Climate Change Adaptation in Water, Agriculture and Livelihood Sectors in Himalaya: Bridging Gap between Climate Science and Local Level Climate Change Adaptation

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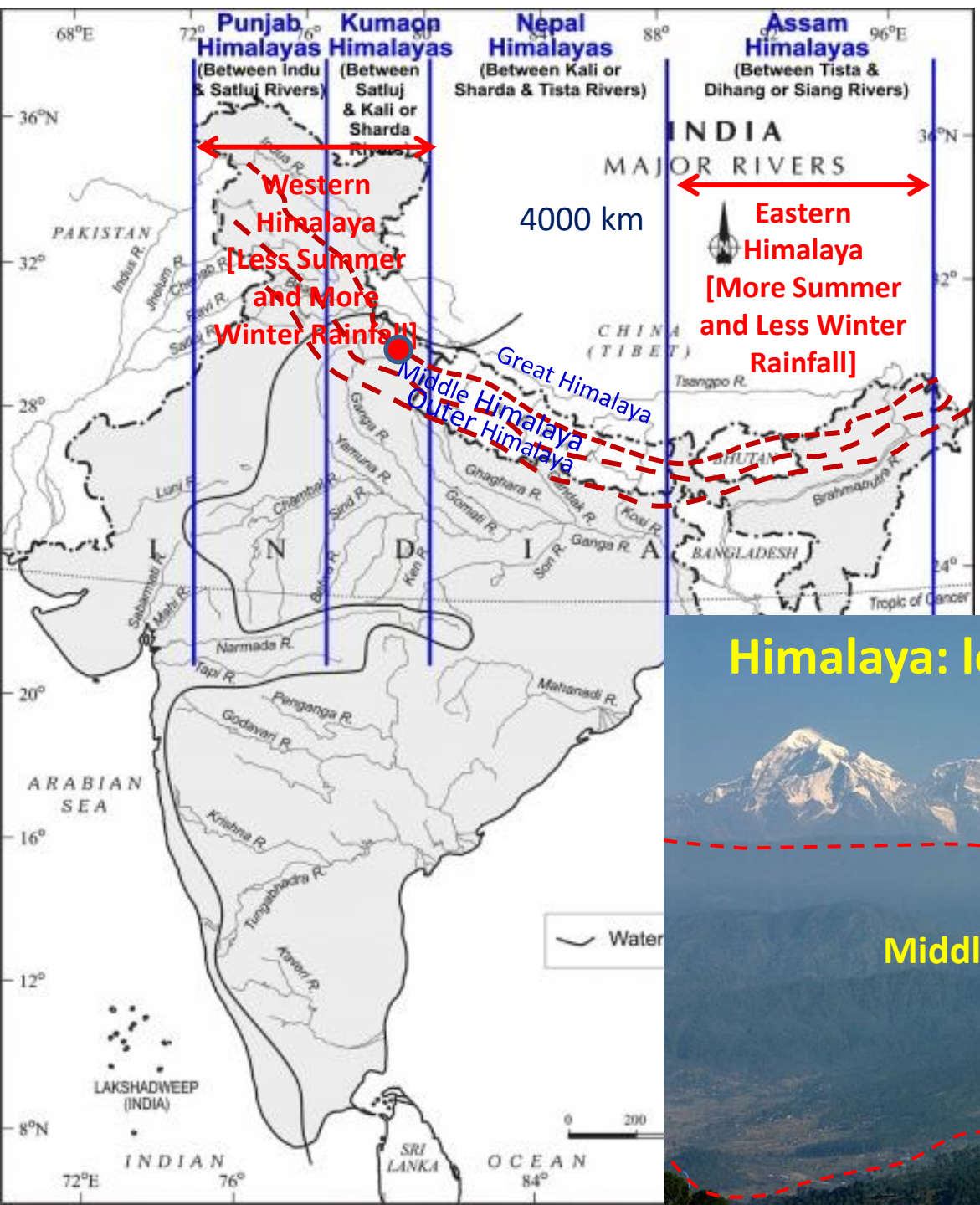
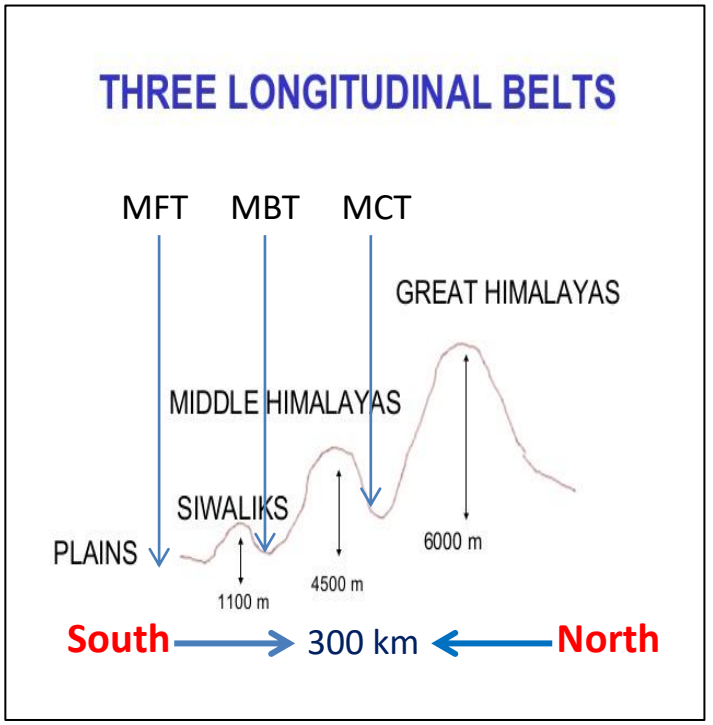
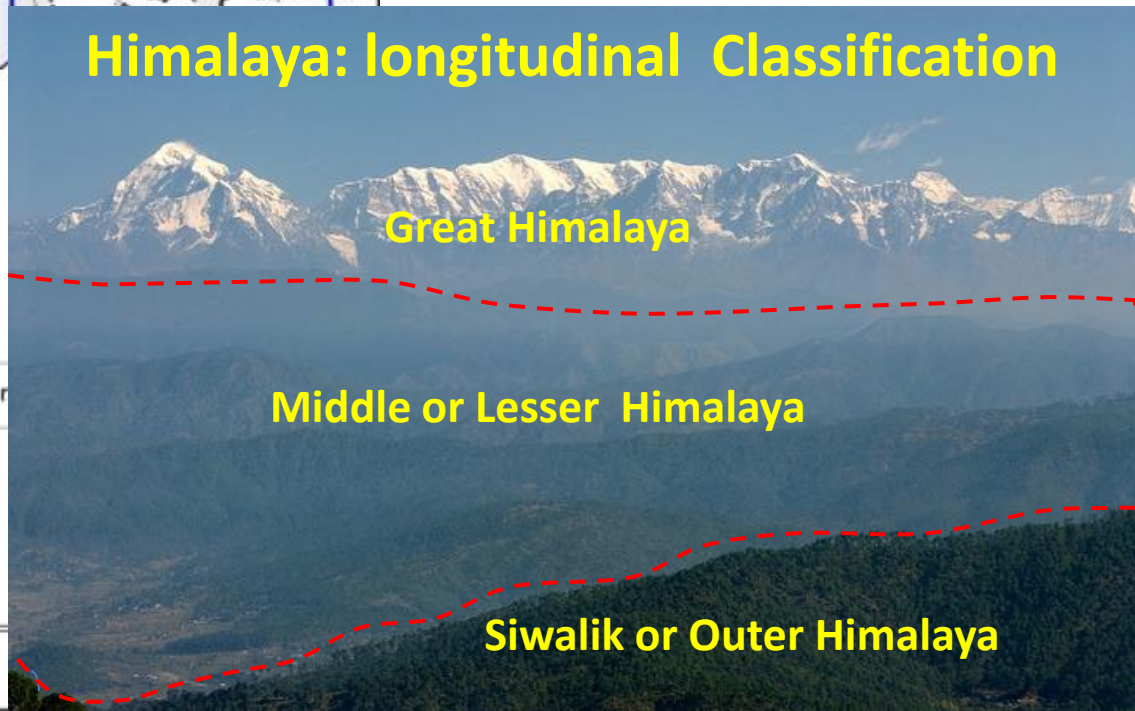
The Mountains of the World

Source: FAO


Punjab Himalayas
(Between Indu & Satluj Rivers)
Kumaon Himalayas
(Between Satluj & Kali or Sharda Rivers)
Nepal Himalayas
(Between Kali or Sharda & Tista Rivers)
Assam Himalayas
(Between Tista & Dihang or Siang Rivers)
INDIA
MAJOR RIVERS
Western Himalaya [Less Summer and More Winter Rainfall]
4000 km
Eastern Himalaya [More Summer and Less Winter Rainfall]
Great Himalaya
Middle Himalaya
Outer Himalaya
PAKISTAN
CHINA (TIBET)
BHUTAN
BANGLADESH
ARABIAN SEA
INDIAN OCEAN
SRI LANKA
LAKSHADWEEP (INDIA)
Tropic of Cancer
Water

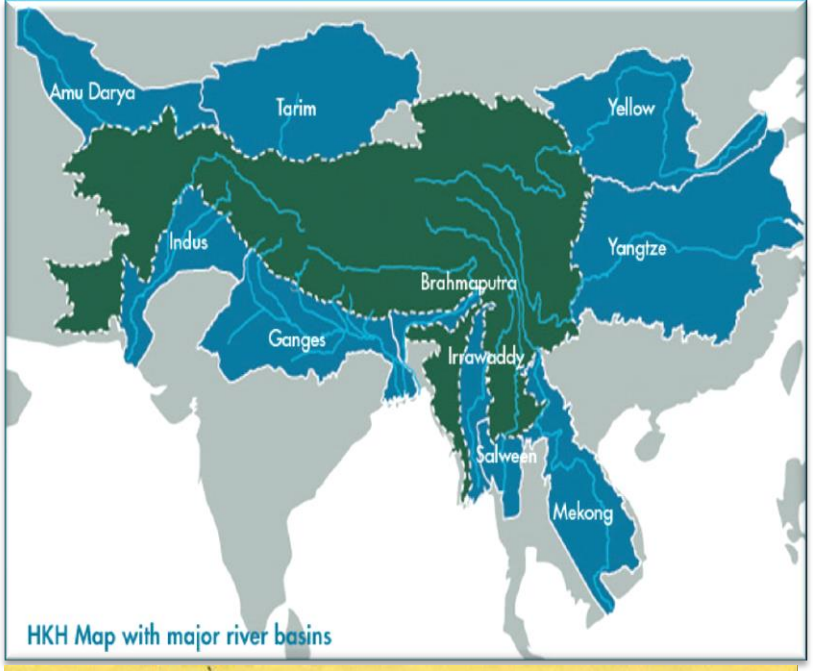

THREE LONGITUDINAL BELTS
MFT
MBT
MCT
GREAT HIMALAYAS
MIDDLE HIMALAYAS
SIWALIKS
PLAINS
6000 m
4500 m
1100 m
South
300 km
North


Himalaya: longitudinal Classification
Great Himalaya
Middle or Lesser Himalaya
Siwalik or Outer Himalaya

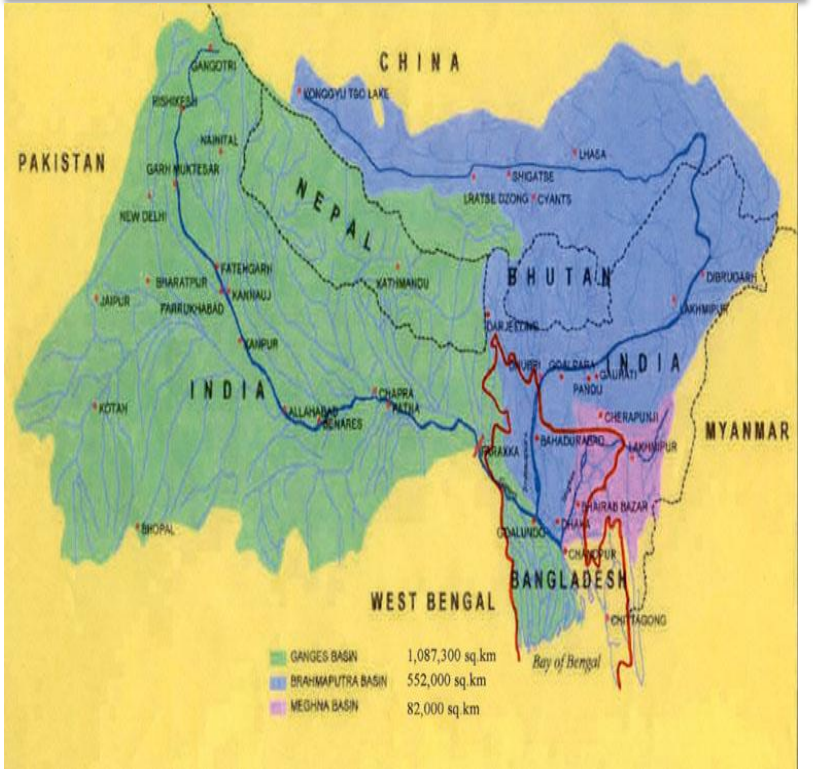
Hydrological Parameters of Principal Rivers of Hindu Kush Himalaya

River Basin	Length (km)	Mean Discharge (m^3/s)	Glacier Melt in River Flow (%)
Yangtze	6,300	34,000	18.5
Brahmaputra	2,948	19,824	12.3
Ganges	2,057	18,691	9.1
Irrawaddy	2,170	13,565	Small
Mekong	4,600	11,048	6.6
Indus	2,900	5,533	44.8
Salween	2,800	1,494	8.8
Yellow	5,464	1,365	1.3
Tarim	2,030	146	40.2

Source: ICIMOD



HKH Map with major river basins



Himalaya:
Highly Vulnerable to Global Environmental Changes

Natural Vulnerability

- Young Mountains
- Geo-tectonically Alive
- High Seismicity
- High Altitude
- Steep and Fragile Slopes
- Large Number of Glacial Lakes

Human Induced Vulnerability

- Densely Populated
- Livelihood Constraints
- Poverty and Marginalization
- High Food Deficit
- Constraints of Infrastructure
- Rapid Urban Growth

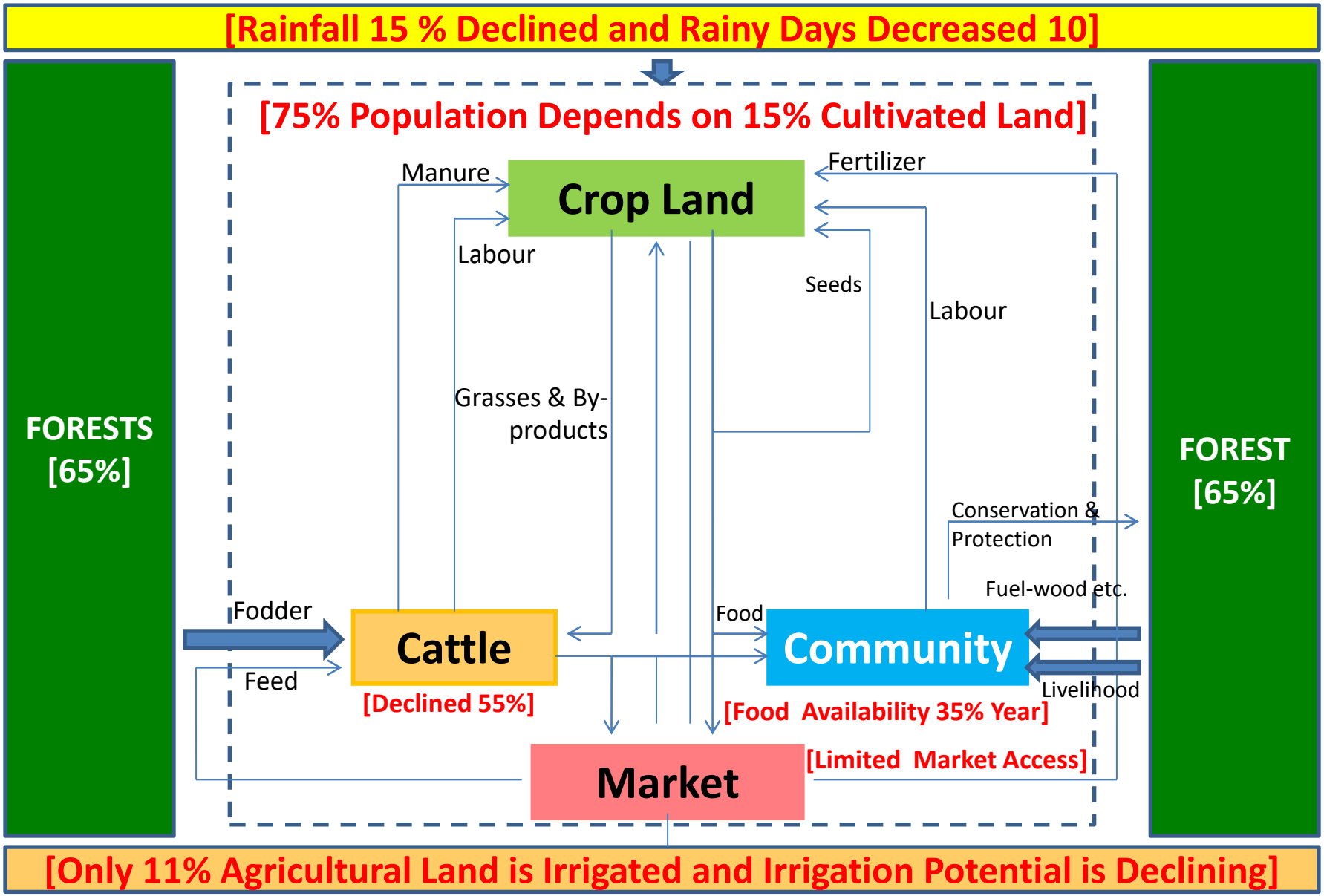
Climate Change Adaptation in Himalaya: Key Issues

- Climate Change Adaptation is multi-institutional and multi-sectoral governance process at local level
- Mainstreaming Climate Change Adaptation [CCA] and Disaster Risk Reduction [DRR] into overall development process is now emphasized by international and national agencies
- What is the most scientific spatial unit for climate change adaptation and its mainstreaming at micro-level
- How cutting edge state-of-art climate knowledge could to be generated at micro-regional level and transferred to local level institutions
- How climate science can help in building adaptive capacity of local level government officials and representatives of community-institutions
- How the hydro-meteorological information gap could be bridged-up in Himalaya
- How climate knowledge could be integrated in building urban resilience

Kumaun University: Adaptation Initiatives

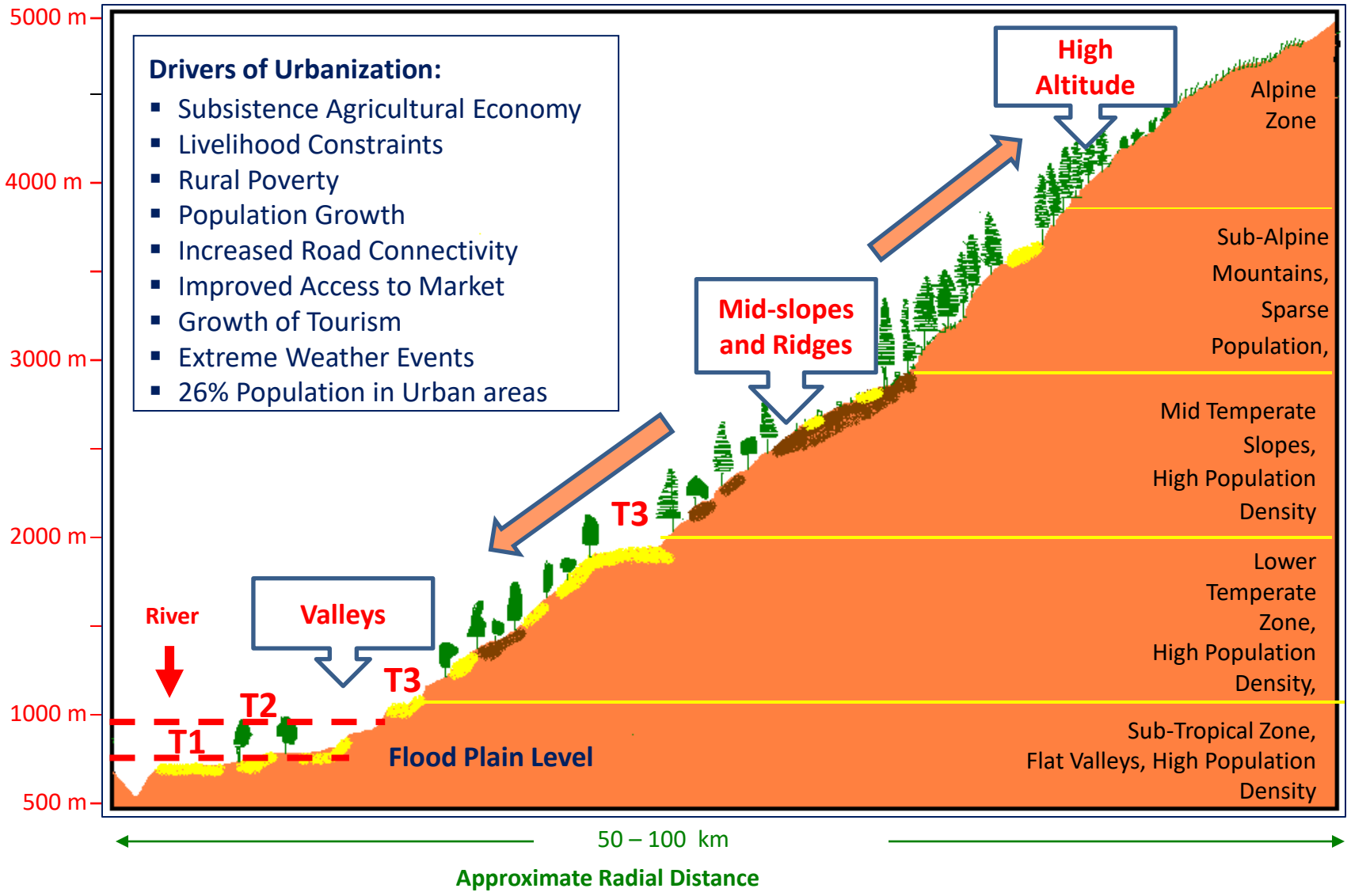
- **Drought Assessment and Adaptive Resource Management in Uttarakhand Himalaya**; in collaboration with Newcastle University, UK [Financial Support from Royal Society, UK under its 'Global Challenges' Programme]
- **Shimla Climate Change Adaptation Partnership Project**, in partnership with Urban Climate Research Network [UCCRN], Columbia University, USA; International City Management Council [ICMA]; and International City-Link Programme [City-Link] [Financial Support from USAID]
- **Urban Climate Change Vulnerability Across Hindu Kush Himalaya**; in association with Yale University, USA; University of British Columbia, Canada; and ICIMOD [Financial Support from NASA]
- **Climate Change Adaptation Tool-kit Development for Uttarakhand Himalaya,** in collaboration with Australian National University, Australia; MAIRS, China; and Newcastle University, UK

Forest-Agriculture-Food-Livelihood in Himalaya

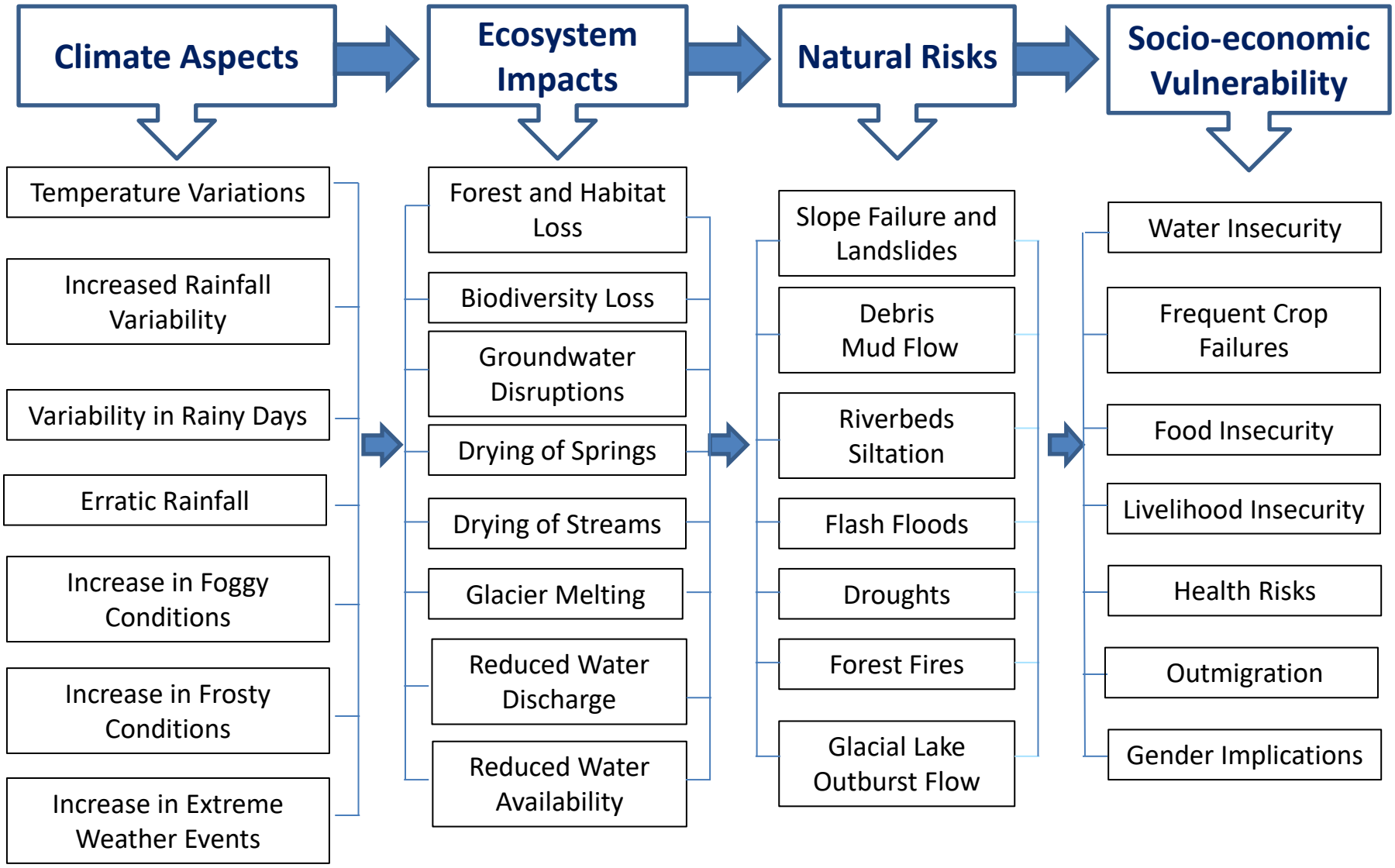


Due to Constraints of Subsistence Economy Large Proportion of Male Population Out-migrates and this Leads to Feminization of Resource Development Process and Agriculture in Himalaya

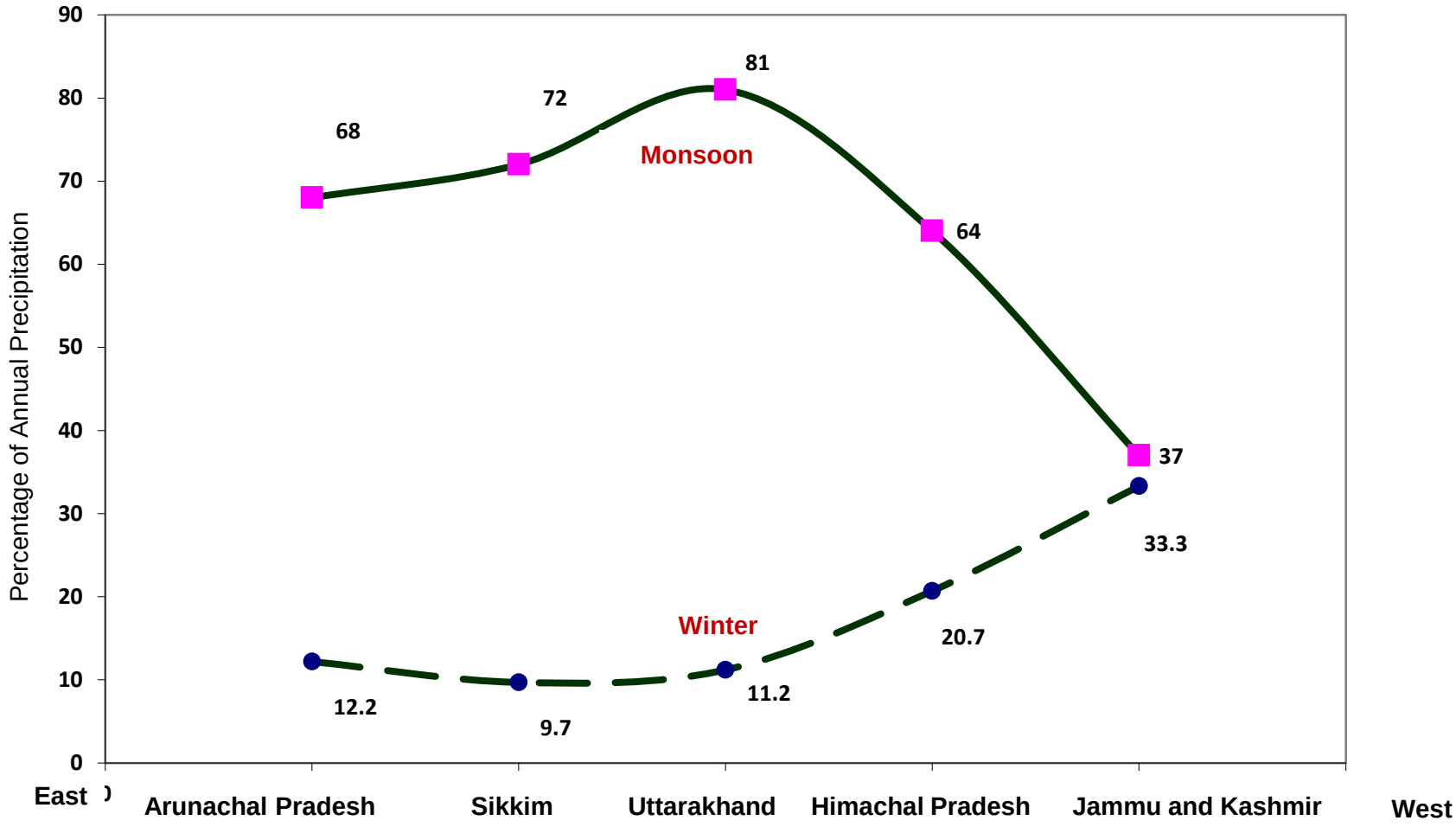
Rapid Urbanization Increasing Climate Change Vulnerability



Climate Change in Himalaya: Observed Impacts and Vulnerabilities



Precipitation Pattern During Monsoon and Winter Season Across the Himalayan States



Status of Water Resources in Western Himalayan Rain-fed Watersheds [1985 – 2015]

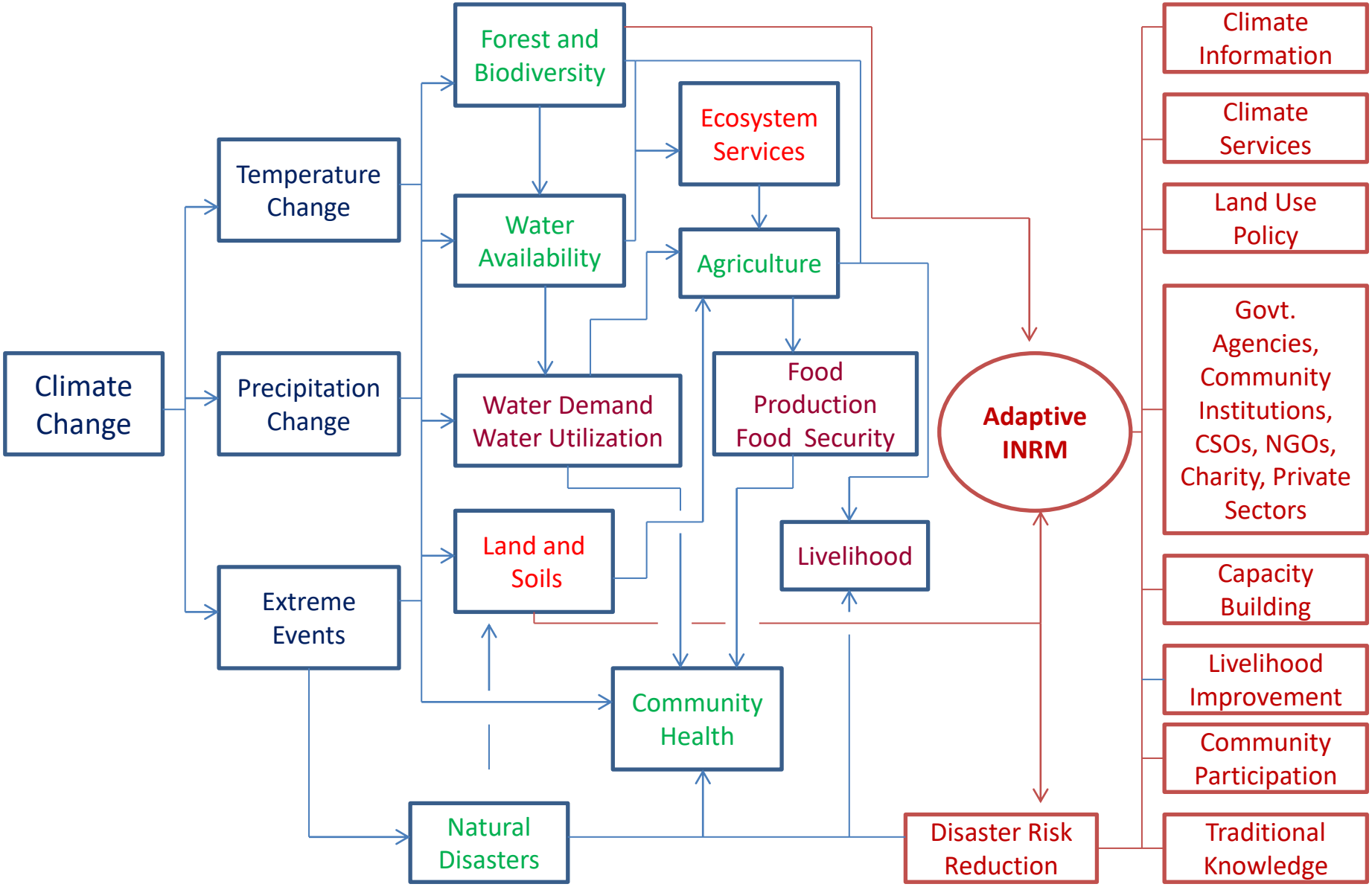
Himalayan State [Western Himalaya]	Watershed	% Natural Springs Dried	Wetland Depleted (No)	% Water Discharge Declined
Himachal Pradesh	Ashwani	25	5	11
Himachal Pradesh	Nauti	31	7	15
Himachal Pradesh	Dhalli	39	3	25
Uttarakhand	Gaula	41	6	47
Uttarakhand	Kosi	35	3	37
Uttarakhand	Ramgad	40	7	41

Projected Climate Trends A1B Scenario (2041-2060) Compared to the Baseline Period (1981-2000)

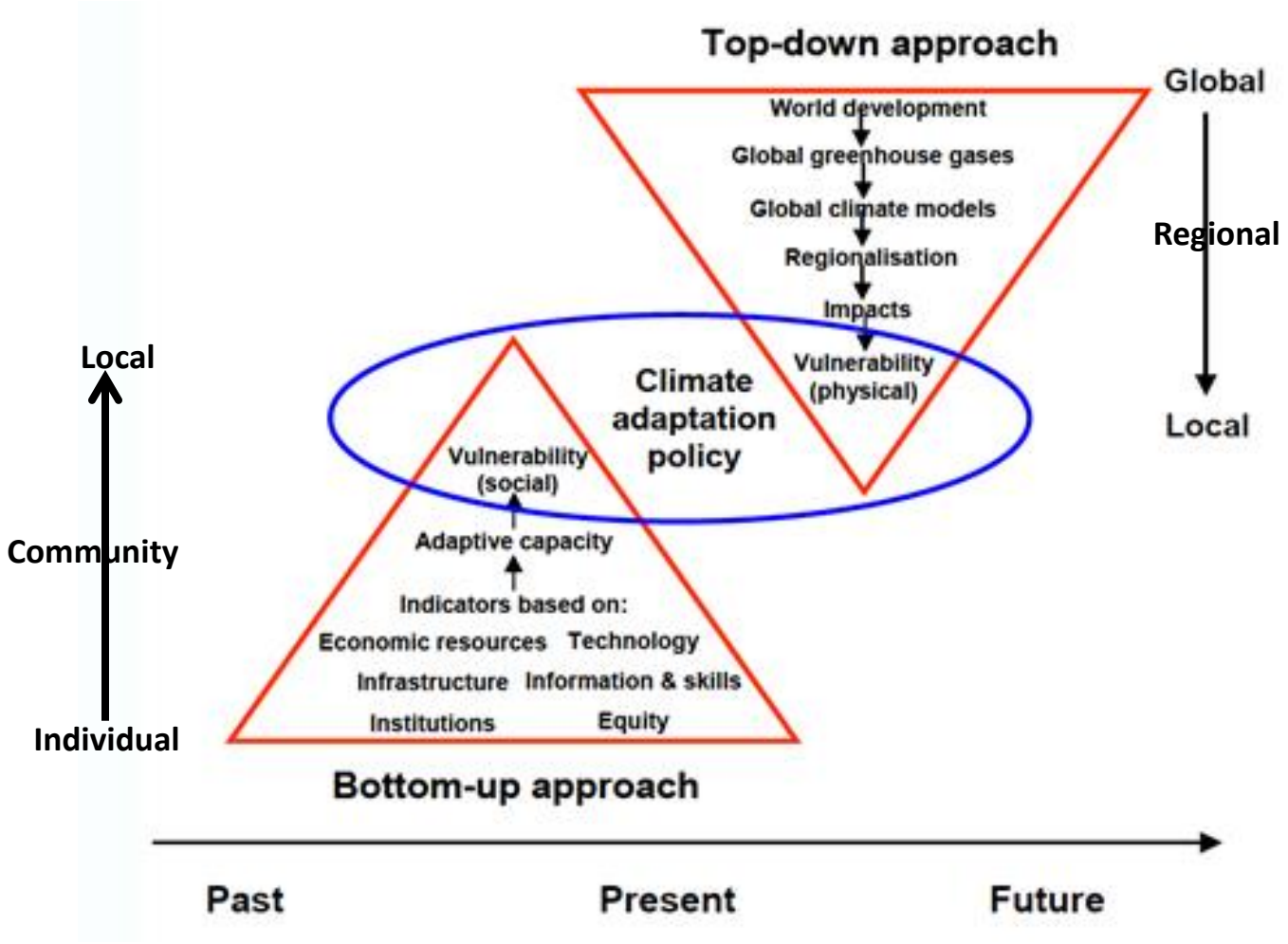
Climate Parameters	Ramgad Watershed , Nainital, Uttarakhand	
	Summer (June-August)	Winter (Nov-March)
Temperature 	Decrease in Max Temp by 1ºC ↓ Decrease in Min Temp by 0.39ºC ↓	Increase in Max Temp by 1.5 ºC ↑ Increase in Min Temp by 2.3 ºC ↑
Precipitation 	Overall increase in mean rainfall by 11% or 55 mm, or total of 559 mm over wet season ↑	Overall decrease in mean rainfall by 15% or 34 mm, or total of 194 mm over dry season ↓
Extreme Events 	Increase incidences of High Intensity Rainfall, flash floods and flooding ↑	The dry season will become drier Higher temperatures will lead to more severe droughts and forest fires ↑

Source: Australian National University, Canberra, Australia; MAIRS, Beijing, China; Newcastle University, Newcastle, UK for APN Project [Climate Change Adaptation Tool Kit Development in Uttarakhand Himalaya 2014-2017]

Climate Change Adaptation Mainstreaming in Development Planning: A Multi-institutional Governance Process in Uttarakhand

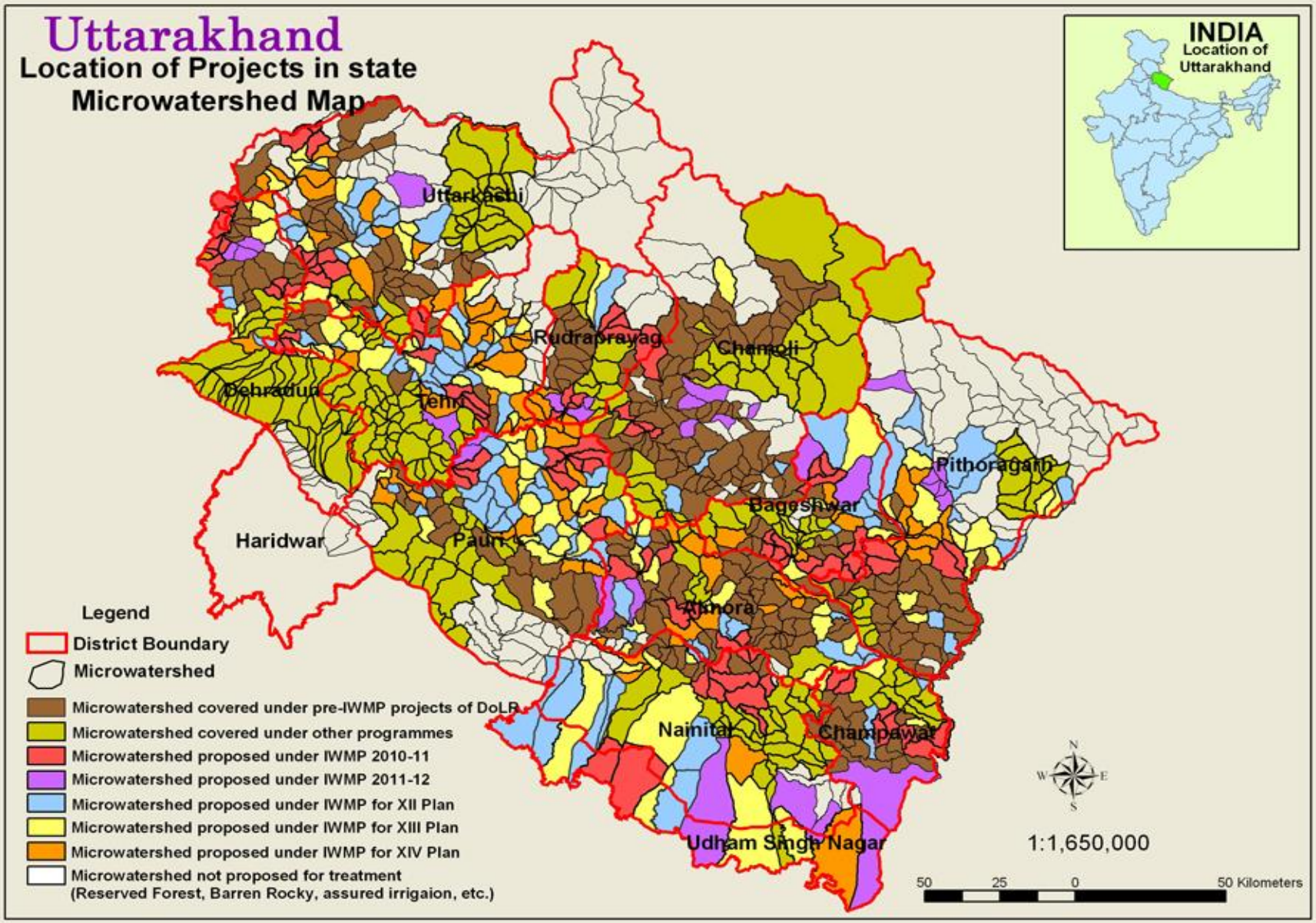


The Spatial Scale of Adaptation

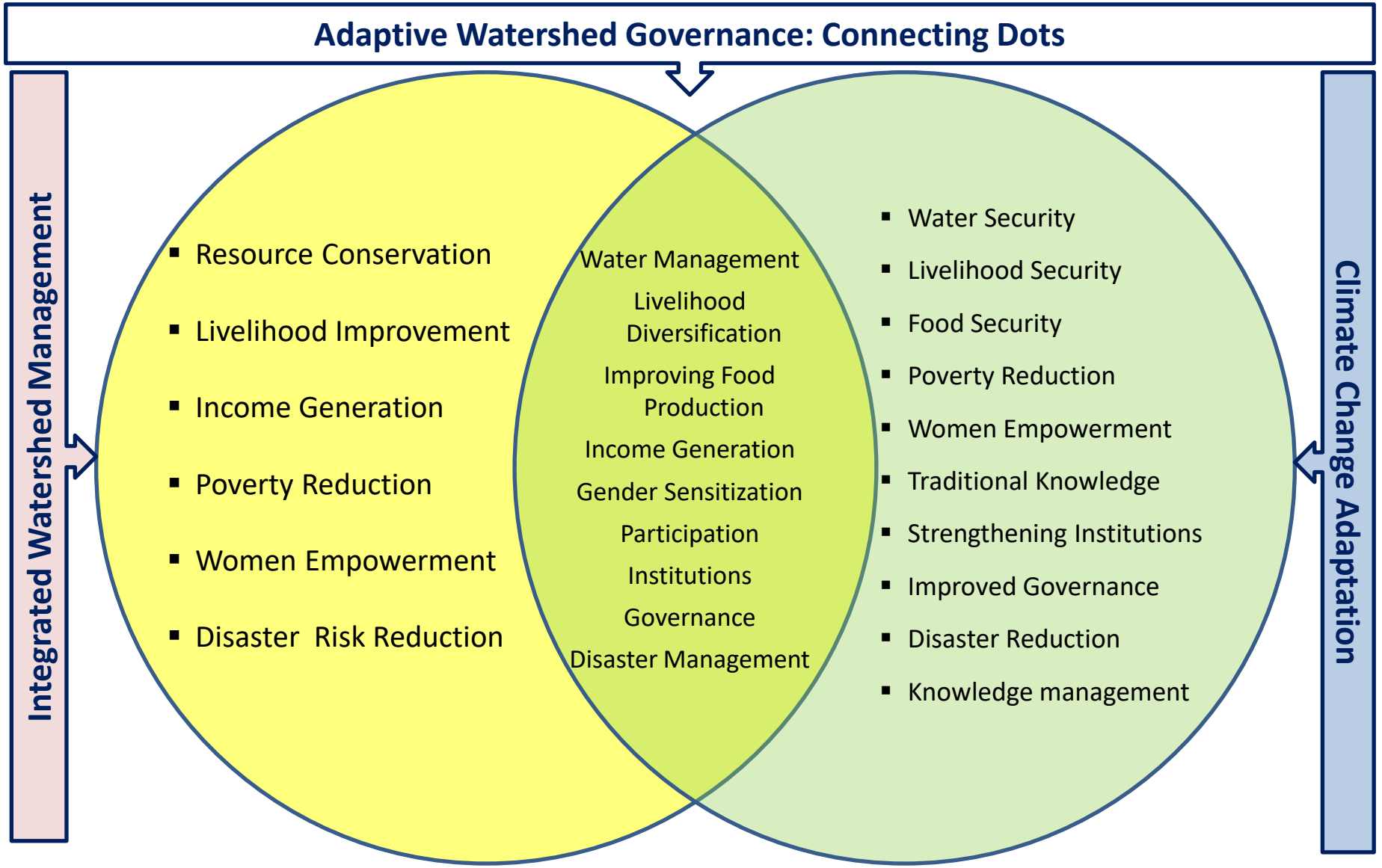


Top-down and Bottom-up Approaches for Assessing Climate Change Vulnerability and Evolving Adaptation Framework

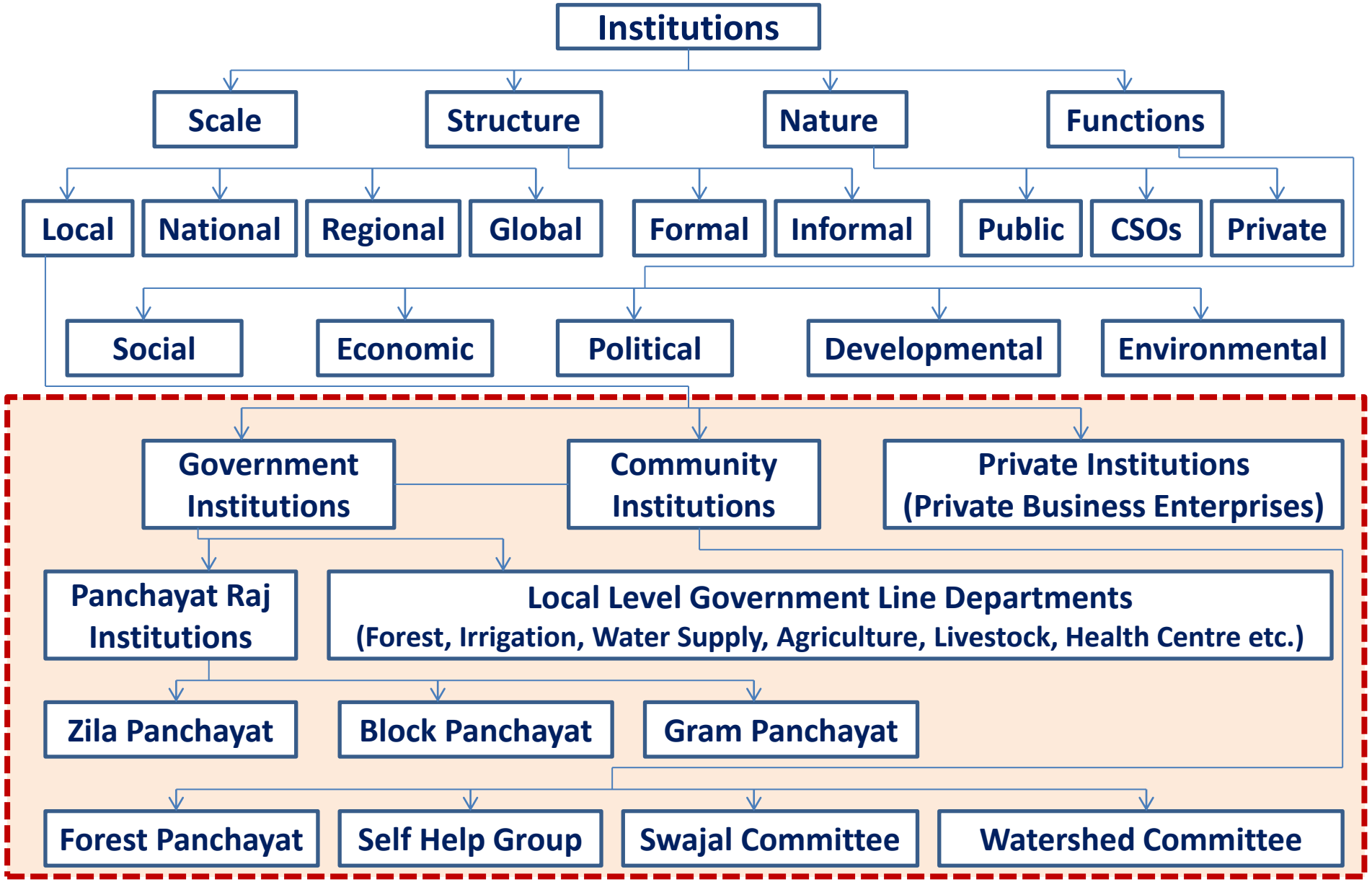
Uttarakhand: Micro-watersheds



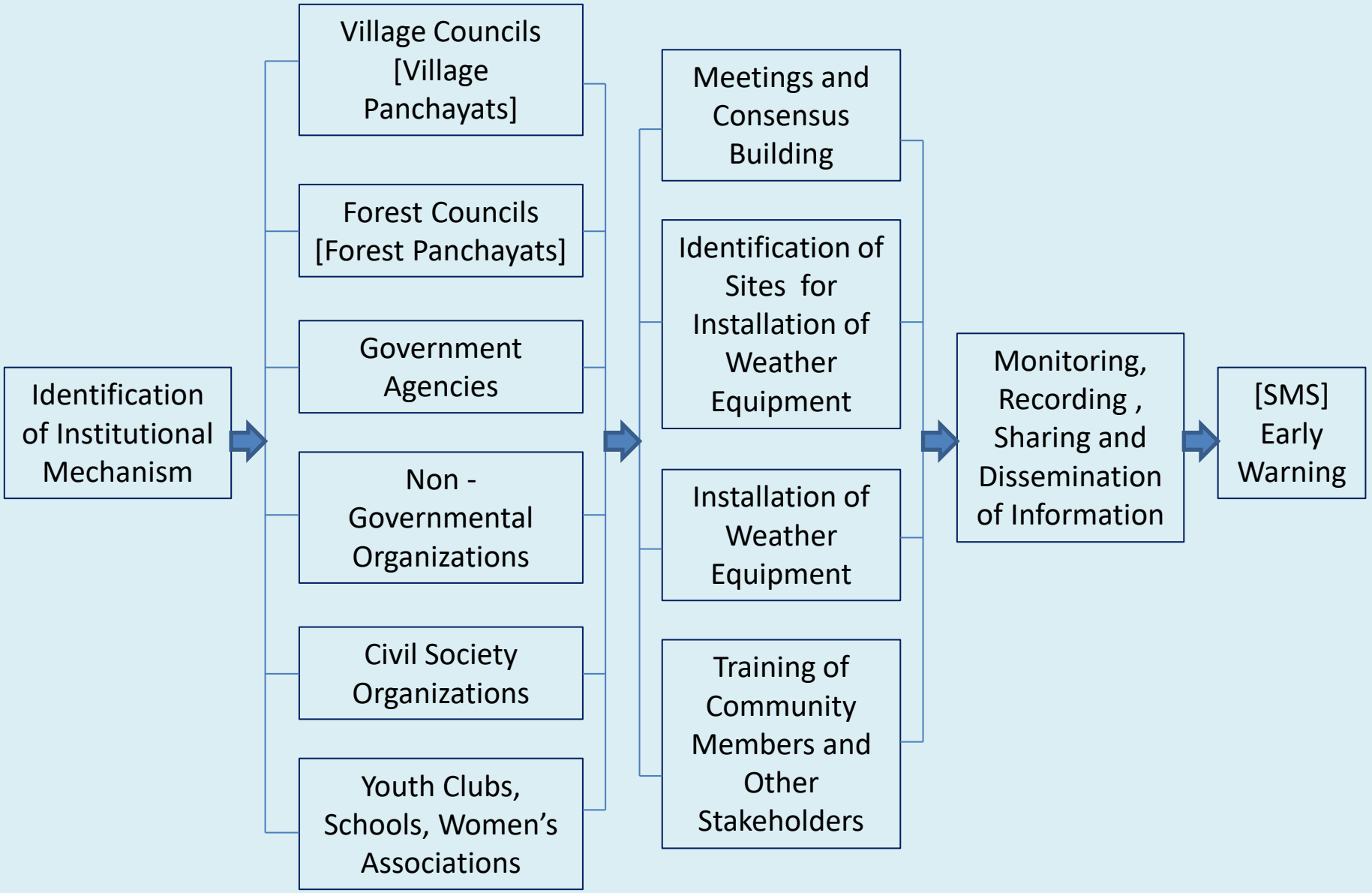
Integrating Climate Change Adaptation and Disaster Risk Reduction at Watershed Level: The Complementariness of Key Components



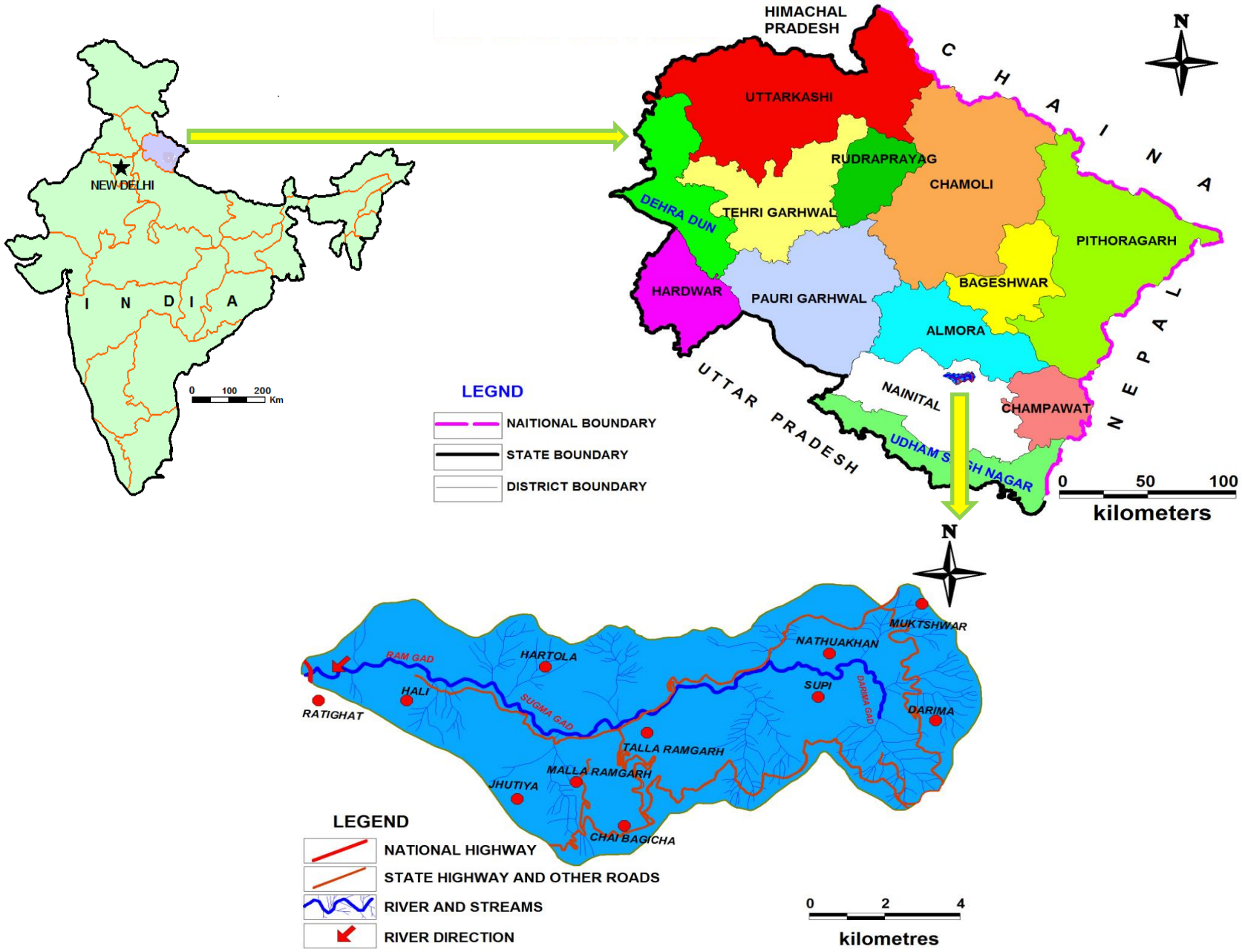
Local Institutions:
Key Actors in Climate Change Adaptation Governance



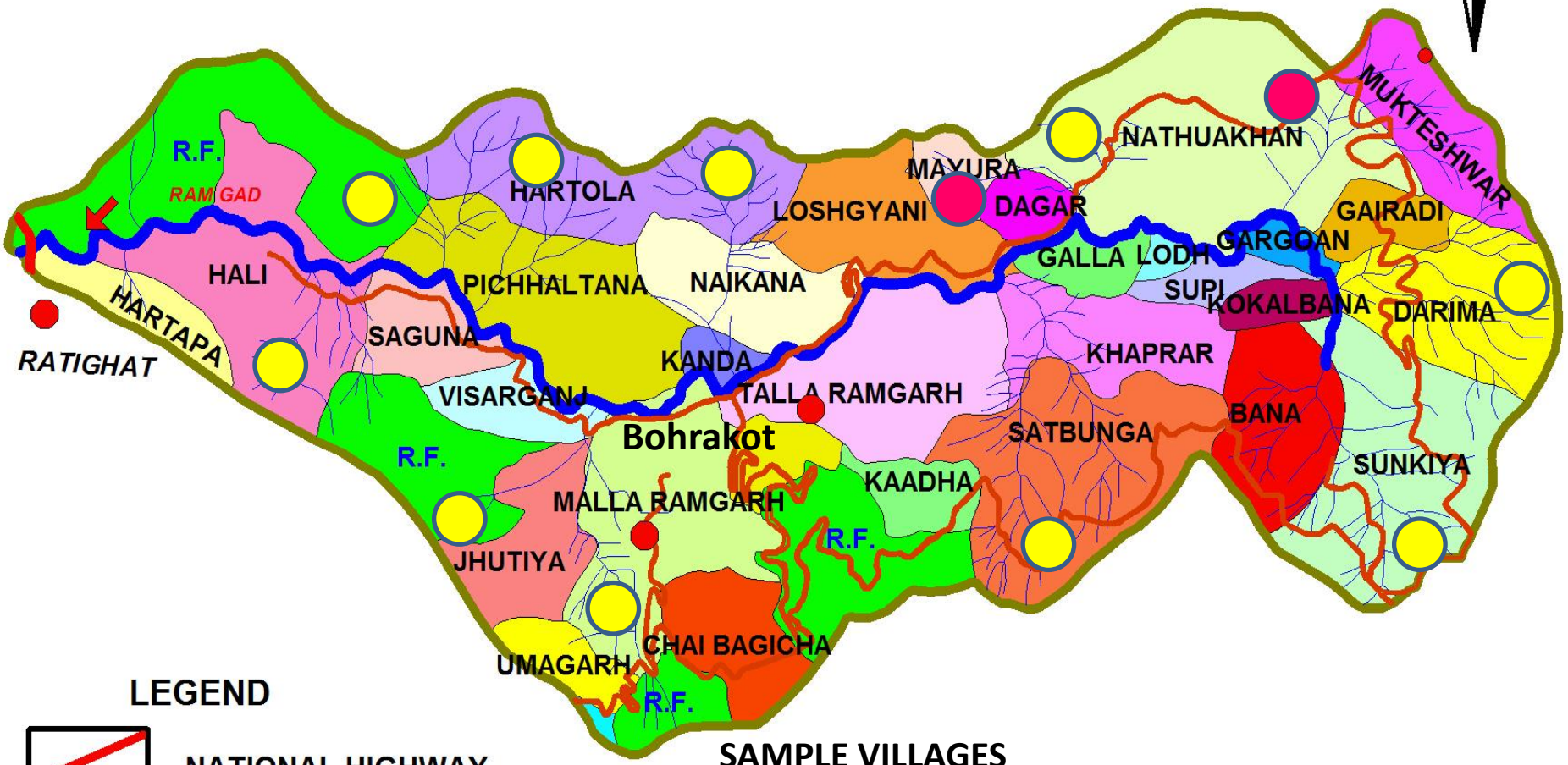
Local Level Climate Information: Improving Adaptive Capacity of Community Institutions



Location Map



Ramgad Watershed: Kumaon Lesser Himalaya
[Community Based Climate Monitoring]



LEGEND

- NATIONAL HIGHWAY
- STATE AND OTHER ROADS
- RIVER AND STREAMS
- R.F. — RESERVE FOREST

SAMPLE VILLAGES

- Nathuakhan
- Bohrakot
- Nikana
- Satbunga

- Automated Weather Station
- Manual Weather Station

0 2 4
kilometers


ससाधन चित्रण ग्राम सूफी
N
353.979 हेक्टेयर
कलसाद
400 नाली
250 नाली
जग्यातालत
120 नाली
सूफी
2000 नाली
तलाई
500 नाली
तल्ला सूफी
1500 नाली
100 नाली
संकेतक

Thanks!