

Forests4Water: The Role of Forest Ecosystems in Safeguarding Water Resources – Session III

12 NOVEMBER 2025

inspiring change

AGENDA

- **Welcome, Introduction and housekeeping**
  Afia Siddiqui, Learn Officer , IWA
- **Forests Safeguarding Waters and Nature's contributions to People**
  Dr. Shalini Dhyani, Principal Scientist, CSIR-NEERI, India
- **Securing the Source: Rethinking Urban Water for Himalayan Cities**
  Dr. Vishal Singh, Senior Fellow and Executive Director, CEDAR
- **Moderated Panel discussions including Q and A ,lessons learned, & Closing**
  Afia Siddiqui, Learn Officer , IWA

INTRODUCTION

- The webinar series is co-organised by the International Water Association (IWA) and the International Union for Conservation of Nature (IUCN).

- It will showcase global and regional experiences on integrating ecosystem-based approaches that harnesses the combined power of forest and water ecosystems for improving city planning and adaptation strategies.

INTRODUCTION

- The third webinar will explore the vital role of mountain forests in regulating water, stabilising slopes, and buffering climate impacts in the mountainous/hilly cities.

- The webinars will anchor discussions around three core dimensions: (1) science, knowledge, and policy to understand forest–water linkages; (2) planning and implementation challenges and solutions; and (3) community innovation and social resilience through inclusive governance, youth engagement, and localised actions.

WEBINAR INFORMATION

- This webinar will be **recorded and made available "on-demand"** on the IWA Connect Plus platform and IWA Network website, with relevant information.
- The **speakers** are responsible for **securing copyright permissions** for any work that they will present of which they are not the legal copyright holder.
- The opinions, hypothesis, conclusions or recommendations contained in the presentations and other materials are the **sole responsibility of the speaker(s)** and do not necessarily reflect IWA & IUCN's opinion.

WEBINAR INFORMATION



- **'Chat' box**: please use this for general requests and for interactive activities.
- **'Q&A' box**: please use this to send questions to the panelists. (We will answer these during the discussions)

Please Note: *Attendees' microphones are muted. We cannot respond to 'Raise Hand'.*

SPEAKERS PROFILE



Dr. Shalini Dhyani, *Principal Scientist, CSIR-NEERI, India*

Dr. Shalini Dhyani is a principal scientist at CSIR-NEERI. She is visiting scientist at CIFOR, Indonesia & UNESCO-TWAS Associate. Shalini has been the Asia vice chair and a steering committee member in the Commission on Ecosystems Management of IUCN. Shalini works on socio-ecological interlinkages, following diverse knowledge systems and sustainability science approaches for ecosystem health assessments and NbS.

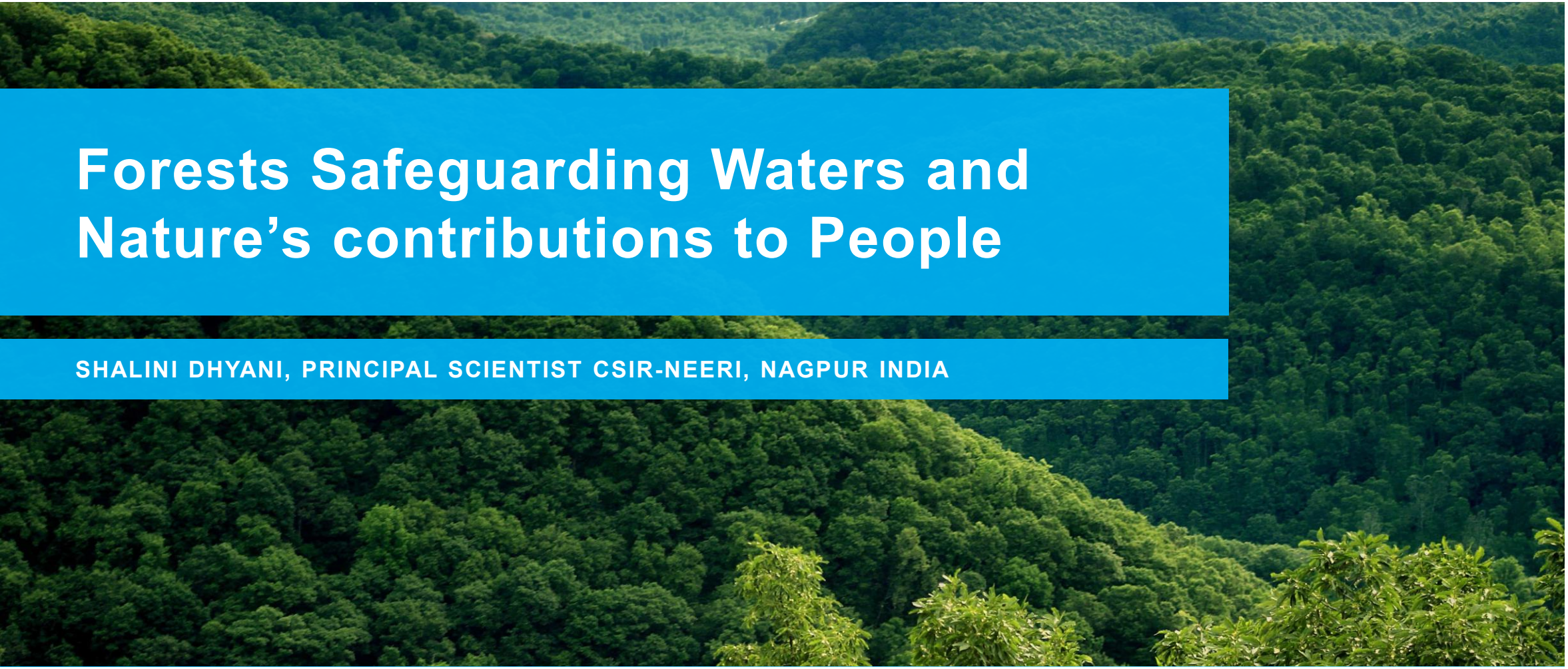


Dr. Vishal Singh*, Senior Fellow and Executive Director, CEDAR*

Dr. Vishal Singh is a translational ecologist working at the intersection of ecology, hydrology, and public policy in the Indian Himalayan Region. At the Centre for Ecology Development and Research (CEDAR), he leads the themes of Urbanisation and Water Security and Climate Change Adaptation, focusing on how mountain ecosystems and human settlements interact around shared water resources. He serves as a Member of the State Namami Gange Committee and is a Senior Fellow at the Institute for Study and Development Worldwide (IFSD), Australia.

Forests Safeguarding Waters and Nature's contributions to People

SHALINI DHYANI, PRINCIPAL SCIENTIST CSIR-NEERI, NAGPUR INDIA



inspiring change



Viewpoint | Published: 02 October 2023

Priorities for progress towards Sustainable Development Goal 15 'Life on land'

H. David Cooper, Musonda Mumba, Shalini Dhyani, Xiaoli Shen, Keping Ma, Rachel Wynberg, Sarah Laird & Jon Paul Rodríguez

Nature Ecology & Evolution **7**, 1570–1575 (2023) | Cite this article

Leave No One Behind

Hindukush Himalayan Region

Driver of strongest monsoon system, source of 10 major river systems, high altitude wetlands, third pole, biodiversity hotspot, home to diverse culture & traditional knowledge systems

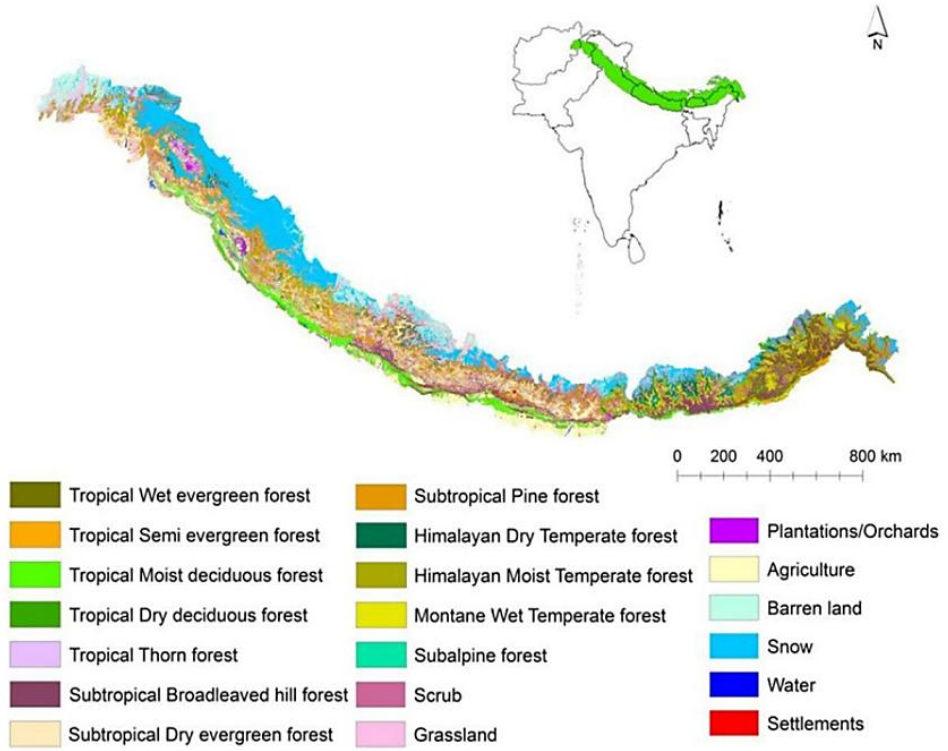
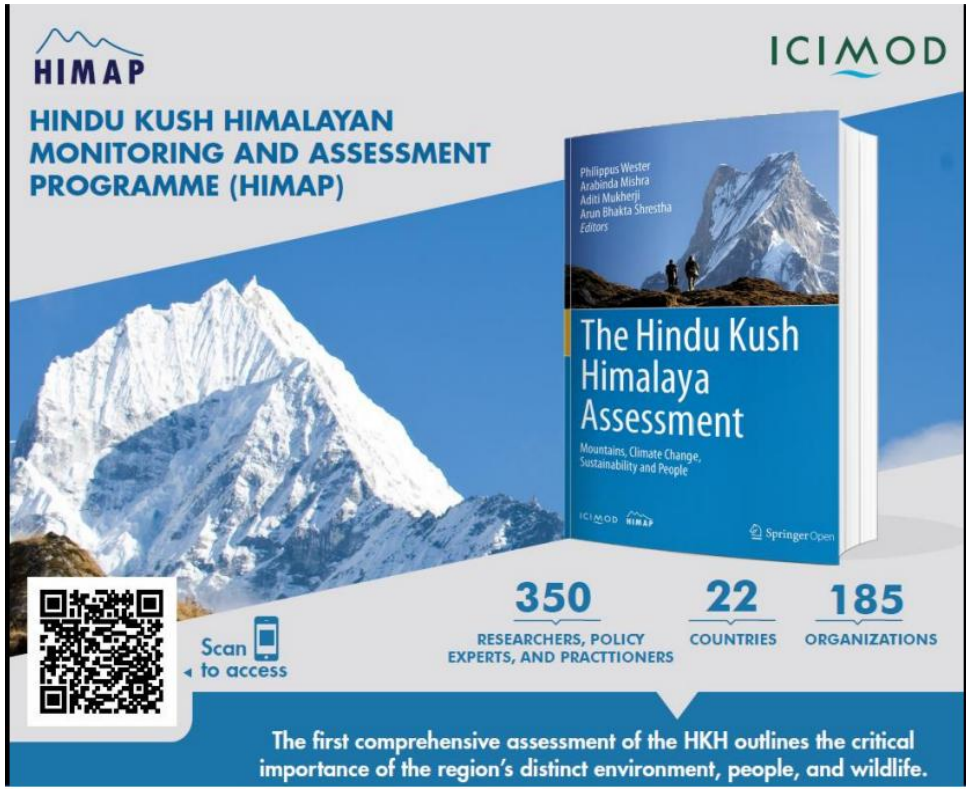


Fig. 1 Map showing the Himalayas and countries in South Asia and the distribution of the dominant forest types. *Source:* Manish and Pandit (2018) and Reddy et al. (2017)



Reddy et al., 2017; Dhyani, 2023

Mountain Forests not just for provisioning benefits





Pictures: Authors own; Dhyani & Dhyani, 2016; Misra, 2008

Riparian forests, fresh water biodiversity compromised due to diverse drivers







Harmonization of Eco hydrological measures with necessary hydro technical infrastructure can help providing system-based solution in a catchment

Pictures: Authors own

Loss of Nature, Ecosystems leading to loss of Nature's Contributions to People

- Increasing population and interests for subsistence, commercial and strategic needs.
- Deforestation and forest degradation rates alarmingly high
- Exponential surge in unsustainable harvesting, developmental projects, urbanization, tourism, pollution and climate change
- Countries in the region with a recent exception of Nepal, are losing their natural forest cover, ecosystem structure and functions

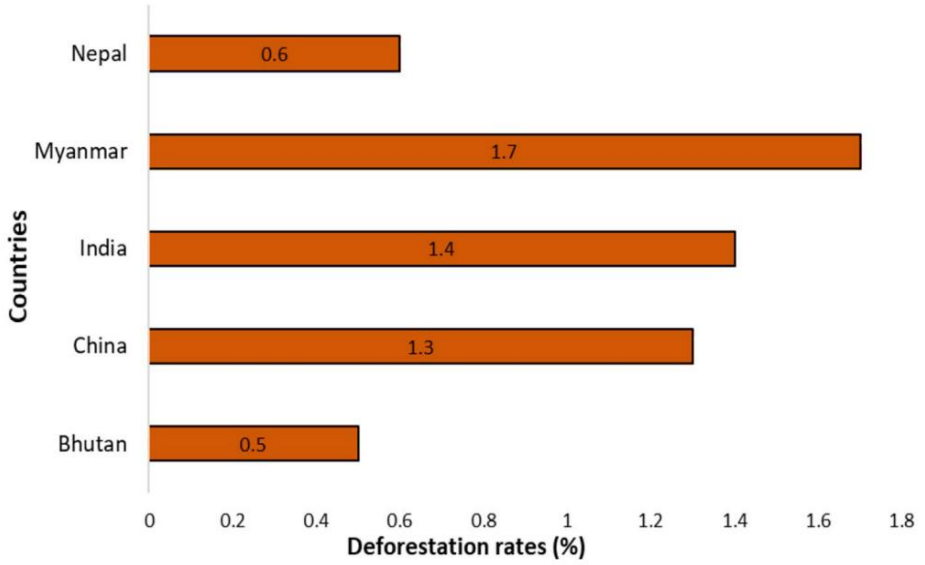
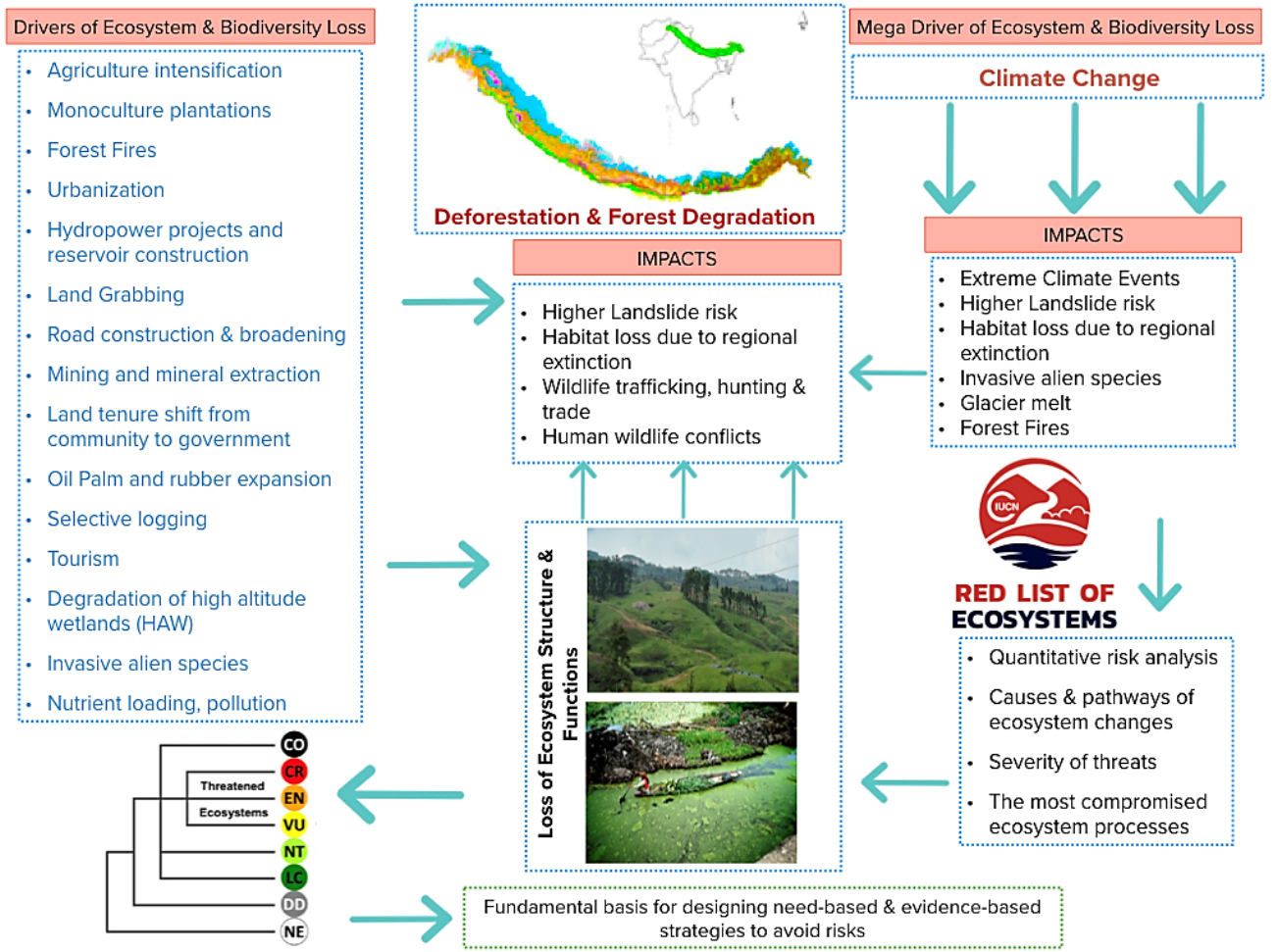


Fig. 2 Decadal deforestation rates (2000–2014) in forests outside protected areas of Himalayan temperate zone. *Source* Brandt et al. (2017)



Dhyani, 2023

Biodiversity and Conservation (2023) 32:3731–3764
https://doi.org/10.1007/s10531-023-02692-x

REVIEW PAPER

Are Himalayan ecosystems facing hidden collapse? Assessing the drivers and impacts of change to aid conservation, restoration and conflict resolution challenges

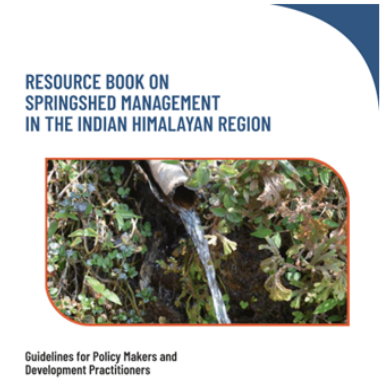
Shalini Dhyani[1,2]

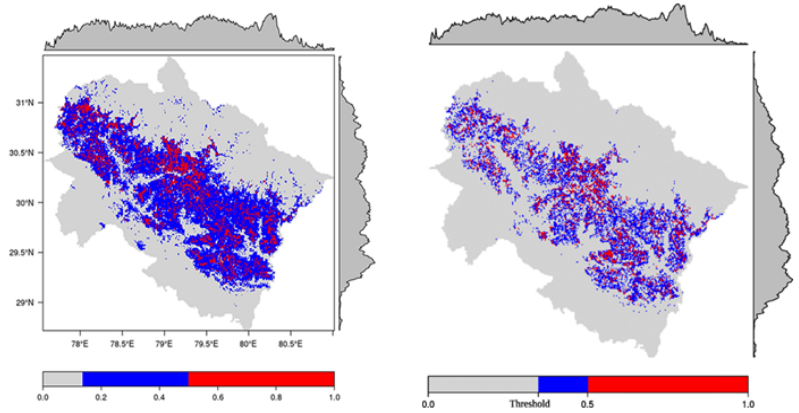
Ecosystem response to hydrological security by Central Himalayan Forests under changing climate



- Oak forests are hydraulic support to Indian Himalayan Region because of significant lower temperatures, high humidity supported by perennial streams inside them
- Oak forests having high carbon pool have vital contribution in conservation of soil, water, and numerous ecosystem services.
- Reduction and degradation of these forest is expected to alter the natural nitrogen cycle and hydrological balances that is apparent due to rapid depletion of natural spring-sheds

"90% of drinking water supply in Indian Himalayan Region is spring based supported by healthy Forests"





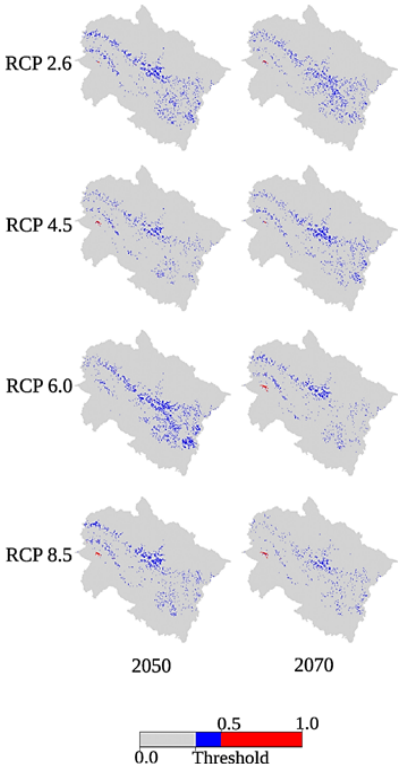
Ecosystem Classification: Global Ecosystem Functional Group, T2.1 Boreal and Temperate High Montane Forests and Woodlands

Regional Environmental Change (2020) 20: 113
https://doi.org/10.1007/s10113-020-01696-5

ORIGINAL ARTICLE

Predicting impacts of climate variability on Banj oak (*Quercus leucotrichophora* A. Camus) forests: understanding future implications for Central Himalayas

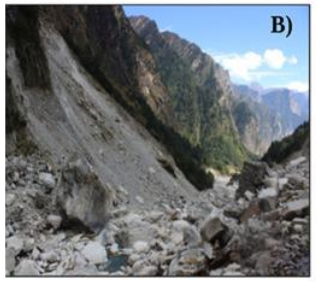
Shalini Dhyani[1] · Rakesh Kadaverugu[2] · Paras Pujari[1]



- High probable habitats (0.5-1) will decline and will almost vanished
- Potential habitats (threshold-1) show declining trends from RCP2.6 to RCP8.5 (20933 km^2 in present year to 4187 km^2)
- Potential habitats getting reduced by almost 80%
- The probable habitats will be scaled to higher altitudes (1754 to 2550 m amsl)
- Temperature seasonality (bio4) and altitude will influence future habitats

Riparian ecosystem health of river Ganga riparian buffers under climate change





- Riparian buffers of the Ganga have undergone significant deforestation resulting in enhanced pressure ecologically sensitive and fragile riparian buffer of the river Ganga.
- Significant loss of overall vegetation cover, i.e. 17.2% in the last decade (2008–2017) was observed.
- Vegetation assemblages are changing from climatic climax vegetation to pioneer species and enhanced invasion.

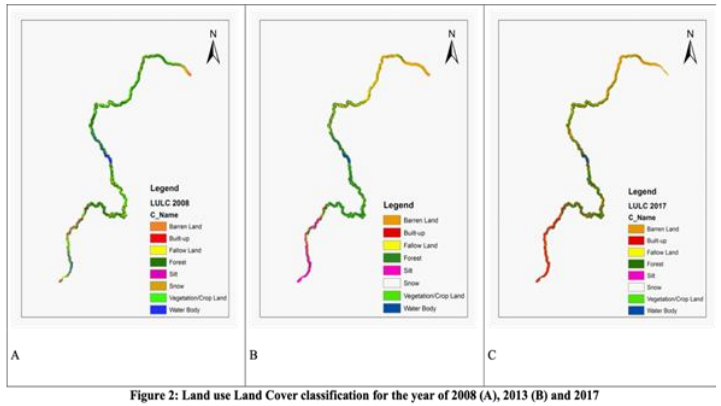


Figure 2: Land use Land Cover classification for the year of 2008 (A), 2013 (B) and 2017

An Integrated Eco-geospatial Approach for Assessment of Riparian Health in Upper Stretch of the Ganga, India

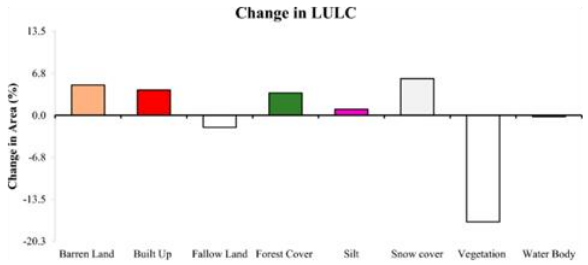
Original Article | Published: 15 May 2024

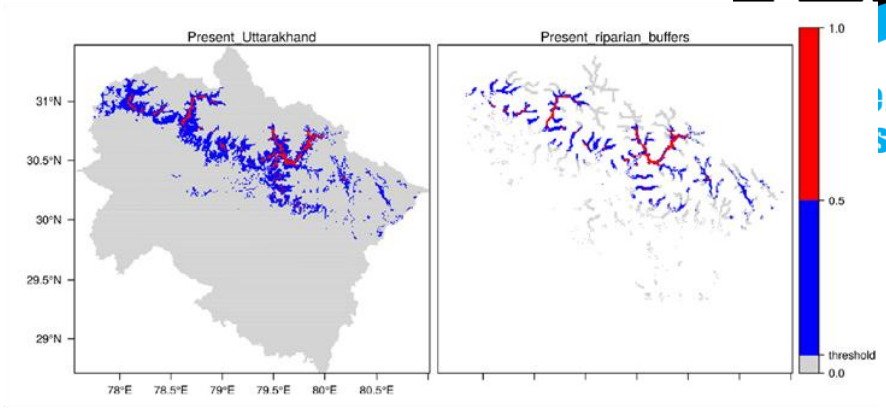












- Natural habitat of Seabuckthorn an indicator species of riparian health is continuously being degraded due to habitat destruction and harvesting.
- By the year 2050 the species will lose 87.2% (average of four RCPs) of the potential habitats
- By 2070 there is a marginal gain of 30 sq. km with respect to 2050, in the riparian buffers.
- 80.6% of the high probable habitat (0.5–1) will be lost by 2050, and 75.6% by 2070, in comparison with the present conditions

Our research highlights the urgent need for *in-situ* and *ex-situ* conservation to protect riparian buffers of river Ganga

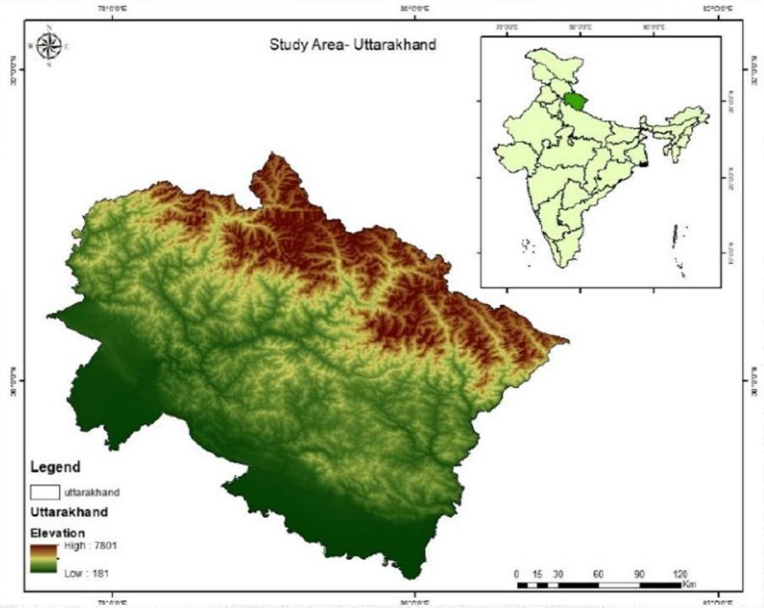
Predicting impacts of climate variability on habitats of *Hippophae salicifolia* (D. Don) (Seabuckthorn) in Central Himalayas: Future challenges

Shalini Dhyani[a,*], Rakesh Kadaverugu[b,*], Deepak Dhyani[c], Parikshit Verma[d], Paras Pujari[a]

Threat status assessment of Temperate Oak and Pine Forests [Sub National]

Ecosystem Classification: Global Ecosystem Functional Group,
T2.1 Boreal and Temperate High Montane Forests and Woodlands

Study Area



Himalayan Moist Temperate Forest

(Gairola et al., 2011)

Broadleaf Forest



Luxuriant highly diverse mixed broadleaved Oak forests

Pine Forest



Pine forest of Uttarakhand at different elevation

RED LIST OF ECOSYSTEMS

Anthropocene Science (2022) 1:211–225
https://doi.org/10.1007/s44177-022-00010-8

OPINION PAPER

Ecosystem Health and Risk Assessments for High Conservation Value Mountain Ecosystems of South Asia: A Necessity to Guide Conservation Policies

Shalini Dhyani[1,5] · Deepu Sivadas[2,5] · Oindrila Basu[3,5] · Madhav Karki[4,5]

Received: 21 September 2021 / Revised: 9 February 2022 / Accepted: 9 February 2022 / Published online: 28 February 2022
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Anthropocene Science (2023) 2:172–175
https://doi.org/10.1007/s44177-023-00062-4

NEWS & VIEWS

Towards the Assessment of Ecosystem Health of Ecosystems in Asia and Promoting Nature-Based Solutions

N. Manika[1,5] · Deepu Sivadas[2,5] · Oindrila Basu[3,5] · Shalini Dhyani[4,5]

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Impact of drivers of biodiversity loss on mountain ecosystems: assessing the need for ecosystem health assessments in Indian Himalayan Region

Shalini Dhyani[1,2]
[1]CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur, Maharashtra, India
[2]International Union for the Conservation of Nature (IUCN), Commission on Ecosystem Management (CEM), Geneva, Switzerland

Jaswal and Dhyani, Under Review

Threat status assessment of Moist Temperate Oak [Sub National]

Criterion	Sub criterion		
A. Reduction in Geographic Distribution	**A1** Past 50 years	**A2** Future or any 50 year period	**A3** Historical (1750)
	NE	EN	DD
B. Restricted Geo. Distribution	**B1** Extent of Occurrence	**B2** Area of Occupancy	**B3** # Threat-defined Locations < 5?
	VU	LC	LC
C. Environmental Degradation	**C1** Past 50 years (1970)	**C2** Future or any 50 years period	**C3** Historical (1750)
	NE	CR	NE
D. Disruption of biotic processes	**D1** Past 50 years (1970)	**D2** Future or any 50 years period	**D3** Historical (1750)
	LC-VU	NE	LC
E. Quantitative Risk analysis	NE		
Overall risk category	EN		

**as per RLE guidelines ver 2.0*

 # threat-defined locations greater than 5

- A decline of approximately 60% and 30% is predicted in broadleaf and pine forest which grades the ecosystem as 'Endangered' and 'Least Concern' under Criterion A2b.
- For the potential habitats of the broadleaf forest, a decline of 86%, probable habitats by 84%, and high probable habitats of 99% by 2070 is revealed, which ranks the ecosystem as Critically Endangered (CR) (Dhyani et al., 2020).
- Data from two landscapes show that the number of oak forest specialist birds decreased dramatically (by around 75%) from natural oak forests to modified land use.

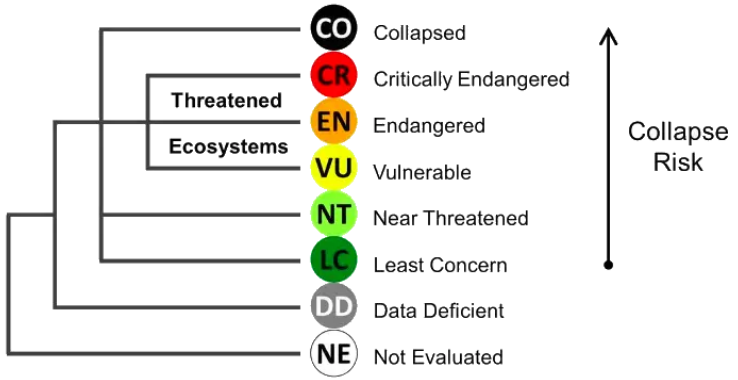
Anthropocene Science (2024) 3:122–130
https://doi.org/10.1007/s44177-024-00074-8

OPINION PAPER

Ecosystem Health Assessment in India for Mainstreaming Global Biodiversity Framework Headline Indicator and Prioritising Conservation Action

Shalini Dhyani[1,9] · Deepu Sivadas[2,9] · Rajiv Chaturvedi[3,9] · Amrita Neelakantan[4,9] · Sonali Ghosh[5,9] · Sarala Khaling[6,9] · Simran Sharma[3] · Dhritiman Das[7,9] · Rajarshi Dasgupta[8,9]

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Structure of the IUCN Red List of Ecosystems categories.

RED LIST OF ECOSYSTEMS

Threat status assessment of Dry Temperate Pine Forests [Sub National]

Criterion	Sub criterion		
A. Reduction in Geographic Distribution	**A1** Past 50 years	**A2** Future or any 50 year period	**A3** Historical (1750)
	NE	LC	DD
B. Restricted Geo. Distribution	**B1** Extent of Occurrence	**B2** Area of Occupancy	**B3** # Threat-defined Locations < 5?
	LC-VU	LC	LC
C. Environmental Degradation	**C1** Past 50 years (1970)	**C2** Future or any 50 years period	**C3** Historical (1750)
	NE	LC	NE
D. Disruption of biotic processes	**D1** Past 50 years (1970)	**D2** Future or any 50 years period	**D3** Historical (1750)
	LC-VU	NE	LC
E. Quantitative Risk analysis	NE		
Overall risk category	VU		

**as per RLE guidelines ver 2.0*

 # threat-defined locations greater than 5

- Significant reduction in very dense and moderately dense forest cover over the past five decades, indicating severe ecosystem degradation
- Expansion of open forest areas, leading to less dense forest cover, impacting biodiversity and ecosystem services
- Increasing fire and landslide hotspots because of forest degradation adding to climate vulnerability.

Jaswal and Dhyani, Under Review

Urban sprawling a mega driver of loss across IHR and beyond

- Almost half a percent (132 sq km) of the geographical area under urban expansion and home to 4 million inhabitants.
- The western and middle Himalayas have seen rampant urban sprawl coupled with demographic changes than Eastern Himalayas
- Rapid population growth (830.92%) followed by demographic changes (333.45%) over almost four decades (1972–2015) and significant upsurge in the mountain population (0.5–1 million)

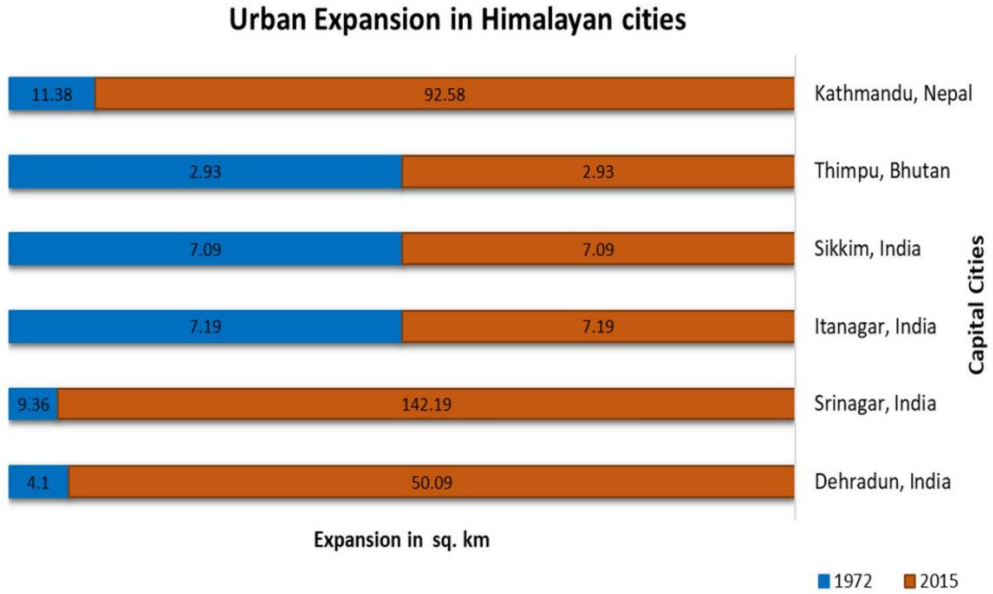


Fig. 4 Urban expansion in fast growing cities across Himalayas. *Source* Diksha (2017)

By 2030 urban areas in China will encroach further inside Indo-Burma hotspots by more than 200%
Multiple geohazards have increased due to rampant un-planned urban sprawl

Dhyani, 2023, 2024



Depopulation in Himalayas

Growing Ghost Villages

Contents lists available at ScienceDirect

International Journal of Disaster Risk Reduction

journal homepage: www.elsevier.com/locate/ijdrr

Governing green change to improve resilience by assessing urban risks for localizing nature based solutions in fast sprawling Dehradun, India

Manu Thomas [a], Athira Prakash [a], Shalini Dhyani [a, b, *], Paras R. Pujari [a, b]

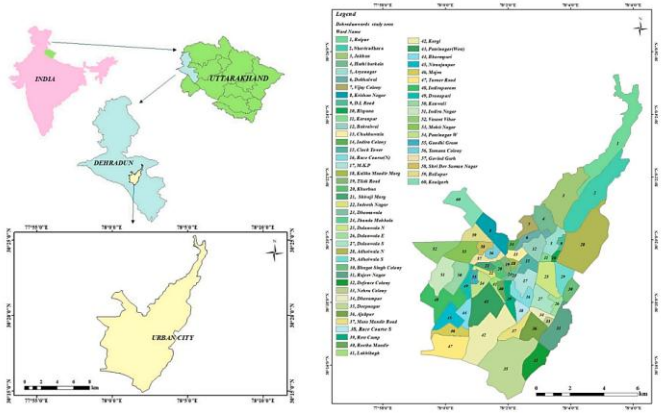
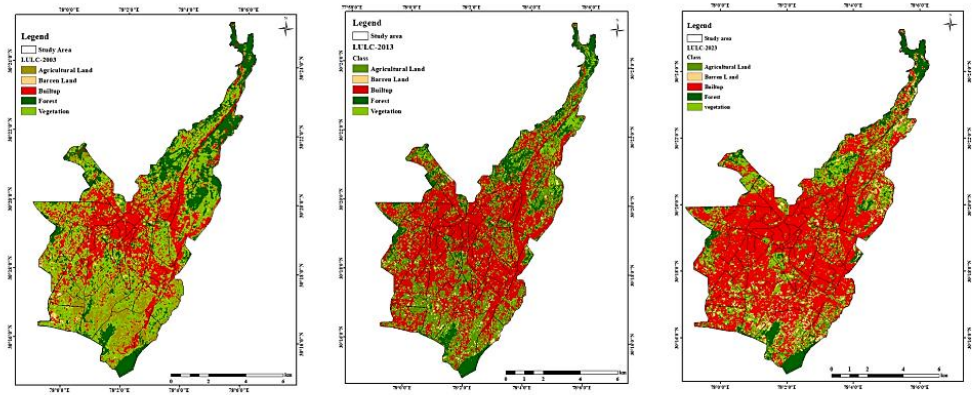
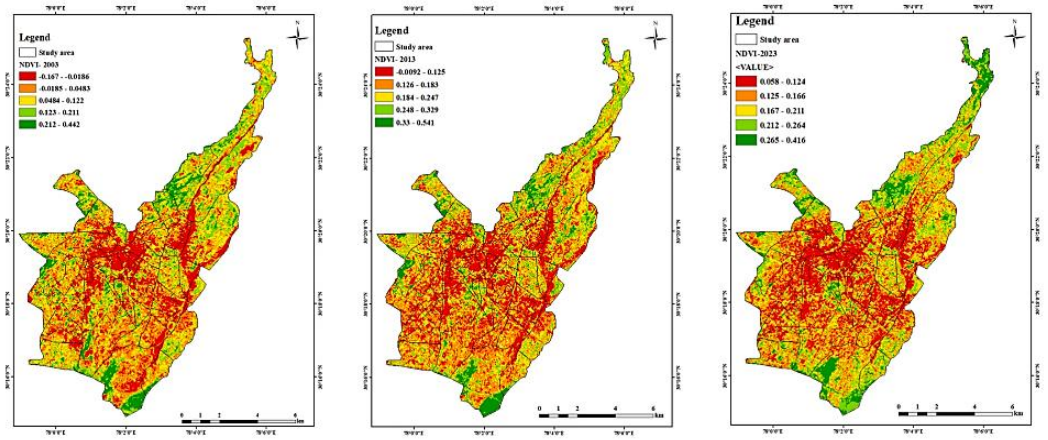


Fig. 1. a) Location of the Dehradun City b) 60 wards of Dehradun Municipal Corporation.



a)2003 b)2013 c)2023

Fig. 4. Decadal changes in LULC for the city of Dehradun.



a)2003 b)2013 c)2023

Fig. 6. Decadal changes in NDVI for the city of Dehradun (a, b, c).



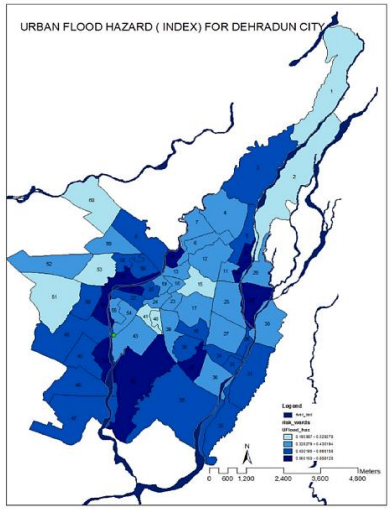
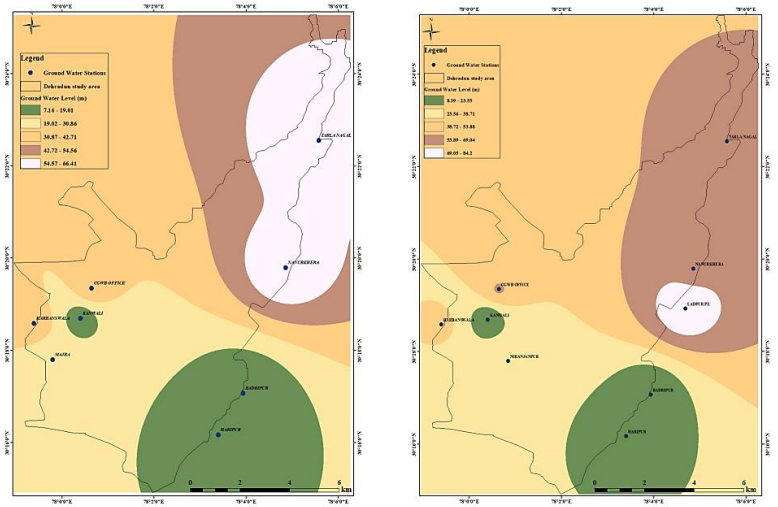


Fig. 11. Ward wise Urban Flood Hazard Index of the study area (Source: 26).



a)2012 b)2022

Fig. 9. Interpolated Groundwater level for the city of Dehradun.

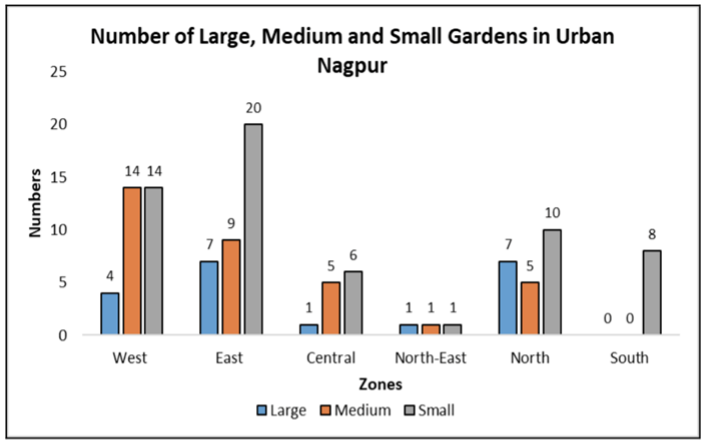
Per capita UGS requirement for good quality of life



World Health Organization (WHO) recommends minimum of **9 m^2 of green space** per individual with an ideal UGS value of 50 m^2 per capita.

Per capita UGS distribution (10 -12 m^2 per-capita green space) in different zones of Urban Nagpur as per URDPFI, 2015

Ministry of Urban Development
Government of India



Open Access Article

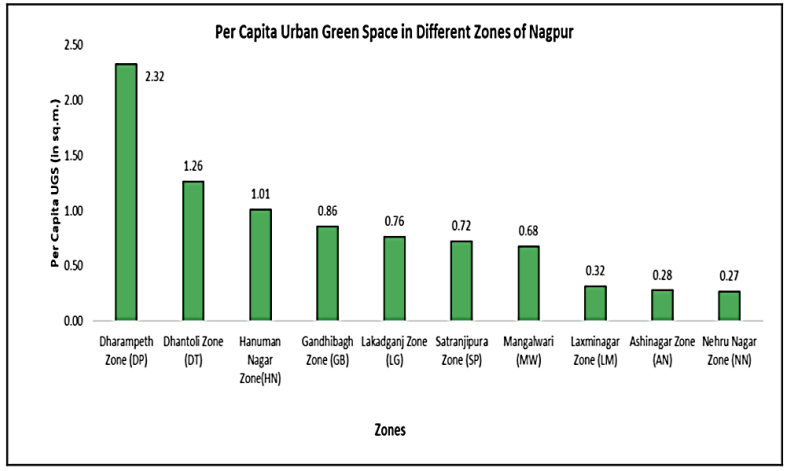
3-30-300 Benchmark: An Evaluation of Tree Visibility, Canopy Cover, and Green Space Access in Nagpur, India

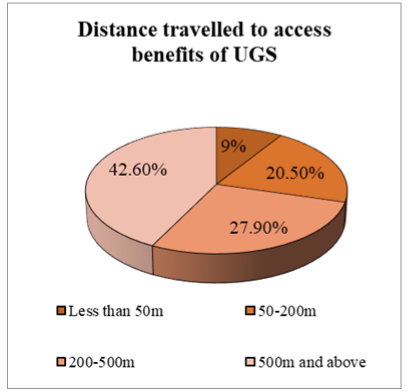
by Shruti Ashish Lahoti [1,*], Manu Thomas [2], Prajakta Pimpalshende [2,3], Shalini Dhyani [2,*], Mesfin Sahle [1], Pankaj Kumar [1] and Osamu Saito [1]

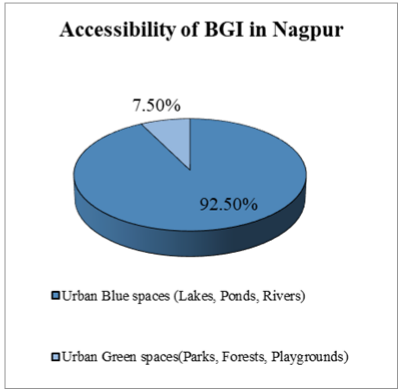
Earth Observation in Urban Monitoring
Techniques and Challenges
Earth Observation
2024, Pages 359-374

Chapter 17 - Shrinking urban green spaces, increasing vulnerability: solving the conundrum of the demand-supply gap in an urbanizing city

Jayshree Shukla [1], Shalini Dhyani [2] *, Soumya Chakraborty [3], Saptarshi Dutta Purkayastha [1], Ramesh Janipella [1], Paras Pujari [1], Atya Kapley [4]







Dhyani et al., 2018; Shukla et al., 2024; Lahoti et al., 2025

Concretizing Lake Buffers: Reducing Blue-Green Ration

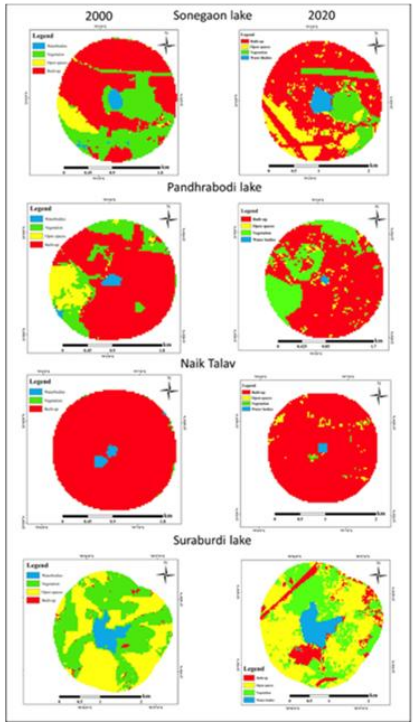
Research Article

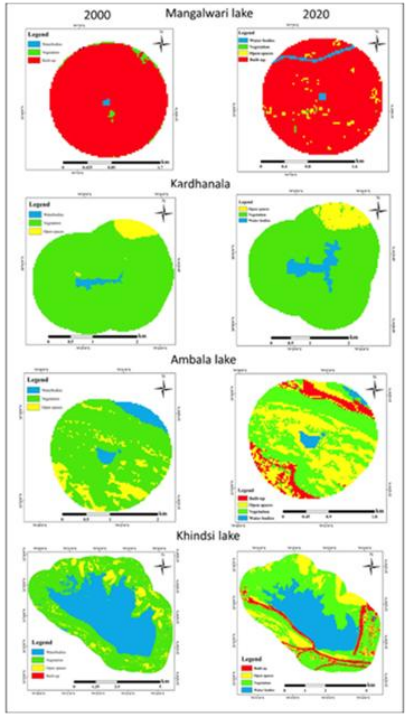
A blue–green ratio of urban wetlands as an ecosystem health indicator: the case of urban sprawl in Nagpur, India

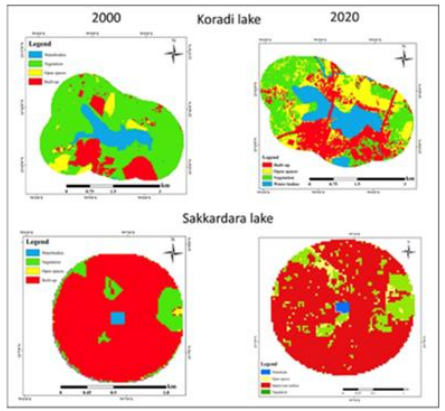
Jayshree Shukla, Mihir Pophali, Saptarshi Dutta, Shruti Lahoti, Paras Pujari & Shalini Dhyani

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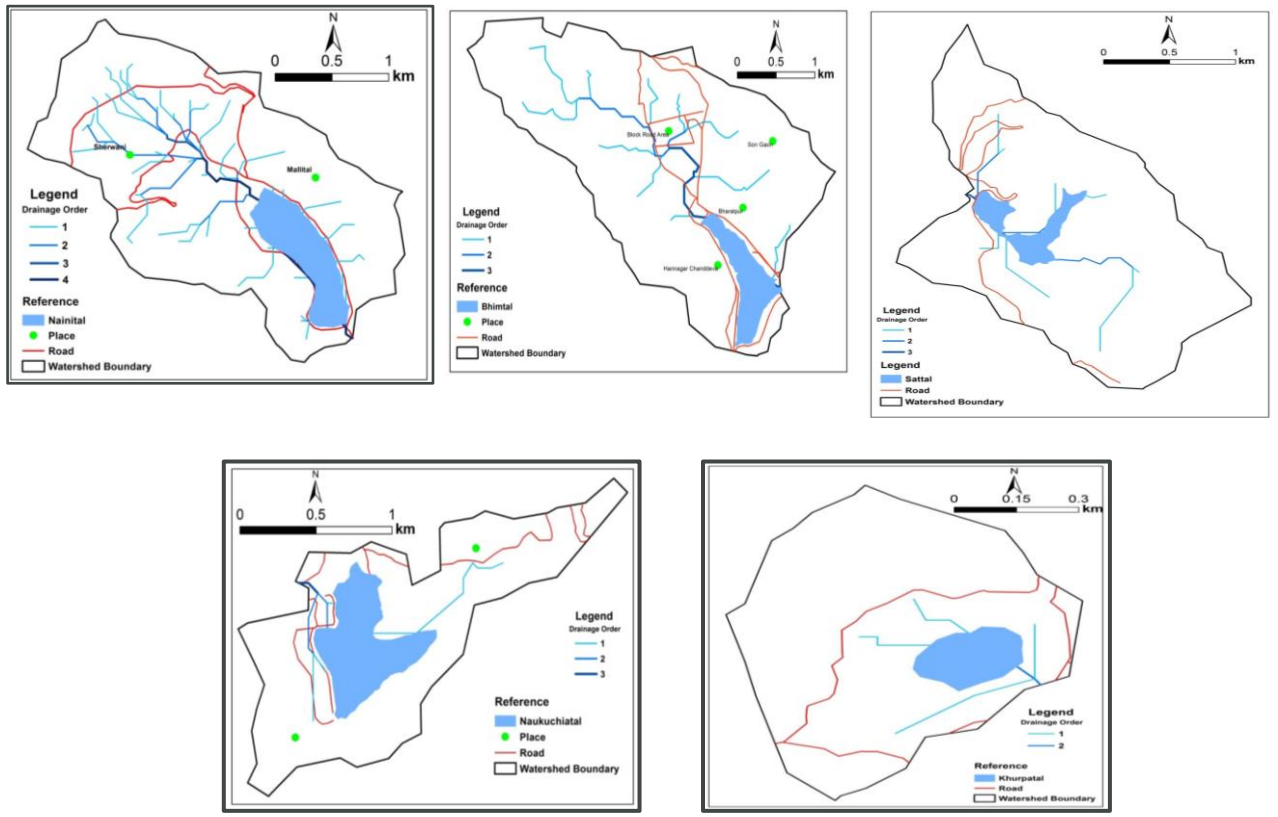
Shukla et al., 2025
NEERI ESR, 2021



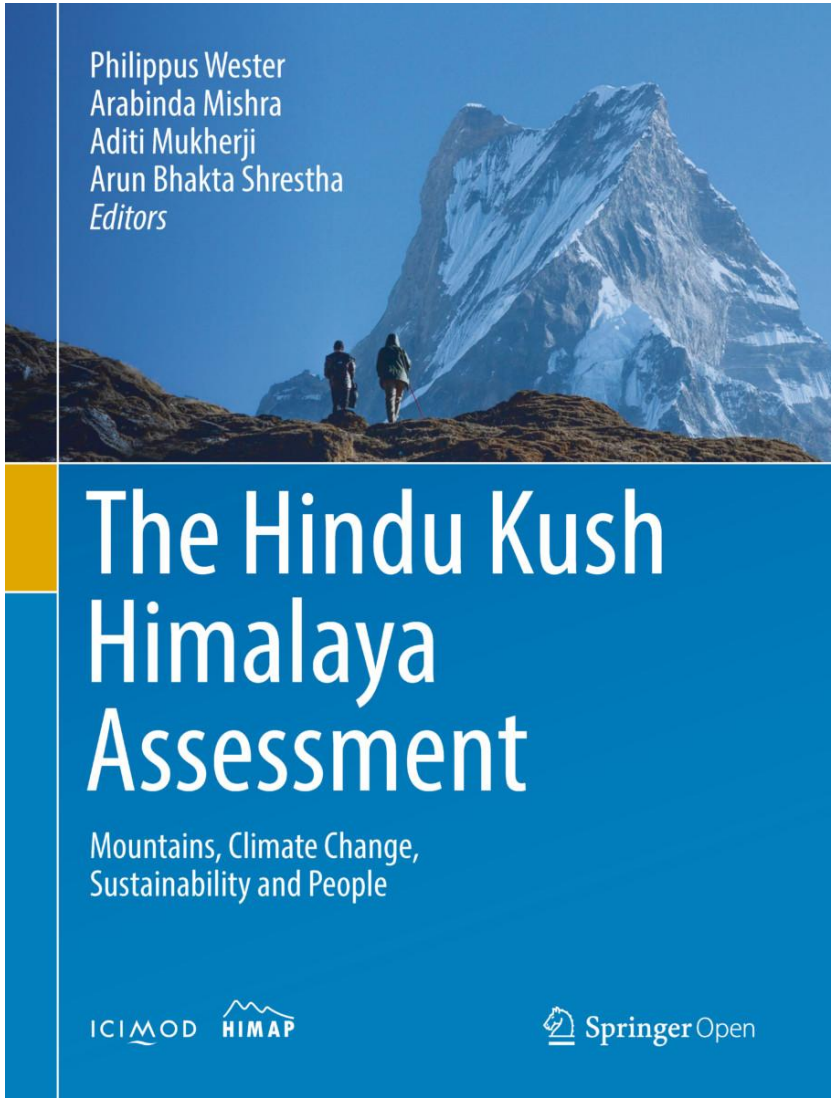


Bearing Capacity and Sustainability around five lakes in Nainital, Uttarakhand

- Excessive pressure on natural resources due to urban sprawling and tourism specially during peak seasons
- Rampant urban sprawling (Construction on steep slope)
- Poor management of Solid and liquid waste (Lack of proper infrastructure)
- Water availability in peak seasons
- Sharp decline in water in wetlands level
- Deterioration in water quality (direct discharge of sewage)
- Landslides/Forest fire/Invasive species/Reduction in natural stream flow



NEERI, 2018



1. Cooperate at all levels across the HKH region for sustainable and mutual benefits

2. Recognize and prioritize the uniqueness of the HKH mountain people

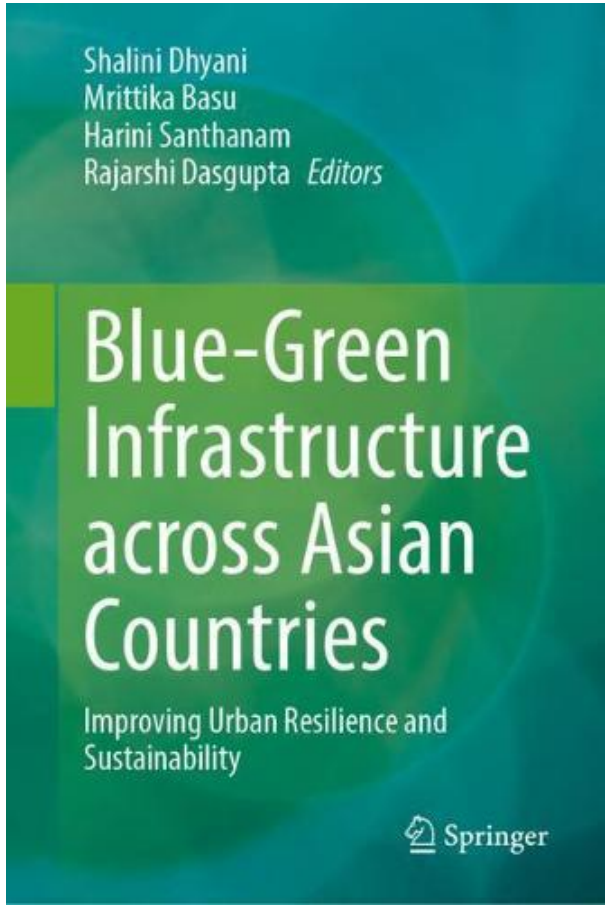
3. Take concerted climate action at all levels to keep global warming to 1.5 °C by 2100

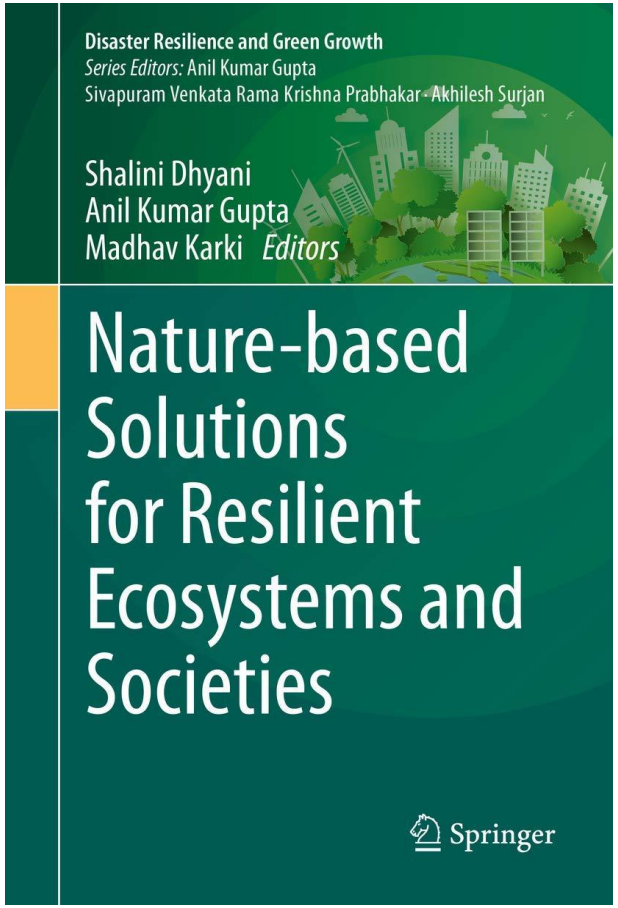
4. Take accelerated actions to achieve the SDGs and 9 Mountain Priorities

5. Enhance ecosystem resilience; halt biodiversity loss and land degradation

6. Regional data and information sharing and science and knowledge cooperation

HIMAP, 2018





Conference Report | Published: 29 August 2016

Ecological engineering for disaster risk reduction and climate change adaptation

Shalini Dhyani & Muralee Thummarukuddy

Environmental Science and Pollution Research **23**, 20049–20052 (2016) | Cite this article

573 Accesses | **16** Citations | Metrics

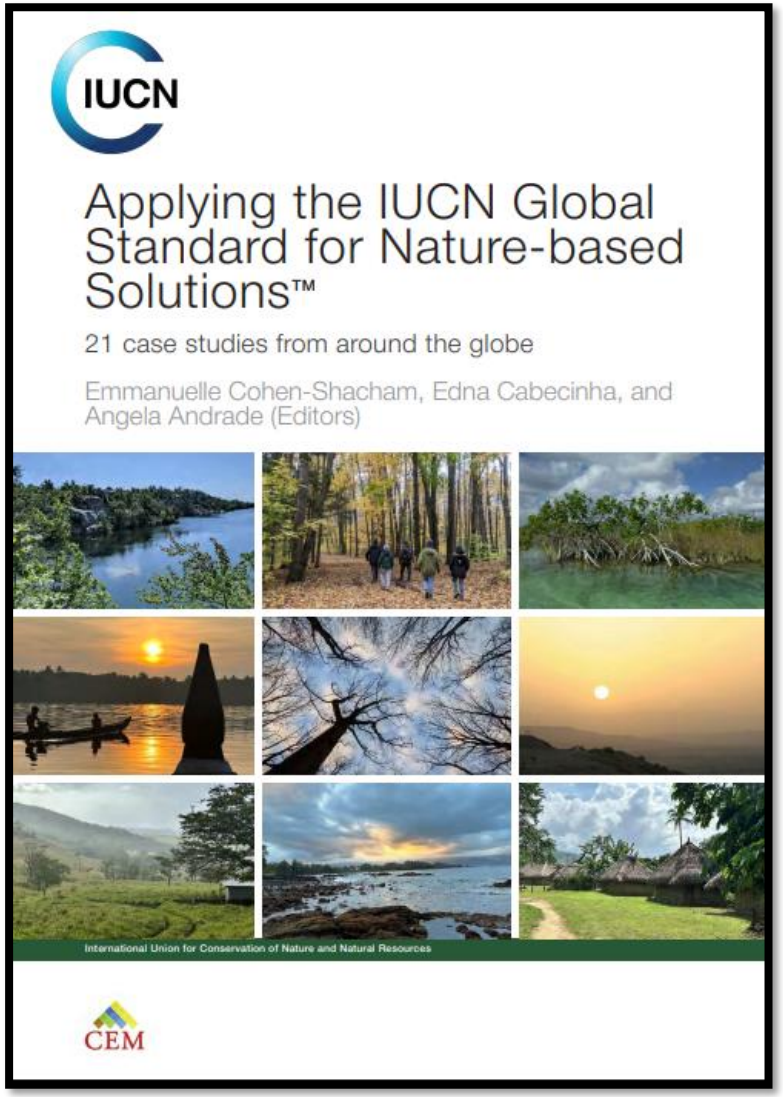
Strategies for Reducing Deforestation and Disaster Risk: Lessons from Garhwal Himalaya, India

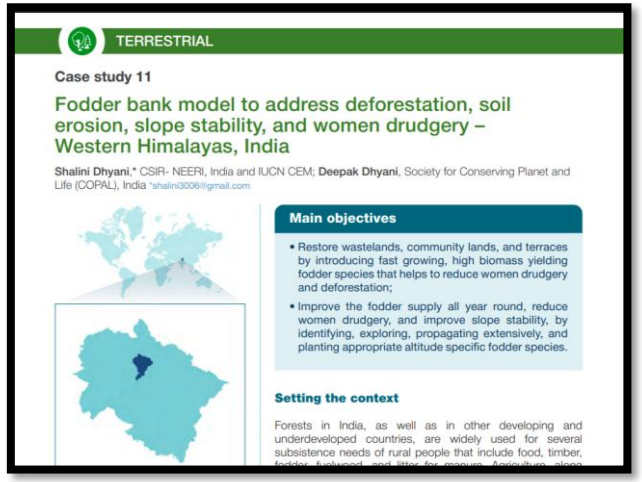
Shalini Dhyani & Deepak Dhyani

Chapter | First Online: 20 August 2016

1802 Accesses | **9** Citations

Part of the Advances in Natural and Technological Hazards Research book series (NTHR,volume 42)





Role of blue and green spaces in mitigating heat stress and providing biodiversity co-benefits in South Korea and India

Jagdish Krishnaswamy[1], Soojeong Myeong[2], and Shalini Dhyani[3]
[1]School of Environment and Sustainability, Indian Institute for Human Settlements, Bengaluru, India (jagdish.krishnaswamy@iihs.ac.in)
[2]Korea Environment Institute, Sejong, South Korea
[3]CSIR-National Environmental Engineering Research Institute, Environmental Impact, Audit and Policy, Nagpur, India

Integration of blue, green, and grey infrastructure in Urban campuses as a Nature based Solution for resilience and harnessing co-benefits

Shalini Dhyani[1] and Jagdish Krishnaswamy[2]
[1]CSIR-National Environmental Engineering Research Institute, Environmental Impact, Audit and Policy, Nagpur, India (shalini3006@gmail.com)
[2]School of Environment and Sustainability, Indian Institute for Human Settlements, Bengaluru, India

IUCN NbS Global Standards Translations Published, Dec 2024



Short videos also prepared and to be launched soon..

Review

Agroforestry to Achieve Global Climate Adaptation and Mitigation Targets: Are South Asian Countries Sufficiently Prepared?

Shalini Dhyani [1,*], Indu K Murthy [2], Rakesh Kadaverugu [3], Rajarshi Dasgupta [4], Manoj Kumar [5] and Kritika Adesh Gadpayle [2]

RE-NEW (OPINION) ARTICLE

Integrated climate sensitive restoration framework for transformative changes to sustainable land restoration

Shalini Dhyani, Debbie Bartlett, Rakesh Kadaverugu, Rajarshi Dasgupta, Paras Pujari, Parikshit Verma

First published: 25 June 2020 | https://doi.org/10.1111/rec.13230 | Citations: 27

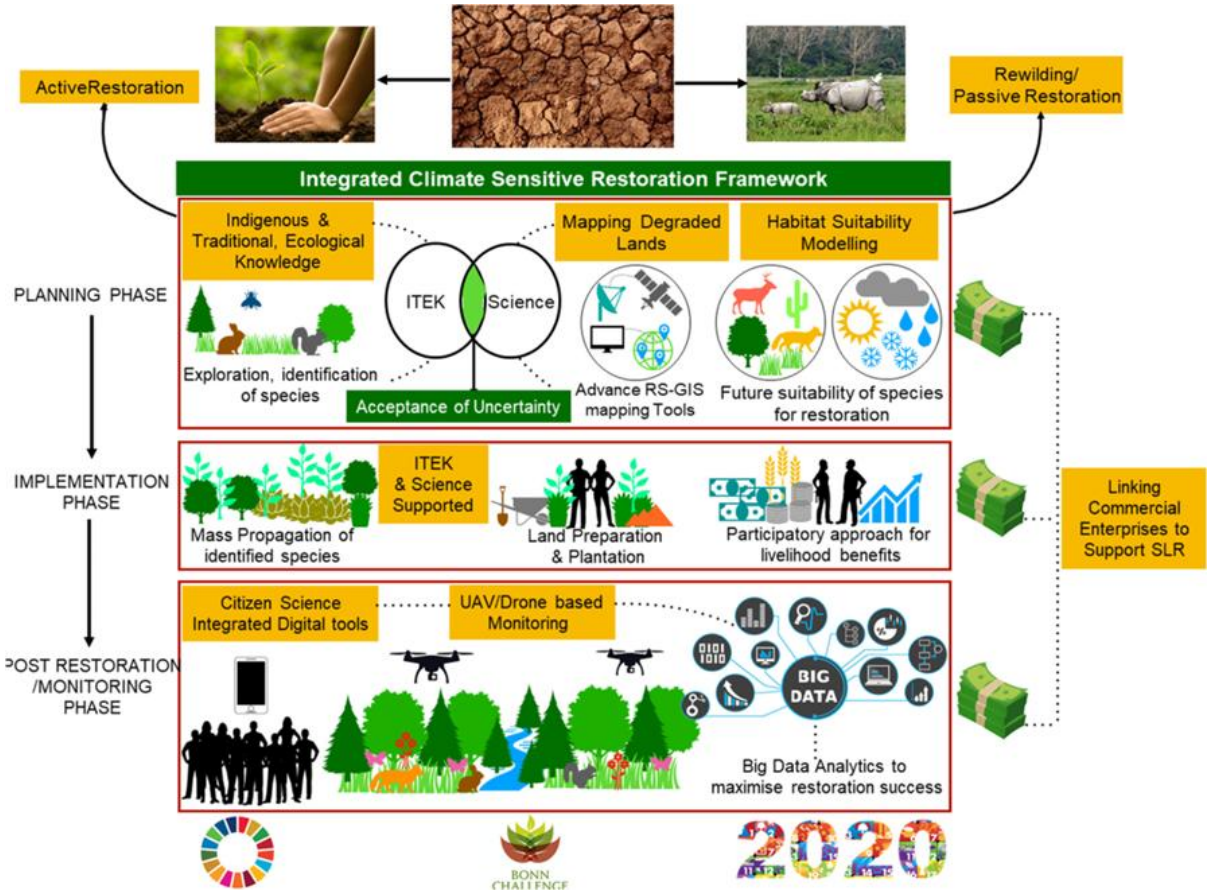
Comment | Open access | Published: 01 March 2023

Combining socioeconomic and biophysical data to identify people-centric restoration opportunities

Pooja Choksi, Arun Agrawal, Ivan Bialy, Rohini Chaturvedi, Kyle Frankel Davis, Shalini Dhyani, Forrest Fleischman, Jonas Lechner, Harini Nagendra, Veena Srininvasan & Ruth DeFries

npj Biodiversity **2**, Article number: 7 (2023) | Cite this article

8970 Accesses | **1** Citations | **97** Altmetric | Metrics



Co-creating, co-implementing and co-managing solutions for larger co-benefits






Science & Technology Development/Policy Issues | Published: 10 August 2013

Utility of Fodder Banks for Reducing Women Drudgery and Anthropogenic Pressure from Forests of Western Himalaya

Shalini Dhyani, R. K. Maikhuri & D. Dhyani

National Academy Science Letters **36**, 453–460 (2013) | Cite this article

Strategies for Reducing Deforestation and Disaster Risk: Lessons from Garhwal Himalaya, India

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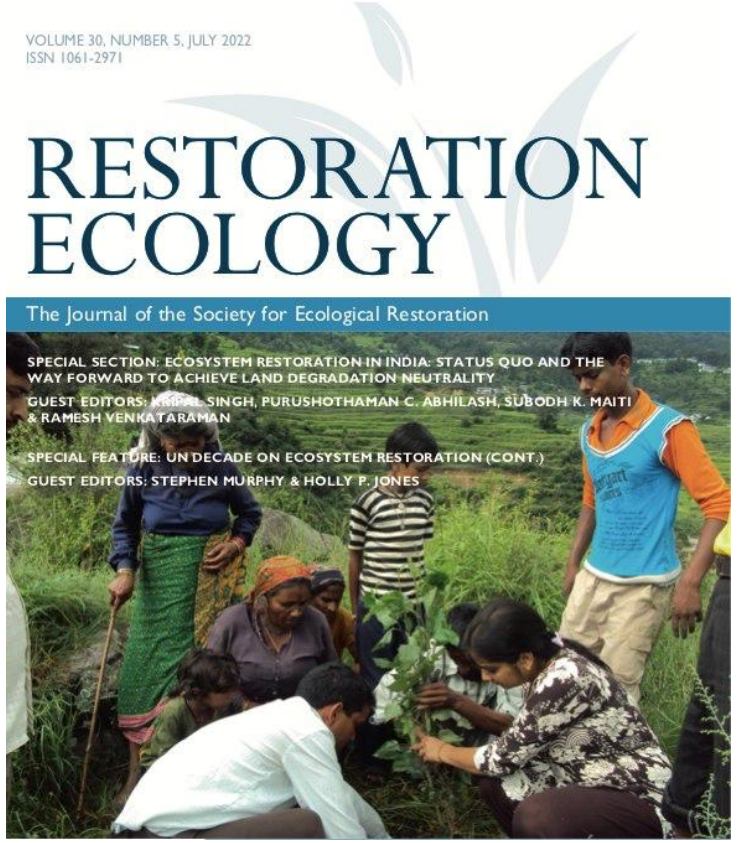
Accelerating the momentum for transformative changes

- Multi-sectoral & People-Centric
- Innovations
- Incentives
- Private Sector Financing
- Convergence
- Monitoring, learning, improving

Actionable recommendations for engage diverse publics in knowledge creation and validation processes in a meaningful way

Thank you for your patience!!

shalini.dhyani@csir.res,in; shalinidhyanineeri@gmail.com





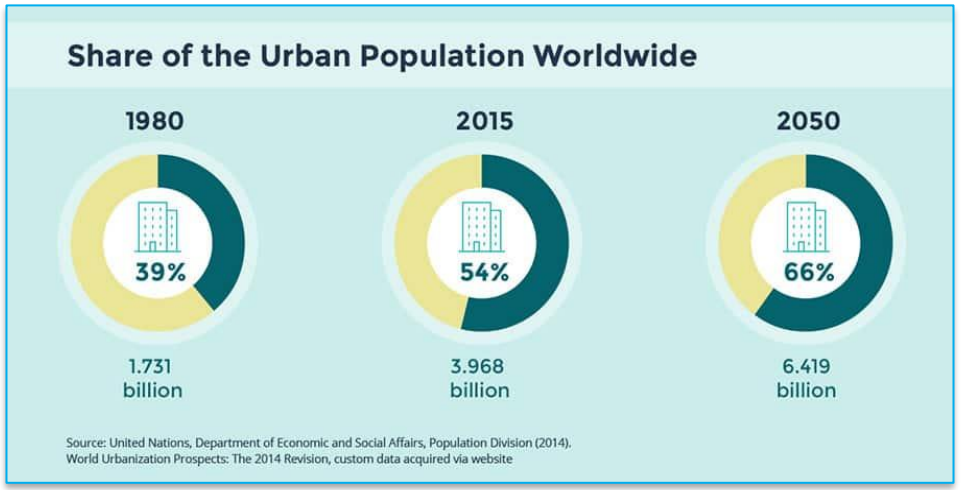
Securing the Source: Rethinking Urban Water for Himalayan Cities

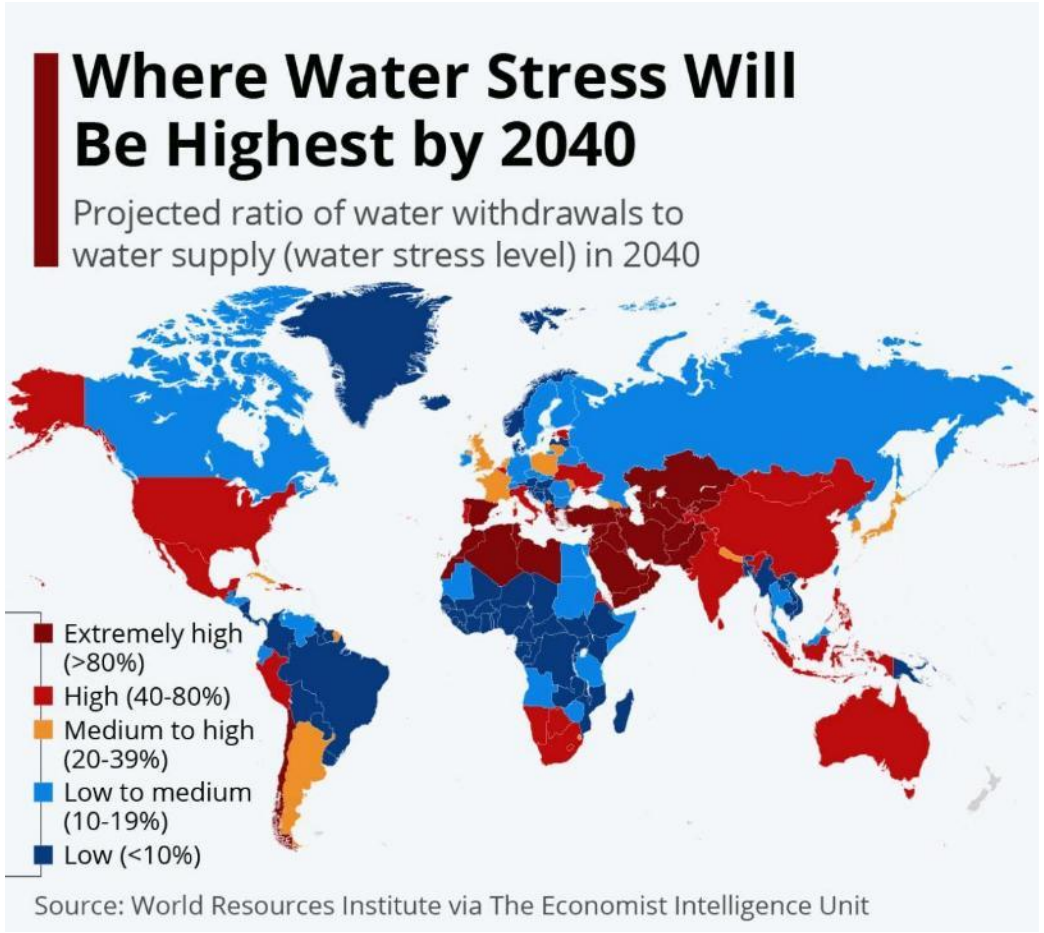
VISHAL SINGH, SENIOR FELLOW AND EXECUTIVE DIRECTOR

inspiring change

GLOBAL SCENARIO

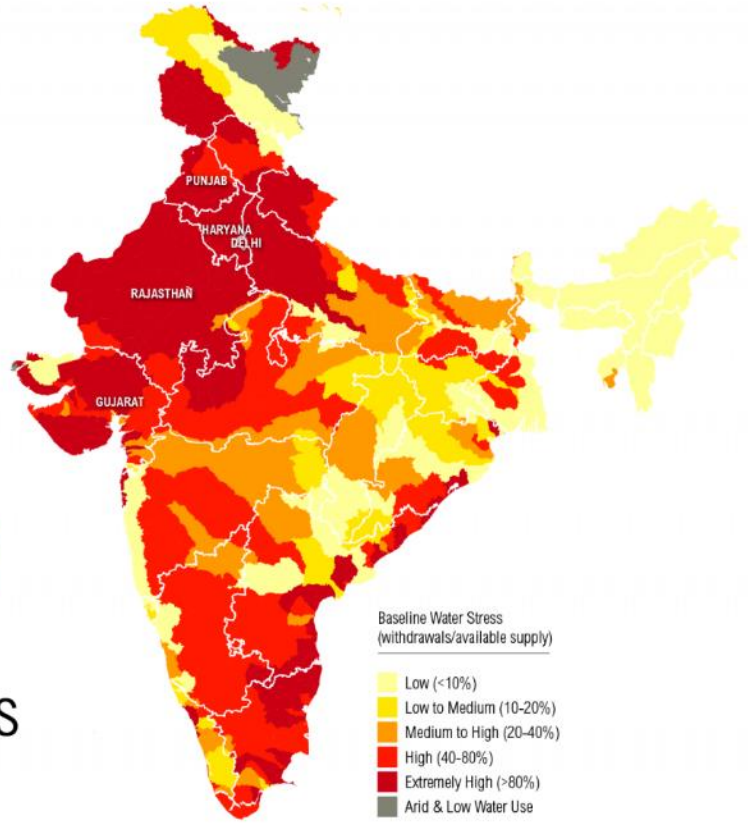
- 2.3 billion people live in water-stressed countries
- Urban growth = 70% population in cities by 2050
- Majority of this growth is going to happen in Africa and Asia
- Cape Town, Mexico City's Shrinking Aquifer





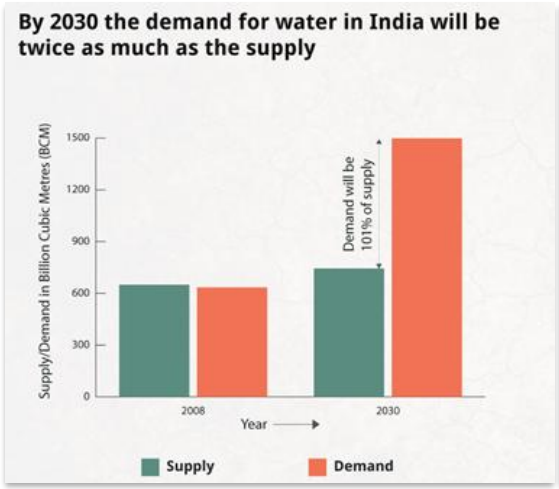
URBAN INDIA GROWING BUT DRYING

54% of India Faces **High** to **Extremely High** Water Stress

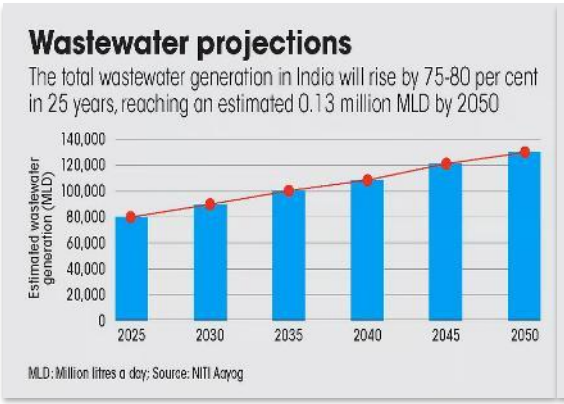


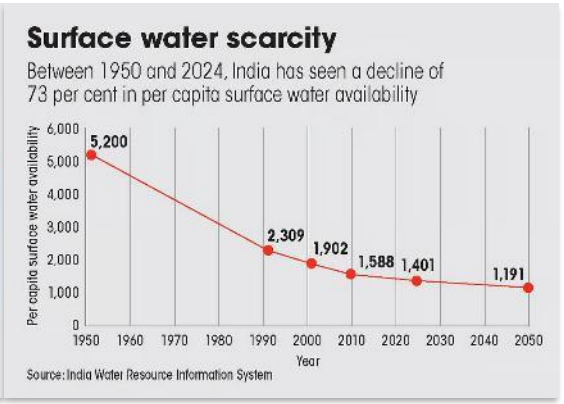
www.indiawatertool.in

WORLD RESOURCES INSTITUTE

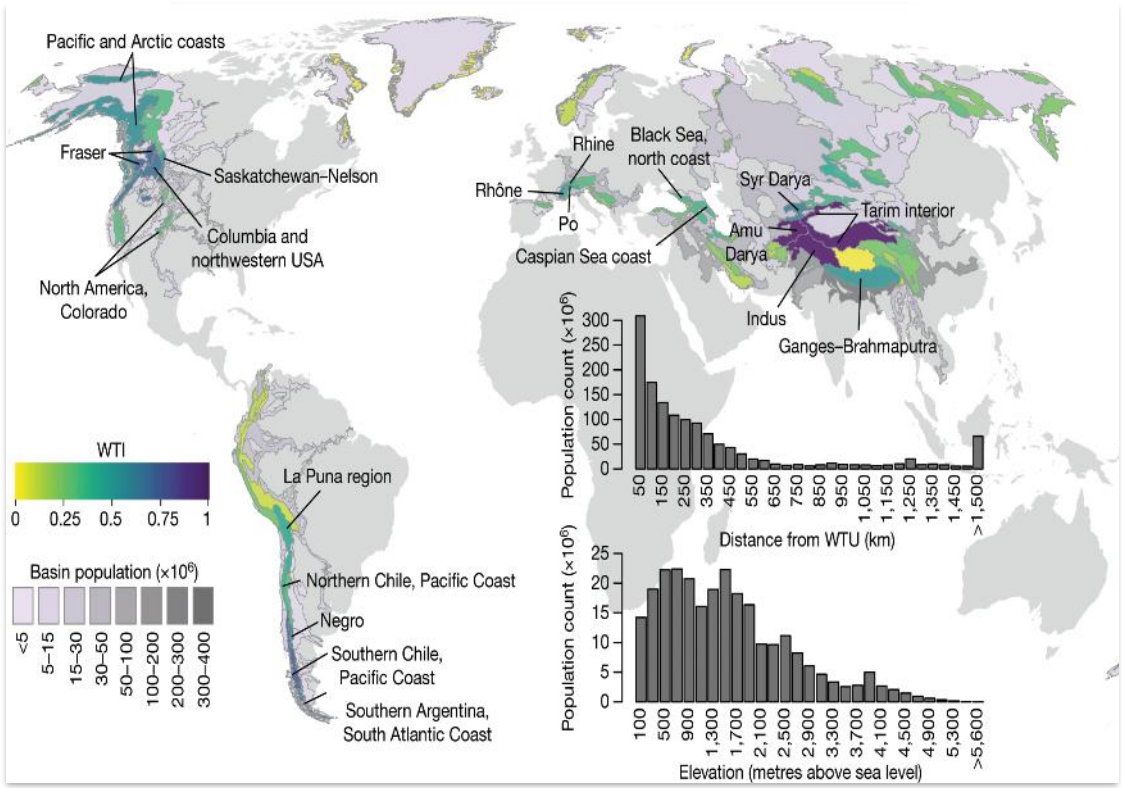


Nearly **70%** of water in India is contaminated.

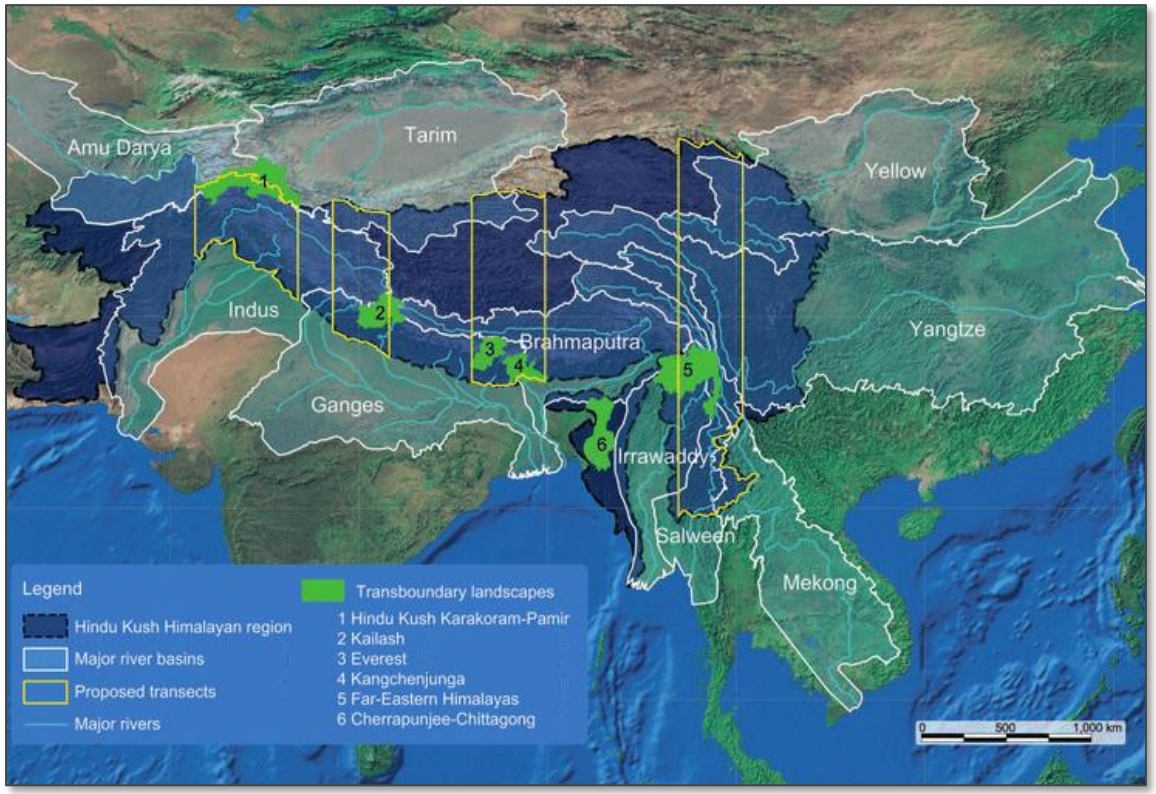




SCARCITY AMONGST PLENTY



Source: Immerzeel et al 2020



Source: Molden et al 2017

WATER TOWERS OR WATER SCARCITY HOT- SPOT

Disproportionate – Glaciers – Rural areas

Urban water/ Ecosystem services – Remains and "Blind Spot"

Springs focus – restricted and Science

- **27.2 %** population urban – likely to increase to **50%** by 2050
- **78.5%** towns (**320**) have less than **20,000** (people)
- More ecological elements and more dependent on ESS's
- Current infrastructure planning – focus on rural or large cities
- Spring dependence – *Mussoorie, Shimla, Almora, Pauri* spring dependence

General Observations



Urban population rise (2001-2011 decade, the urban population grew by a substantial 40%)



High Tourism activity



Increase in impervious surface



Unregulated construction and Encroachment of CWZ's

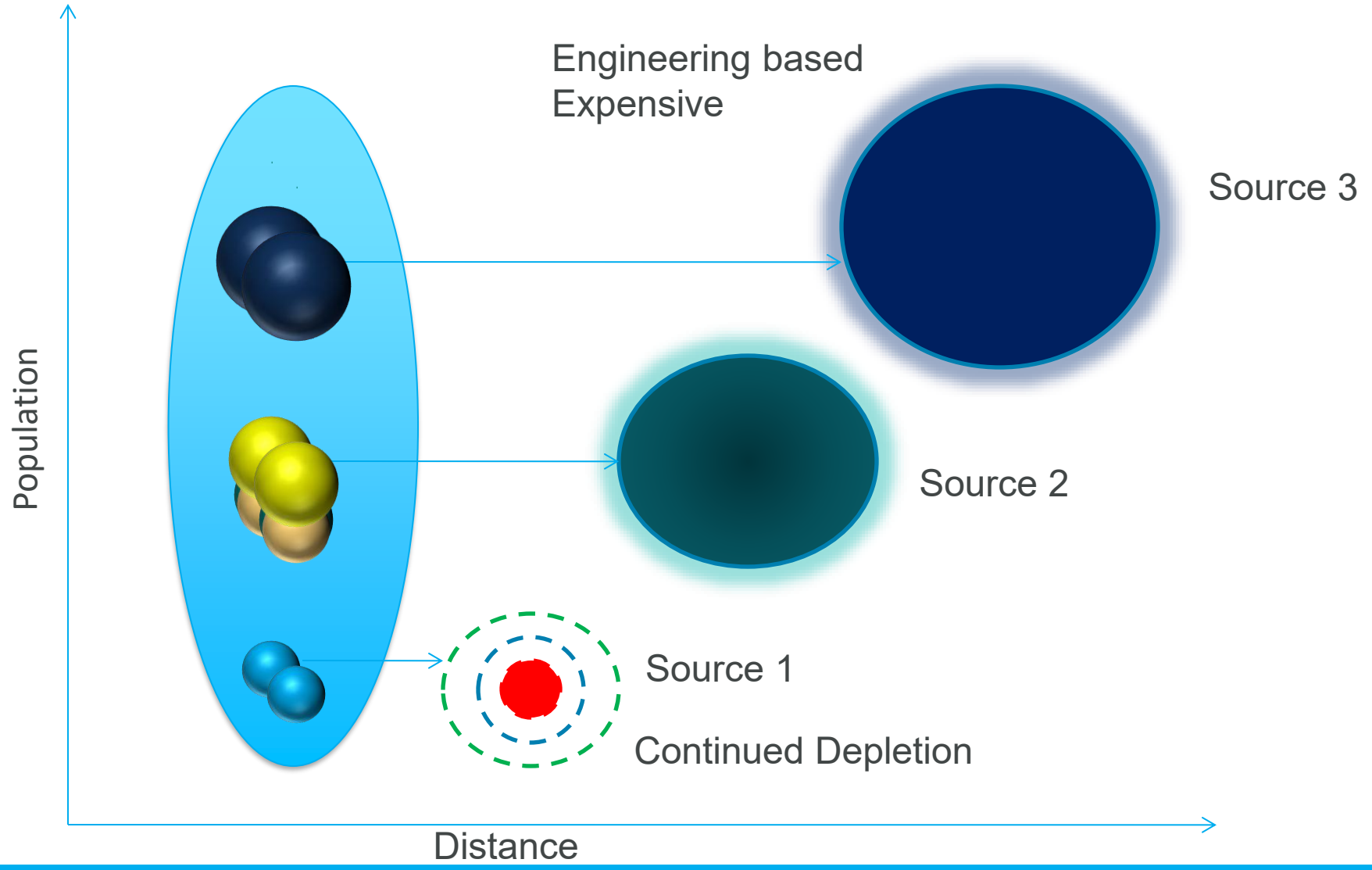


Unscientific development



Old growth forests and forest degradation

SOURCES ARE MOVING FURTHER



POLITICAL ECONOMY WATER SECURITY, ECOSYSTEM SERVICES AND LIVELIHOODS IN THE WESTERN HIMALAYAS

Tourist based water demands and resultant stresses on available water resources

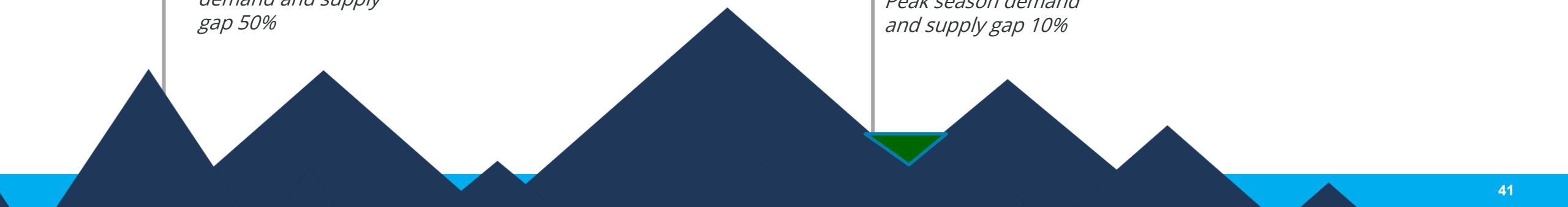
MUSSOORIE

- Declining spring discharge
- Adequate water
- Several Critical recharge zones under threat
- Plan to pump water from Yamuna 21 km in 4 stage pumping – 2042
- Non Equitable water distribution
- Dominating Water tanker supplier lobby

Spring
Peak season
demand and supply
gap 50%

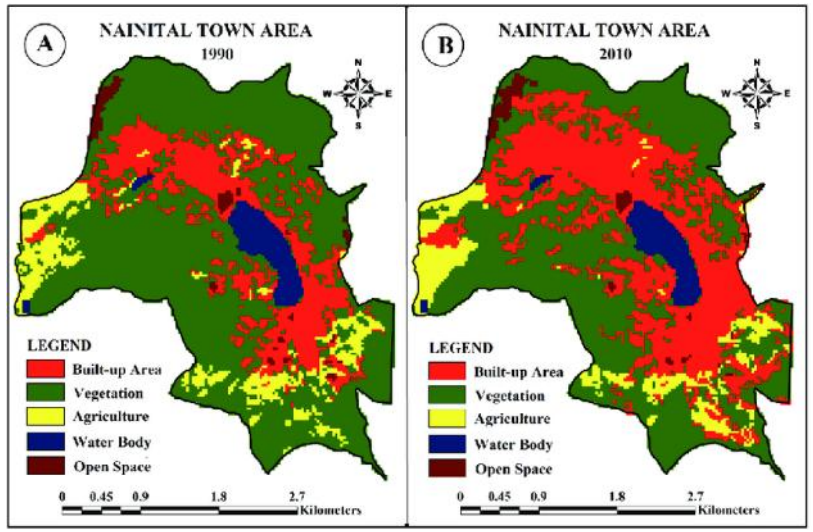
NAINITAL

Lake
Peak season demand
and supply gap 10%



CASE STUDY – NAINITAL

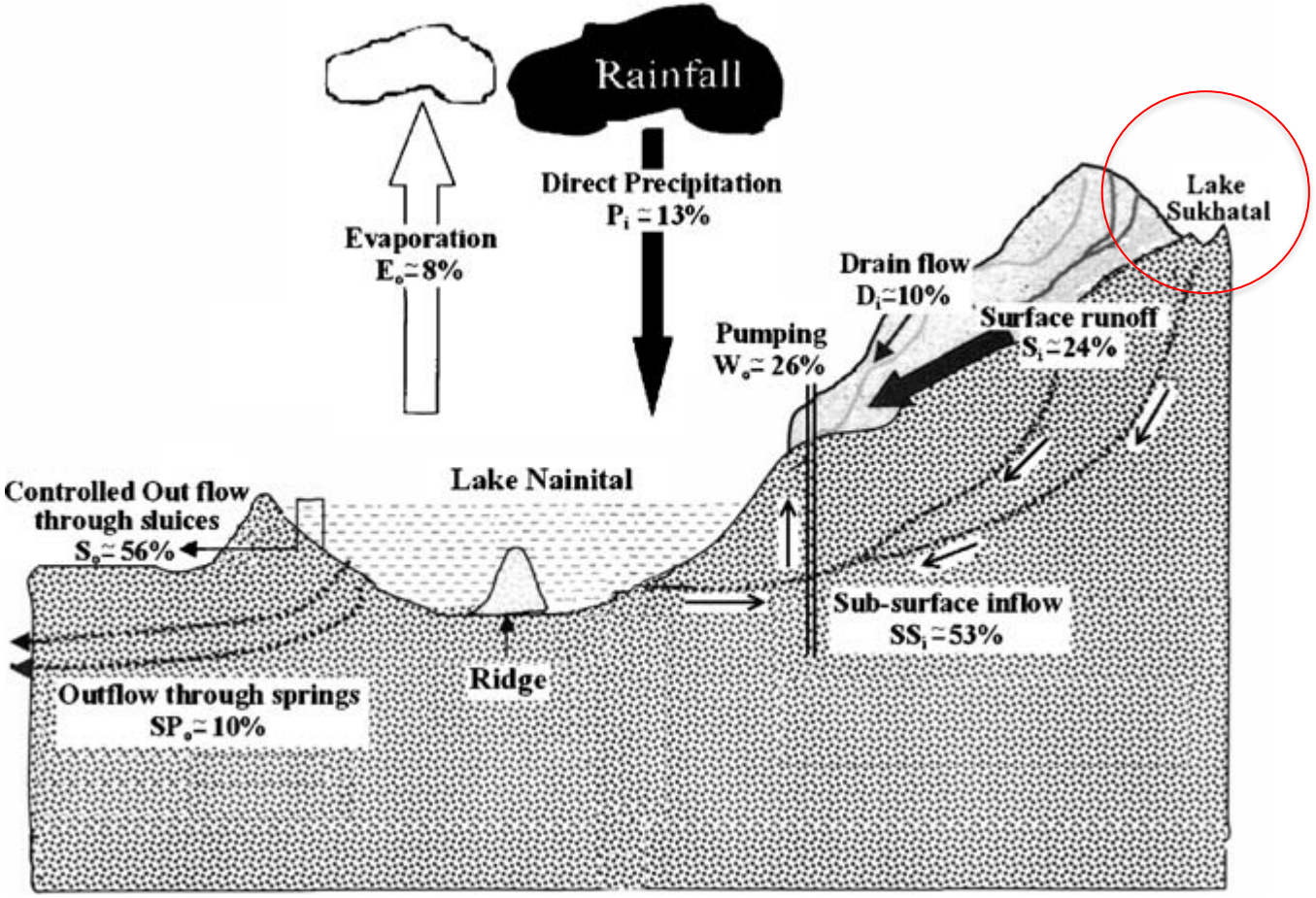


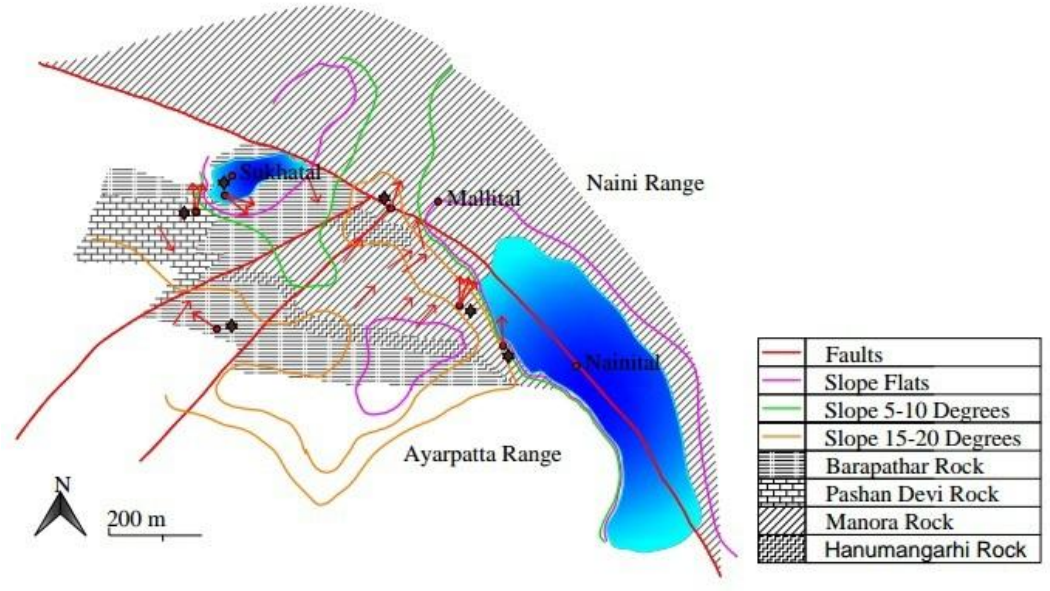


Rawat *et al* 2013

- A Small tourist town with a population of 42,000
- Economy of the town revolves around a 48 hectare water body which is supported by the catchment (3.49 km²) and sub catchments, majority of drinking water is derived from the lake, previously springs
- Old growth Forest*

WATER BALANCE





SUKHATAL



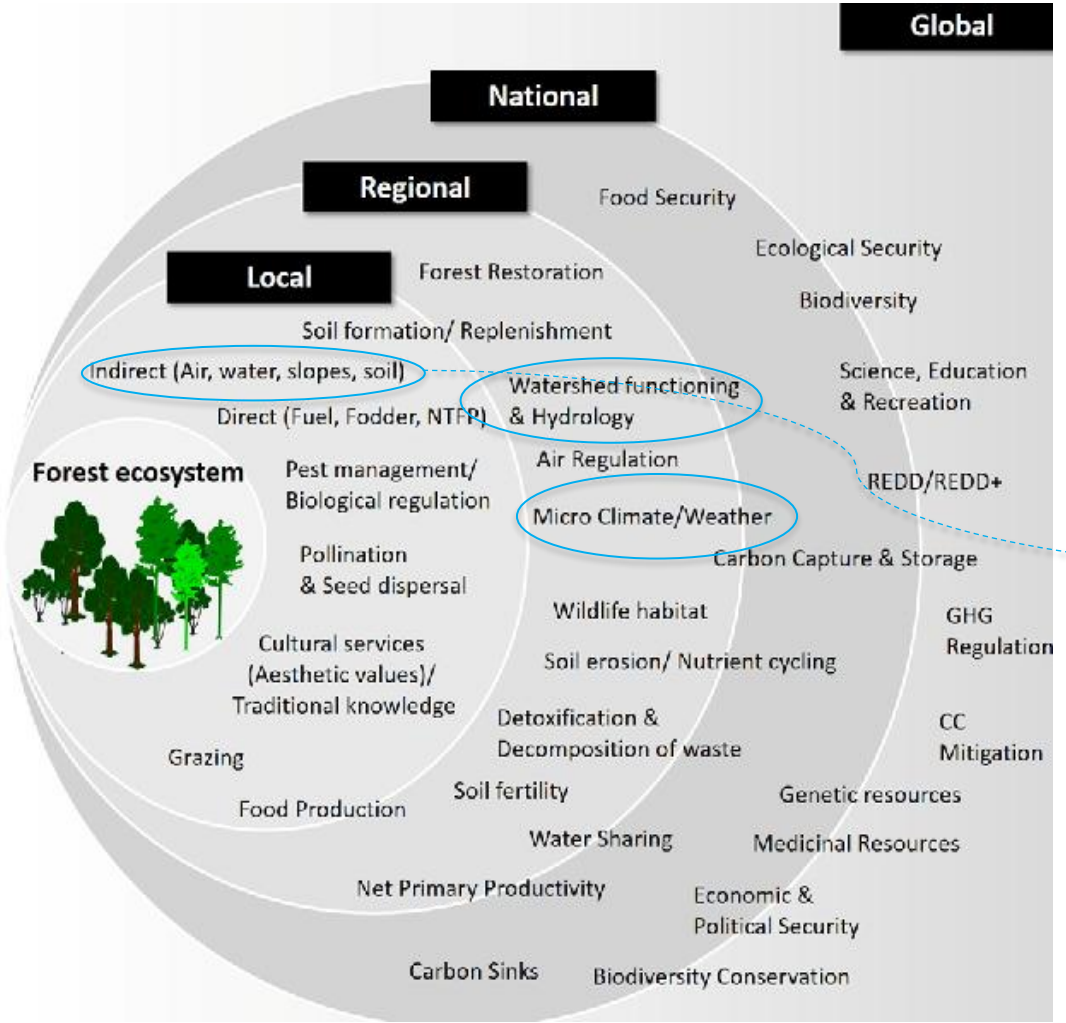


NAINITAL AND FORESTS



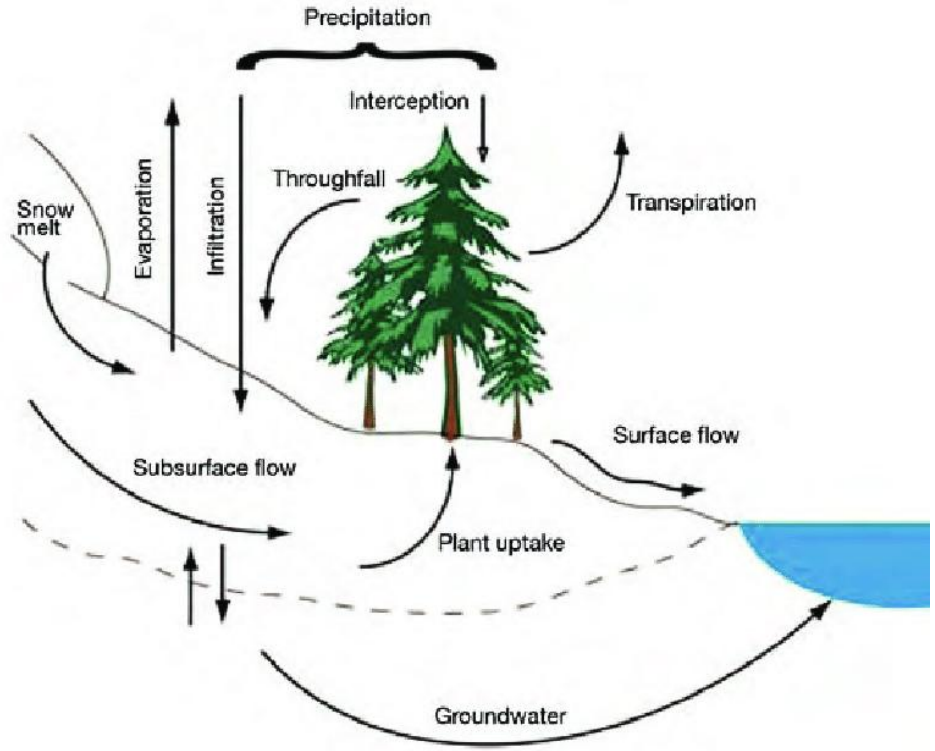


ROLE OF FORESTS

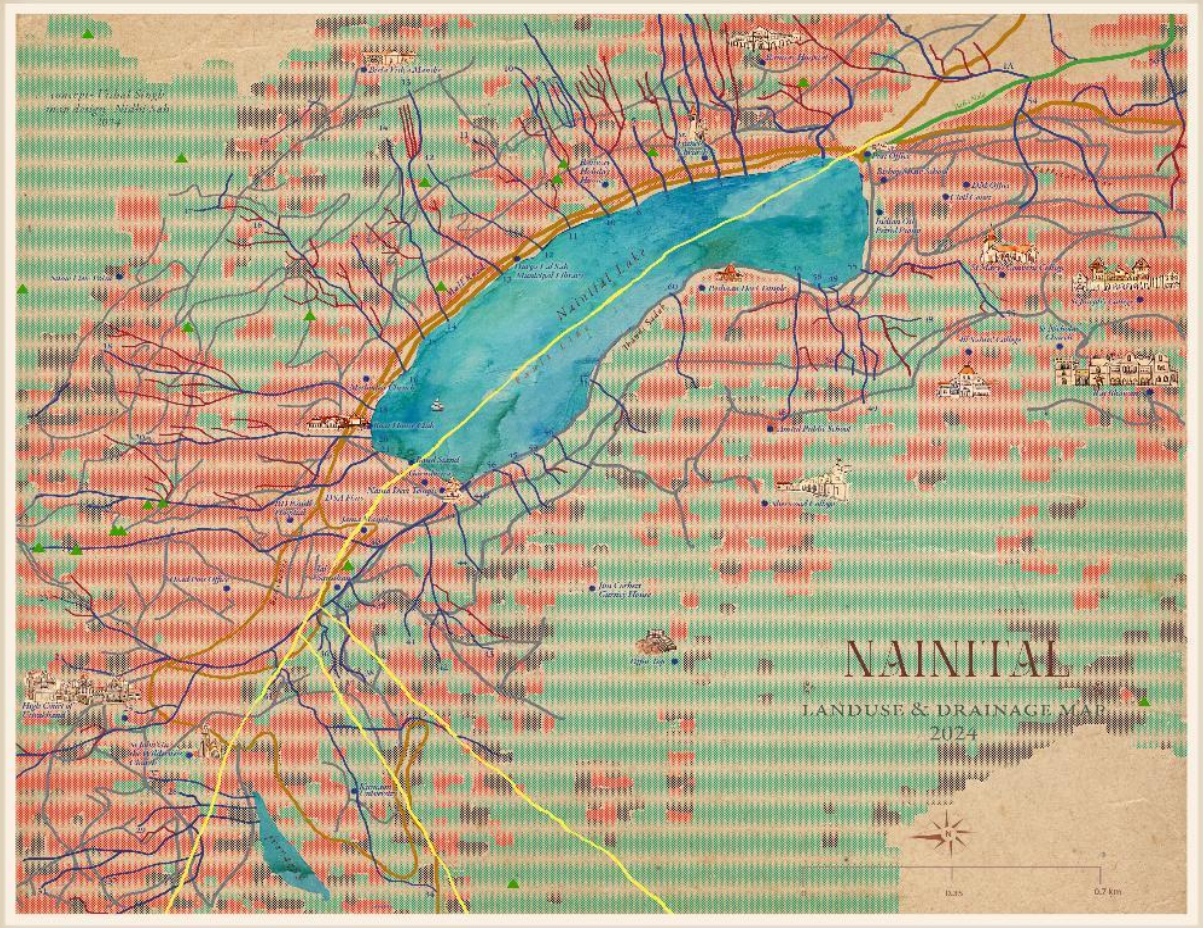


Joshi and Joshi 2019

Joshi and Joshi 2019



Walker et al 2008

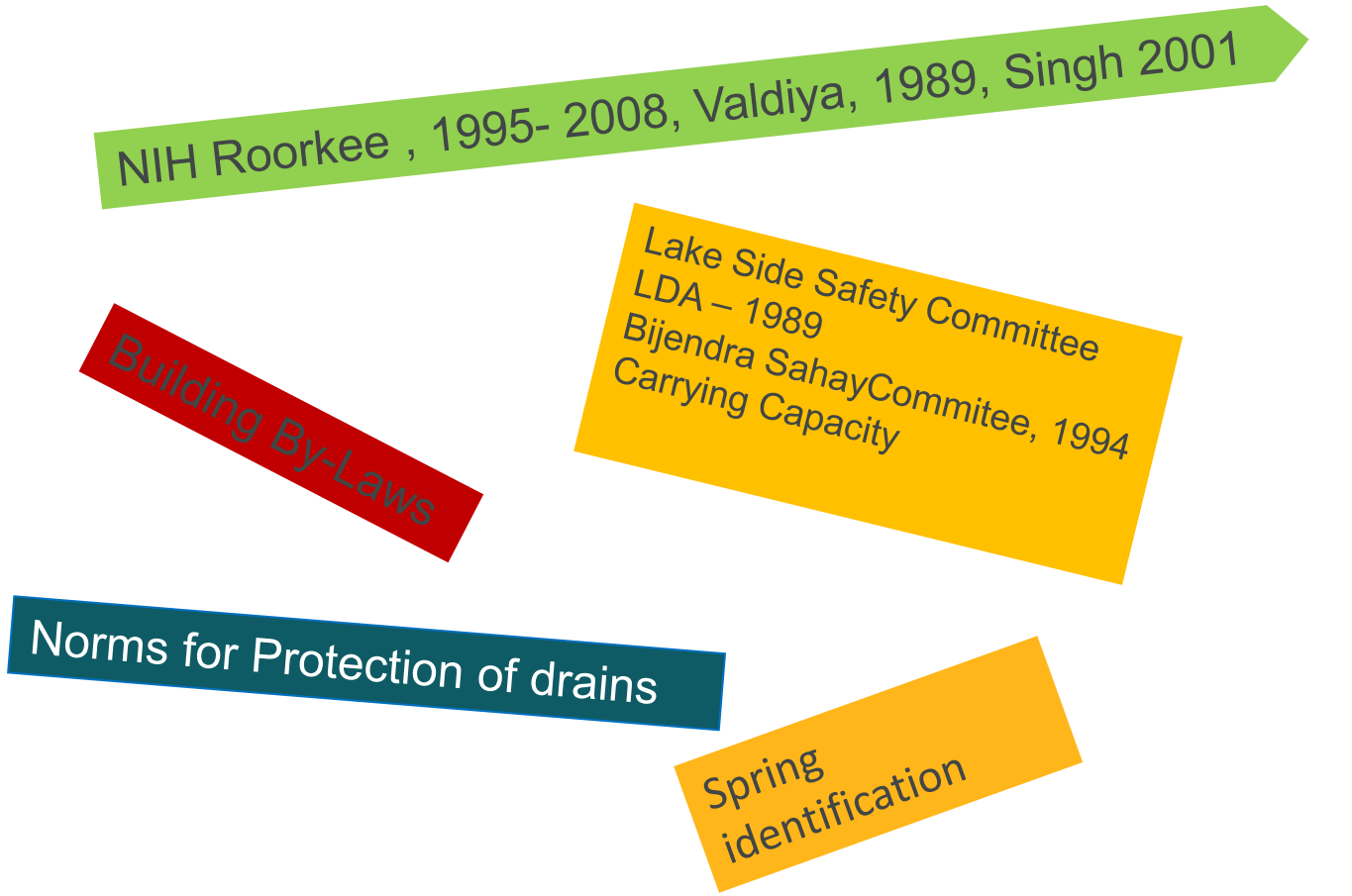




79 Km Drainage Network

SIGNIFICANCE AND APATHY

- About 1.75 ha , an ephemeral lake
- 400 m (L) 200 m (w)
- 8 m deep
- Remains filled with water 4 months
- Paying ground for the rest of the months
- 10 % drinking water to the town
- High infiltration rate, Valley fill – underlying karst topography



AFTER ALL THE INGREDIENTS



Sukhatal Lake bed 2006



Sukhatal Lake bed 2014

CONSEQUENCE

- The lake level plummeted by **18 ft below zero level** – as early as January
- **10 times** since 2000 onwards
- in the 20th century 2 twice 1923-1980



Major recharge zone providing 40-50 % subsurface flow to Naini lake



Excessive withdrawal 12 pumps

Low winter rainfall

Pre monsoon drought

Increased Evaporation

SCIENCE IS NOT ENOUGH

Stakeholder meetings → Validation through expert meetings → Strategic communication → Collaboration

PIL filed → Immediate steps → Sukhatal ignored

REMOVAL OF CONSTRUCTION OVER THE DRAINS





*More than **500 people** were living in the hotels*

MAJOR CHALLENGE WAS SUKHATAL

Knowledge – deficit model

Effective transmission of scientific knowledge to non experts

Translational ecology

Intentional processes which researchers, decision makers and stakeholders work together via join consideration of social, environmental and political context



PROCESSES

- Creation of Citizens for Nainital group
- Social media platforms
- Print and electronic media
- Strategic engagements with top level politicians and bureaucrats
- Identification of local leaders

Meanwhile, DPR commissioned -



Convert Sukhatal into a artificial lake



Restaurants – boats etc

NEXT STEPS









Citizens wrote to Honorable Chief Justice – Suo Moto Cognizance was taken.

STRATEGIC MEETINGS

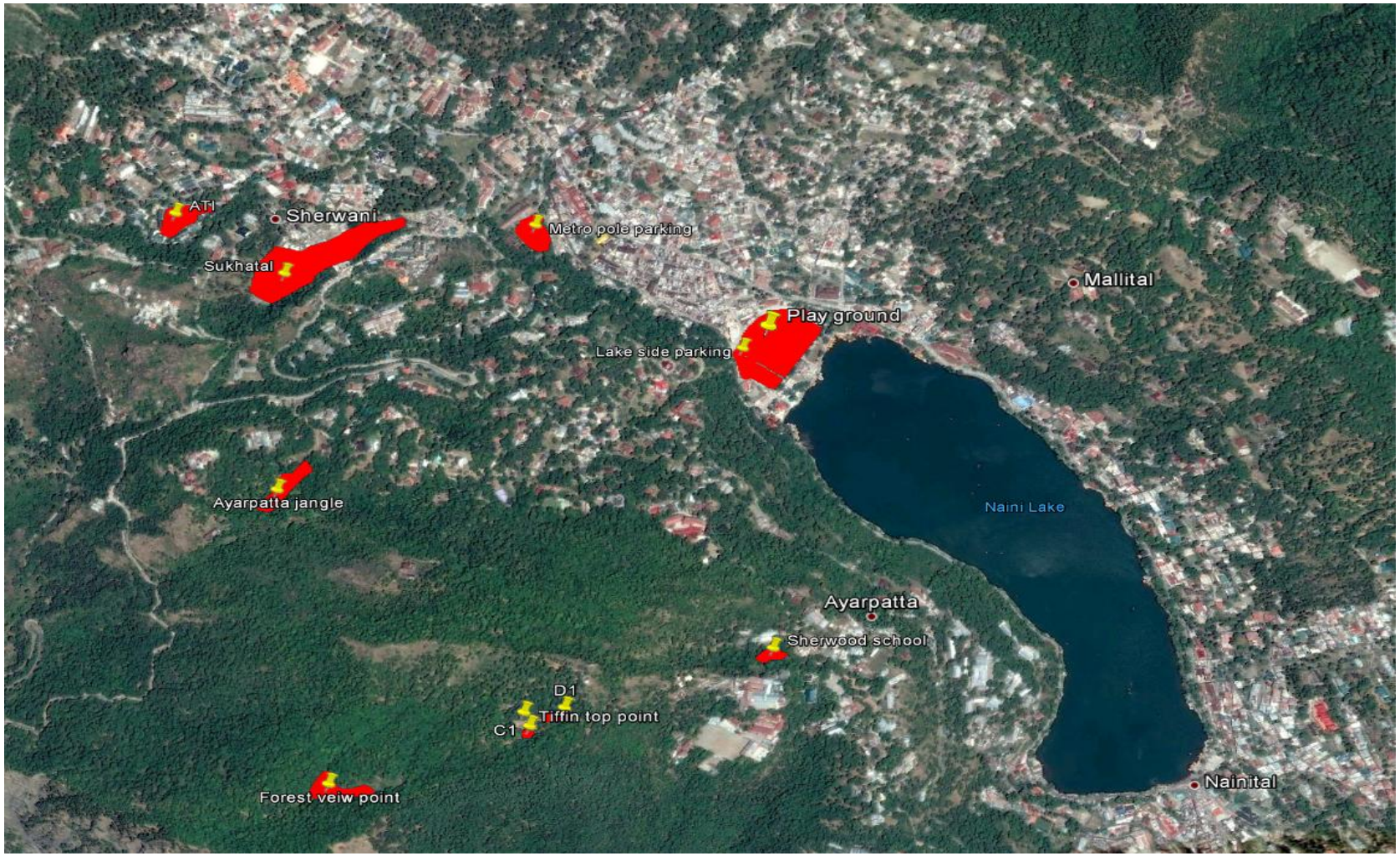


Meeting Honorable Governor, CM, CS and Principal Secretaries



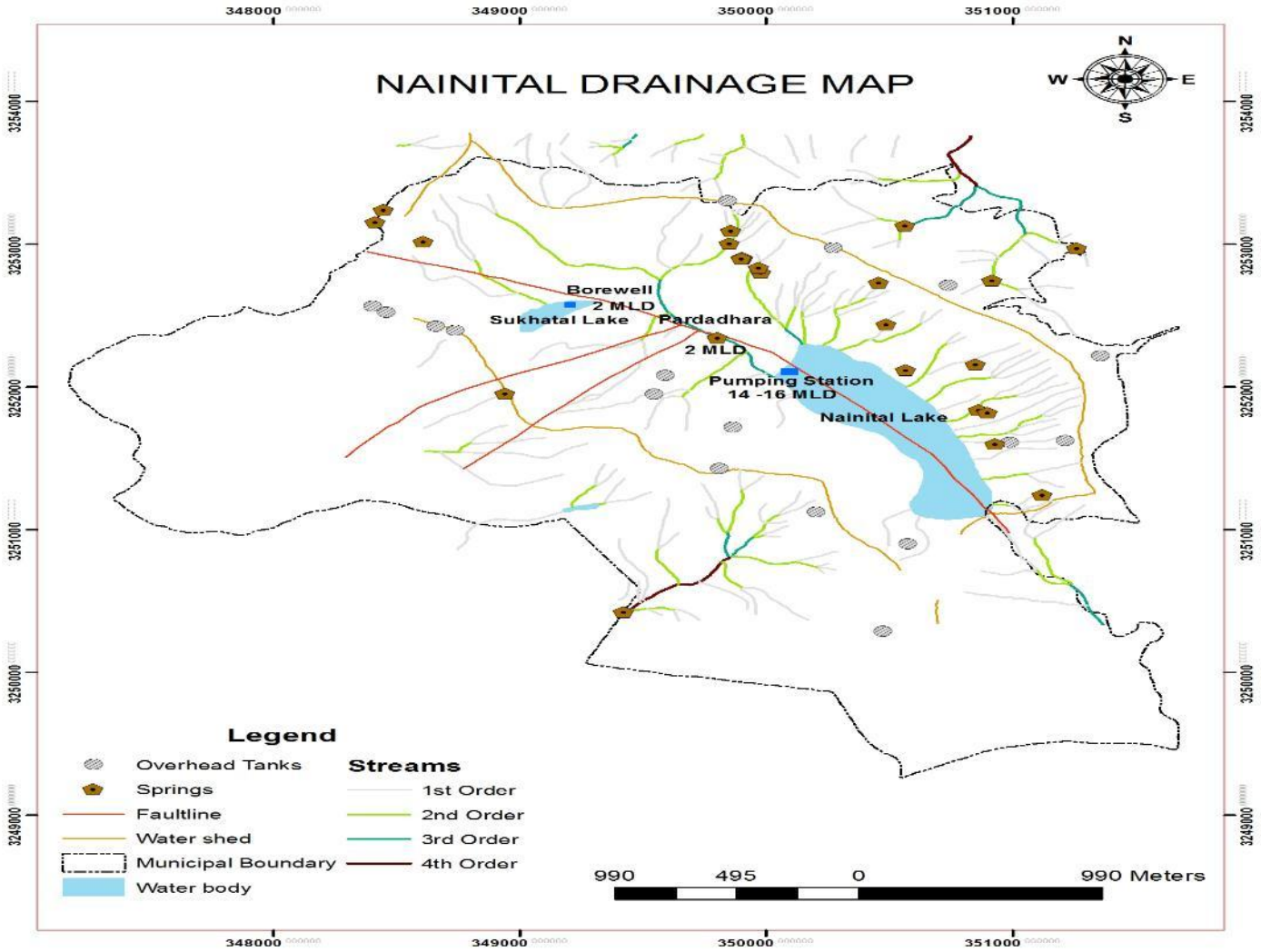
Citizens and Concerned

RECHARGE ZONES DELINEATED AND MARKED



S.No.	RECHARGE AREA	km^2
1.	Staffhouse *	1,691
2.	Birla Vidya Mandir	6,155
3.	Golf Course*	15,707
4.	Governor House	15,546
5.	Forest View Point	3,162
6.	Tiffin Top*	812
7.	Sherwood Parking	945
8.	Ayar Jungle	3,078
9.	Sukhatal	21,467
10.	ATI	3,860
11.	Metropole	3,793
12.	Flats	22,163
	TOTAL	**99,067**

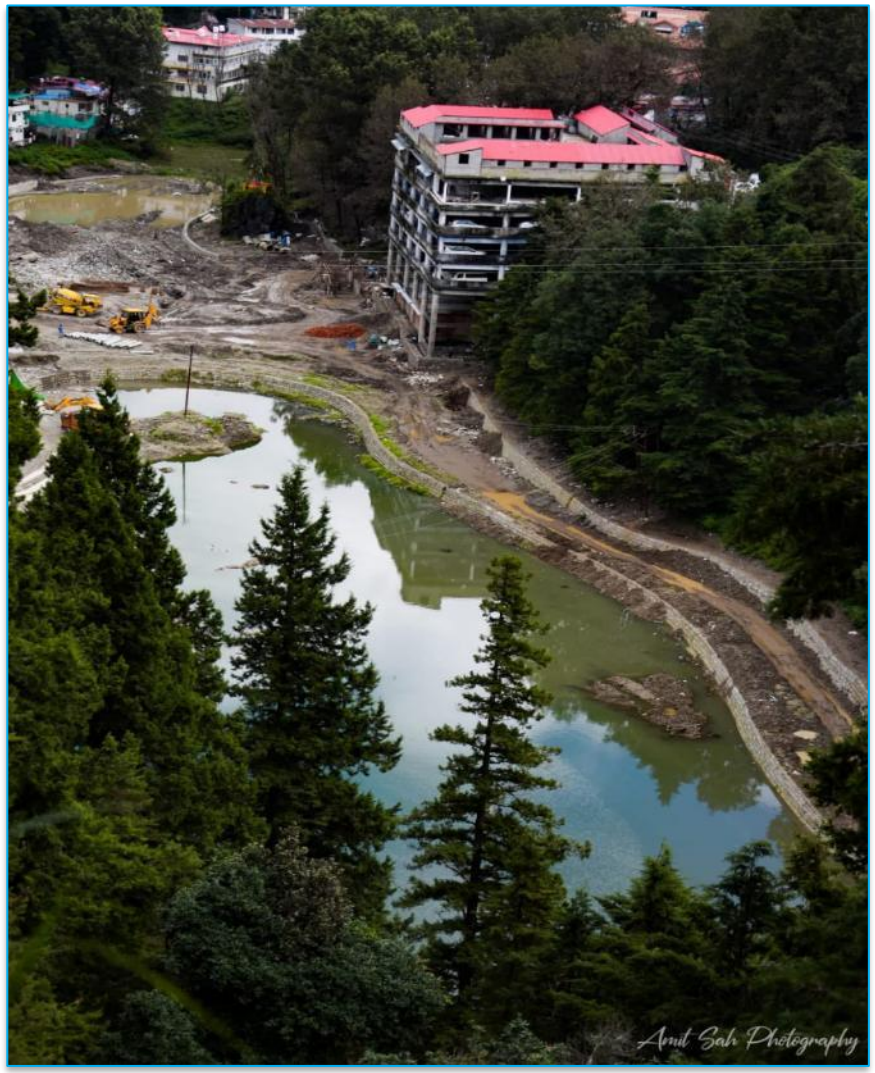
SPRINGS



Short, Medium and Long Term

- **26 cr** released for rejuvenation of the Sukhatal
- Water roistering started from February – only **8 mld – 18 mld**
- Hill side safety committee revived
- Irrigation department complete responsibility of lake

SUKHATAL TODAY



A lot has been lot, despite revival efforts Sukhatal struggles to revamp its ecological and hydrological significance!

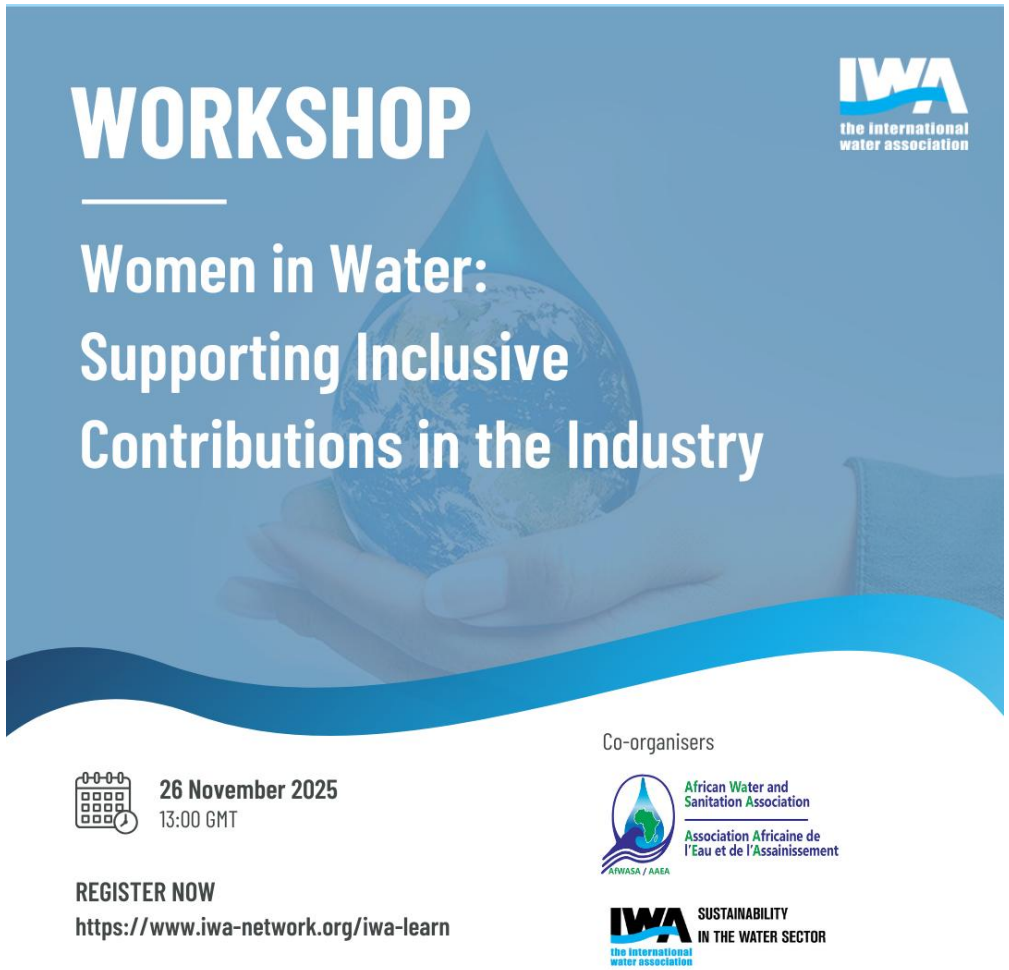
Nevertheless, These processes provide hope and direction to save other natural ecosystems – if timely action is taken

Thank you for your patience!

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