

# Evaluating the Costs and Benefits of Disaster Risk Reduction under Changing Climatic Conditions:

*The Case of the Rohini River Basin, India*

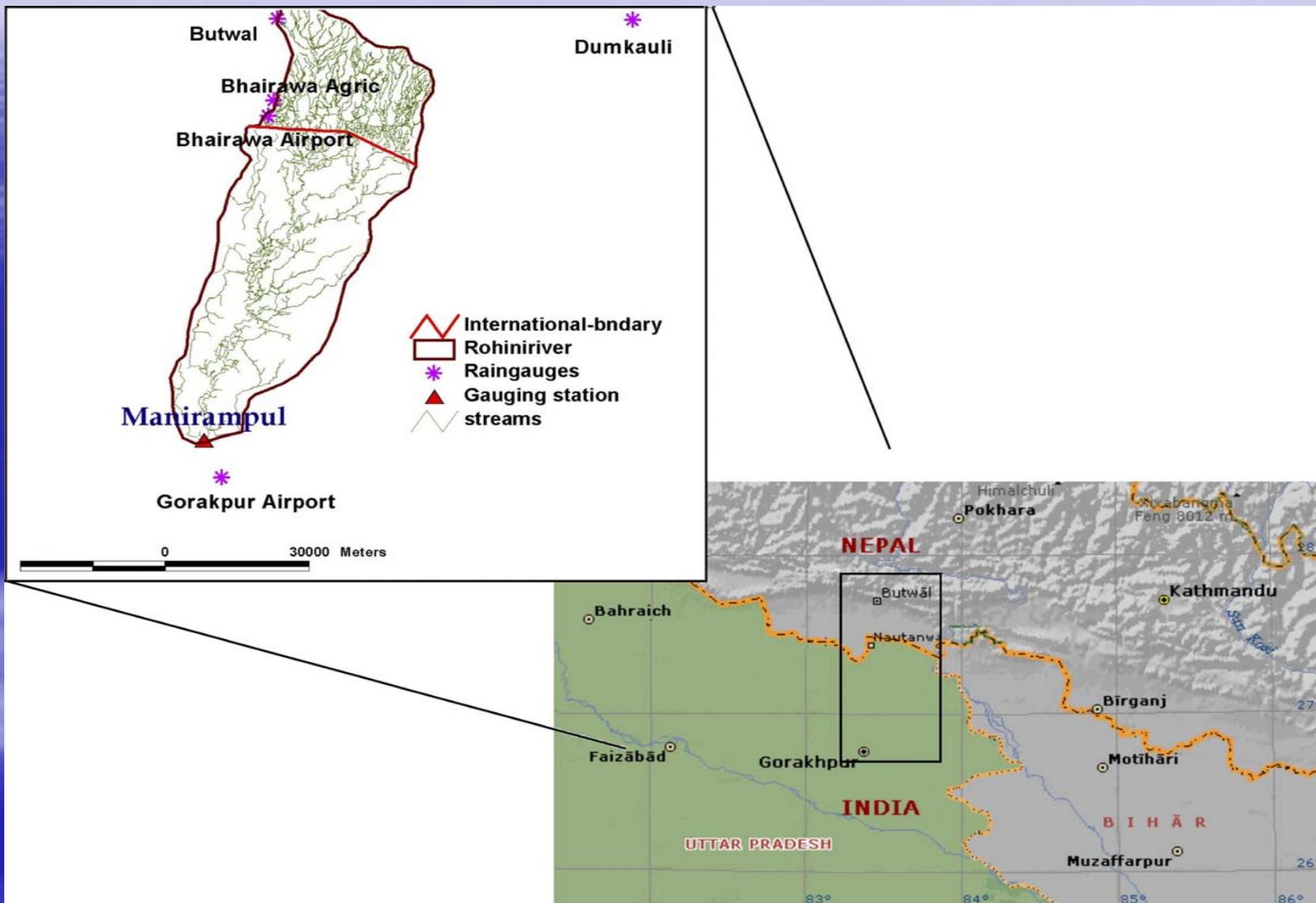
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- Context
- Flood Hazard and Risk
- Flood Risk Management Strategies
- Methodology
  
- *Results of Quantitative Assessment (Daniel Kull, IIASA)*

# Location of case study



# The Region:

## *Geography, Demography, Economy and Development*

- The Rohini River part of Gangetic Basin located in Gorakhpur and Maharaganj Districts (*terai* region) of Uttar Pradesh, India
- International river starts in Nepal (30% catchment in Nepal; cloudbursts cause intense rainfalls)
- Large number of small water bodies—encroached; role in flood management
- Paddy, Wheat, vegetables
- High population density (about 1000 persons per km<sup>2</sup>)

# The Region:

## *Geography, Demography, Economy and Development..*

- Lags on various human development indicators, compared to both national and state averages (Uttar Pradesh itself being lower than most of India) (30% BPL, UP: 25.5% India: 21.8%)
- 50% of households < 0.4 ha of land
- Occupation: farming (65%), agricultural labor (14%), non-farm wages (14%), business (4%), service (2%), and animal husbandry (1%)
- 60% household earn income from local opportunities; 22% migrate for compensating household income

# Flood hazard

- Every year some flooding
- Major floods: 1954, 1961, 1974, 1993; in past decade intensity and frequency of floods increased (1998, 2001 and 2007)
- Embankments cause
  - Waterlogging and drainage congestion
  - Earlier floods were considered beneficial but now they cause immense damage
- ***Overall, major problems bank cutting, waterlogging and sand-casting***

# Flood Risk

- Poor WSS and other infrastructure, health impacts
- Dependant on distance from river/embankment
  - Trapped between embankments and river—refuge to shelters on embankment (land degradation)
  - Just behind the embankment—long duration waterlogging, land degradation

# Flood Risk Reduction Strategies

- Primarily embankment (construction since 1970s)—“Centralised” [maintenance, breaches, increase river bed, reduced carrying capacity of river)
- “People centered” decentralised strategies
  - At households level (individualistic);
  - Requiring community organizations (community level interventions);
  - Societal level interventions (interventions requiring support through regional as well as local action)

# “People Centered” Strategies

- **Household level (individualistic) interventions**
  - Raising plinth
  - Raised fodder storage unit
  - Drinking water and sanitation package
- **Community level interventions**
  - Early warning
  - Raised Handpumps and Temporary Elevated Toilets
  - Flood shelters (strengthening and raising schools and panchayat buildings)
  - Community grain bank
  - Community seed bank
  - Maintenance of key drainage points
  - Self Help Groups (SHGs)
  - Community boat

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# “People Centered” Strategies

- **Societal level interventions**
  - Flood adapted agriculture
  - Strengthening overall healthcare system

# Methodology

## 1. Quantitative framework

- Series of three interdependent modeling—climate downscale modeling, preliminary hydrologic and flood inundation, and stochastic cost-benefit analysis.
- Secondary data (hazard, demography, spending and investments, impacts)
- Primary survey
  - 17 villages from different zones;
  - Ten percent of the households selected in each village capturing landholding size, caste, women headed households;
  - Total households surveyed 208
  - Household questionnaire

# Methodology

- Qualitative framework involved FGDs with various community groups and interviews of key informants
  - Complements the quantitative framework-- helped capture non-tangible and non-monetary aspects of costs and benefits of DRR strategies.