Ongoing ARCP Project on Climate Change Adaptation Modelling-Mangroves Ecosystem

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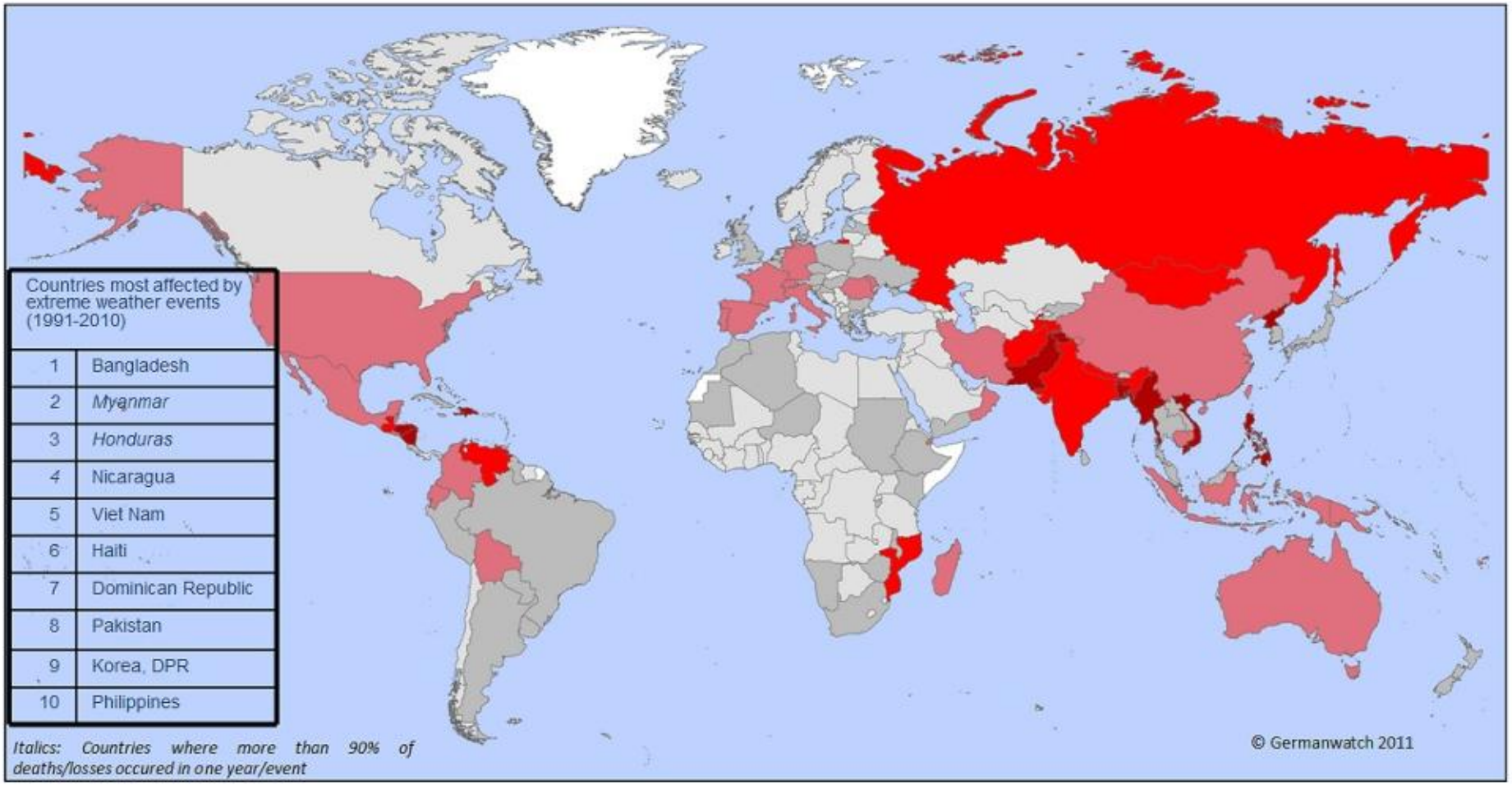
Outline

- Climate Change Impacts and Vulnerabilities- Mangroves Ecosystem
- Climate Change Adaptations and Sustainable development
- Partnership and networking

Global Climate Risk Index 2012 (covering 1991–2010)

Source: Germanwatch and Munich Re NatCatSERVICE

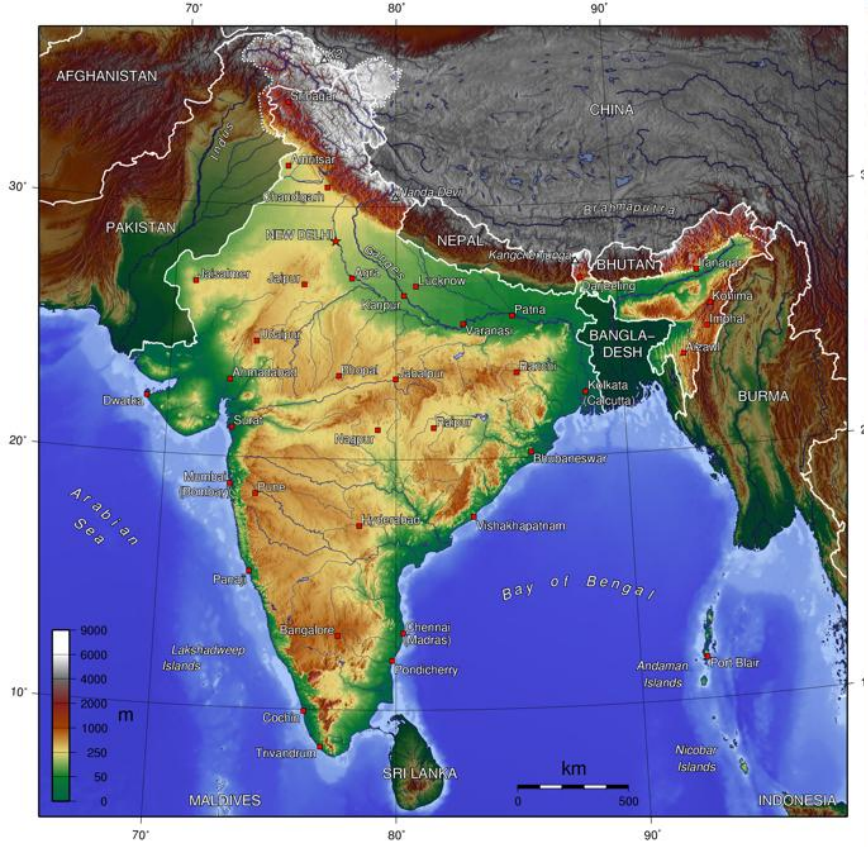
GERMANWATCH



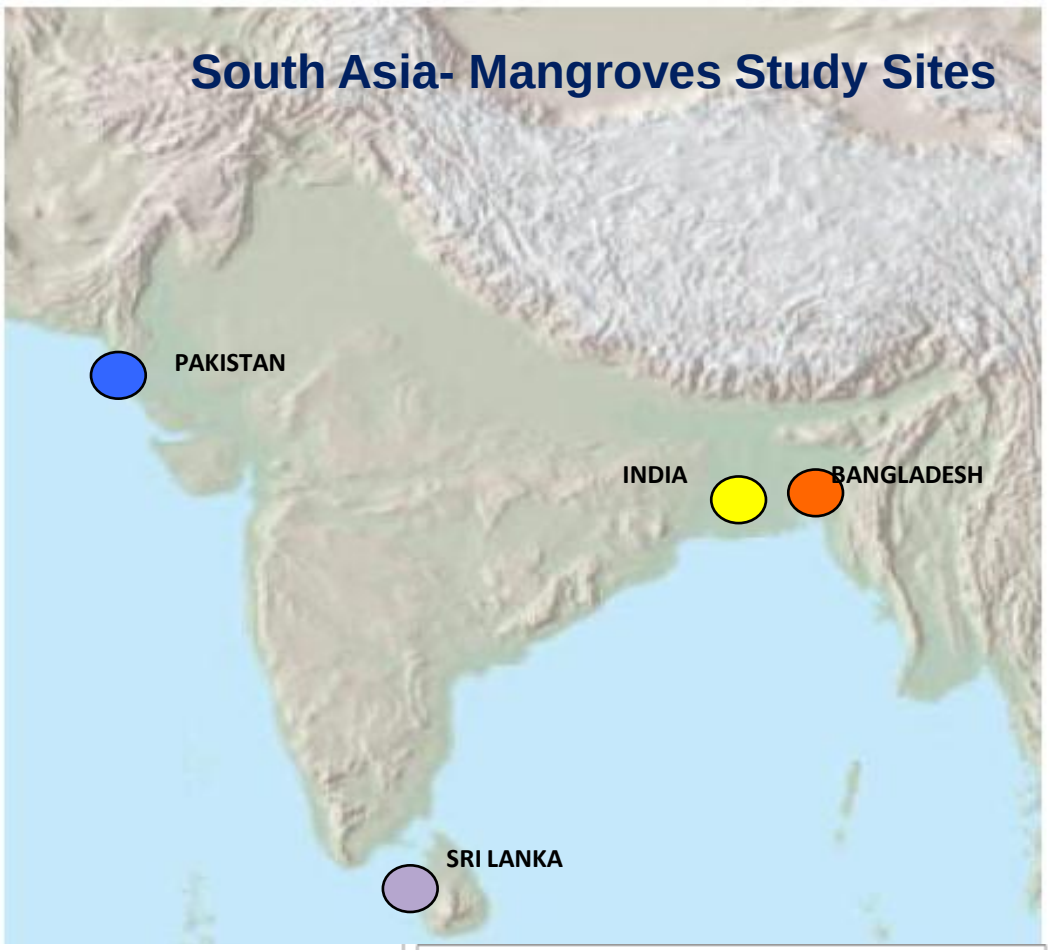
Climate Risk Index: Ranking 1991 – 2010

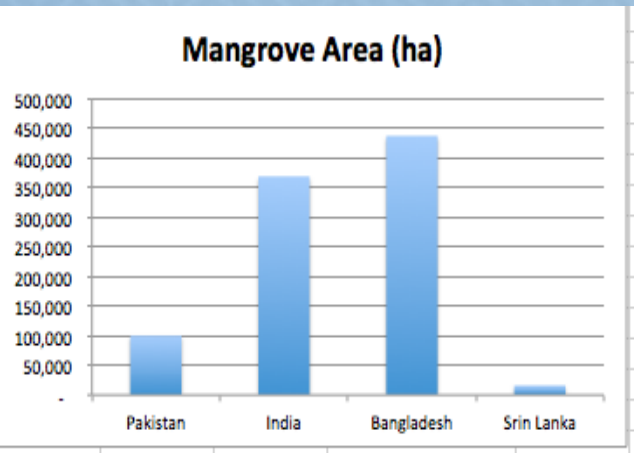
1 - 10 | 11 - 20 | 21 - 50 | 51 - 100 | >= 100 | No data

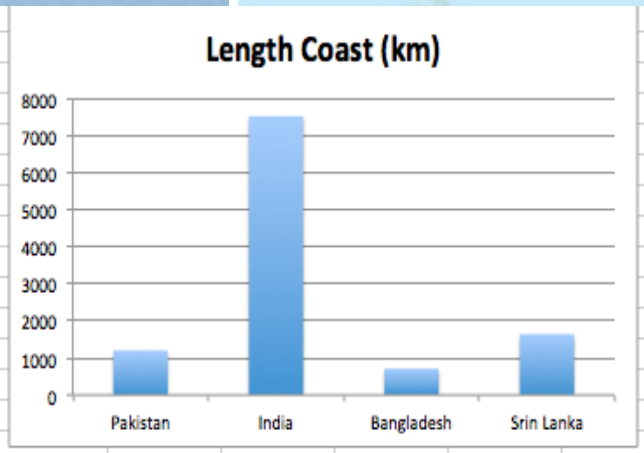

Fresh Water Resources
Mountain and Forests Ecosystem
Farmland Ecosystem
Rangeland and Desert Ecosystem
Deltaic and Coastal Ecosystem
Sea

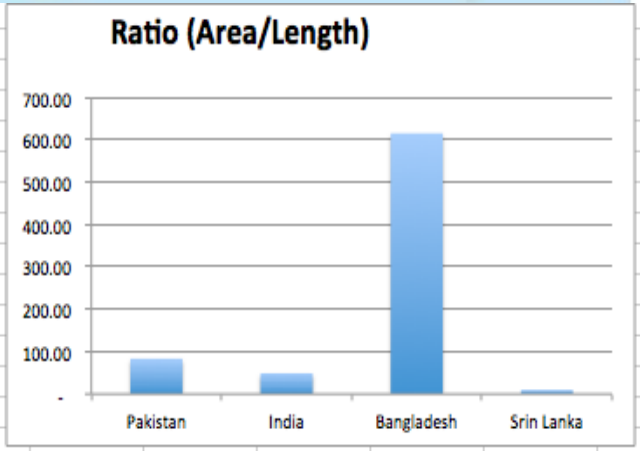


From Giri et al 2011









Research Objectives/Questions

- What are the different climatic and hydrological factors under climate change scenarios and assess how they are linked and interact with each other in mangrove ecosystems

- What socio-economic vulnerabilities are more common and how do they influence mangrove vulnerability?

- What are the commonalities/differences mangrove spatial distribution and extension and management issues in South Asia (Bangladesh, India, Sri Lanka, Pakistan) ?

- How does the current knowledge about mangrove resources (extension, distribution, biomass) is incorporated in policies in each country; how do these policies compare?

Climate Change Scenarios Development for mangroves study sites

Phase I

- Downscaling of GCMs and validation of RCM-GCM combination in base period
- Comparison of ECHAM GCM with the Downscaled results of ECHAM-PRECIS and RegCM3-ECHAM5 combinations (effects of uncertainties introduced by RCM)

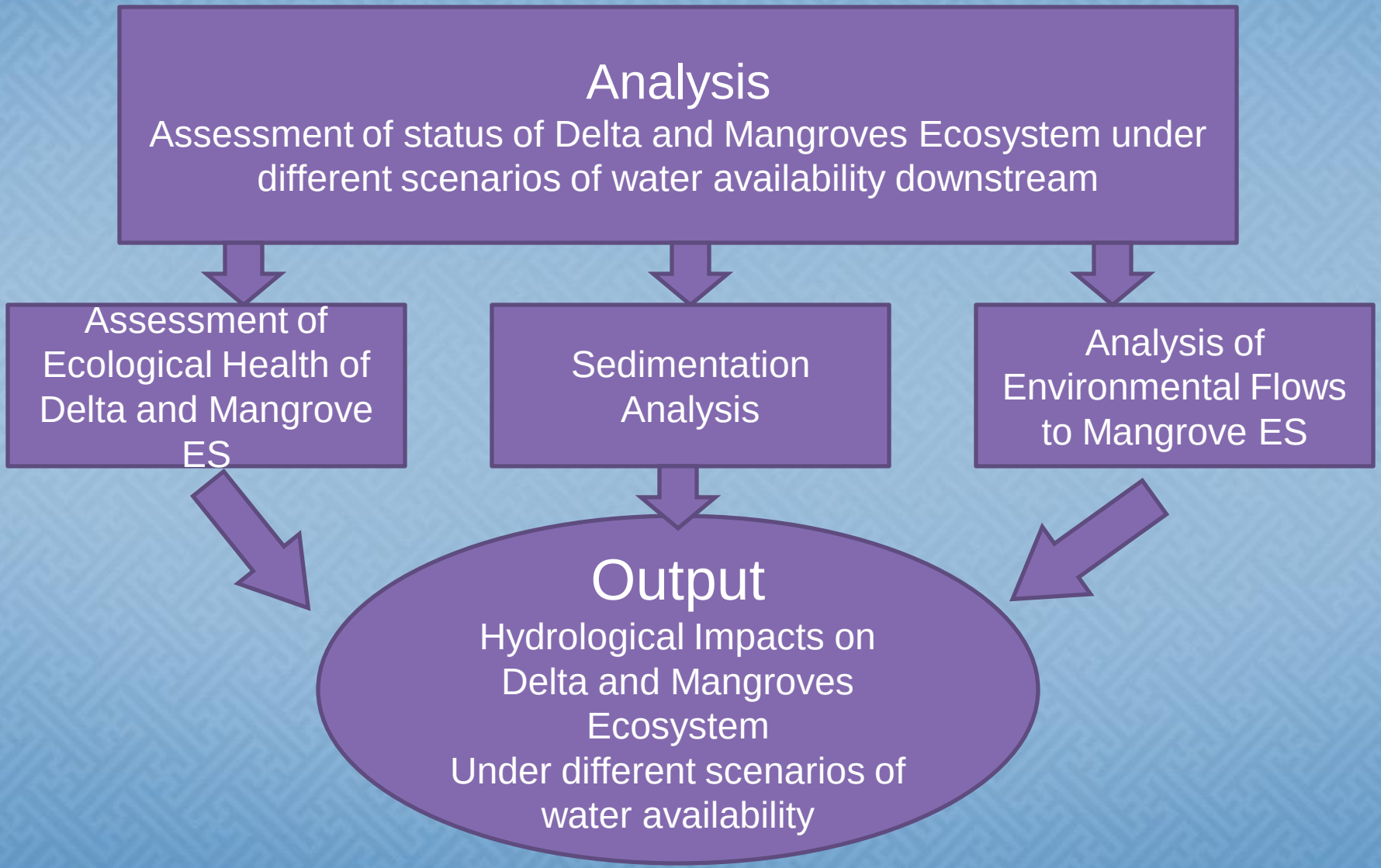
Phase II

- Comparison of the future projection over South Asia
- Time series analysis

Phase III

- Selection of Mangroves Forest Map over South Asia
- Preparation of a gridded Forest Map for Analysis
- Extraction of data for different parameters (precipitation, temperature etc)

Analysis of Environmental Flows and its impact on delta and Mangrove Ecosystem



Society:
Mangroves and society, culture, settlement, education level, etc

Understand societal Sensitivity and Mangroves Ecosystem

Economy:
Mangroves and Livelihood dependency, Livelihood patterns, Income level, employment opportunities, etc

Understand Economic Sensitivity and Mangroves Ecosystem

Environment and Climate change:
Hydrology, Temperature, SLR, Rainfall, etc

Understand Exposure to changing climate and Environment

Potential Impacts:
Infrastructure, Poverty, Health, Deforestation, Ecosystem, Tourism, etc

Understand Potential Socio-Economic Impacts to changing climate and Environment

Adaptive capacity :
Income, Institutions, Social and Economic diversity, Dependency ratio, etc

Understand Adaptive capacity to changing climate and Environment

Socio-Economic Impact Assessment Indices development

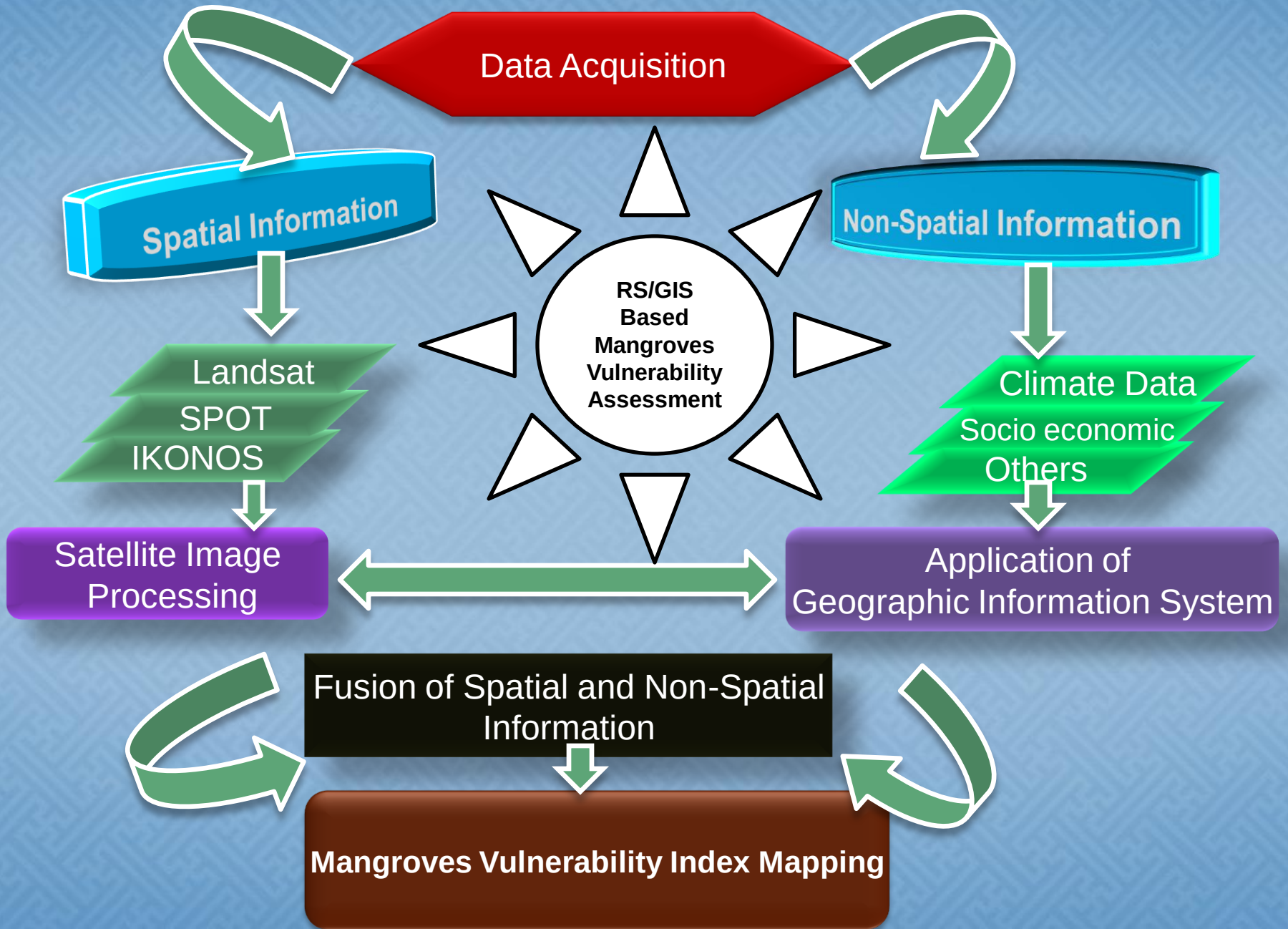
Coding of responses

Screening of responses

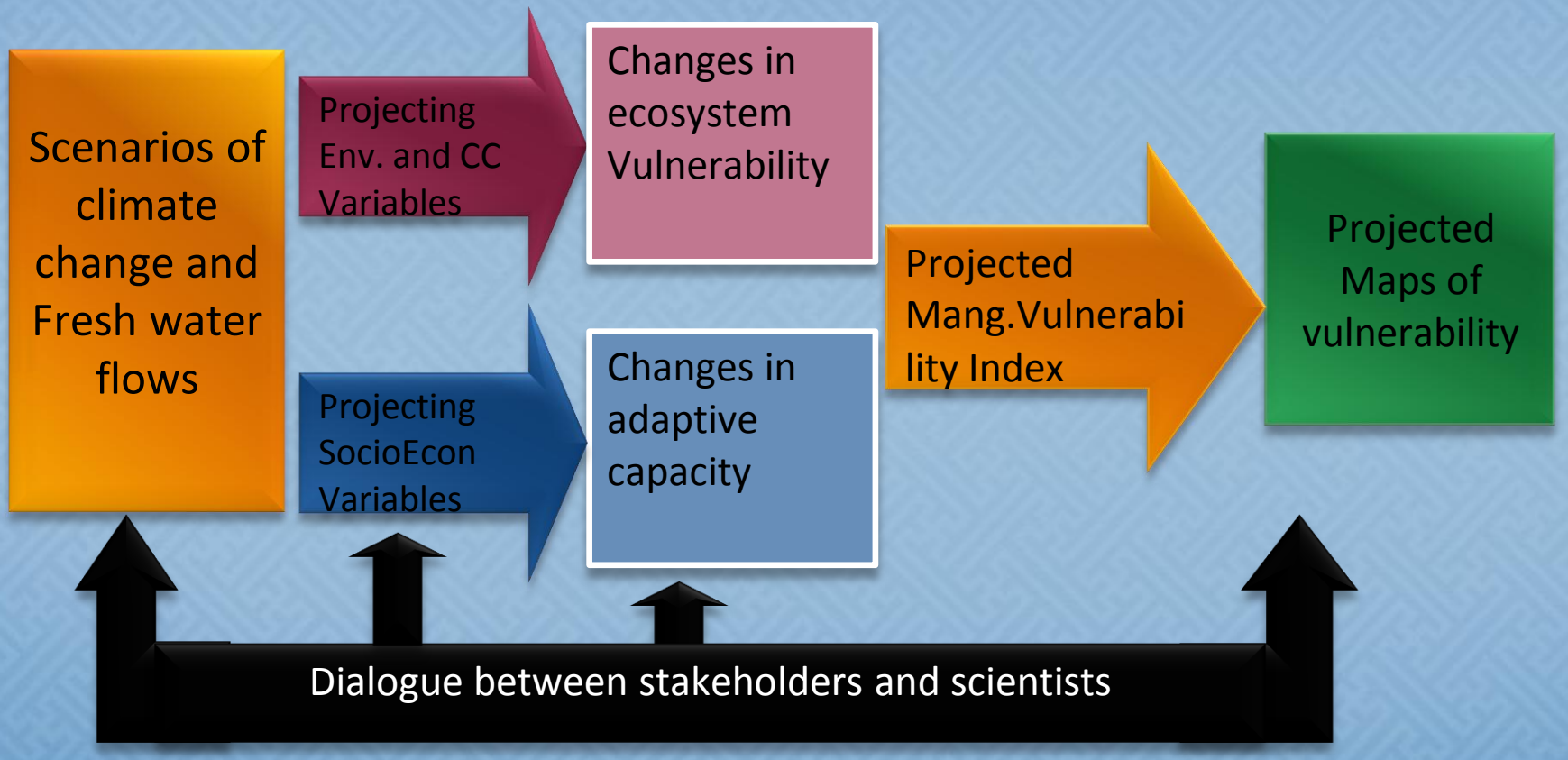
Measurement Scale

Assignment of Weights and ratings

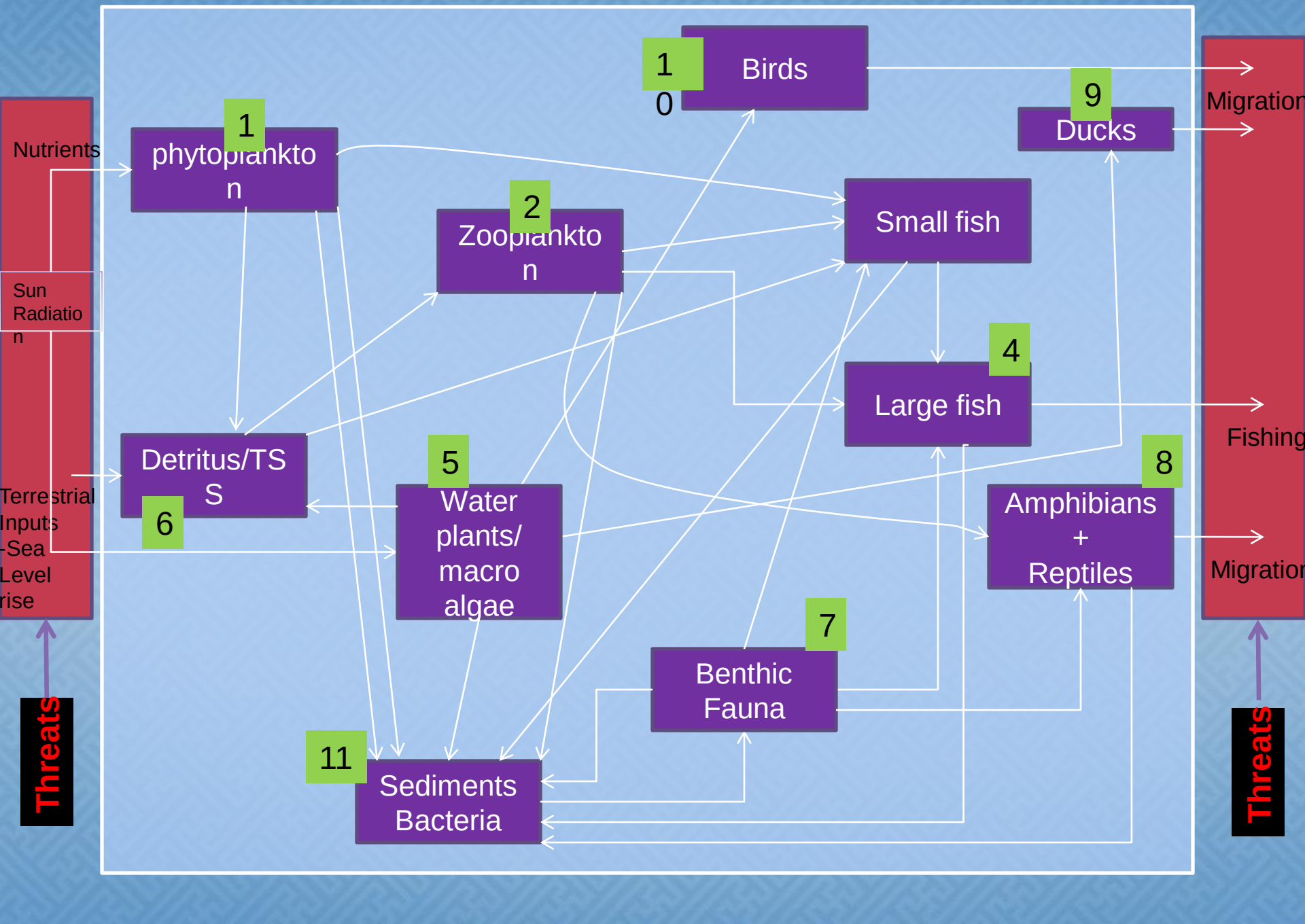
Generalized Diagram of Methodology



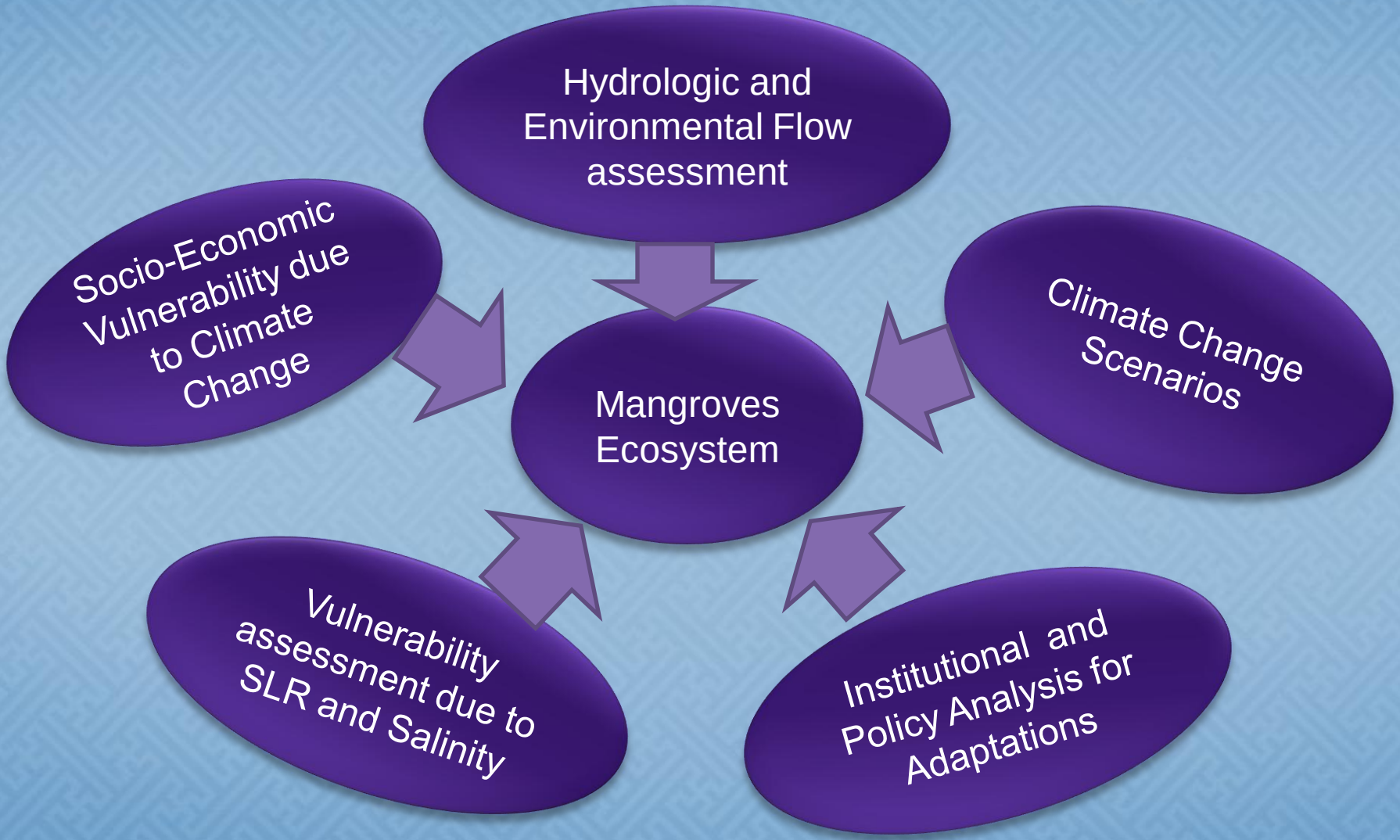
Linking vulnerability assessment with different scenarios



Example Ecosystem Model for Mangrove Study sites



System Approach to study the impact of climate change on mangroves Ecosystem

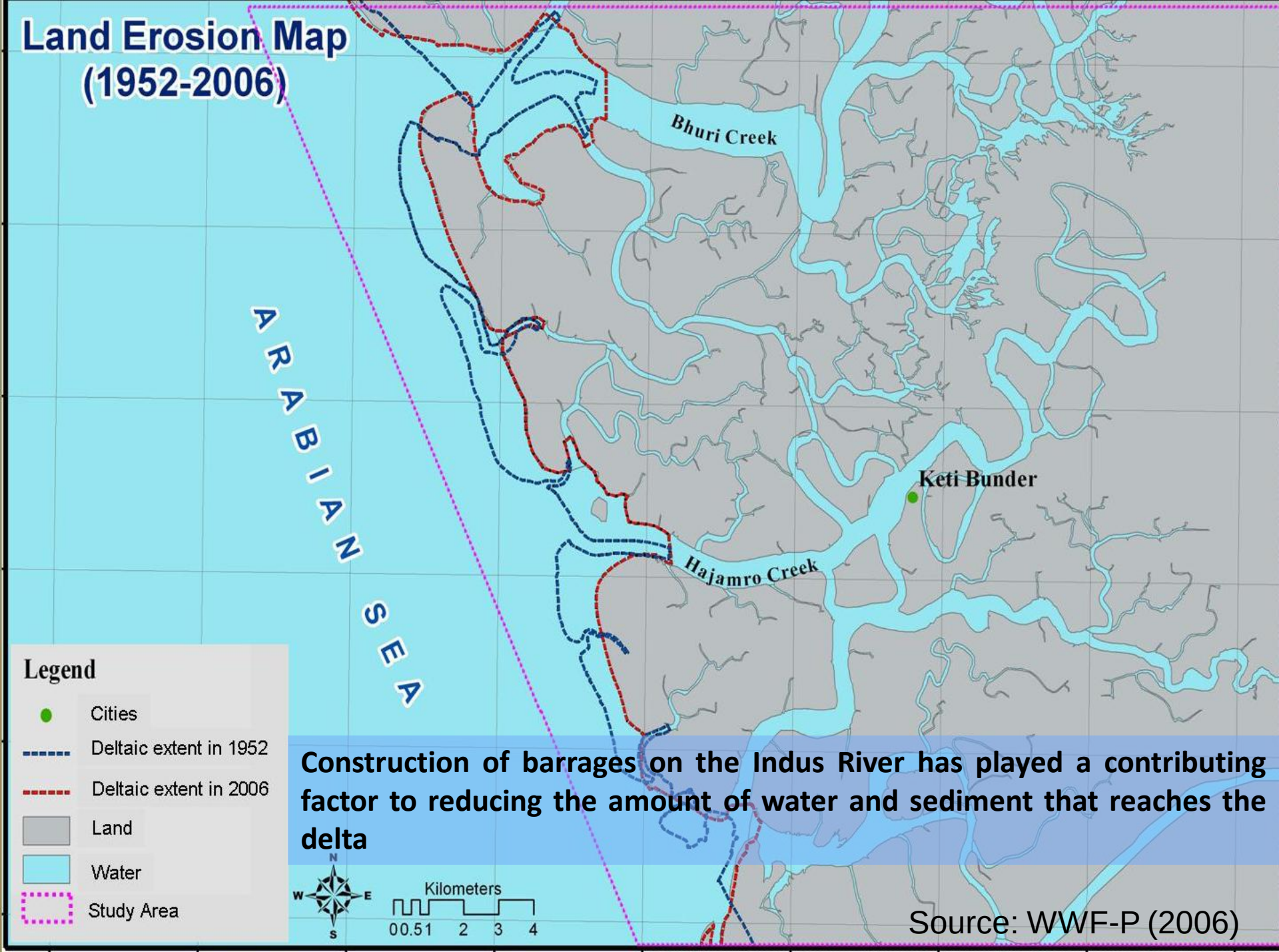


Ecosystem degradation-Some facts

- **Mangroves Forest extent:** Anthropogenic activities are rapidly degrading the mangrove forests, this has degraded the mangrove cover from 2,83,000 ha to 1,60,000 ha in 1990
  - Mangroves are declining at an alarming rate only 73,000 ha (WWF-P, 2006) is left
- **Sea Water intrusion:** of saline water in the Indus delta will pose risk to agriculture, fresh drinking water and livelihood of dependant communities**. (**Sea water intrusion inland up to 100 kilometers north)
- **Fisheries Lost:**25% reduction in marine fisheries in last 5 years and 40% in last 10 yrs.
- **Mangroves Species:** In the past few decades, 4 out of 8 species have been lost

Pressures on the mangrove ecosystem

- Sea intrusion (saline water 40ppt)
- Reduced flow of nutrient rich silt (200 m.tons in 1955 to 50 m. tons in 1990s).
- Deforestation due to illegal cutting and grazing (18000 tons/yr, 16000 camels)
- Pollution (>6000 industrial units)
- More devastation by cyclones & Tsunamis


Land Erosion Map
(1952-2006)
Bhuri Creek
ARABIAN SEA
Keti Bunder
Hajamro Creek
Legend
Cities
Deltaic extent in 1952
Deltaic extent in 2006
Land
Water
Study Area
N
W
E
S
Kilometers
0 0.5 1 2 3 4
Construction of barrages on the Indus River has played a contributing factor to reducing the amount of water and sediment that reaches the delta
Source: WWF-P (2006)

Scale of devastation is alarmingly high with an estimated rate of erosion is 1.5’ per day

Old and dense mangroves are being uprooted by strong waves

Source: WWF-P (2012)

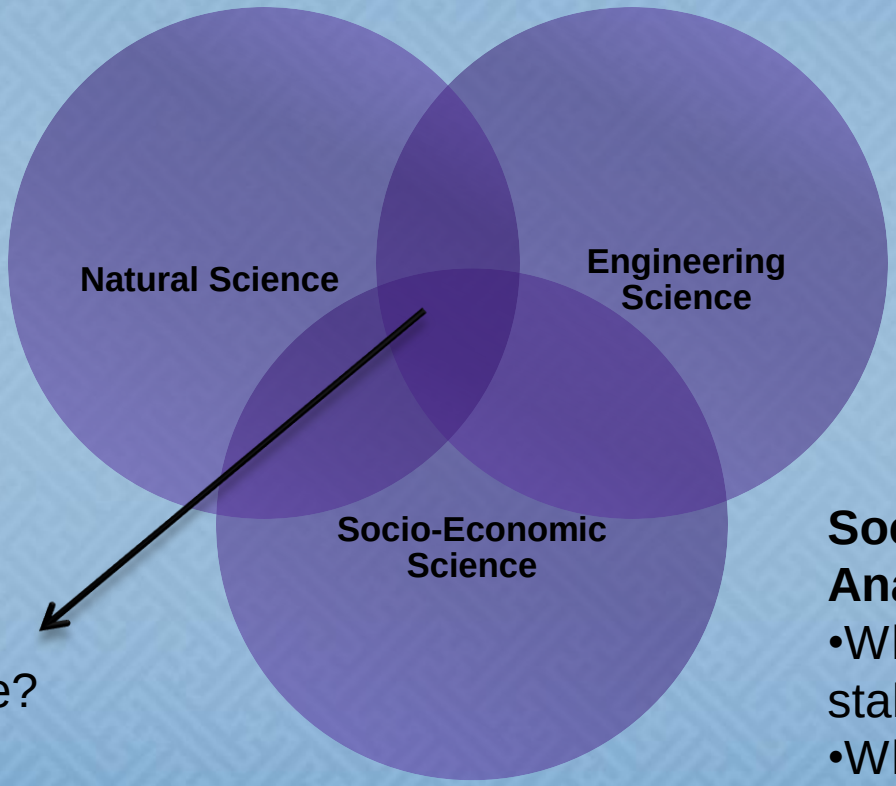
Loss of Human Life & Property

Homeless; Phirth village

Migration; Mero Dablo Village

Adaptations: Modelling for Rehabilitation of Mangrove Ecosystem

Natural Science:
•Driving processes and impacts, etc?
•Linkages, trends and status?



Engineering:
•What will be solutions of sea intrusion, SLR, erosion, etc?
•How and what cost?

Adaptation:
•What is feasible?
•How it will be done?

Socio-Economic Analysis:
•Who is at what stake?
•What opportunities available?

One Focus Adaptation Area would be:
For Hazard Resilience in Coastal Communities

Goal: Communicate the Understanding of the Risks related to Living and Working

Strategies would be:

- **Investigate interactions** among:
  - sea level rise,
  - erosion, and storm surge,
  - including implications for sea water intrusion,
  - coastal flooding,
  - agriculture, human health and safety,
  - and other climatic extreme.
- Develop **models of successfully resilient communities** including contributions of
  - community demographics,
  - economic base,
  - insurance coverage,
  - building codes,
  - education programs,
  - heath care resources,
  - fishery infrastructure, and development.

***Second Focus Adaptation Area would be*:**

Hazard Resilience in Coastal Communities and Institutions

Goal: Capacity to Prepare for and Respond to Hazardous Events

Strategies would be:

• Capacities of institutions for improved land use and water planning due to climate change and its related extreme events.
•Preparing building codes and disaster preparedness plans for coastal communities

• Understand, quantify, and predict impacts of both natural features, including mangroves forests rehabilitations, fisheries, and agriculture

•Providing physical defense against tropical storms and storm surges.

Partnership and Networking- Prospects and Limitations for this project

New Adaptations Technologies and Modeling Techniques: requires multidisciplinary inter-institutional collaboration; and this will be tried in this project by collaborating with USA as an expert country and four developing countries.

Limitation in assessment of impacts and devise adaptations due to high cost and high scientific capabilities: therefore

- Networking and partnerships required for:

DATA, MODELS, CAPACITIES, JOINT PTOJECTs , FINANCIAL RESOURCE.

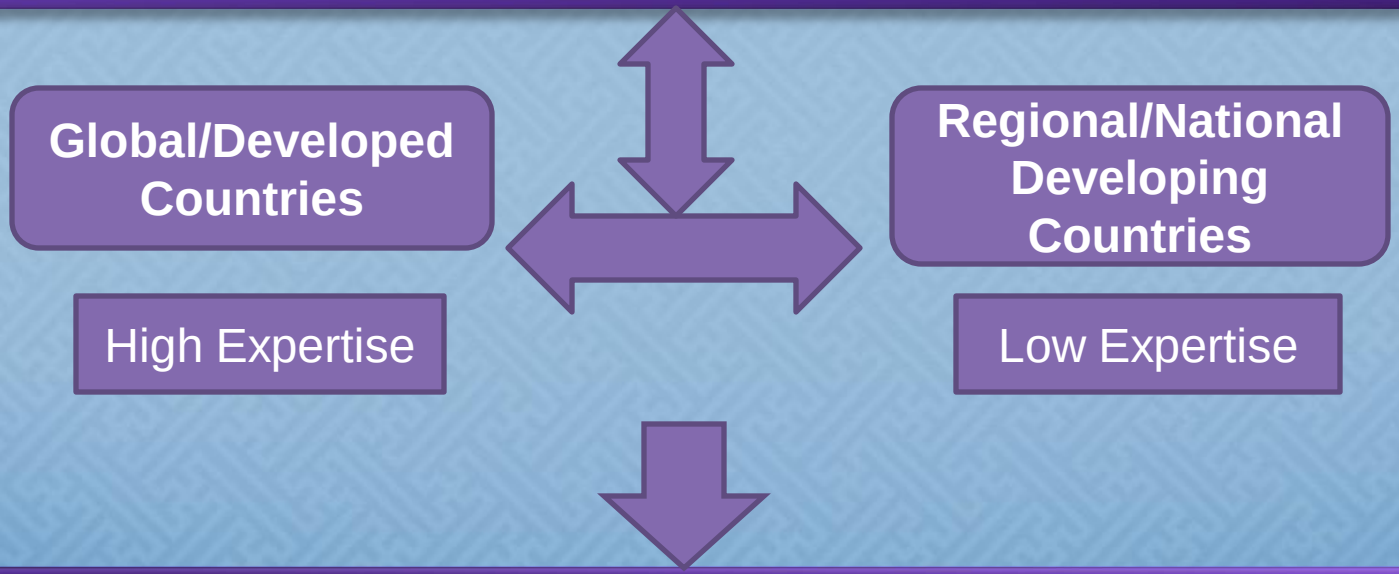
Identification of most Important issues of ADAPTATION research having regional aspects

Establishment of regional FUNDS for ADAPTATION (R&D)

Identification of Institutions/Organizations with common research agendas and experience in adaptation research

Push - Help - Pull – Join

International agencies and Donor's role



Regional Solutions/Cooperation for Adaptation under Climate Change

World map of climate risks

Loss of Artic sea ice

Species loss

Glacier retreat

Species loss

Methane outburst

Shutdown of thermohaline circulation

Harvest loss

Storms

Sea-level rise

Floods

Droughts

Glacier melt and hydrological cycle

Water scarcity

Monsoon suppression

Droughts

Food insecurity

Tropical Monsoon suppression

Diseases

Species loss

Sea-level rise

Food insecurity

Sea-level rise

Sea-level rise

Collapse Amazon forest

Floods & Storms

Loss of coral reefs

Loss of species & ecosystems

Collapse West Antarctic Ice Sheet

Conclusion:

Robust and collective global to regional responses for climate change adaptations will be achieved through a joint research-policy-action by sharing of technology, knowledge and experiences.

Thank You