Development of Adaptation framework & Capacity through Stakeholder participation

"Workshop on Meta-guidelines for water and climate change"

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Structure of Presentation

Creating Innovative Solutions for a Sustainable Future

1. **Adaptation: Stakeholder Involvement**
2. **Scenario planning approach for IWRM & CC Adaptation**

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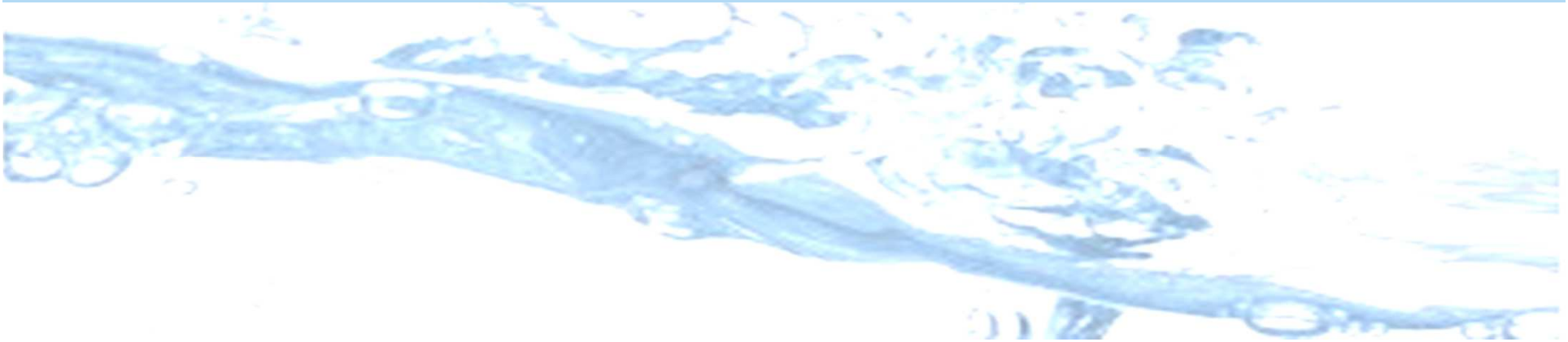
Major Challenges



State of water resources: Major Issues

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Existing Challenges in Water Sector

- Declining per capita water availability
- Many river basins are water stressed and likely to be water scarce.
- Increasing & competing water demand
- Overexploitation/Depletion of groundwater
- Water quality issues
- Urban (NRW/UFW); Rural
- Tariff, equitable access
- Others

Impact of Climate Change

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Impacts of Climate Change

- The impacts of **climate change may further exacerbate the situation**. Some of the observations over the 20th century include **(IPCC, 2007);**
  - **Increase in temperatures ,** Decrease in snow and ice cover **(Glacial melting),** Rise in global average **sea level rise (SLR), Rise in Sea Surface Temperatures (SSTs), Increase in frequency and intensity of extreme events**
- **Changes in precipitation/rainfall, its frequency and intensity.**
  - Directly **affecting** the **runoff** rates and thus the **surface and groundwater supply (availability & quality)** to various sectors including irrigation, domestic, industries etc..

NAPCC (National Water Mission) *(Revised draft 2009)*

- **Conservation** of water, **minimizing wastage** and ensuring its **more equitable distribution** both across and within States **through integrated water resources development and management"**

Global atmospheric CO_2 concentration

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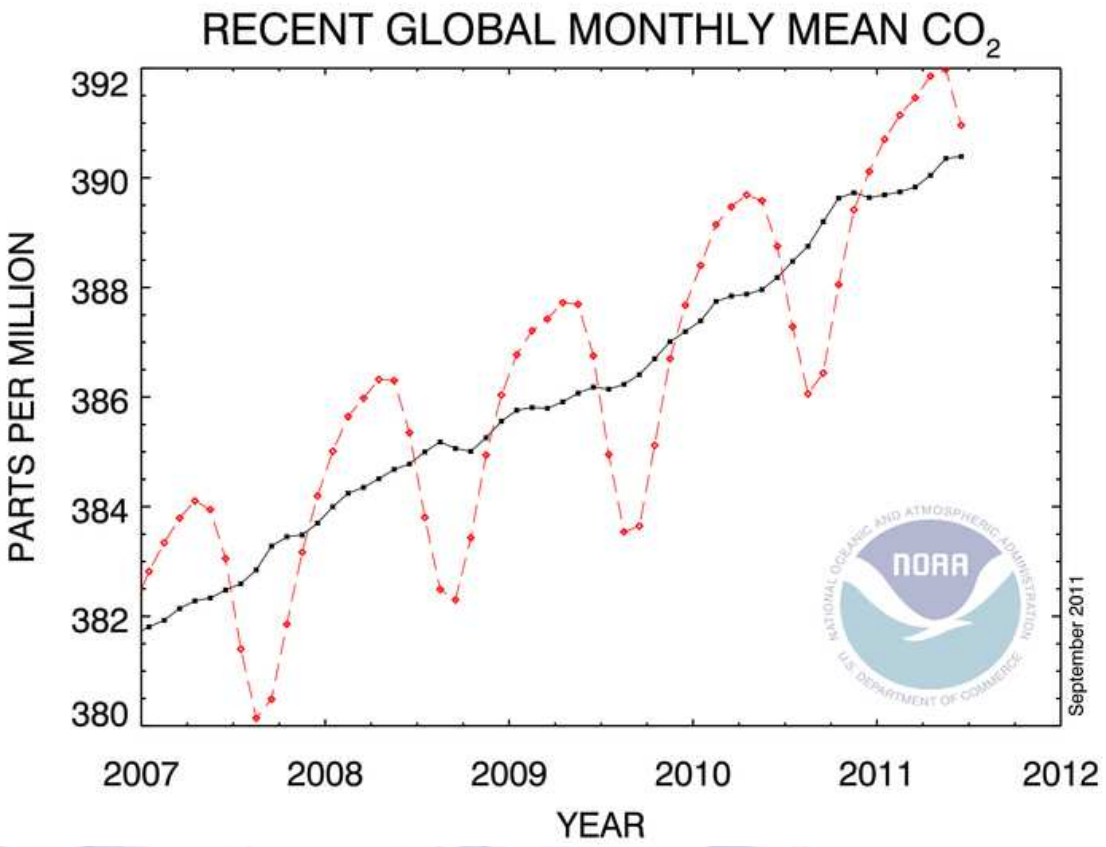
Annual Growth Rates (decadal means)
1970 – 1979: 1.3 ppm/year
1980 – 1989: 1.6 ppm/year
1990 – 1999: 1.5 ppm/year
2000 – 2010: 1.9 ppm/year



Data Source: Thomas Conway, 2011, NOAA/ESRL + Scripts Institution

Climate projections

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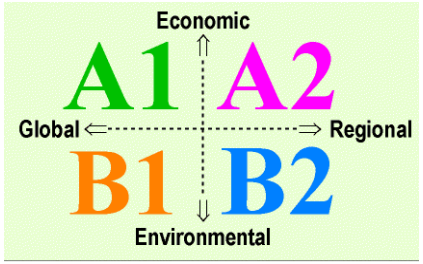
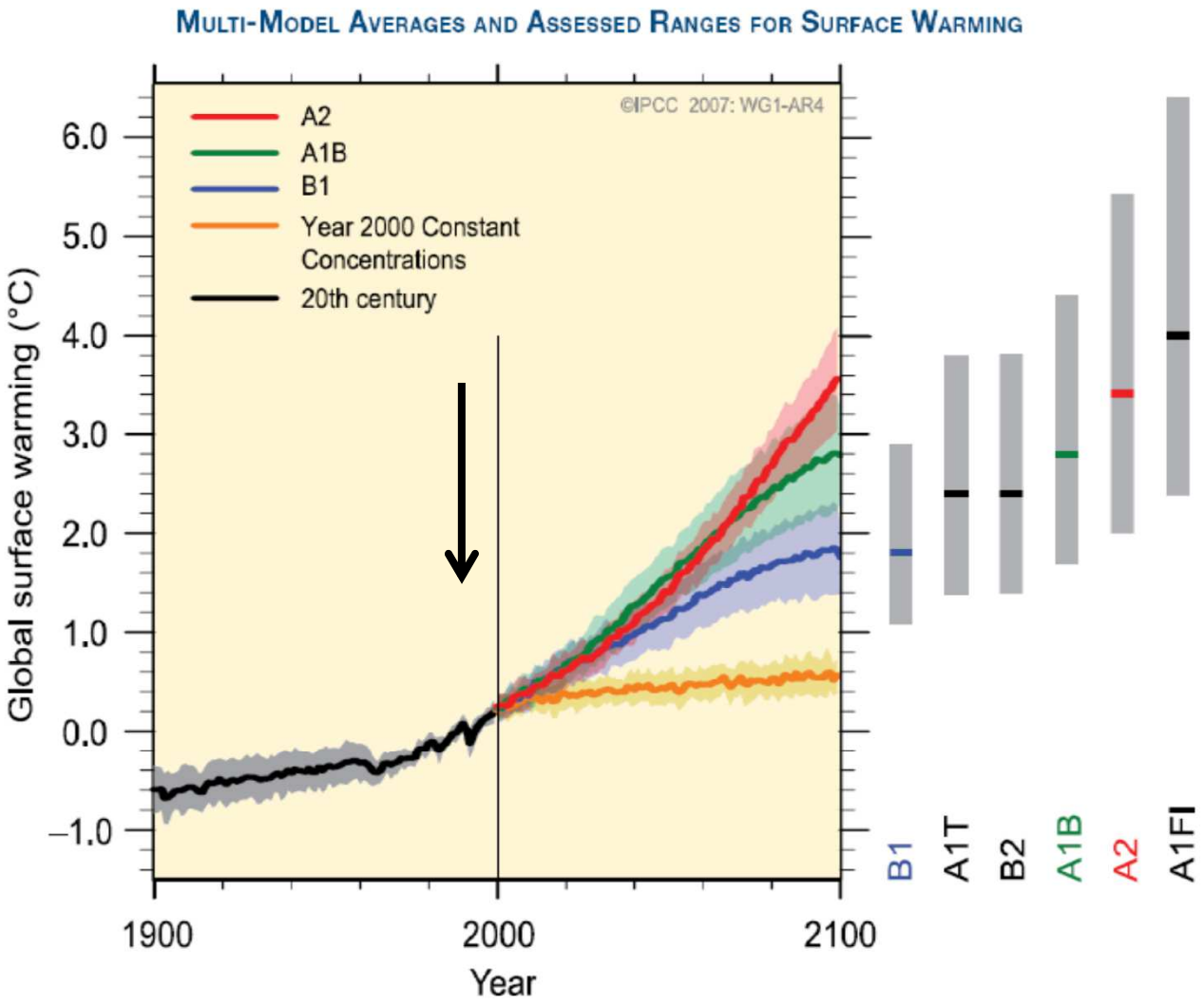
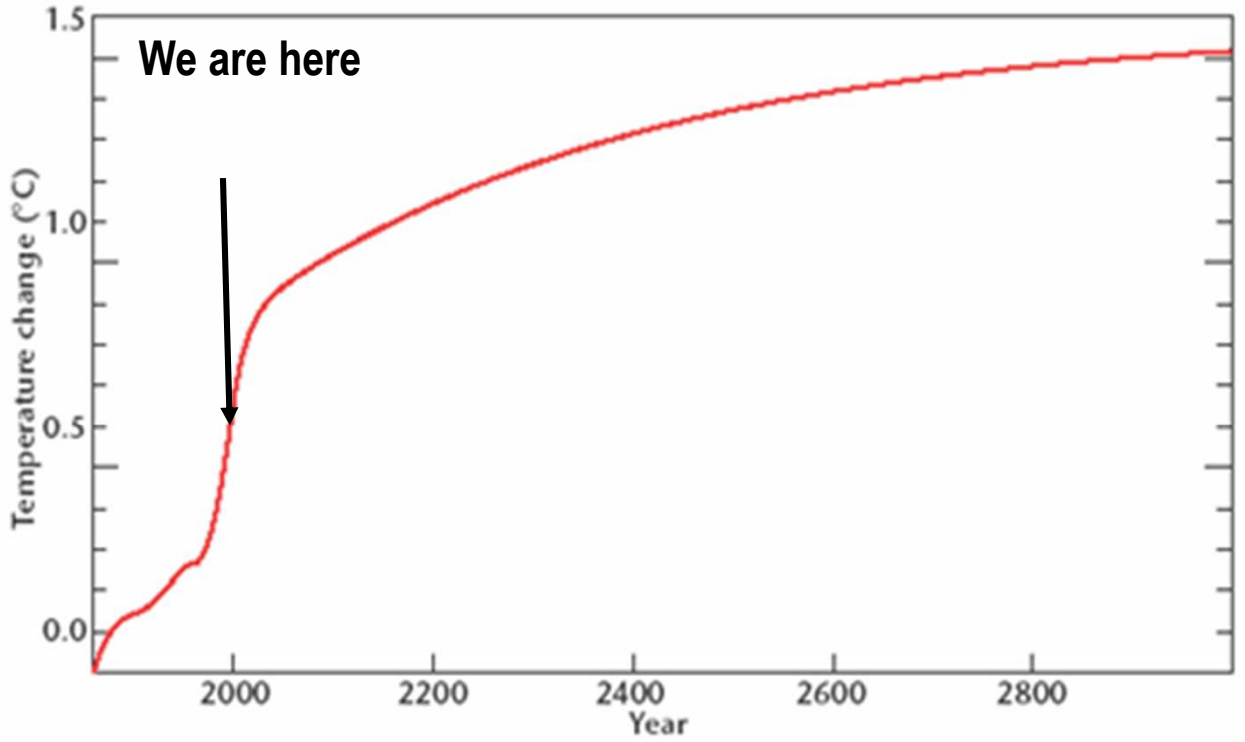




Adaptation is still needed even if GHG concentration is stabilized at present levels



The rise in global mean temperature following stabilisation of greenhouse gas concentrations at present-day levels.

Source: Hadley

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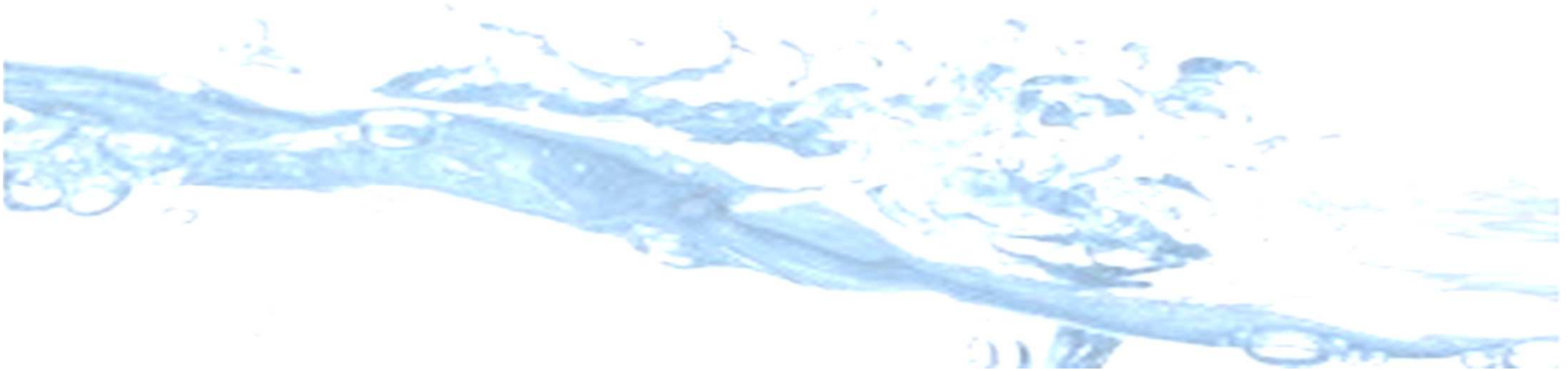
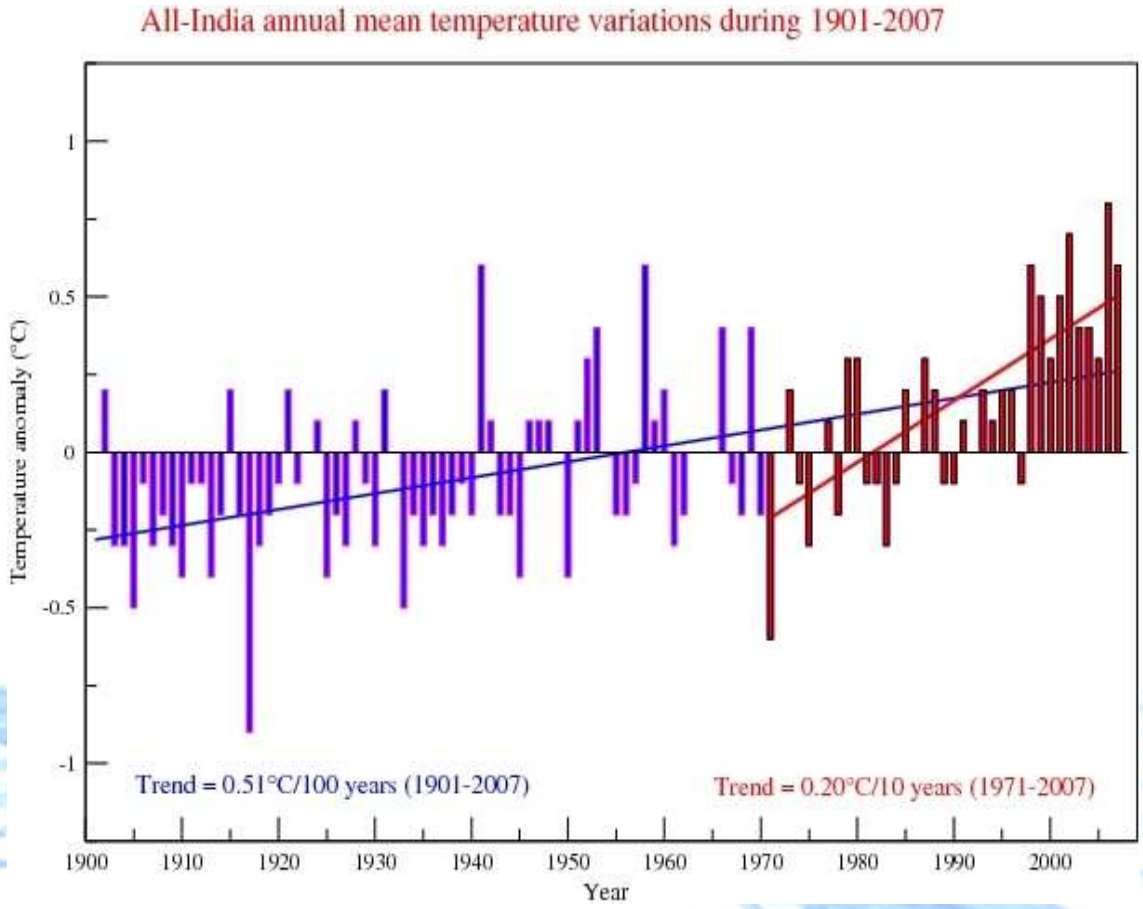
Regional climatic trends and scenarios: India



Indian Climate Trends

Temperature



Kumar et al. 2006

- **Past trends:**
  - **0.5°C/100 years (1901-2007)**
  - **0.2°C/decade (1971-2007)**
- **Future trends**
  - **Winter temperatures expected to increase 3.2°C in the 2050s and 4.5°C by 2080s**
  - **Summer temperatures expected to increase by 2.2°Cin the 2050s and 3.2°C in the 2080s**

Indian climate trends (contd..)

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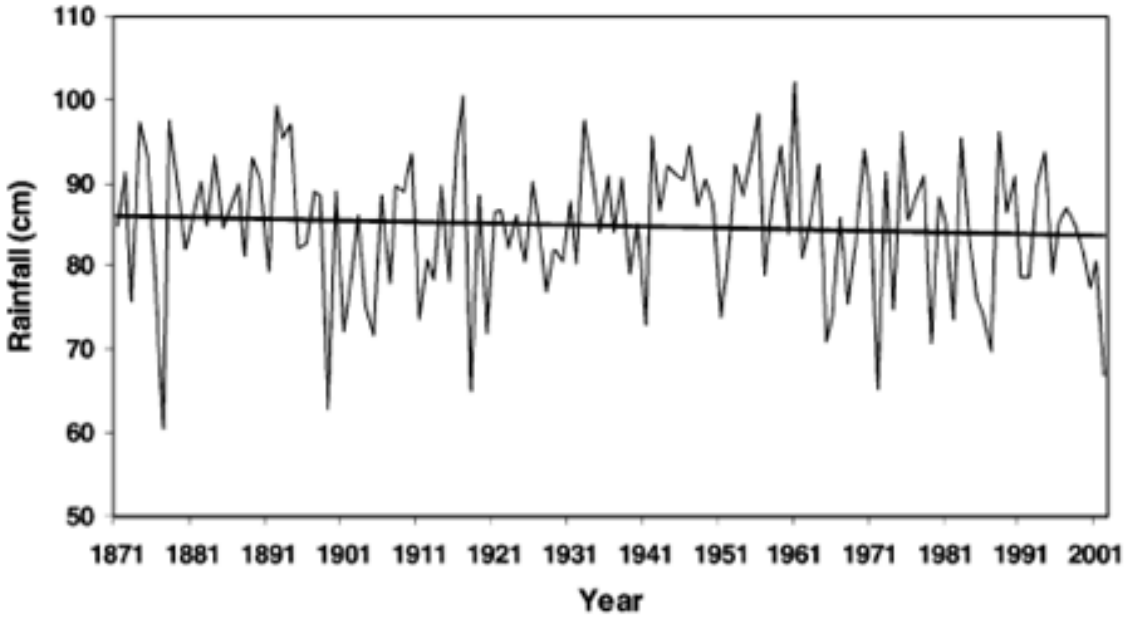
- **Reduction and increased variability of summer monsoon rains**



Dash and Hunt, 2007

Water availability in the Basin impacted by:

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- **Changes in patterns of glacier/snow melt: rivers like the Ganga**

- **Changing monsoon patterns; associated extremes**

Requirement is…

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- **To focus on an integrated water resources management (IWRM) promoting equity, efficiency, conservation & sustainability**
  - that takes into account the need of **all stakeholders falling in trans-boundary, inter-river basin,** sub-basin, watersheds
- **Adaptation and mitigation for impacts of climate change**
- **Multi agency, multi disciplinary and multi faceted approach**

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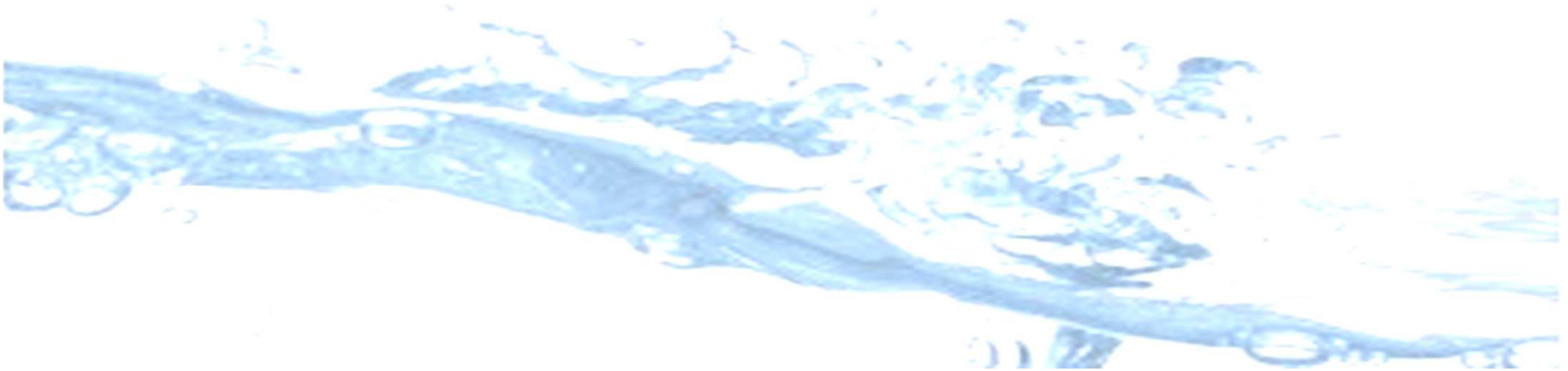
Adaptation to Climate Change: Stakeholders driven adaptation framework

Case Study-1: Krishna Basin
Case Study-2: Ganga Basin



Krishna Basin

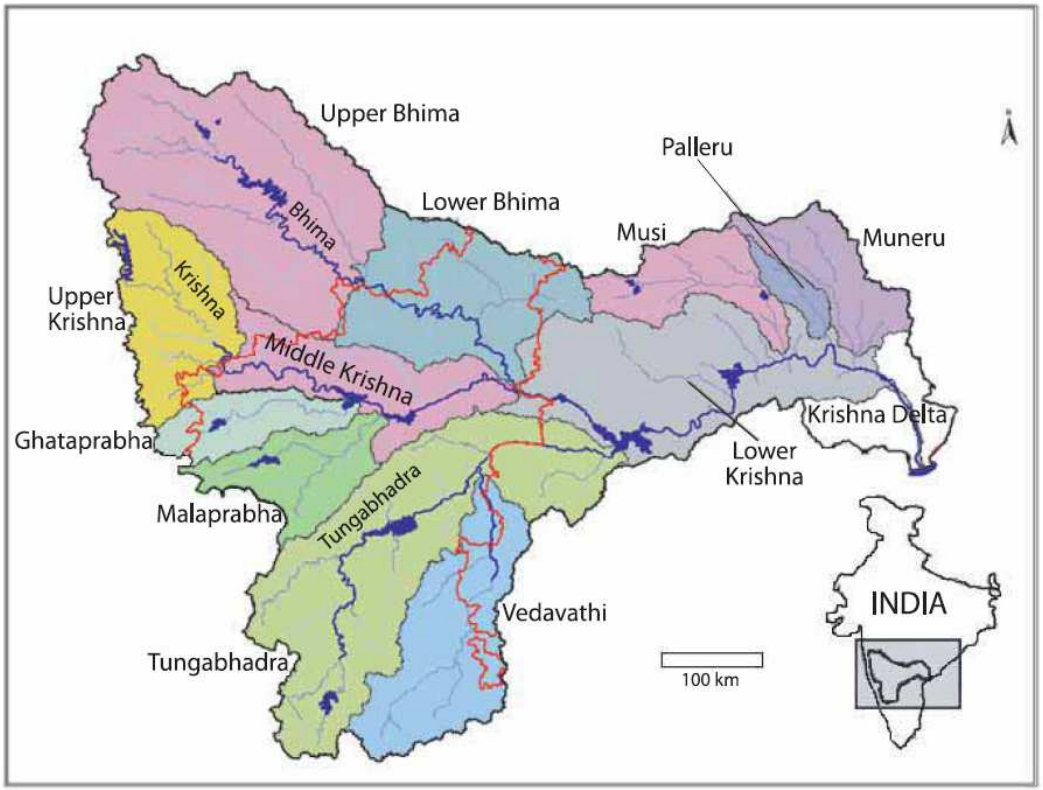
Krishna Basin:

Total Geo graphical **area** is **2,65,812 km²**

River length :1485 km

The Basin falls in the states of

- **Karnataka:** 1,11,381 km²
- **AP:** 84,083 km²
- **Maharashtra:** 70,348 km²



Source: IWMI

- **Major intra-basin transfers** to the Middle and Lower Krishna occur **from** the **Upper Krishna,** where **~50 %** of the basin's **discharge originates**
- **Groundwater irrigated area exceeds surface water irrigated area** in the basin.
- The number of **shallow tube wells increased from 35,000 in 1987 to 137,000 by 1994** ***(Ministry of Water Resources 2001)***

Ganges Basin: Case Study Domain

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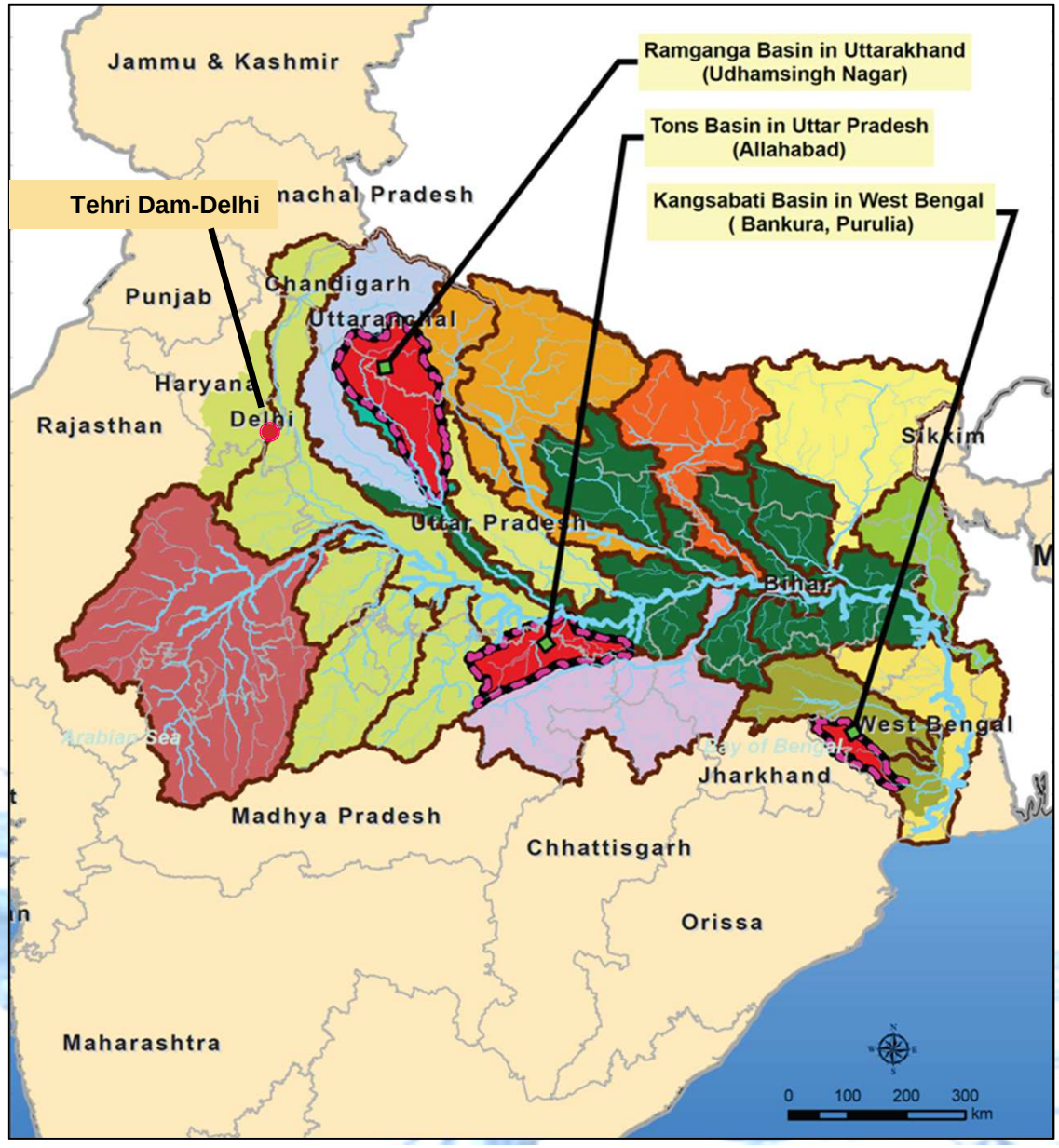
4 Case studies within Ganges Basin

- **NCT of Delhi** and its links to Tehri Dam
- **Udham Singh Nagar** district in **Ramganga basin**
- **Allahabad** district in **Tons basin**
- **Bankura-Purulia** in **Kangsabati basin**



Regional Modelling Framework

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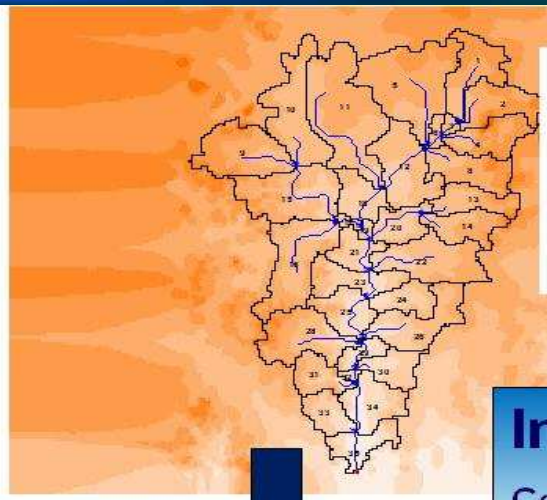
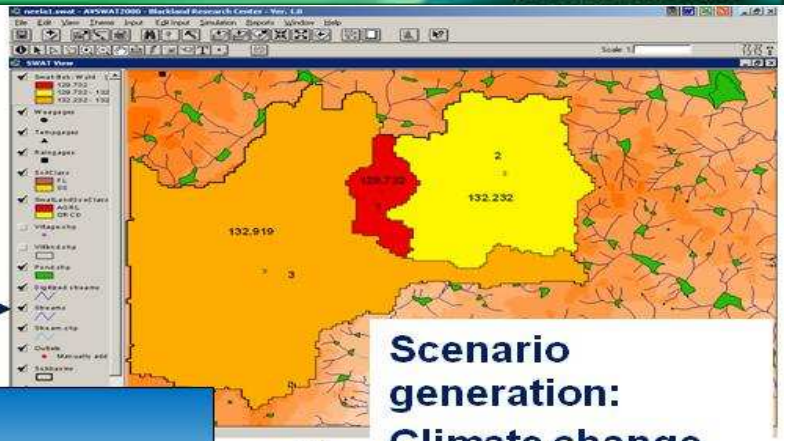


GIS Database
Climate
Landuse
Soil
Topography
Socio-economics



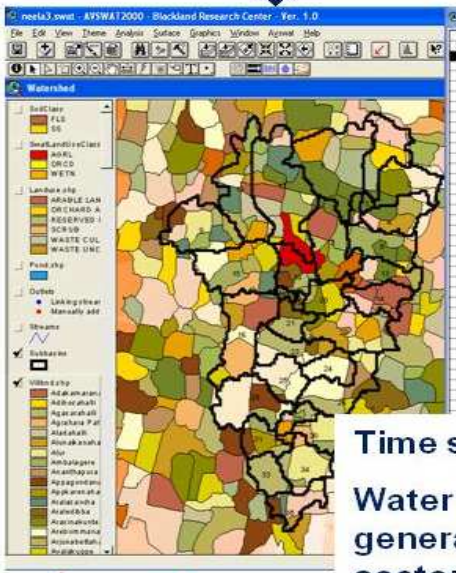
Scenario generation:
Climate change
Landuse change
Groundwater
Economic development

Interventions

Conservation measures

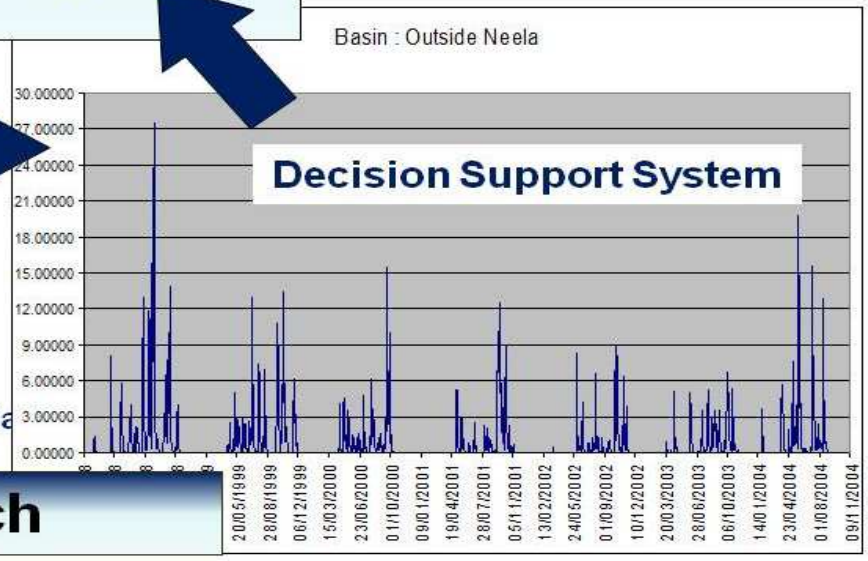
Technological measures/ Implementation

Strategy development – fiscal, institutional, technical, building adaptive & supportive capacities



Time series analysis

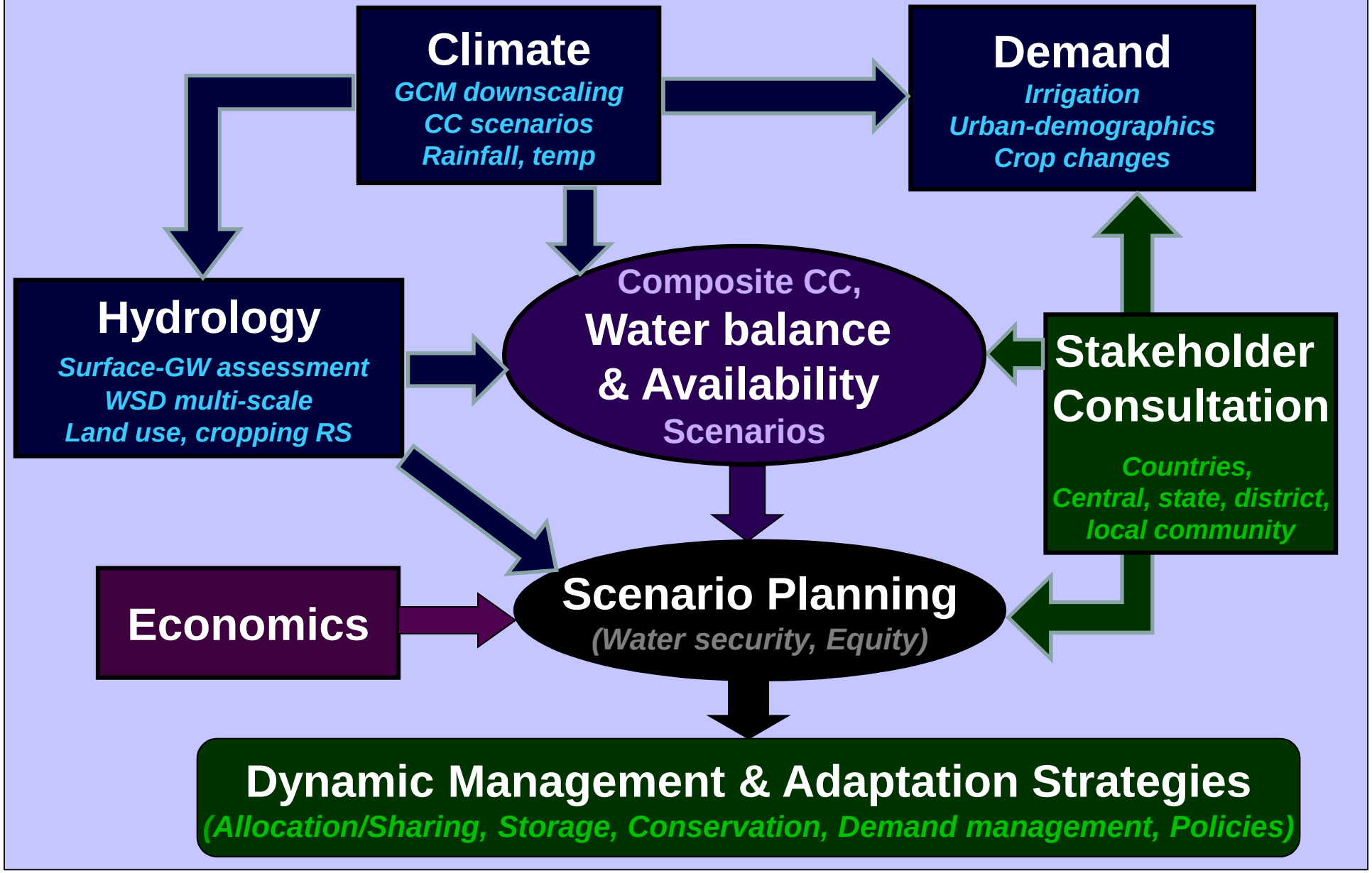
Water use, demand, and wastewater generation: Agriculture sector, Industria sector, Domestic sector



Decision Support System

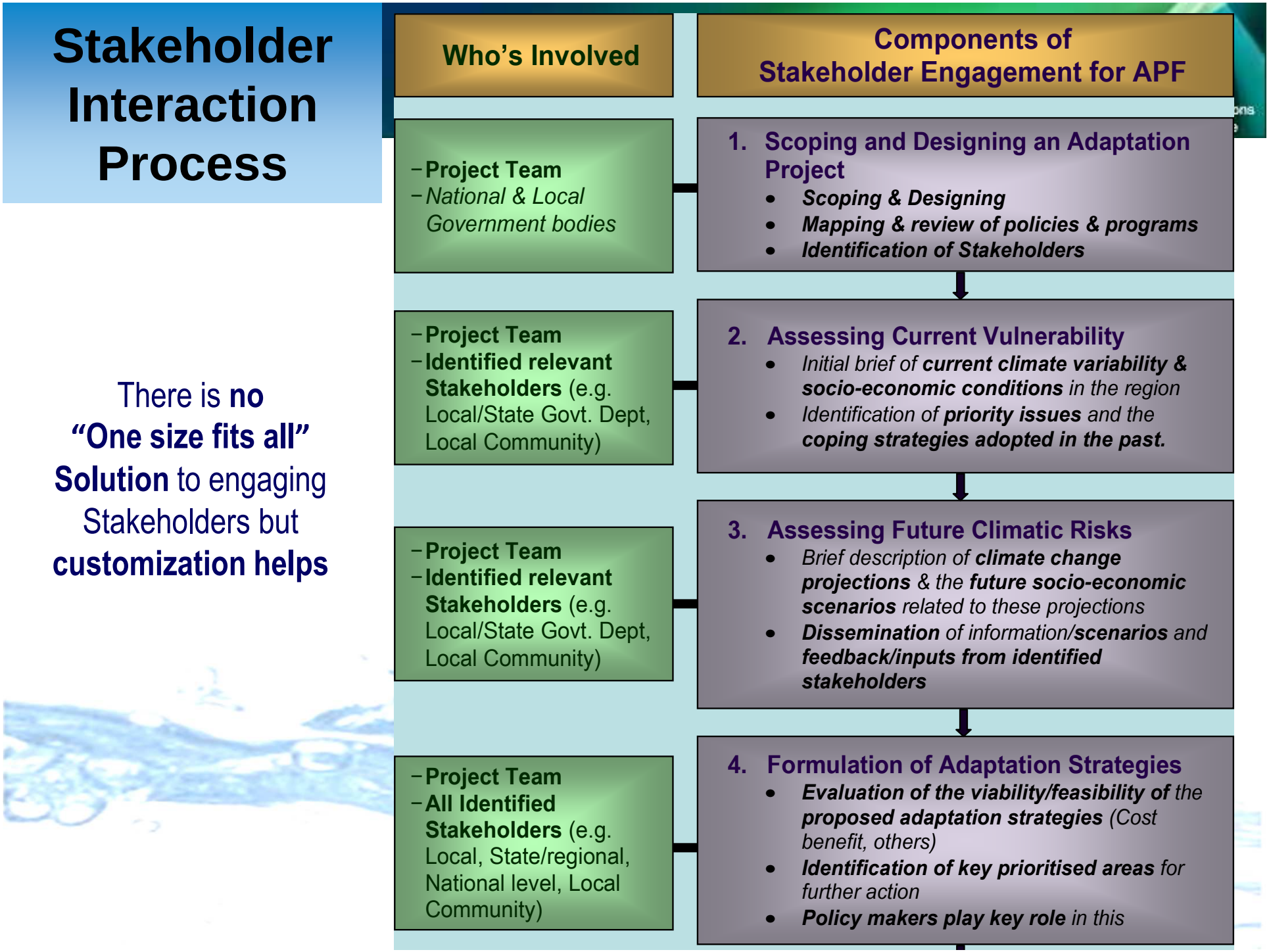
Approach

Regional Planning Framework



Stakeholder Interaction Process

There is **no "One size fits all" Solution** to engaging Stakeholders but **customization helps**



Multi-Stakeholder driven approach

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	Level	Category	Stakeholders
1	National	Government	***Ministry of Water Resources*** as the **nodal ministry** for all water related policies and programmes**, *Ministry of Home Affairs*** **(National Institute of Disaster Management and National Disaster Management Authority), CWC, CGWB** and **DST**
		Experts	Independent Consultant (IITs)
2	State	Government	Krishna Water Disputes Tribunal, Agriculture Department, Irrigation and Command Area Development, Rainshadow Area Development Department, Rural Development, K&G River Basin Organisation
		Research/ Academic	Centre for Economic and Social Studies, , Environment Protection Training and Research Institute , IWMI, ICRISAT
		Universities	Acharya N G Ranga Agricultural University, JNTU
		Civil Society	Community Based Organisations
3	District/ Block	Government	Agriculture Department, Irrigation Department, Water Department (Watersheds), Rural Development and Panchayati Raj Department
		Civil Society	Community Based Organisations
4	Community	Government	Panchayats
		Villages	Households within, key informants, Women, Elders etc.

Multi-stakeholder involvement

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State → District → Community

Why is Stakeholder involvement necessary?

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- **Involvement in all critical stages of planning and execution of interventions is important**
- **Consider their priority issues & policies. Align the research priorities/direction**
- **Knowledge exchange (Scientific - Traditional)**
- **Acceptability of the decision**
- **Sustainability of interventions (Participatory management; O&M)**

Planner ⟺ Implementer ⟺ Benefitiary group

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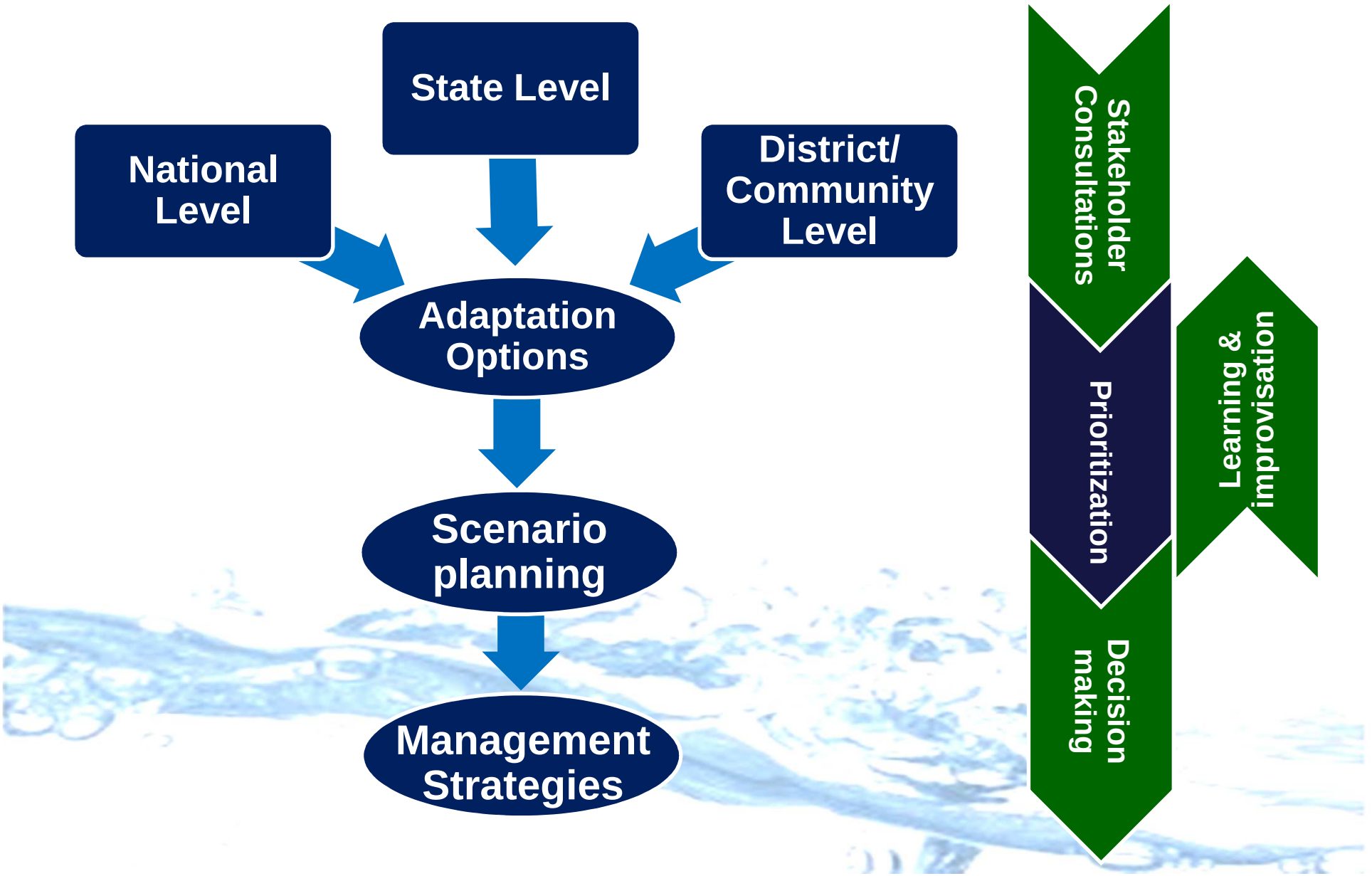
Adaptation options

The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities"

(IPCC)

Stakeholder consultations: Strategies



Adaptation options (e.g.)

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Mix of structural and non-structural measures

	Adaptation options emerging at Community Level from Bankura district
Agriculture	Climate-tolerant crop varieties, soil and water conservation practices, changes in cropping patterns given good returns, agro-forestry
Water resources	Efficient irrigation practices, reviving traditional water conservation structures, water recycle and reuse,
Forestry	In-situ species conservation, climate-hardy varieties, community engagement in forest conservation
Health	Better public health care, awareness at the local level

Adaptation options by stakeholders

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	Upstream	Midstream	Downstream	Criteria (examples)
Community	1. Monitoring of sand mining from river banks 2. Construction of stone embankments Afforestation 3. Livelihood diversification 4. Capacity building for more efficient farming practices	1. Water harvesting structures like ponds/ water storage 2. Drip/Sprinkler Irrigation systems 3. Agro-forestry 4. Crop diversification 5. Afforestation	1. Awareness camps 2. Rain water harvesting 3. Organic farming 4. Integrated farming 5. Short duration varieties 6. Afforestation 7. Deep tube-wells	• Immediate impact on livelihood • Contribution to an increase of water availability • Equity • Costs • Long term impact
District	1. Public awareness for needs and methods for water conservation 2. Monitoring sand mining from river banks 3. Better forecasting systems 4. Limiting cultivation of summer rice 5. New varieties under crop insurance schemes 6. Livelihood diversification	1. Afforestation or large scale plantations 2. Promoting new technologies like sprinkler irrigation with demonstration 3. Field bunding 4. Use of heat-tolerant and drought-tolerant crop varieties 5. Lining of canals in water scarce areas 6. Construct soak-pit	1. Check dams 2. Surface water bodies 3. Field bunding 4. Crop diversification 5. Integrated farming 6. Organic farming	

Prioritization Process

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Initial consultations

Short-listing of preliminary options

Frequency analysis,

(Tier wise)

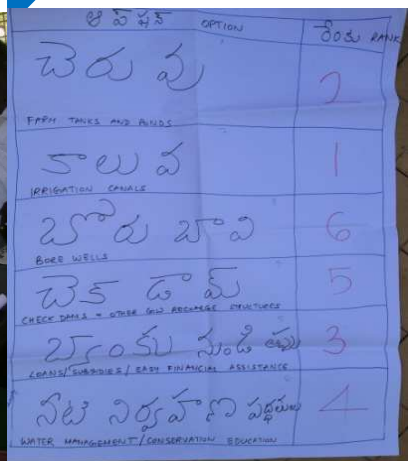
Preliminary "first" list of options

(not in order of preference)

Ranking of options,

(Criteria analysis)

Prioritized (ranked) list of options



Adaptation options prioritized by stakeholders

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Stakeholder Prioritized Adaptation Options

State Level *Tier-2*	District Level *Tier-3*	Community/Farmer *Tier-4*
1. Diversification of livelihoods	1. Increased participation from farmers in government schemes	1. Farm ponds and tanks to be constructed
2. Change in cropping pattern	2. Strict water allocations within the basin	2. Need more canal irrigation systems
3. Repair/renovate existing structures	3. Change in cropping patterns	3. Need water resources that we can control
4. Regulatory body to check water withdrawal limits	4. Improve efficiency of water management within the basin	4. Need ground water recharge structures like check dams and bunds
5. Convergence of institutions	5. Dissemination of new technologies to farmers	5. Need simpler process to obtain financial assistance (loan/subsidy/crop insurance)
6. Temporal water apportionment	6. Improved accuracy in weather forecasting	6. Create awareness on water conservation and management practices
7. Creating more water storage structures	7. Dissemination of information through IT to farmers	7. Farm ponds and tanks to be constructed
8. GW Regulation *(Restriction on bore well digging)*		

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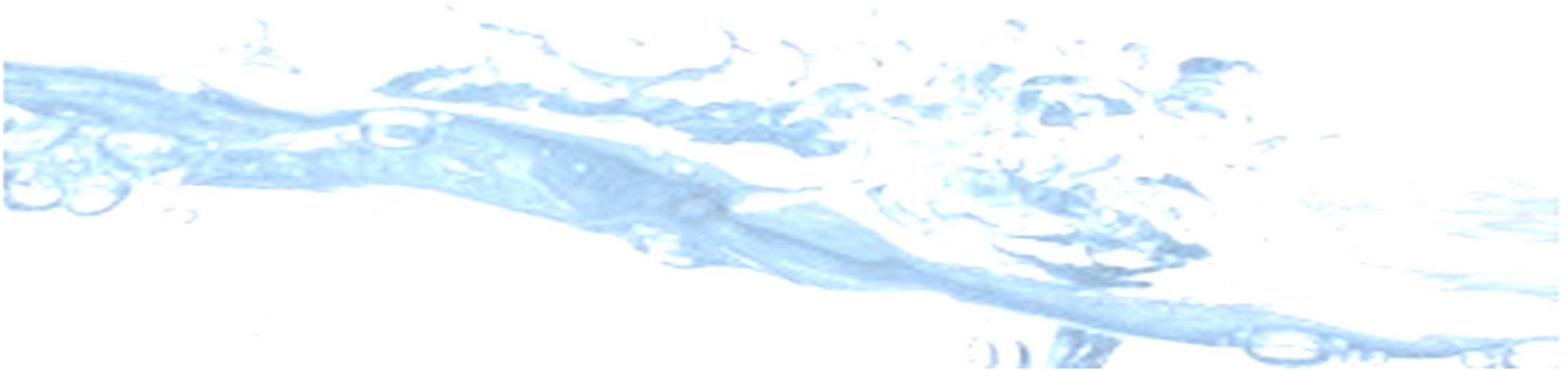
Scenario planning approach for river basin management



Regional Planning Framework

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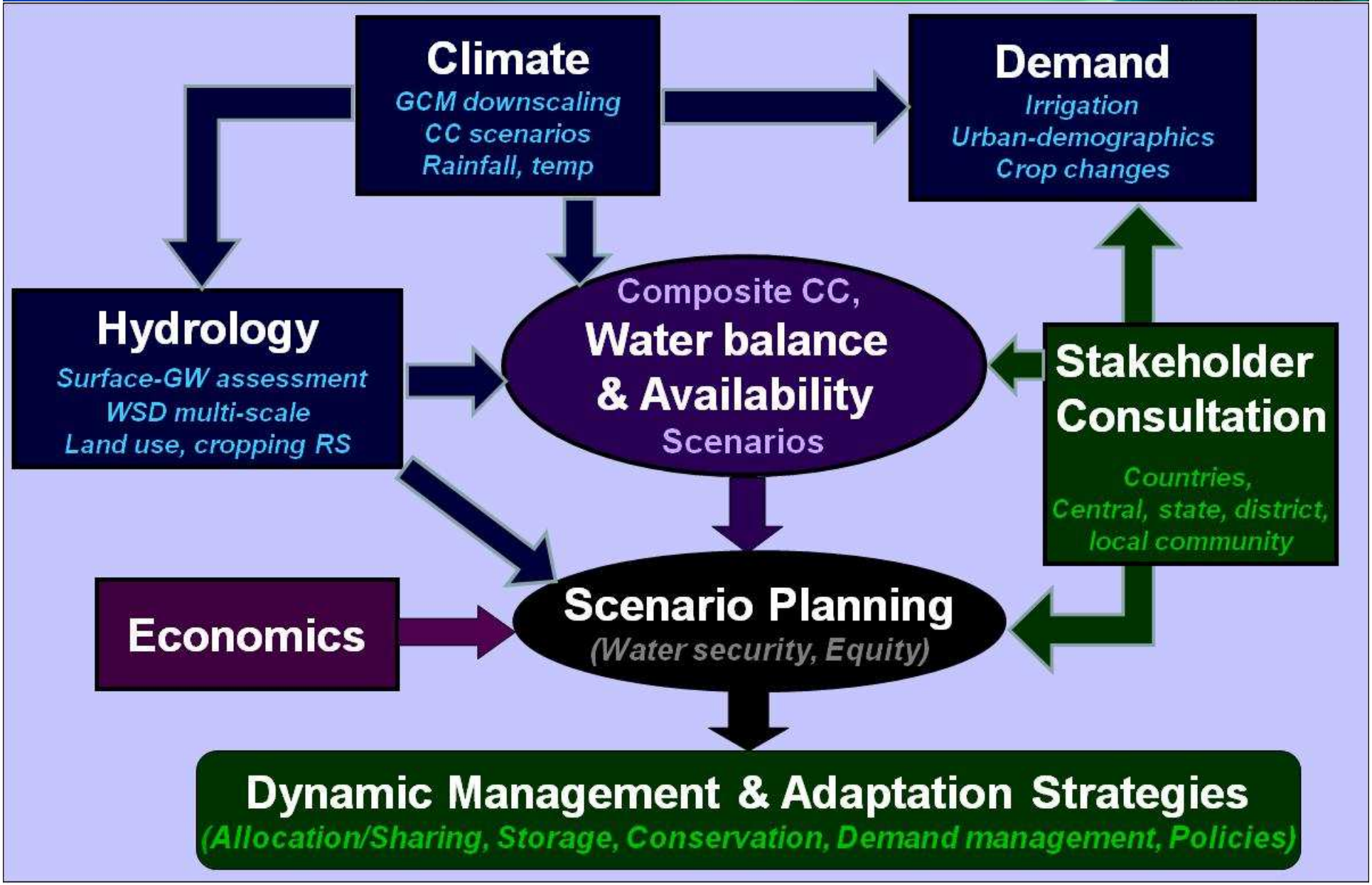

Problem uncertainties

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- **Multiple Uncertainties**:
  - **Cognitive**: lack of (or limited) scientific knowledge, e.g. Climate predictions
  - **Strategic**: many actors & different perceptions
  - **Institutional**: decisions made by fragmented institutions
- **Imperfection** of **knowledge**: *(historical)* hydrology, behavioural
- **Instability**: Problem evolve *(change over time)* as solutions are being sought
- **Multi-causality** and **interdependencies**: solutions lead to unforeseen consequences (difficult to identify all the causes and effects of highly complex problems)

What is the best approach?

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- Problem uncertainties and instability **requires flexibility over time**
- Requires capacity for **adaptive decision making**
- Flexibility & adaptive capacity:- to identify **"no-regrets measures"**
- Two key elements needed to address complexity and uncertainty: ***(allow corrective measures over time)***
  - **Assess** whether **policy (strategies) meets –economic, environmental and social sustainability objectives –**
  - **Adaptive policy** framework **should account for continuous changes in biophysical and policy environment**
- Require **collaborative partnerships** between **science**, **stakeholders** and **decision makers** supported by research evidence.

Traditional Planning

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- Is largely **deterministic**
- Process **relies on** a **single most likely alternative** future forecast
  - **Desire for single right answer**
  - Often **anchored in present rather than future**
- Cause of failure of traditional planning
  - **Deterministic view of future**
  - **Forecasts often go wrong**

*The **accuracy of forecasts falls** as we move **into** the **future**. (an equivalent phenomenon as in business sales)*

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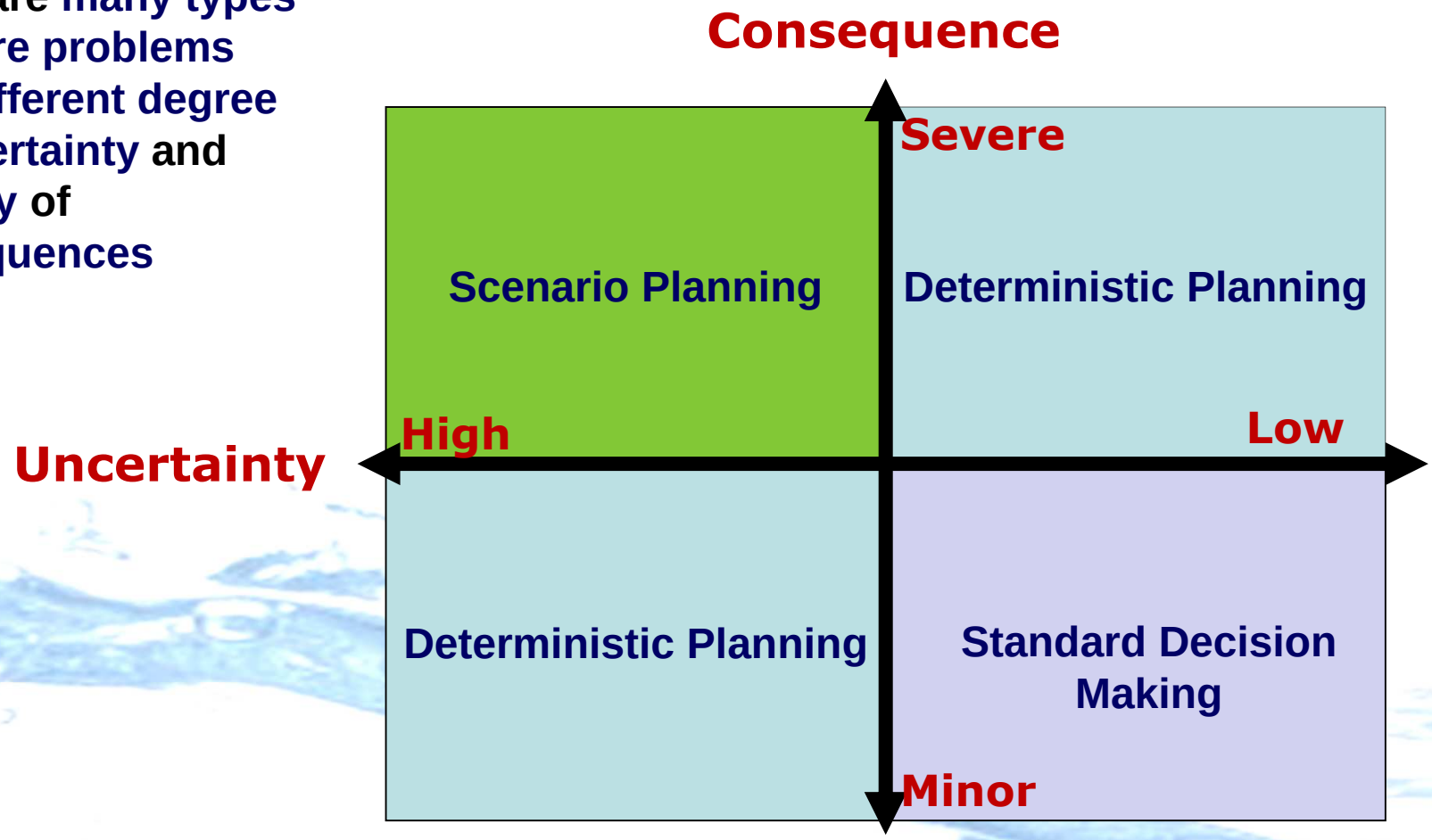
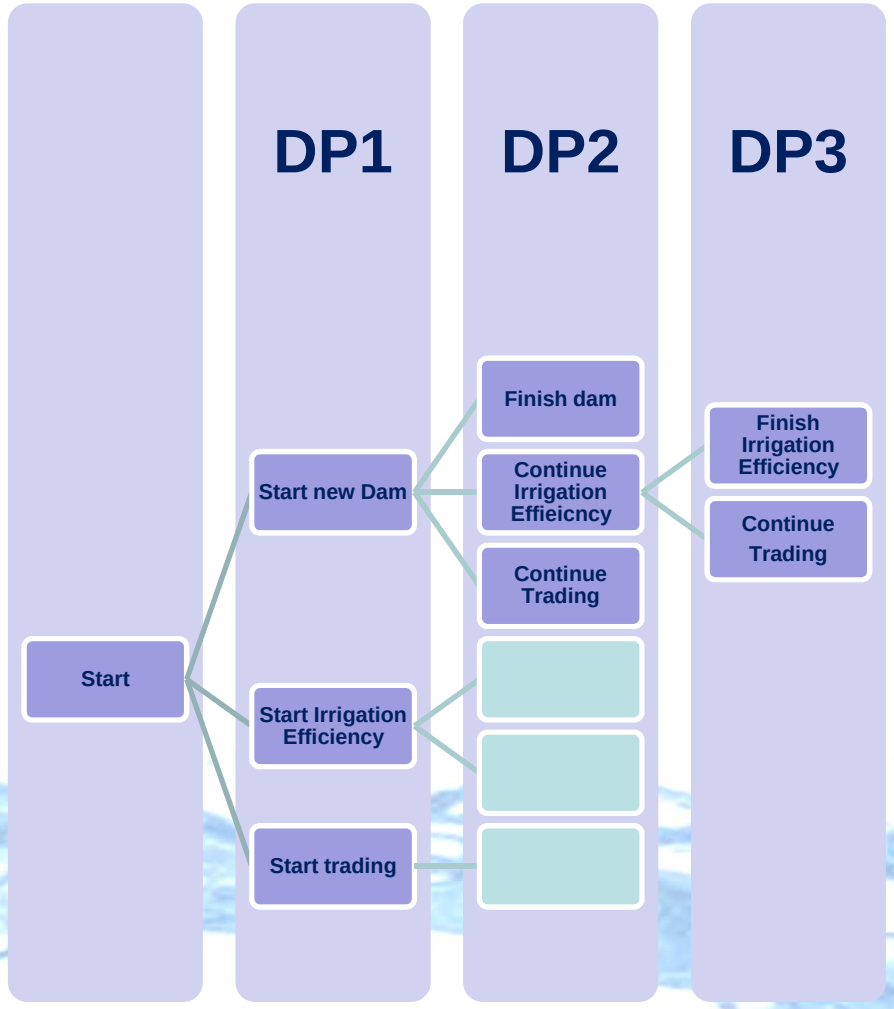
Why & when to Use Scenario Planning

There are many types of future problems with different degree of uncertainty and severity of consequences



Real Options:
Evaluating responses



- **At each** decision point (DP), **decisions** must be **made** about **how to go forward**
- Decisions are **based on new information available** at each decision point
- **Risks and probability must be updated** on the basis of scenarios updates and subjective probabilities

Integrated Scenario Planning & Management

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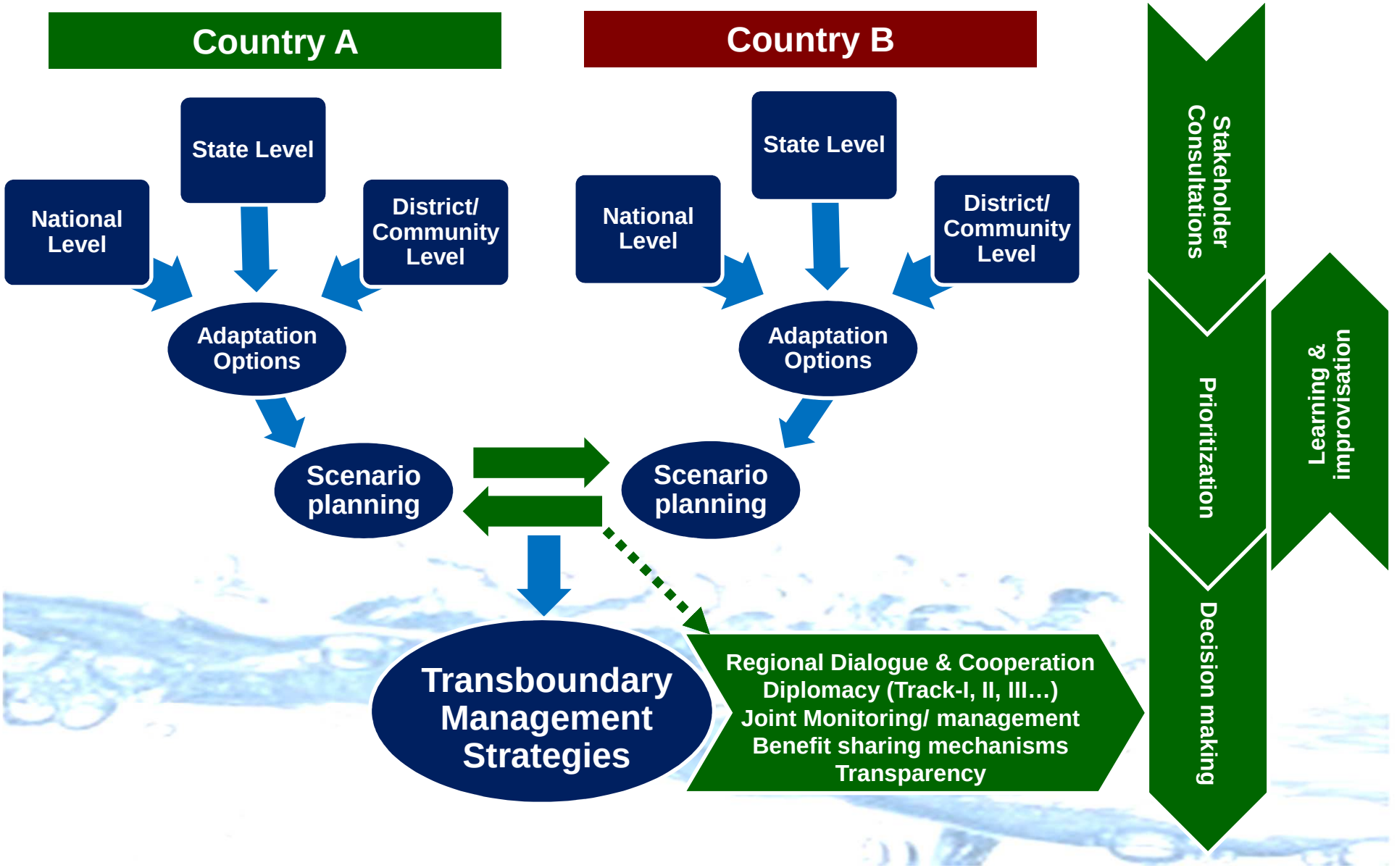

Summary

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- **Develop plausible future scenarios**.
- **Choose few** (2 or 3) as **most likely scenarios**
- **Segment degree of likelihood** for each scenario line
- **Develop alternative responses** to each scenario combination
- **Evaluate strategy (response)** performance **hydrologically** and **economically (Real Options)** using probabilities of occurrence (objective & subjective)

Conclusion

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- **Strategies for climate change adaptation and watershed development** are **subject to** a **number of uncertainties** (cognitive, strategic & institutional).

- **More flexible and adaptive approach should be undertaken** based on **plausible future scenarios** combined with **associated stakeholder defined adaptive responses/options.**

- A **wide-based stakeholder consultative approach should be used** to **elicit basic scenarios,** plausible **responses** and **design** water management **adaptation strategies.**

Thank You

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