# Climate Resilient Development –

## A New Approach to Promote Security and Sustainability


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The Endangered Earth – What the Asia Pacific Can Do About Climate Change

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# CONTENTS:-

- Introduction-Definitions
- Drivers – Temperature, Precipitation, Sea-level and Climate Variability
- Anticipated Impacts & Vulnerability
- National Issues:-

  How to balance adaptation and mitigation?

  How to strengthen adaptive capacity amidst uncertainties?
- Implications for Regional Cooperation

# Definitions

- **Climate Change** - Climate change refers to any change in climate over time, whether due to **natural variability** or as a result of **human activity**. (IPCC FAR, 2007)

- **Climate Change** - "a change of climate which is **attributed directly or indirectly to human activity** that alters the composition of the global atmosphere and which is **in addition to natural climate variability** observed over comparable time periods." (Article 1, UNFCCC)

- Changes in climate may be due to natural processes or to persistent anthropogenic changes in atmosphere or in land use. The definition of climate change as used in the United Nations Framework Convention on Climate Change includes only those changes which are attributable directly or indirectly to human activity.

- **Climate Change – Any change in climate over time that directly or indirectly affects humans and their activities as well as natural systems and its processes. (National Policy on Climate Change, Draft version 23 Dec 2008)**

# Definitions

**Mitigation**

- An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.

  Examples include using fossil fuels more efficiently for industrial processes or electricity generation, switching to solar energy or wind power, improving the insulation of buildings, and expanding forests and other "sinks" to remove greater amounts of carbon dioxide from the atmosphere (IPCC).

- UNFCCC…. “mitigation” refers to reducing greenhouse gas emissions and protecting and enhancing its greenhouse gas sinks and reservoirs (UNFCCC, Article 4.2).

# Definitions

**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. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (IPCC, FAR; 2007).
- Actions taken to help communities and ecosystems cope with changing climate conditions (UNFCCC Secretariat).

# Definitions

**Adaptive Capacity**

- 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 consequences (IPCC, FAR; 2007).
- Refers to both actual and potential features, encompassing current coping ability and measures that expand future coping ability
- Main determinants: economic wealth, access to technology, information and skills, infrastructure, institutional arrangements & equity.

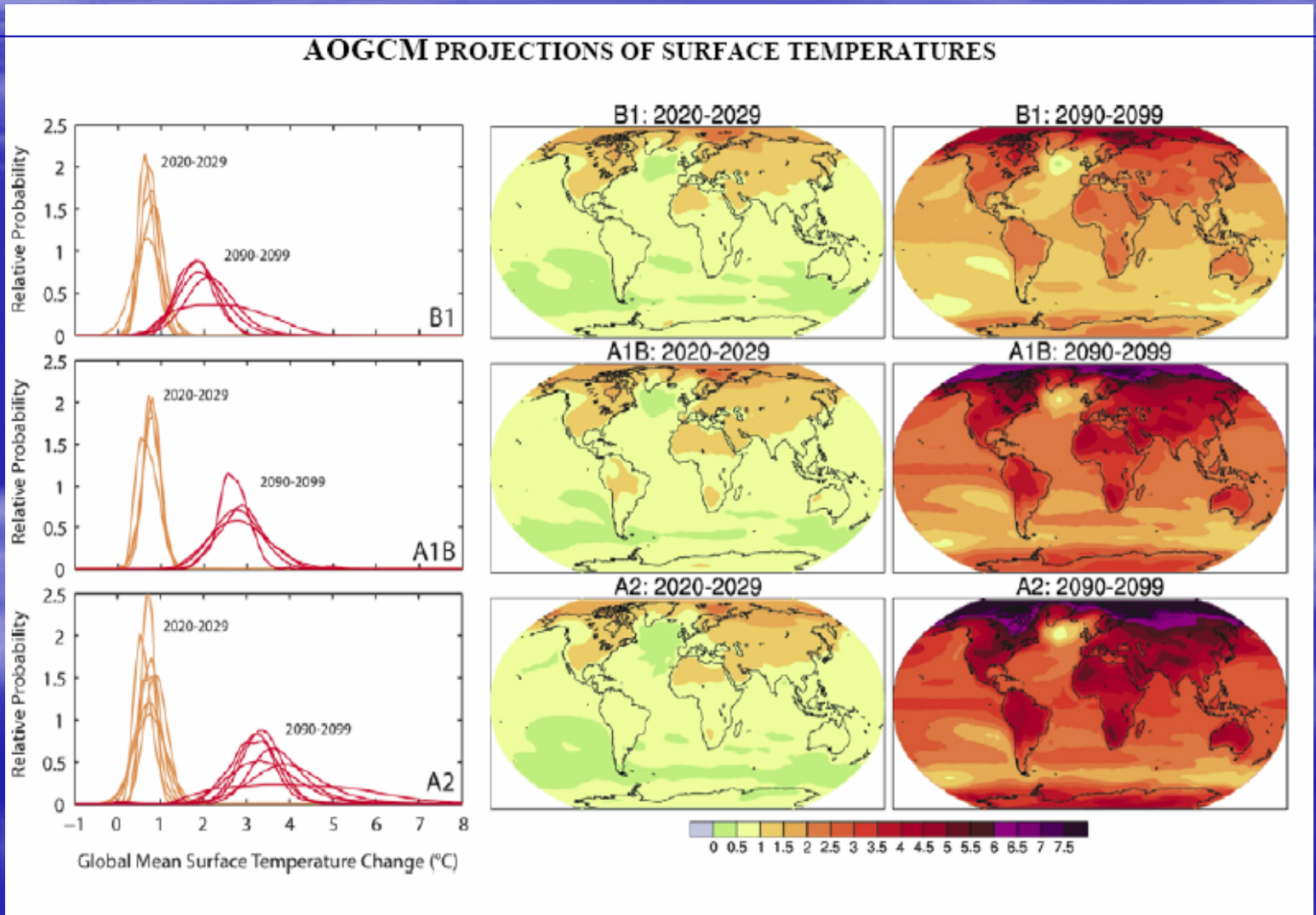
# Definitions

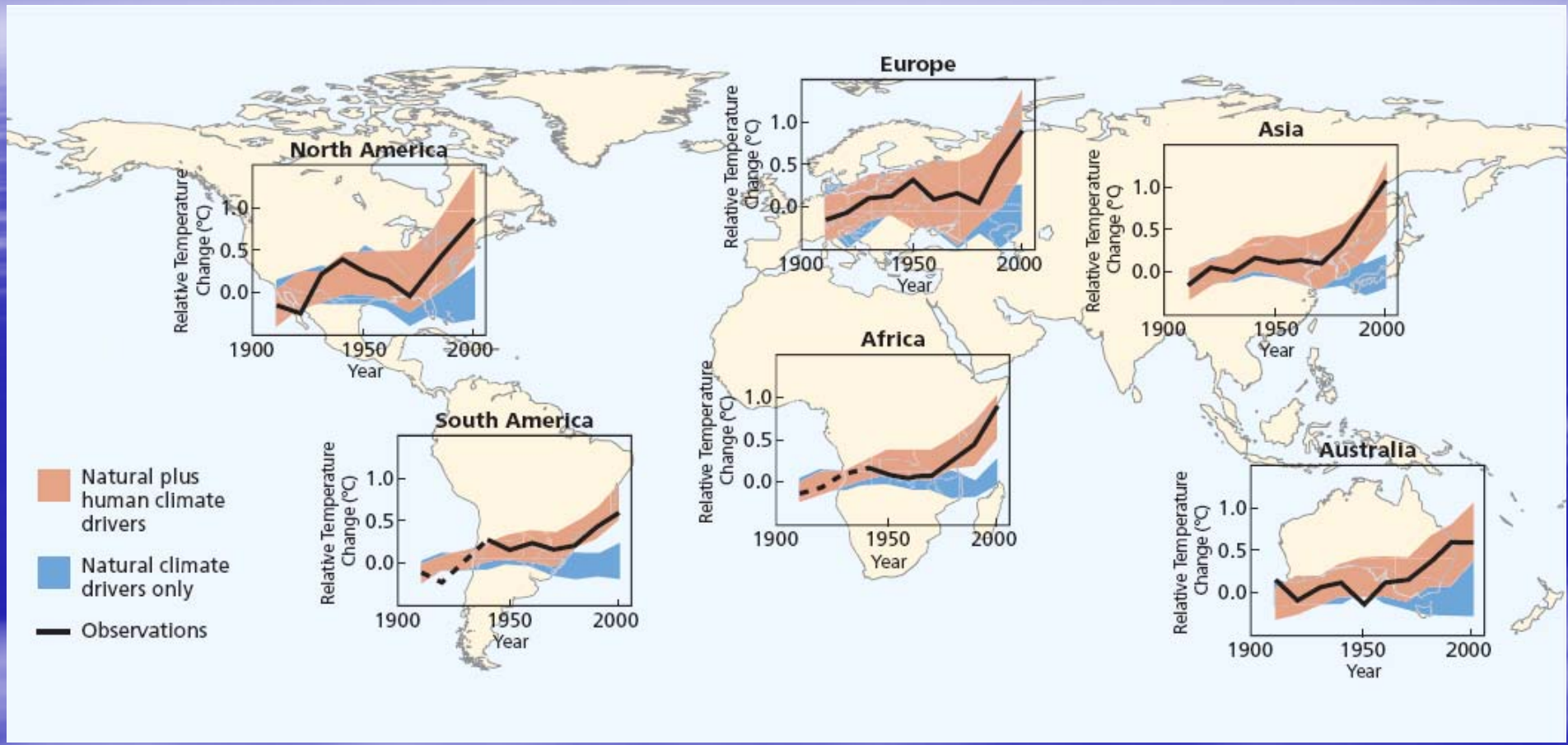
**Vulnerability**

Vulnerability - 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 a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system. (FAR IPCC, 2007)

**Vulnerability** - the degree to which a community, population, species, ecosystem, region, agricultural system, or some other quantity is susceptible to, or unable to cope with, adverse effects of climate change (website of the UNFCCC Secretariat).

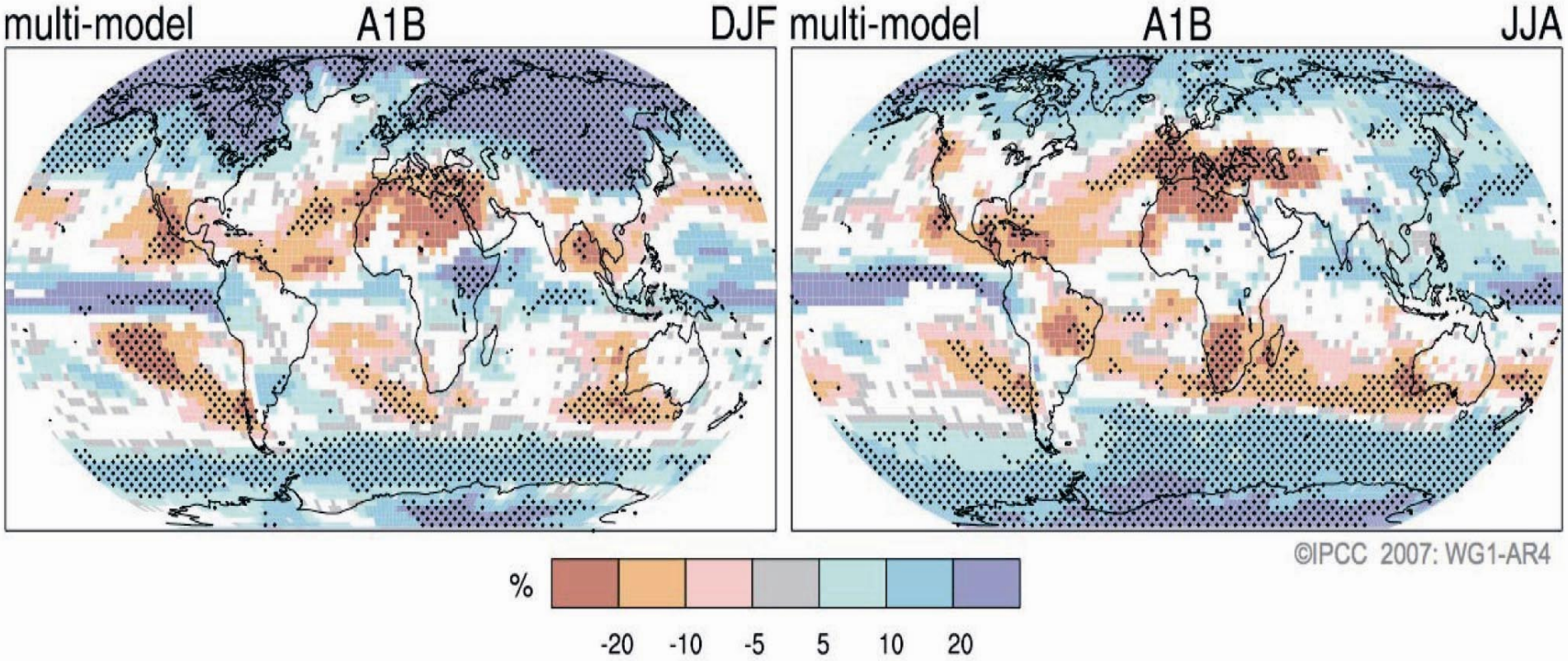
**Projected global average temperature changes for the early and late 21st century relative to the period 1980 – 1999, as calculated by multi-model averages for a *low* (B1), a *medium* (A1B) and a *high* SRES scenario for the decades 2020-2039 (left) and 2090-2099 (right). (IPCC, 2007)**



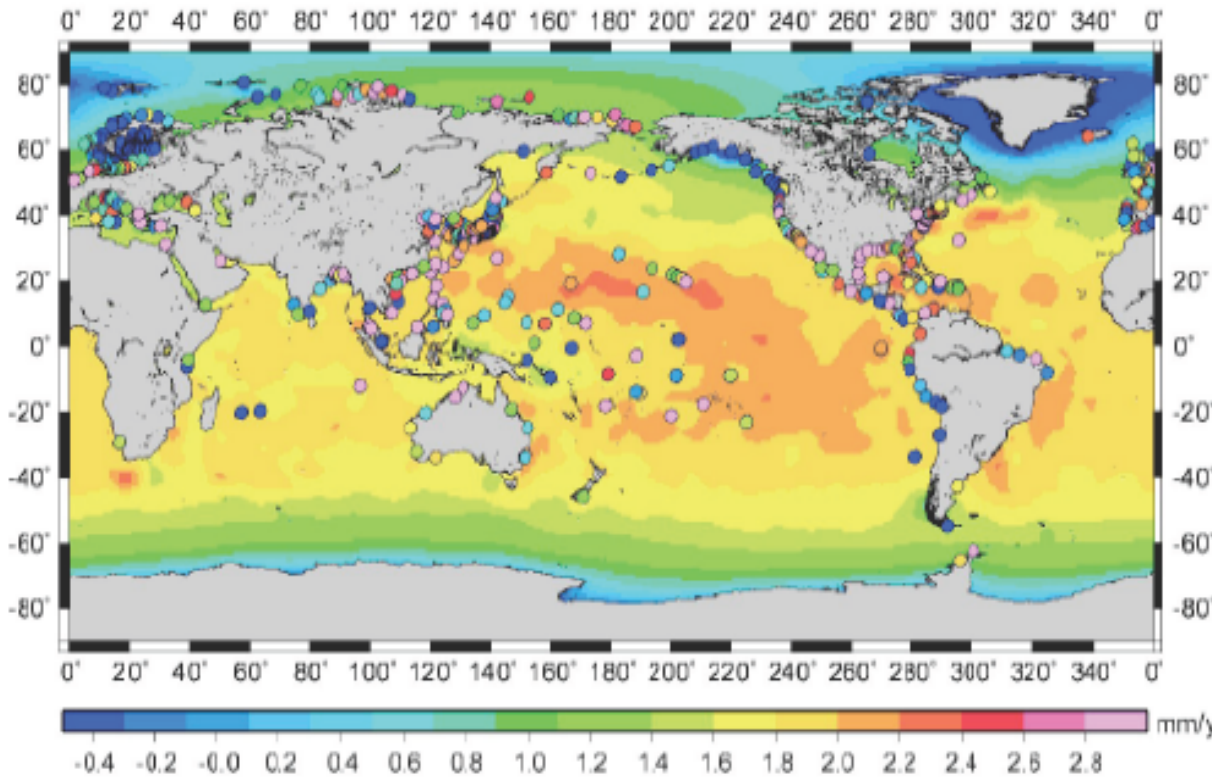



Source: IPCC, 2007

**Projected global average precipitation changes for the late 21st century (2090-2099) relative to the period 1980–1999. The estimates are based on multi-model average projections for the *medium* (A1B) scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. (IPCC, 2007)**



## Estimated Global Sea Level Rise Using Tide Gauges and Satellite Altimetry (1900–2003)

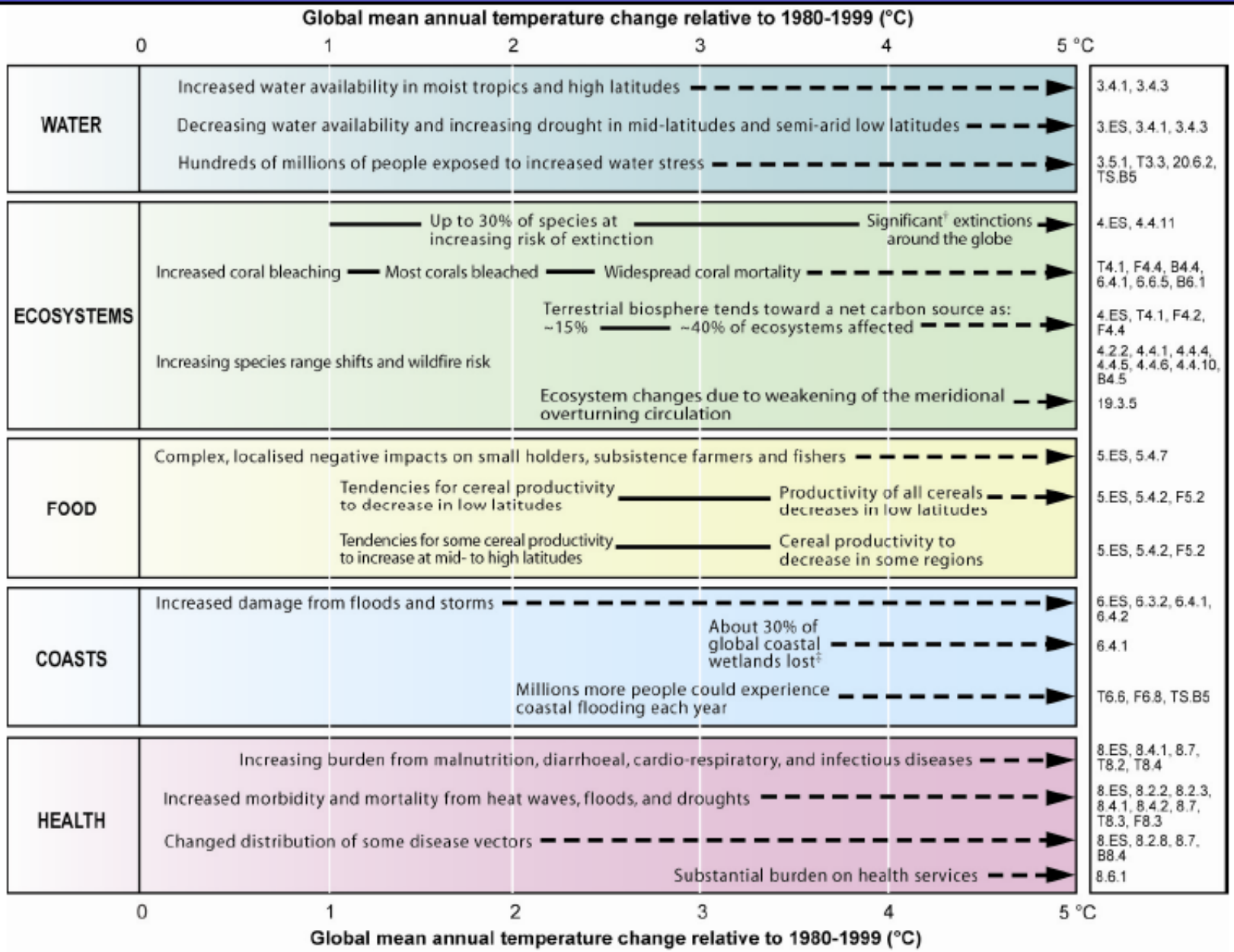



**Estimated Sea Level Rise = 1.73±0.21 mm/yr**

**585 selected tide gauges, multiple satellite altimetry used**

The total 20th century global sea-level rise is estimated to be 0.17 [0.12-0.22] m. It is projected to increase 0.18-0.59 m at the end of the century.

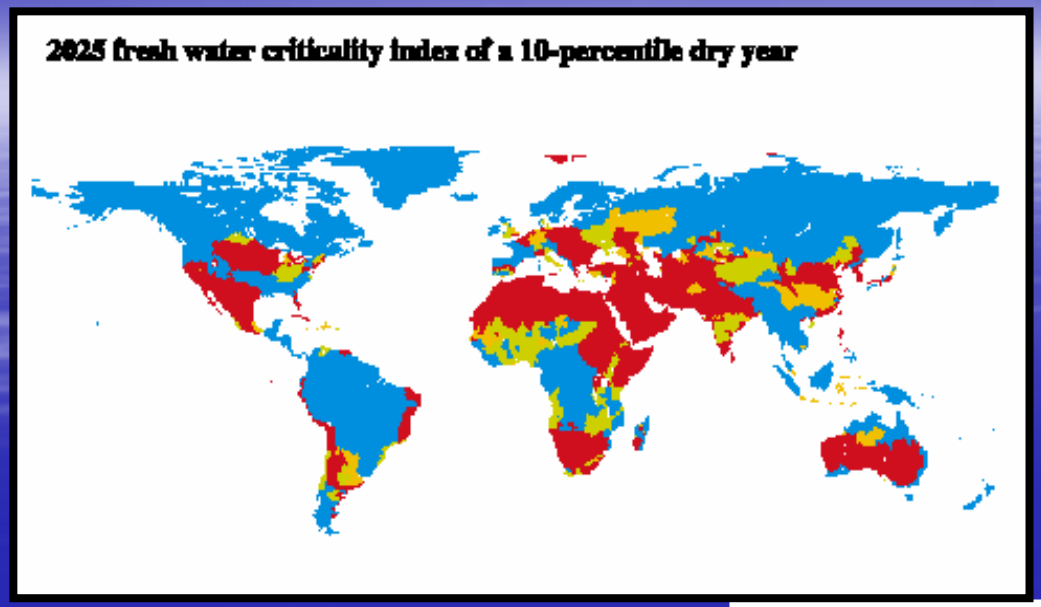
Global sea-level rose faster over 1993-2003 ( 3.1 [2.4-3.8] mm per year) compared to 1961-2003 (1.8 [1.3-2.3] mm per year) (IPCC, 2007)

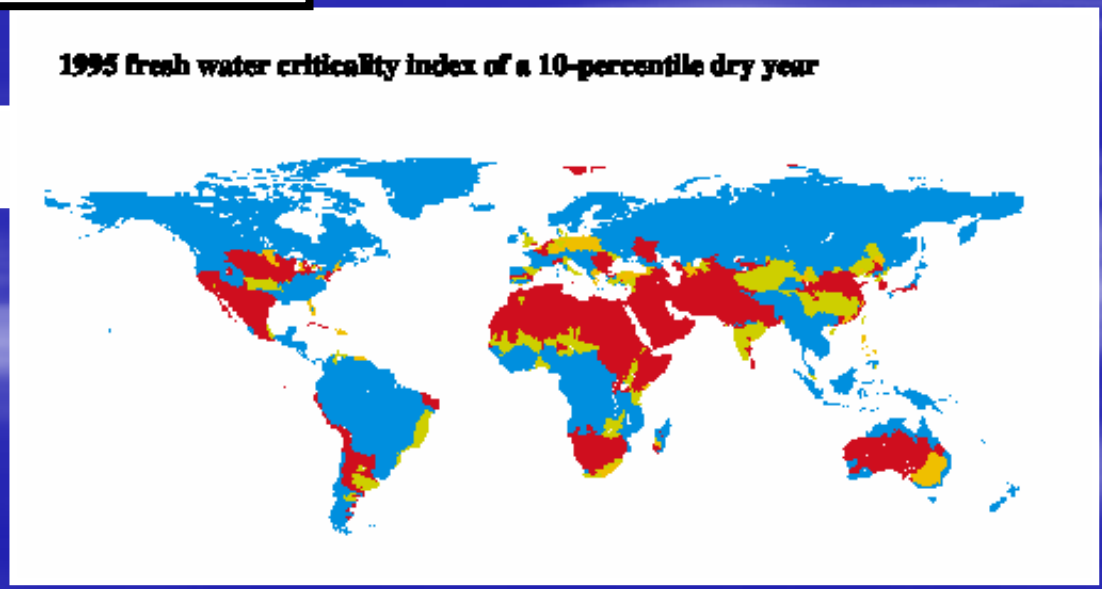



**Source: IPCC, 2007**

† Significant is defined here as more than 40%.
‡ Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080.

# Growing water scarcity(1995-2025)

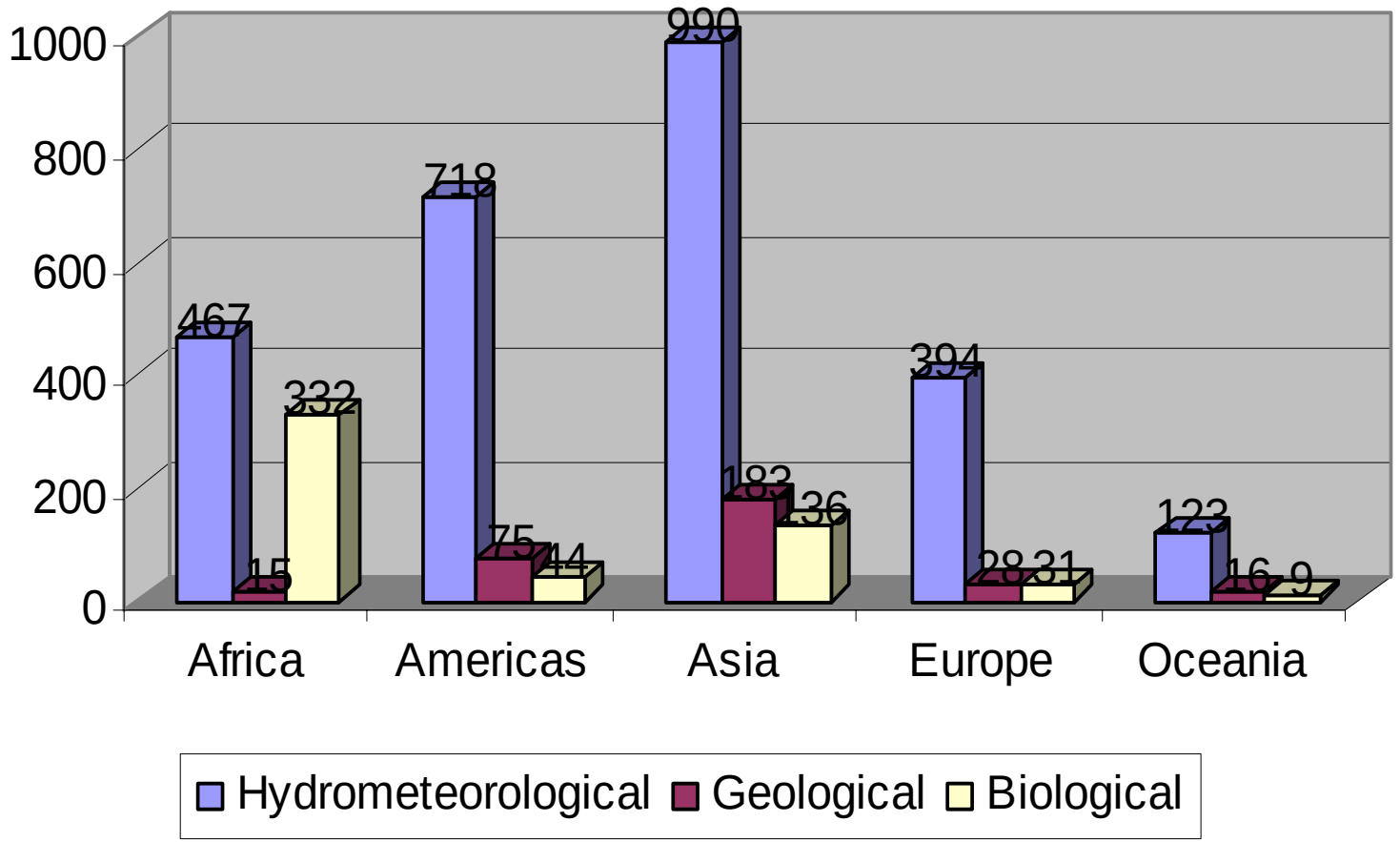


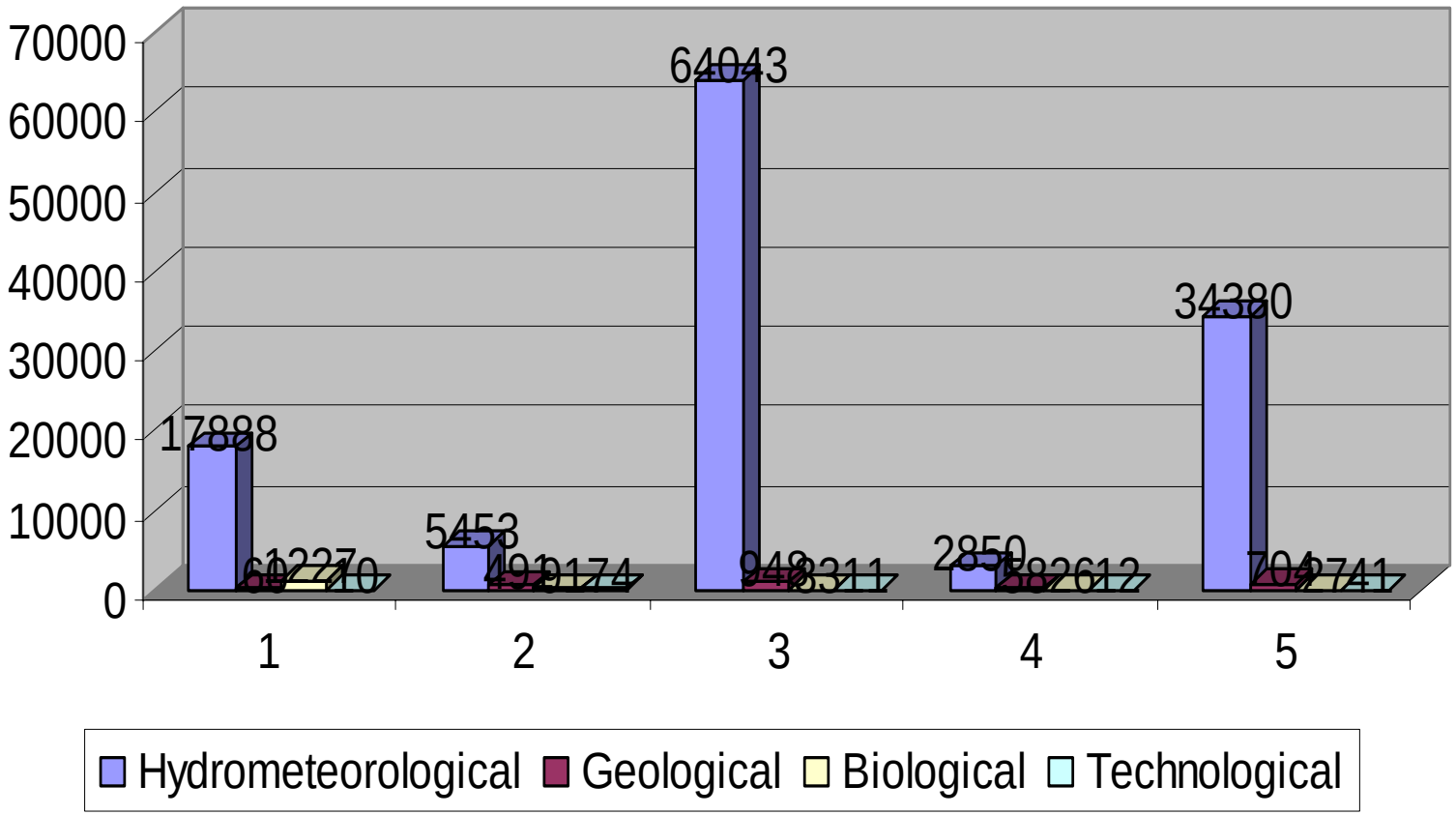

1 2 3 4

*SEI - Criticality index (Source: WaterGAP)*

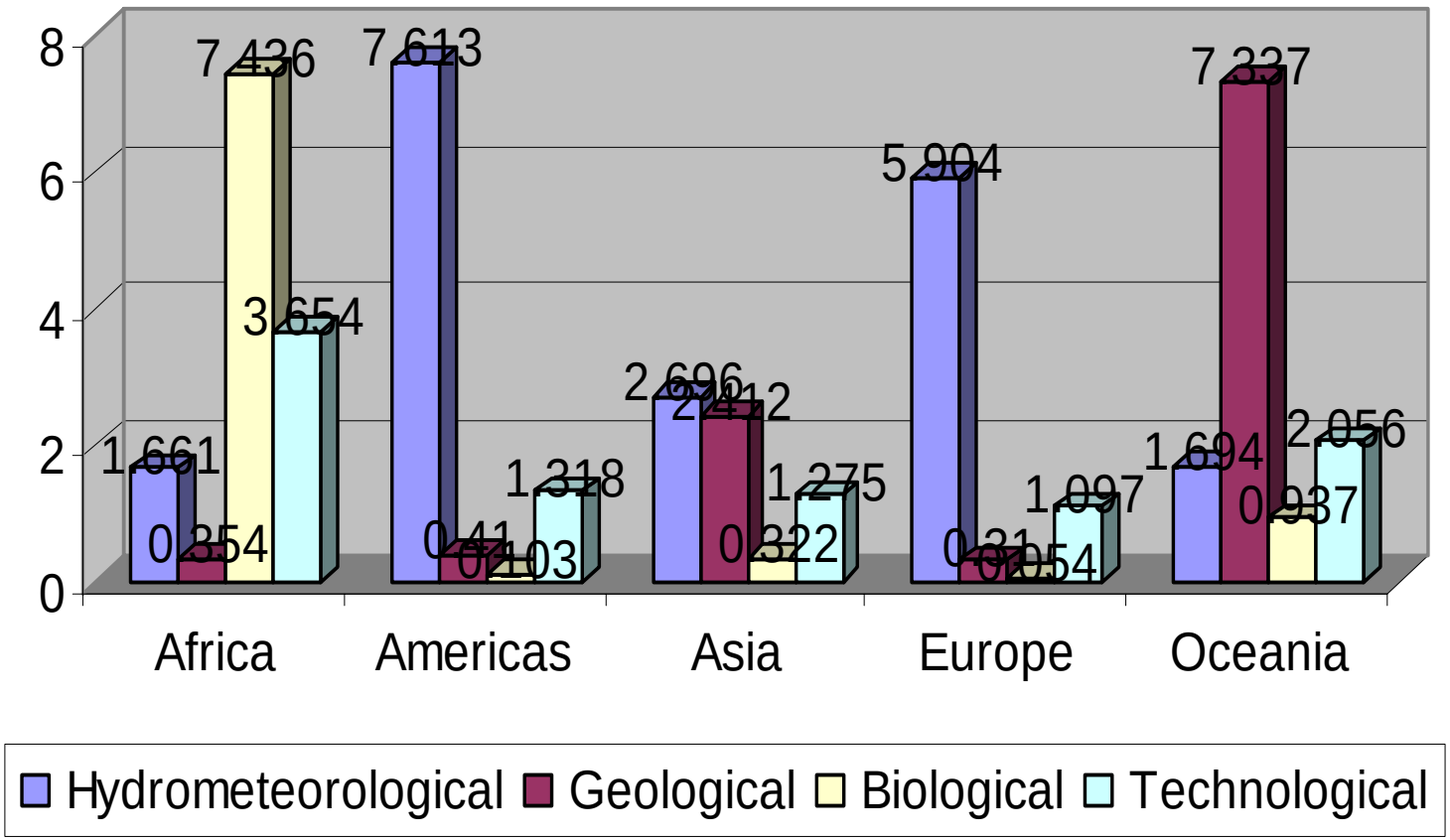
# Distribution of Natural Disasters by Origin, 1994-2003 Source: OFDA/CRED International Disaster Database



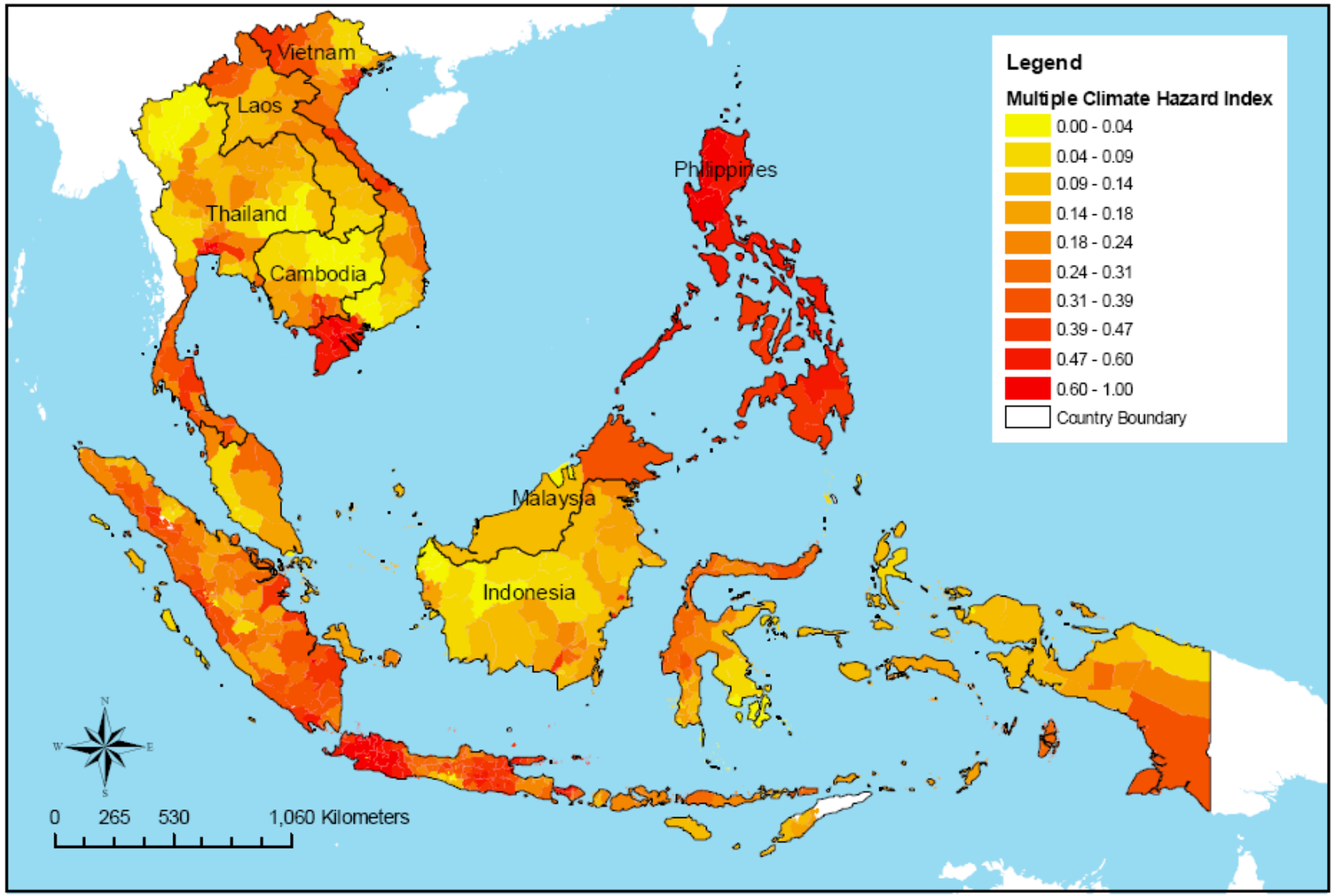
# Average number of people affected per million inhabitants,1994-2003 Source: OFDA/CRED International Disaster Database



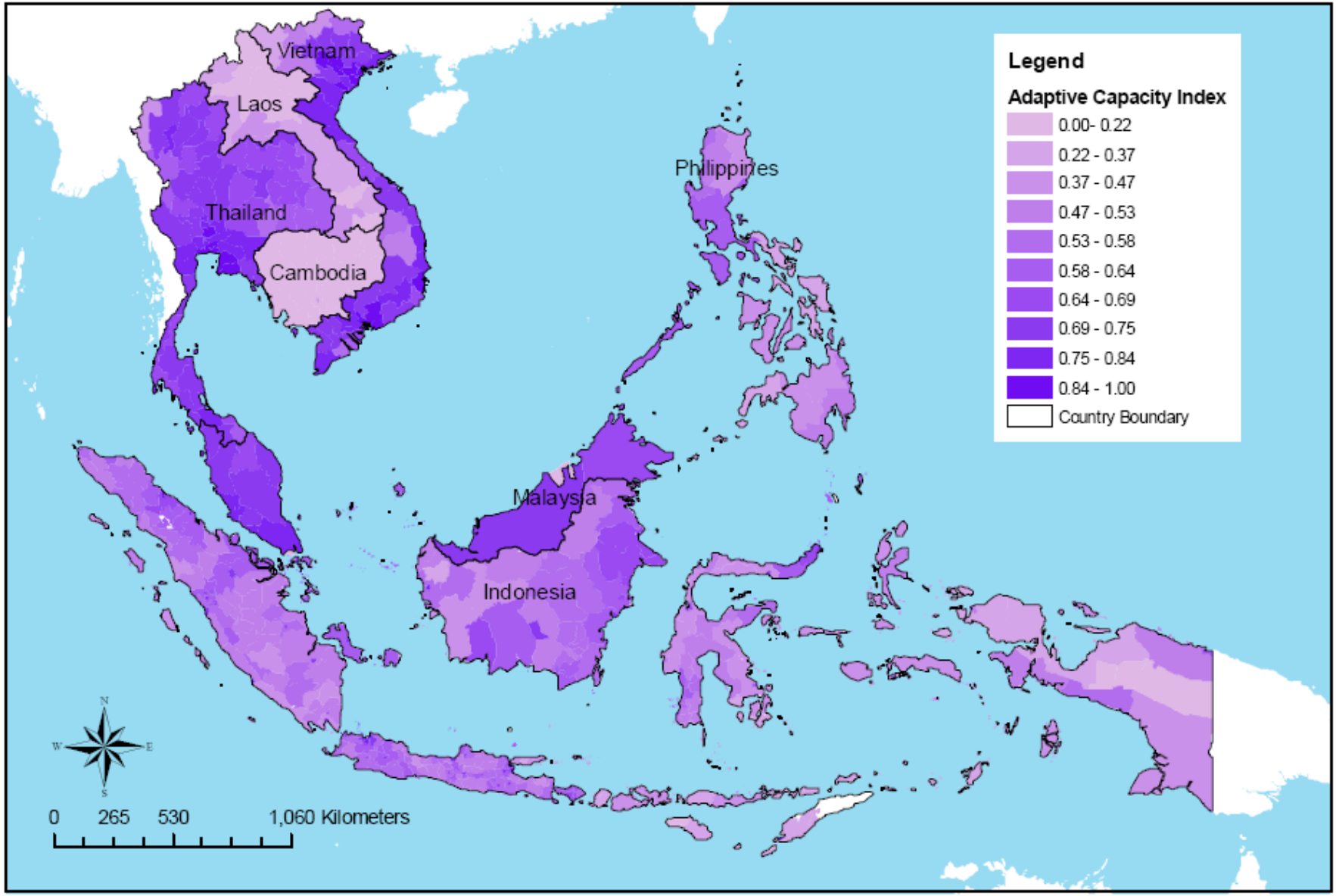
# Average Number of People Killed per million inhabitants, 1994-2003 Source:OFDA/CRED International Disaster Database



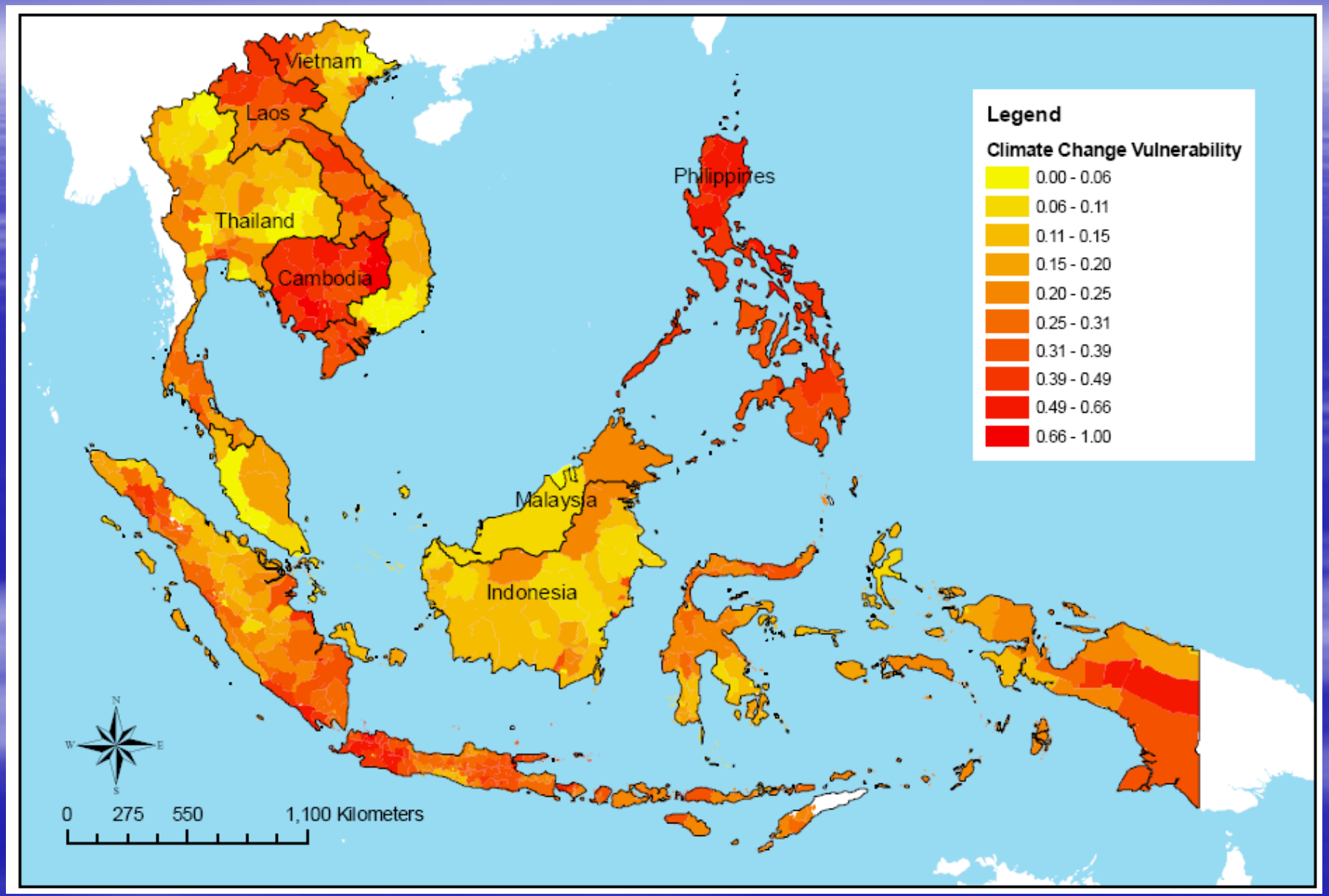
# Multiple Climate Hazards Map (Source: EEPSEA 2009)



# Adaptive Capacity of Southeast Asia (Source: EEPSEA 2009)



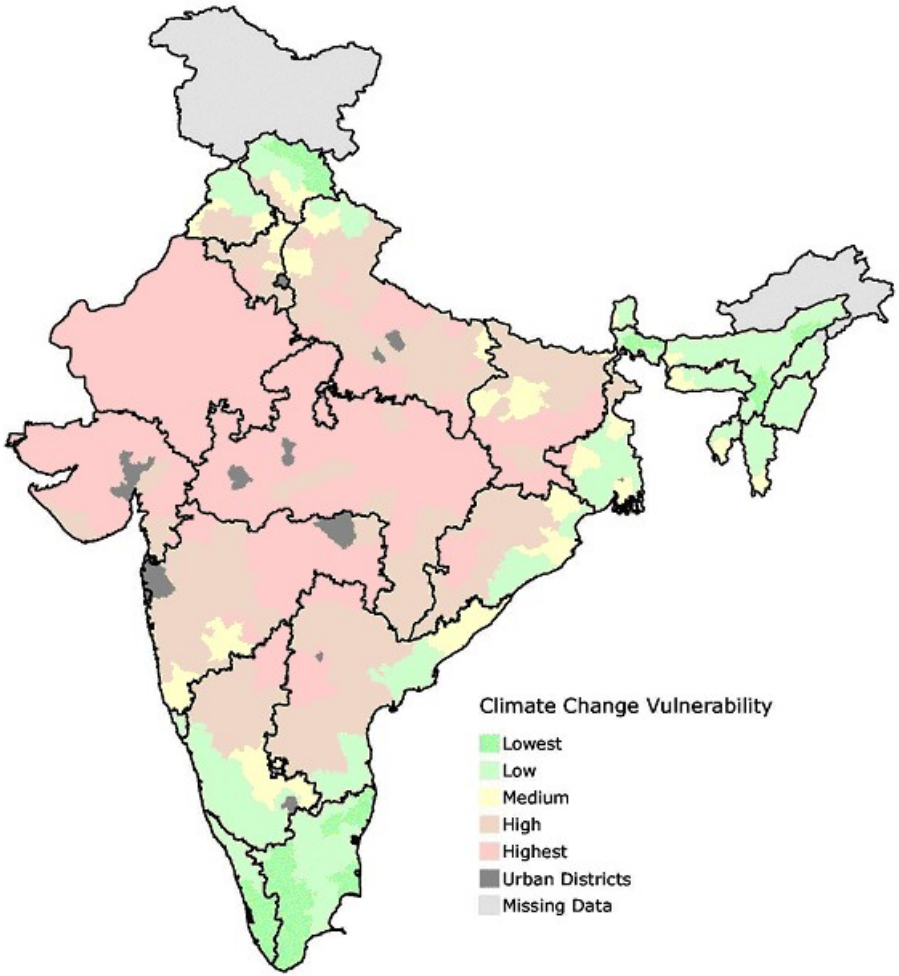
# Climate Change Vulnerability of Southeast Asia (Source: EEPSEA 2009)

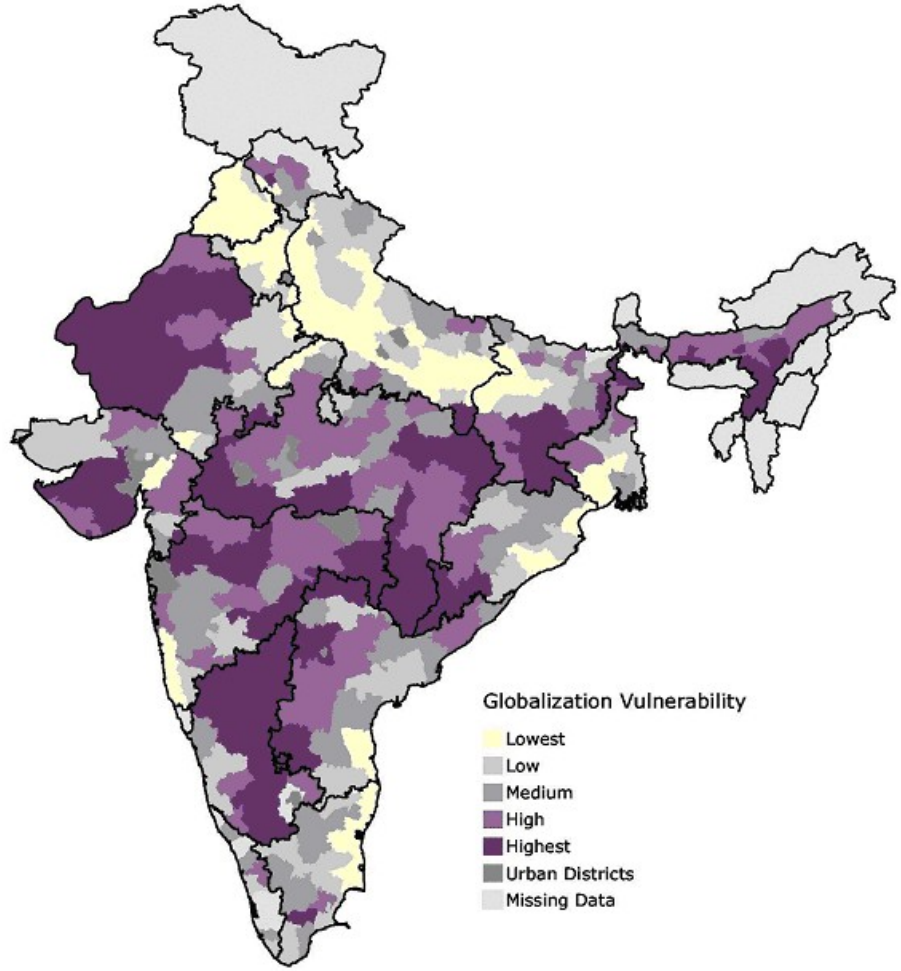


# Climate Change – The Socio-Political Challenge

- Mitigation
  - – driven primarily by international agreements requiring national responses
  - – common but differentiated responsibility and respective capabilities...
- Adaptation
  - – involves action by affected entities at national, state, local and community levels
  - – is unavoidable
- Balancing adaptation and mitigation
- Focus – adaptation & co-benefits of mitigation

# Vulnerability Profiles
## [Source: TERI, 2009]




Adaptive capacity + Climate sensitivity

Adaptive capacity + Trade sensitivity

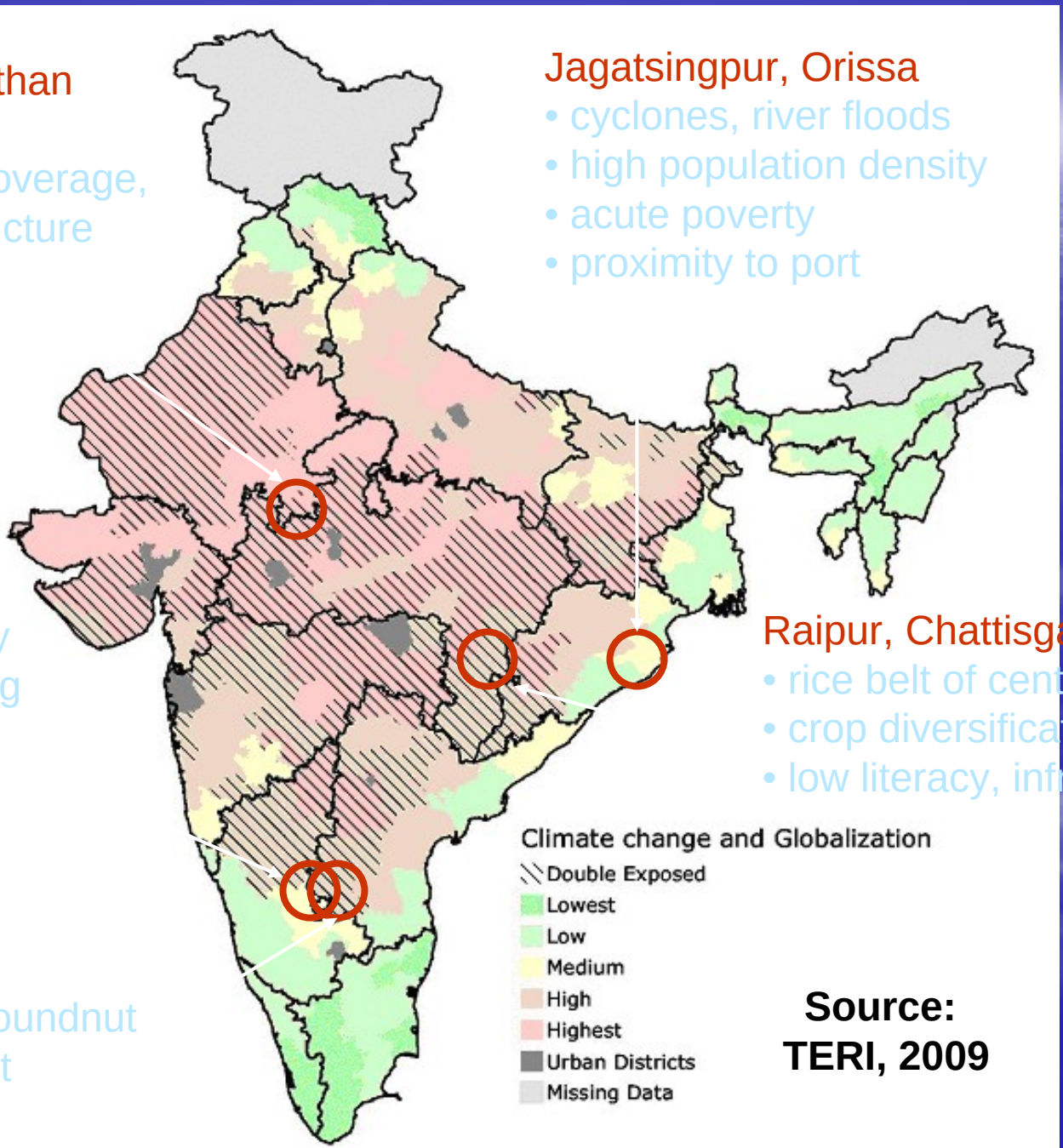
Jhalawar, Rajasthan
- drought prone
- low irrigation coverage, literacy, infrastructure

Jagatsingpur, Orissa
- cyclones, river floods
- high population density
- acute poverty
- proximity to port

Chitradurga, Karnataka
- water scarcity
- proximity to city
- contract farming and exports

Raipur, Chattisgarh
- rice belt of central India
- crop diversification
- low literacy, infrastructure

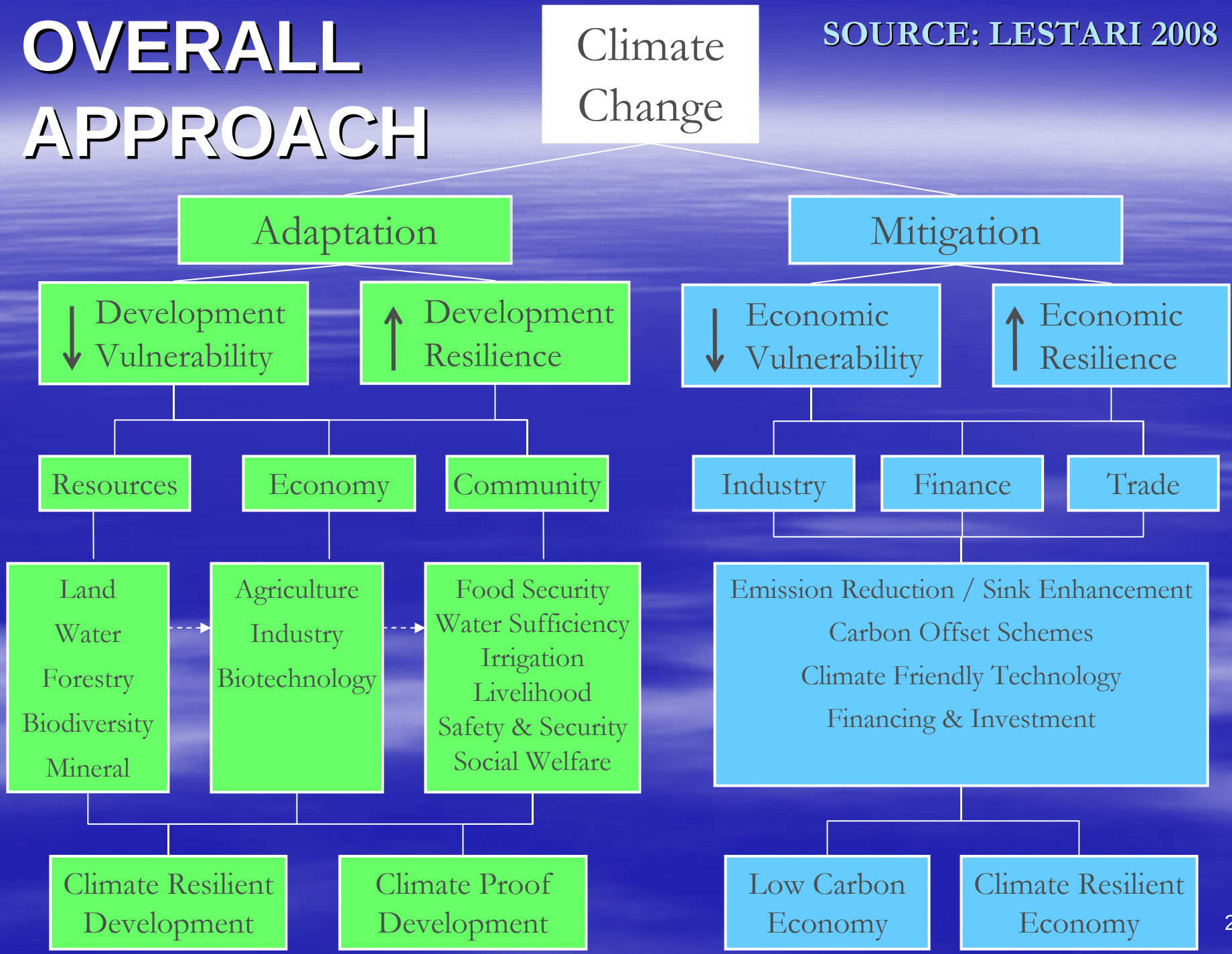
Anantapur, Andhra Pradesh
- semi-arid
- response of groundnut farmers to import competition




**Source: TERI, 2009**

# OVERALL APPROACH

SOURCE: LESTARI 2008



# OVERALL APPROACH

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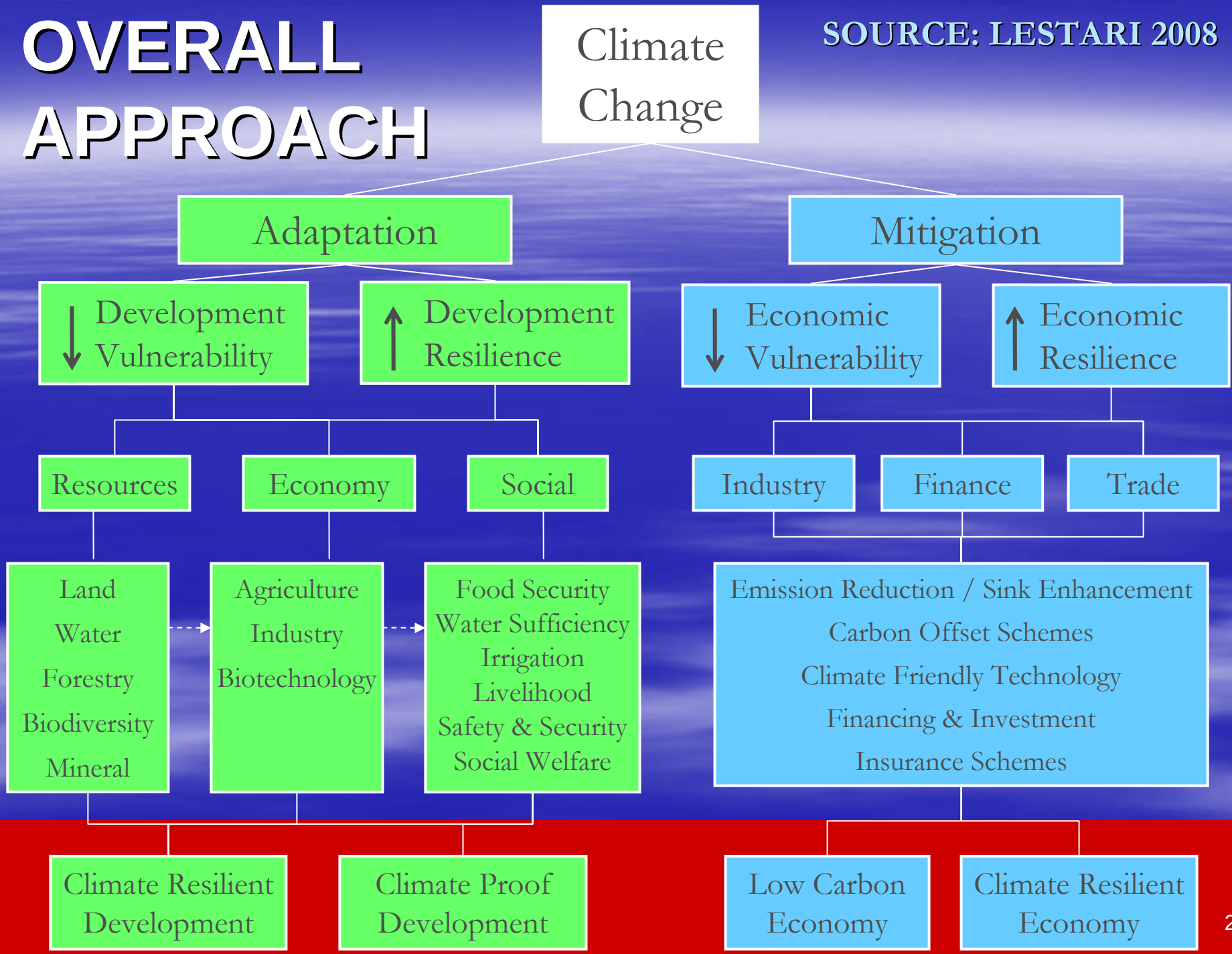


# Climate-Resilient Development

Development that integrates response measures on:-

- physical manifestations of climate change and extreme weather; and
- international socio-political obligations

SOURCE: LESTARI 2008

# Balancing Adaptation & Mitigation


*Source: NAHRIM (2008)*

**Possible climatic change in Peninsular Malaysia by 2041-2050:**

- Temperature rise $2^0$C
- More extreme hydrological conditions
  - Higher maximum rainfall;
    Lower minimum rainfall.
  - Higher high riverflow;
    Lower low riverflow.

**Potential implications**

- **Water balance → Water sufficiency**
- **Crops yields → Food security**
- **Plantation → Economic loss**
- **Infrastructure → Repairs & reconstruction**

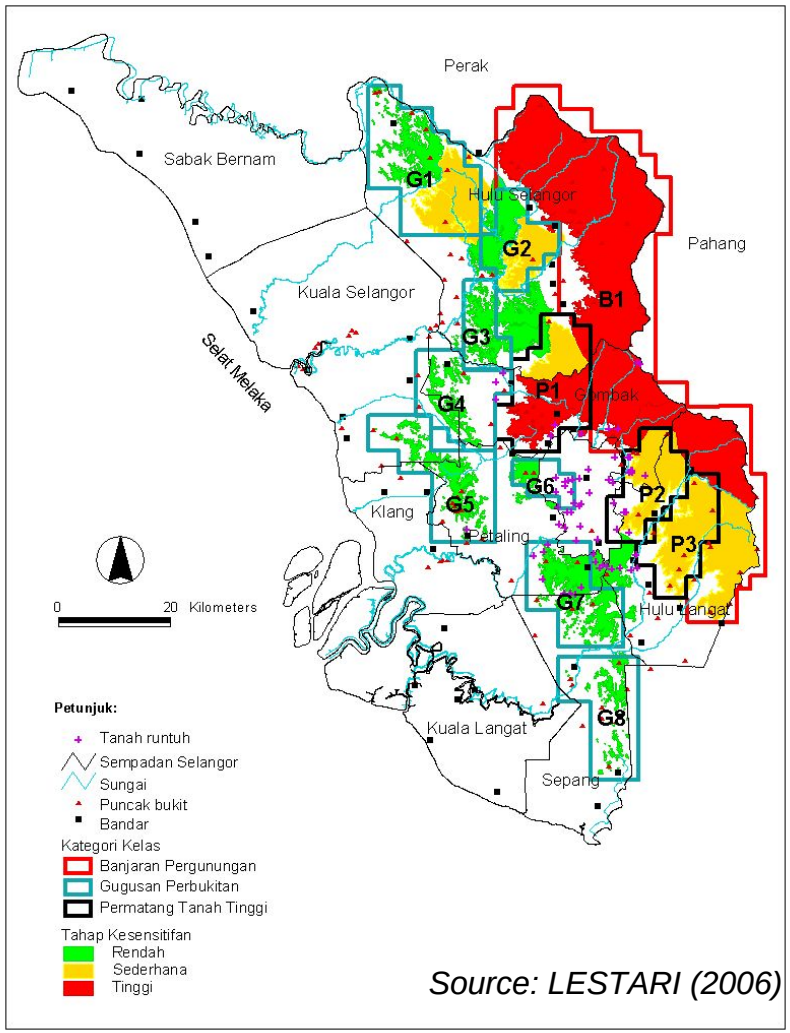
**Adaptation based on wise resource management;**
**Mitigation to enhance adaptation & sustainable development**



SOURCE: LESTARI 2008

# Climate Change – Additional Stressors to Existing Sensitivity!

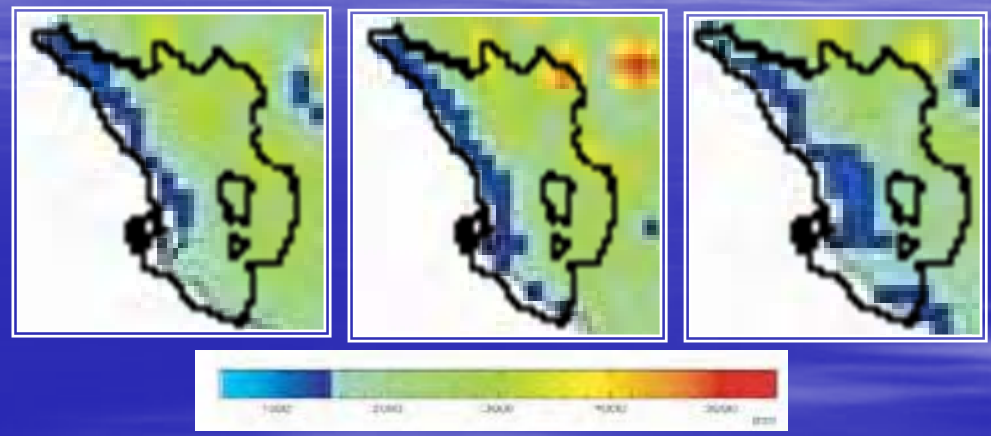
## Environmentally Sensitive Areas in Highlands of Selangor




*Source: LESTARI (2006)*

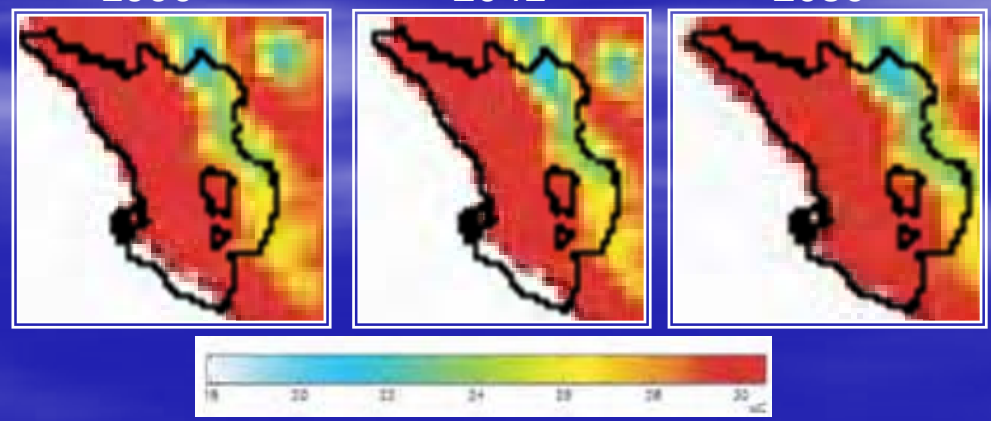
## Precipitation

1990 2041 2050



## Soil Surface Temperature

1990 2041 2050



*Source: NAHRIM (2008)*

# Adaptive Capacity: End-Point Approach

- Design and implementation of adaptation:
  - Future climate change
  - Vulnerability in biophysical factors
- Uncertainties in the approach:
  - Climate scenarios
  - Climatic effects on sectors
  - Future socio-economic conditions
  - Unknown if adaptive capacity assets will be drawn in time of need
- Shortcomings:
  - Highly dependent on climate scenarios (CC may alter in a different way than expected) → adaptation measures may become inappropriate

Source: Tan et al. (2008)

# Adaptive Capacity: Starting-Point Approach

- Adaptive capacity of the present's system:
  - Socio-economic factors + Biophysical factors
  - Enhancing the present's ability to respond to stressors and secure livelihood
- Pro:
  - Practical for coping with changes and uncertainties
  - Promote sustainable development
  - Facilitate cheaper adaptation strategies
  - Target the poor and vulnerable groups more effectively

Source: Tan et al. (2008)

# Sources of Vulnerability

- Greater reliance on agriculture for income
- High dependence on subsistence agriculture
- Less protective infrastructure for coastal communities
- Existing land degradation and desertification
- Existing water scarcity
- Rapid rates of urbanization
- High levels of poverty
- High prevalence of HIV/AIDS
- High rates of population growth
- High rates of infectious disease
- Absence of insurance infrastructure
- Low levels of savings or absence of savings

**Source: Begum & Raja Zaharaton (2008)**

# Major Challenges

**R&D**

- Methodology development
- Information  availability
- Physical science focused adaptation tools

**IMPLEMENTATION**

- Governance over scales
- Balance between top-down and bottom-up approaches
- Balance between sector-based & macro-based approaches
- Linking adaptation to growth agendas
- Pro-poor adaptation
- Transforming livelihoods and coping mechanisms
- Climate justice and rights

# Regional Cooperation

- Improvement of mechanisms for sharing experiences and enhancing common understanding on societal values, attitudes and goals for economic prosperity, human health and environment;
- Strengthening of networking between practitioners and researchers from various fields & disciplines for understanding trade-offs between environment and development in the present as well as in the future;
- Training and capacity building in various areas based on national needs and priorities
- Technology exchange (high-tech & indigenous)
- Finance and resource allocation

# THANK YOU!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