

# **IPCC FOURTH ASSESSMENT**

## **CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY**

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**April 18, 2007**



**Intergovernmental Panel on Climate Change Working Group II**



# THE PROCESS

- 394 Authors
- 45 Review Editors
- 4 Review Cycles
- 1,183 Expert Reviewers
- 49,610 Review Comments
- Five year process 2003 – 2007
- Approved in Brussels, 6<sup>th</sup> April 2007



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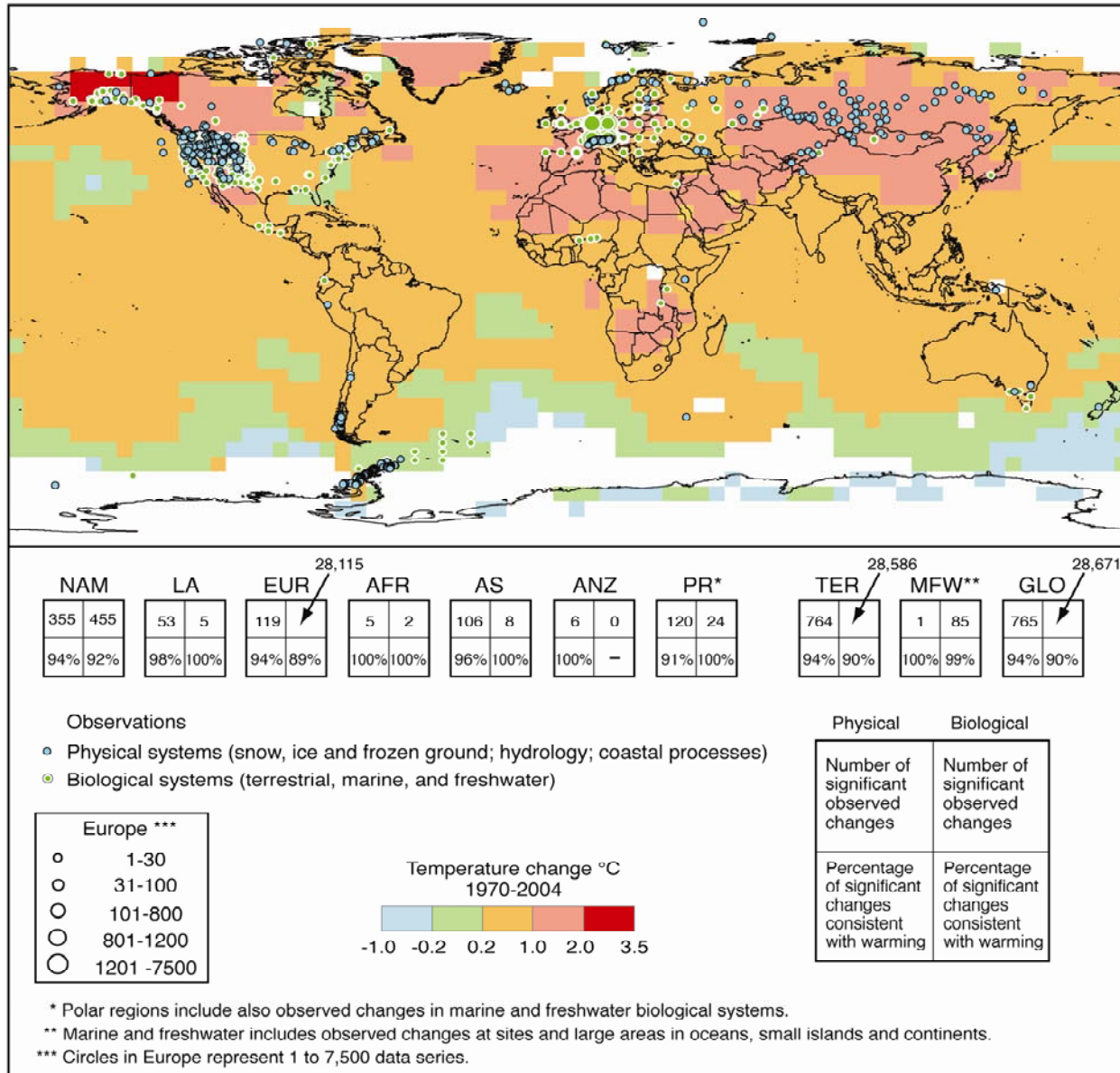


# Structure of Report

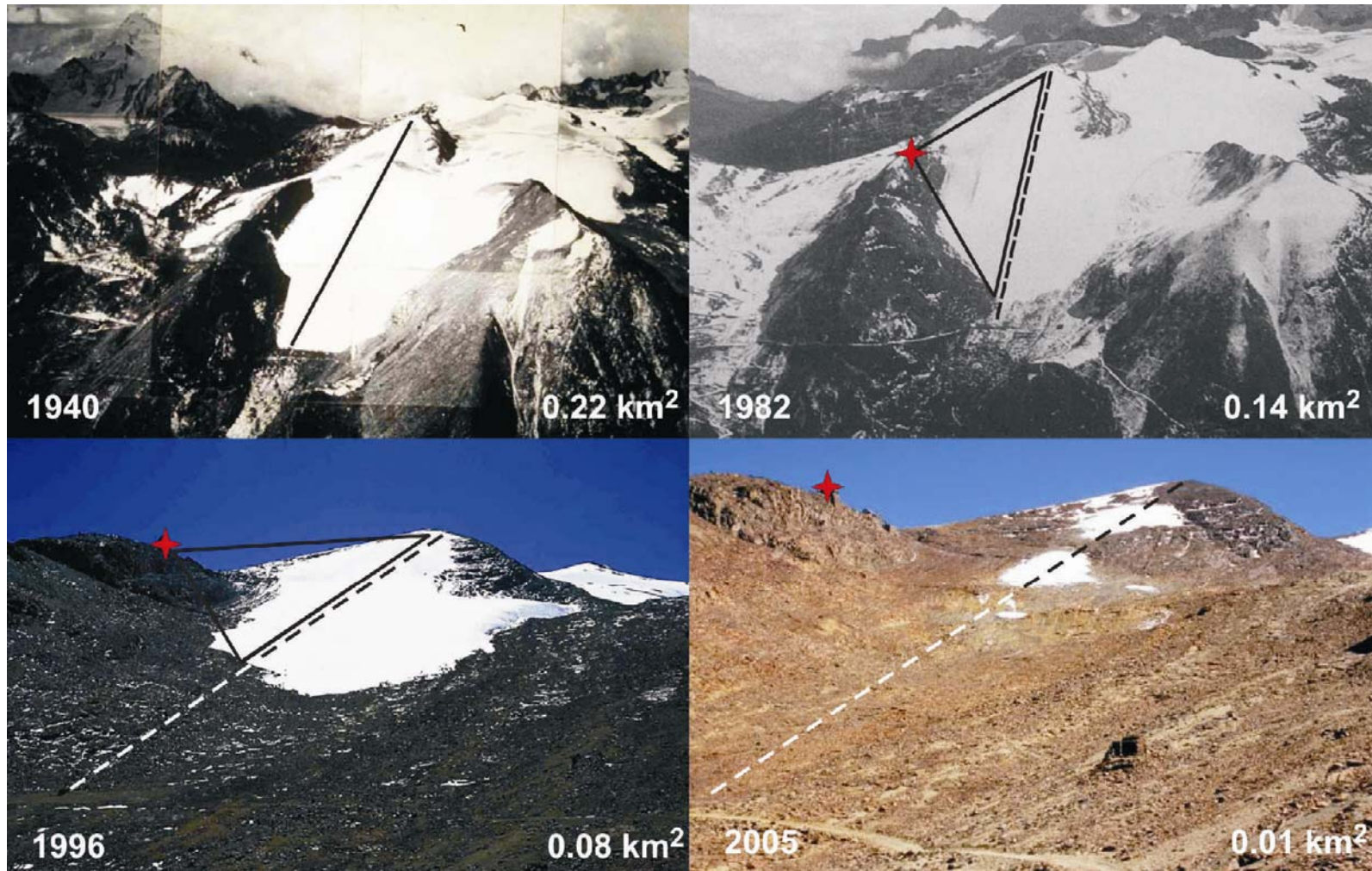
- Section 1 – Observed Impacts
- Section 2 – Future Impacts on Systems and Sectors
- Section 3 – Responding to Climate Change

# OBSERVED IMPACTS OF CLIMATE CHANGE

- We can now detect the global effects of anthropogenic warming
  - Second Assessment 1995: detected the anthropogenic influence on global climate
  - Third Assessment 2001: detected the physical and biological effects of regional climate change
  - Fourth Assessment 2007: detected the global effects of anthropogenic warming on physical and biological systems



## Changes in physical and biological systems and surface temperature 1970-2004



**Areal extent of Chacaltaya Glacier, Bolivia, from 1940 to 2005**

# FUTURE IMPACTS OF CLIMATE CHANGE

**Six Sectors:** Freshwater Resources and their Management; Ecosystems, their Properties, Goods, and Services; Food, Fibre, and Forest Products; Coastal Systems and Low-lying Areas; Industry, Settlement and Society; Human Health

**Eight Regions:** Africa, Asia, Australia and New Zealand, Europe, Latin America, North America, Polar Regions, Small Islands



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# SECTORS

**Water:** Water supplies stored in glaciers and snow cover are projected to decline, reducing water availability in regions supplied by meltwater from major mountain ranges, where more than one-sixth of the world population currently lives.

**Ecosystems:** ~20-30% of plant and animal species assessed so far are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5-2.5°C.

**Food:** At lower latitudes, crop productivity is projected to decrease for even small local temperature increases (1-2°C). At higher latitudes crop productivity is projected to increase for temperature increases of 1-3°C, then decrease beyond that.

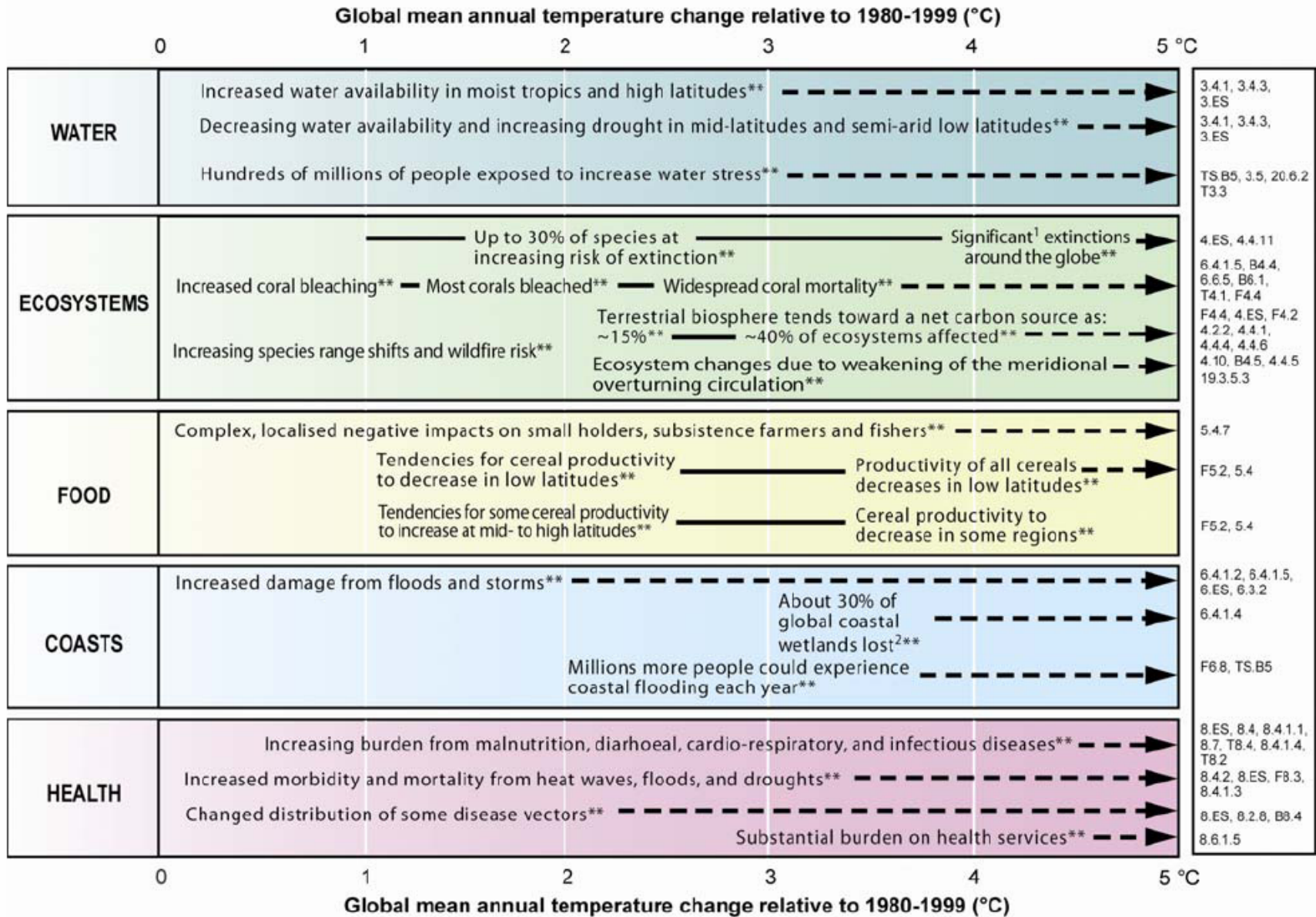
**Coasts:** Many millions more people are projected to be flooded every year due to sea-level rise by the 2080s.

**Industry, Settlement and Society:** The most vulnerable industries, settlements and societies are generally those in coastal and river flood plains, those whose economies are closely linked with climate sensitive resources, and those in areas prone to extreme weather events, especially where rapid urbanisation is occurring.

**Human Health:** Projected climate change-related exposures are likely to affect the health status of millions of people, particularly those with low adaptive capacity.



# Key Impacts as a Function of Increasing Global Average Temperature Change (Impacts will vary by extent of adaptation, rate of temperature change, and socio-economic pathway)



<sup>1</sup> Significant is defined here as more than 40%.

<sup>2</sup> Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.

Phenomena <sup>a</sup> and direction of trend [WGI SPM]	Likelihood of future trend based on projections for 21st century using SRES scenarios [WGI SPM]	Examples of major projected impacts by sector  <b>Extreme Events</b>			
		Agriculture, forestry and ecosystems [4.4, 5.4]	Water resources [3.4]	Human health [8.2]	Industry/settlement/ Society [7.4]
Warmer and fewer cold days and nights; warmer/more frequent hot days and nights over most land areas	Virtually certain <sup>b</sup>	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks	Effects on water resources relying on snow melt; increased evapo-transpiration rates	Reduced human mortality from decreased cold exposure	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow, ice; effects on winter tourism
Warm spells/heat waves: frequency increases over most land areas	Very likely	Reduced yields in warmer regions due to heat stress; wild fire danger increase	Increased water demand; water quality problems, e.g., algal blooms	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially-isolated	Reduction in quality of life for people in warm areas without appropriate housing; impacts on elderly, very young and poor.
Heavy precipitation events: frequency increases over most areas	Very likely	Damage to crops; soil erosion, inability to cultivate land due to water logging of soils	Adverse effects on quality of surface and groundwater; contamination of water supply; water scarcity may be relieved	Increased risk of deaths, injuries, infectious, respiratory and skin diseases, post-traumatic stress disorders	Disruption of settlements, commerce, transport and societies due to flooding; pressures on urban and rural infrastructures

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Area affected by drought: increases	Likely	Land degradation, lower yields/crop damage and failure; increased livestock deaths; increased risk of wildfire	More widespread water stress	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases	Water shortages for settlements, industry and societies; reduced hydropower generation potentials; potential for population migration
Intense tropical cyclone activity increases	Likely	Damage to crops; windthrow (uprooting) of trees; damage to coral reefs	Power outages cause disruption of public water supply	Increased risk of deaths, injuries, water- and food-borne diseases; post-traumatic stress disorders	Disruption by flood and high winds; withdrawal of risk coverage in vulnerable areas by private insurers, potential for population migrations
Increased incidence of extreme high sea level (excludes tsunamis) <sup>c</sup>	Likely <sup>d</sup>	Salinisation of irrigation water, estuaries and freshwater systems	Decreased freshwater availability due to saltwater intrusion	Increased risk of deaths and injuries by drowning in floods; migration-related health effects	Costs of coastal protection <i>versus</i> costs of land-use relocation; potential for movement of populations and infrastructure; also see tropical cyclones above

# REGIONS

**Africa:** By 2020, between 75 and 250 million people are projected to be exposed to an increase of water stress due to climate change.

**Asia:** Projected crop yields could increase up to 20% in E and SE Asia while they could decrease up to 30% in C and S Asia by the mid-21st century.

**Australia and New Zealand:** Significant biodiversity loss is projected to occur by 2020 in some ecologically-rich sites including the Great Barrier Reef and Queensland Wet Tropics.

**Europe:** Initially, climate change is projected to bring benefits to Northern Europe (reduced energy demand for heating, crop and forest growth increases) whilst Southern Europe is expected to experience increased heat waves, wildfires and reduced crop productivity.

**Latin America:** By mid-century, climate change is projected to lead to the gradual replacement of tropical forest by savanna in eastern Amazonia.

**North America:** Cities currently experiencing heat waves will experience many more in the future with adverse health impacts.

**Polar Regions:** Climate change is projected to impact natural ecosystems with detrimental effects on many organisms including migratory birds, mammals and higher predators.

**Small Islands:** Deterioration in coastal conditions e.g., through beach erosion and coral bleaching is expected to affect local resources e.g., fisheries and tourism.



# Vulnerable Sectors

**Some systems, sectors and regions are likely to be especially affected by climate change**

The most vulnerable sectors are:

- Some ecosystems
  - Terrestrial: tundra, boreal forest, mountain, mediterranean-type ecosystems;
  - Along coasts: mangroves and salt marshes; and
  - In oceans: coral reefs and the sea ice biome.
- Low-lying coastal regions due to the threat of sea-level rise and increased occurrence of extreme weather events.
- Water resources in mid-latitudes and the dry tropics due to decreases in rainfall and higher rates of evapotranspiration.
- Agriculture in low-latitude regions due to reduced water availability.
- Human health in areas with low adaptive capacity



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# Vulnerable Regions

The most vulnerable regions are:

- The Arctic, because of the impacts of high rates of projected warming on natural systems.
- Africa, especially the sub-Saharan region, because of current low adaptive capacity.
- Small islands, due to high exposure of population and infrastructure to sea-level rise and increased storm surge.
- Asian megadeltas, such as the Ganges-Brahmaputra and the Zhujiang, due to large populations and high exposure to sea-level rise, storm surge and river flooding.

In all regions, there are certain areas, sectors and communities which are particularly vulnerable, for example the poor, young children and the elderly.



# Responding to Climate Change

- ***Adaptation*** is occurring now, but more extensive adaptation is required to reduce vulnerability to future climate change.
- A portfolio of ***Adaptation and Mitigation*** measures can diminish the risks associated with climate change
- Criteria for ***Key Vulnerabilities*** include magnitude of change and distribution of effects,
- ***Sustainable Development*** can reduce vulnerability to climate change, and climate change could impede nations' abilities to achieve sustainable development pathways.

