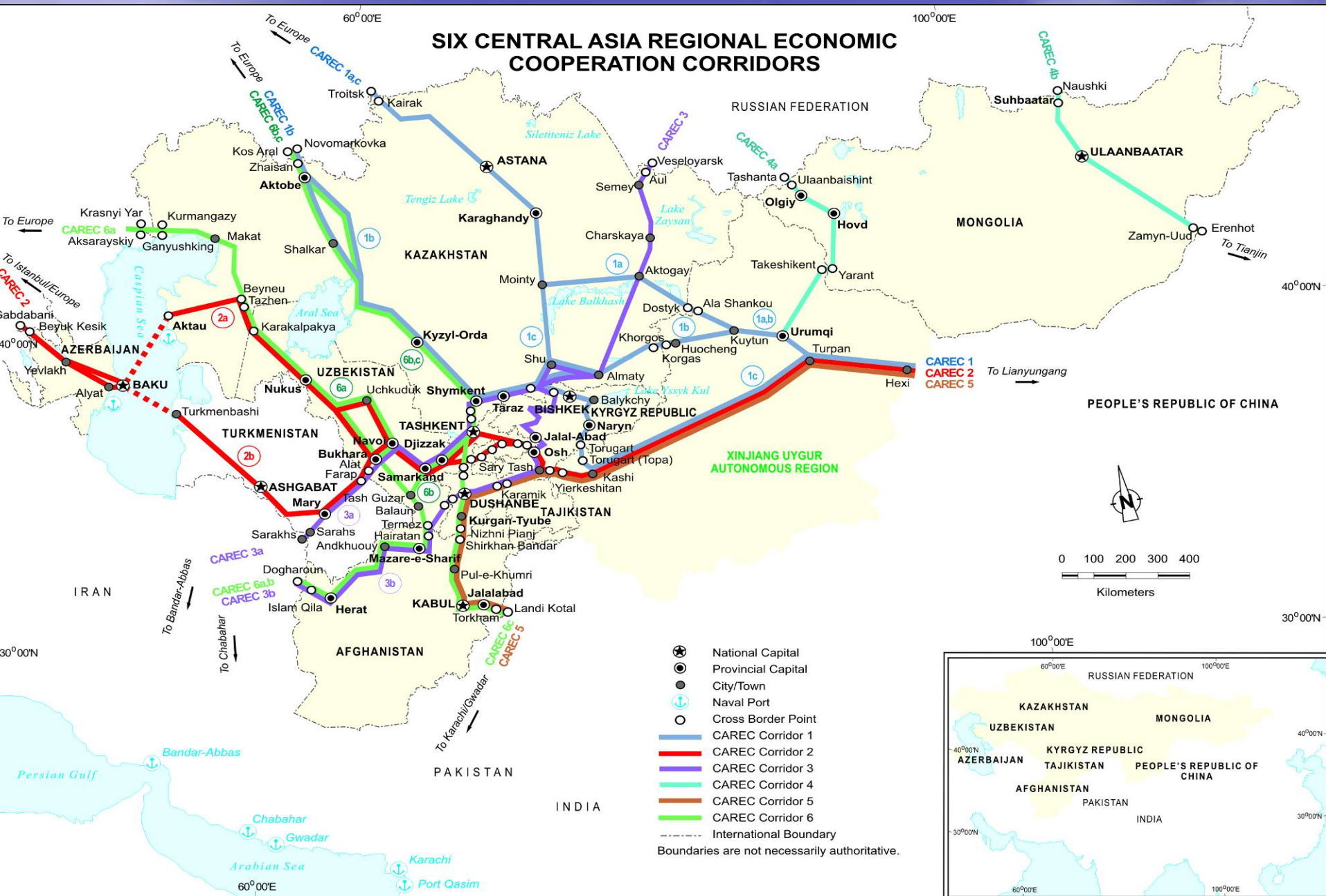
Desertification (deserts, semi-arid and arid lands expansion)

Sources: National Communications from Iran, Azerbaijan, Armenia, Kazakhstan, Russia, Turkmenistan to the United Nations Framework Convention on Climate Change (UNFCCC); Yu. Izrael 1997; S. Rodionov 1998; International Research Institute for Climate Prediction 2001, IPCC 2001; V. Mikhailov, G. Richagov and E. Povalishnikova 2002; Russian Hydrometeorological Service 2002; T. Henrichs and J. Alcamo 2002; M. Zappa and J. Gurtz 2002; V. Arora and G. Boer 2002; K. Arpe 2005.

Climate Impacts on Transportation

ADB

Climate Impacts - Transportation



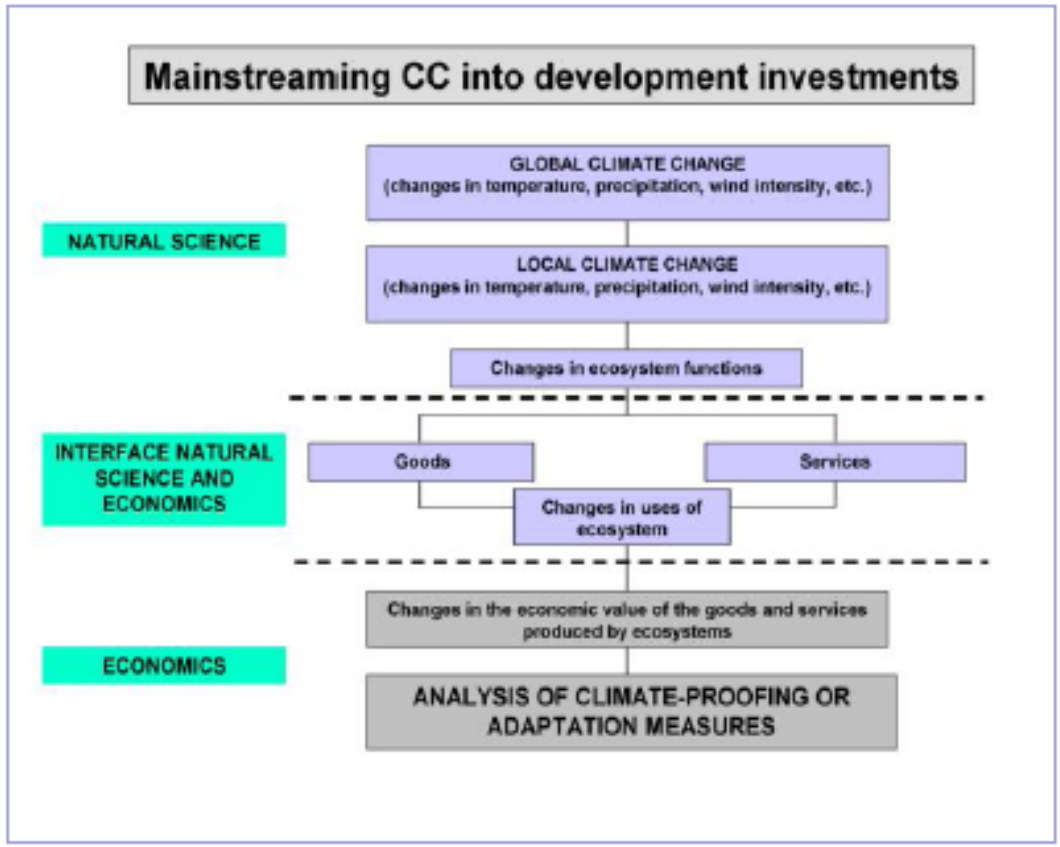
Climate Impacts - Transportation

- Transportation corridors impeded by recurrent extreme events (100 year event now 10 year event)
- Storm sewers and sanitary systems unable to deal with more frequent, high-intensity rainfall and storms
- Increased precip, temp change, and flash flood causing increased road maintenance costs: pavement softening; debris flow

ADB

Some Adaptation Actions

Climate Change Adaptation - Process



Risk Management and Adaptation

Project Screening

Step A

Hazard assessment

Step A1: Determine the basin in which the project is located;
Step A2: Identify the hazard level for this basin.

Q1: **Potential Climate Hazards:** Is the project vulnerable to any climate hazards?

Step B

Vulnerability assessment

Step B1: Determine the development field;
Step B2: Identify the different impacts of the respective hazards on the project;
Step B3: Assign the appropriate levels to the three components of vulnerability;
Step B4: Determine the level impact on the society and the strategic importance;
Step B5: Determine the appropriate vulnerability level.

Q2: **Vulnerabilities:** Are the intervention's objectives vulnerable to variations in climate?

Step C

Risk assessment

Step C1: on the basis of the hazard and vulnerability levels, determine the appropriate risk level;
Step C2: Determine the appropriate action and validate this recommendation..

Step D

Identification of risk management and adaptation options

Step D1: Identify potential options;
Step D2: Rate the different options;
Step D3: Summarize all options.

Q3: **Existing Risk Management:** Does the intervention already take climate hazards into consideration?

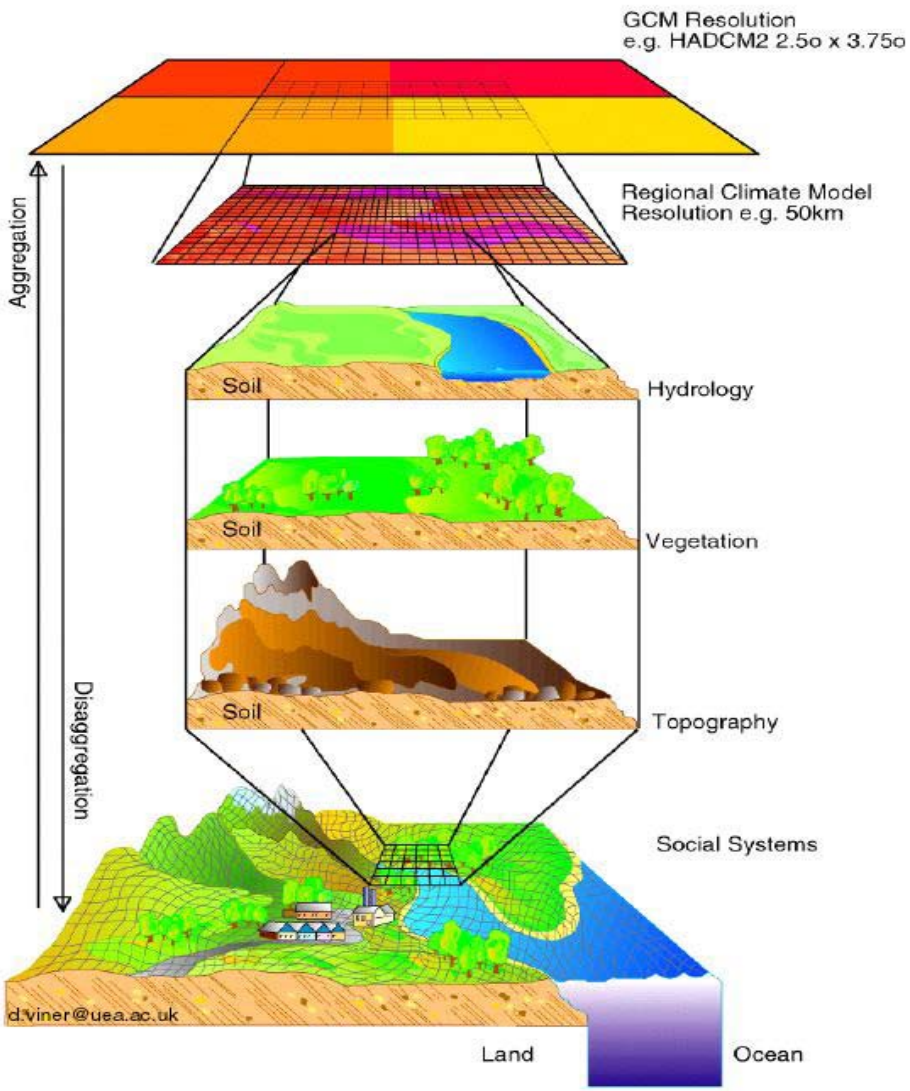
and,

Q6: **Risk management options:** What risk management options are to be implemented? What options could be implemented in addition?

Step E

Recommendations

Impact and Vulnerability Assessments: Modeling



Climate Impact Assessment: Focus on Climate

- SRES scenarios*
- GCM selection
- Downscaling

Vulnerability Assessment: Focus on the Project

- Site characteristics
- Vulnerabilities
- Coping capacities
- Drivers of change
- Governance
- Exposure to natural hazards

Image: www.cccsn.ca/.../Downscaling_html_m5385e5b8.jpg

ADB

Adaptation Actions: Transportation

- Bioengineering: re-forest/re-vegetate unstable slopes; stone-filled nettings
- Hazard mapping of road networks
- Improved longitudinal/transverse drainage capacity (more intense and frequent flood load)
- Greater road surfacing resiliency against anticipated temperature and precipipitation extremes

ADB

Two outcomes…the first:

Improved planning for rural roads to accommodate climate changes

- **Prepare vulnerability maps for rural roads:**
  - *due to climate change*
  - *to improve planning for climate changes*
  - *include potential climate change down scaling*

- **Identify potential adaptation options:**
  - *prioritize them*
  - *use an economic analysis of climate-proofing measures*
  - *to support the decision making process*

ADB

Thanks!

Peter J. Hayes

Senior Climate Change Specialist
CWRD, Asian Development Bank

phayes@adb.org

ADB