



The State of Water Resources in Bhutan

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Bhutan

- Area – 38,394 Sq. Km
- Population – 668,000
- Location – TAR (China) in the north, Indian States of Sikkim in the west, West Bengal and Assam in the south and Arunachal Pradesh in the east
- Country's Development Philosophy – Gross National Happiness and not Gross National Product



- 1. Preservation of culture**
- 2. Conservation of environment**
- 3. Sustainable development**
- 4. Good governance**





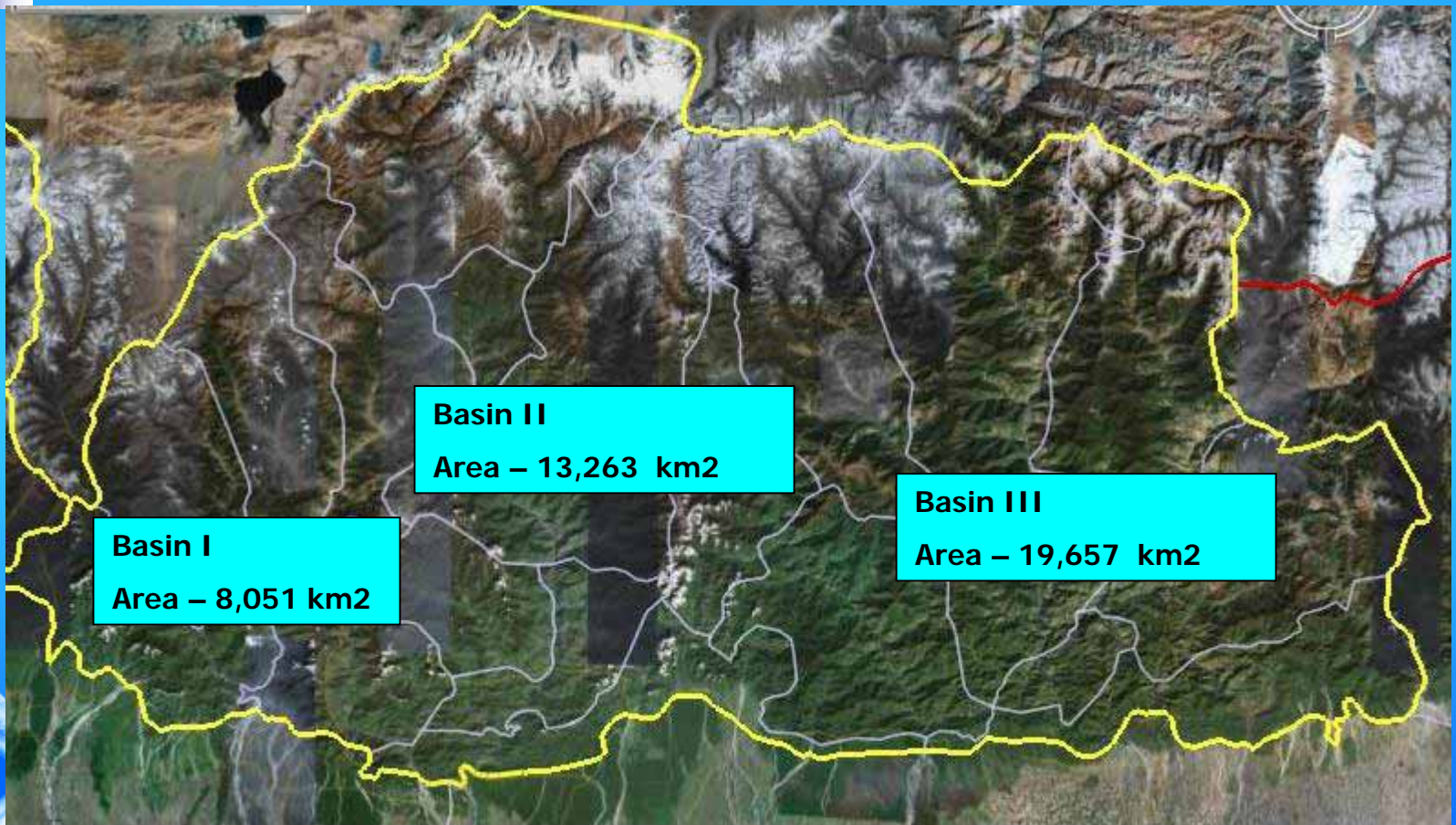
The National Water Resource

- Occurrence
- Quality
- Problems
- Uses



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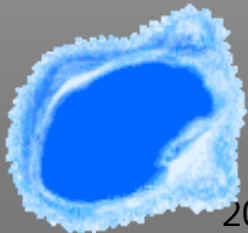
The National Water Resource





Occurrence

- Endowed with abundant water resources of good quality
- Climate dominated by monsoon bringing in rain from June-September
- Mean annual rainfall between 500 to 5000 mm
- Major rivers flow from north to south with source in the alpine zone
- Large volumes of flow in monsoon and snowmelt at the end of dry season
- Information on groundwater scarce as exploration and development in infancy





Occurrence

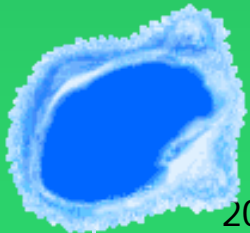
- Long-term mean annual flow for entire country
 - 2,325 m³/s (73,000 million m³/year)
- Per capita mean annual flow availability
 - 109,000 m³
- Minimum 7 days flow of 10 year return period
 - 427 m³/s (13,500 million m³/year)
- Per capita minimum flow availability
 - 20,000 m³





Quality

- On a macro scale, the state of the country's water resources good
- The main rivers and the tributaries are of pristine water quality with no tendency of heading towards eutrophication
- River water quality characterized as highly oxygenated, slightly alkaline with low conductivities and no recorded salinities
- Localized pollution problems do exist due to human activities



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Problems

- Though it is recognized that there is ample water resources, too much water is also a problem
- Glacier lakes provide a hazard in many basins of Bhutan
- Temperature increases due to apparent climate change have changed glacier behavior
- There exist the possibility of excessive melt water bearing down on moraine dams causing GLOFs (Glacial Lake Outburst Floods)



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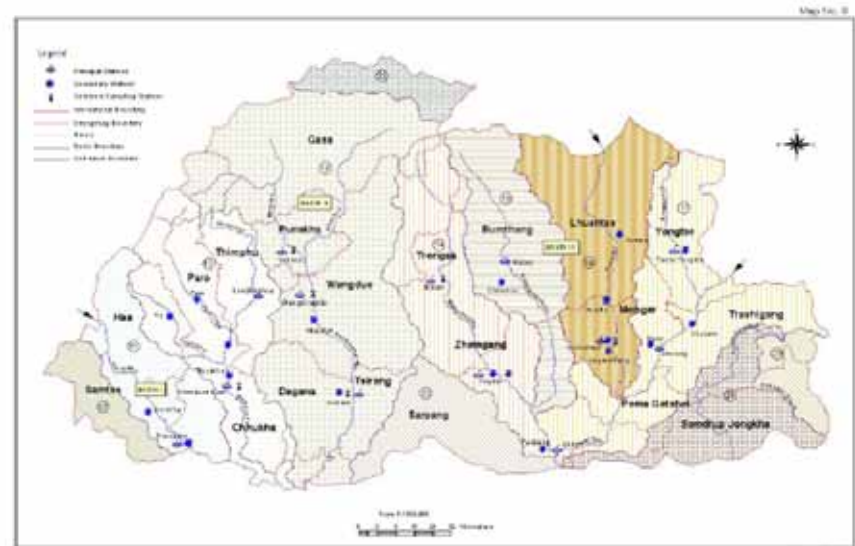
Protection against GLOF in northern Bhutan



Damaged housing colony by flash flood in southern Bhutan

Water Uses

- Water users in Bhutan draw water from three distinctively different sources
 - Main Rivers – Provide water for hydropower generation, waste assimilation, tourism/recreation and ecology
 - Tributary Rivers – Provide sources for all water uses in Bhutan mainly irrigation and water supply from headwater streams
 - Sub-surface water – in the form of springs and aquifers provide water for domestic water supply and small scale irrigation



Water Uses



The many faces of Bhutan's water resources



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Why Water Management in Bhutan

- The mountainous terrain limits agricultural production, less than 8% of the total land area arable but 79% of population engaged in agriculture. Therefore, sustainable land and water management is necessary for this sector as it forms the backbone of the rural economy
- The main sector for water resource management is hydropower, generating substantial revenue for the Government. Seasonal fluctuations and increased sediment transport affect the optimal generating capacity and thus the life of hydropower plants
- The Government is now moving towards Integrated Water Resources Management (IWRM) as the main paradigm for the management of its water resources





Why Water Management in Bhutan

- The country is working to establish a decentralized governance structure and this is in line with the decentralized component of IWRM
- WHAT IS THE MAIN CHALLENGE ?
 - **Addressing the dual needs for conservation and development**
 - **Promotion of equitable access – While policies permit benefits to the country through promotion of tourism and hydropower development, some local communities are denied access by the same policies**

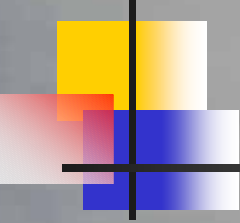




Capacity Building for IWRM

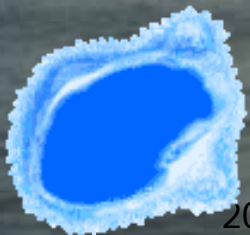
- The Hydro-met Services and NEC with support from FAO is implementing a one year project for capacity building. The project aims at developing and implementing good water governance through development of the knowledge base, institutional set up and planning tools for IWRM within the context of integrated watershed management. The project also aims to implement decentralized IWRM so that local stakeholders and national policies are properly linked.





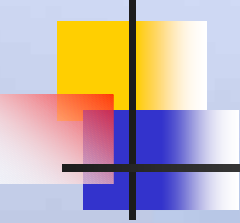
IWRM Capacity Building

- The specific objectives are:
 - Development of the knowledge base on IWRM, specifically on the ecosystems services generated in the watersheds that are essential to sustain the existing hydropower generating capacity.
 - Support institutional development in IWRM at national level within the context of integrated watershed management. Specifically the development an institutional framework for IWRM (in relation to the Water Act currently under preparation) and decentralized water governance



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IWRM Capacity Building

- Capacity building of government officials at national and regional level in the facilitation of participatory processes for decentralized water management planning and in structured analytic approaches to consciously identify and address trade-offs involved in managing water for multiple objectives, including food security & livelihoods and hydropower generation
- Raise the capacities of local stakeholders and government officials in some selected areas for decentralized implementation of IWRM and integrated watershed management through the execution of a local pilot project.





Project Components

- Knowledge development on watershed processes and practices in relation to ecosystem services
- Institutional development for IWRM
- Capacity building for decentralized implementation of IWRM





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