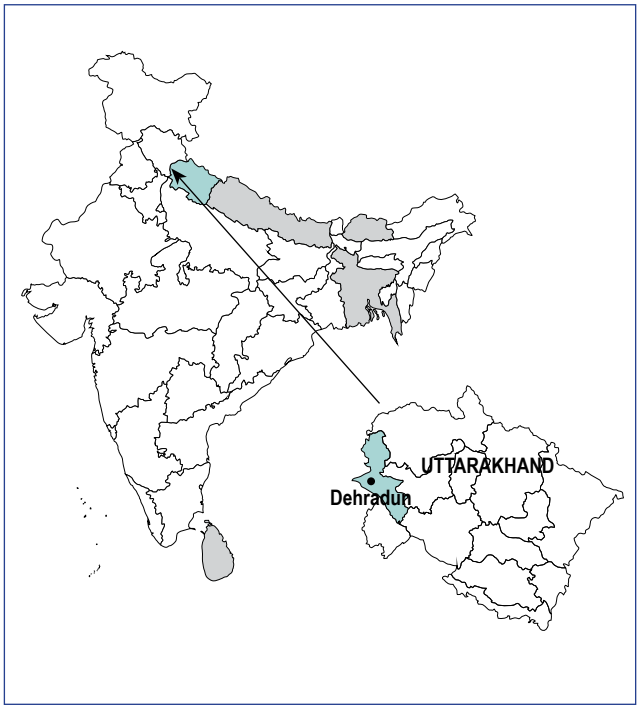
City Resilience Strategy: Dehradun

Dehradun, one of the oldest cities of India is the capital city of Uttarakhand since the year 2000, when the state was formed. It is situated in Dehradun district at 31°19'N and 78°20'E and is bound physically by the seasonal Rispana River and Bindal River, on the east and west respectively.

A number of reputed institutes are located in Dehradun such as the Forest Research Institute, Indian Institute of Petroleum, Oil and Natural Gas Corporation Ltd., and Survey of India. The city currently has a population of around 569,000, contributing to a high urban growth rate in the state. It has emerged as the leading business centre in the Garhwal region. Summer temperatures fluctuate between 36°C and 16.7°C, while in winter it is between 23.4°C and 5.2°C. Dehradun is one of the rainiest capital cities of India, receiving around 2,865 mm of rainfall and is prone to multi-hazards like heavy rain, cold wave flash flood and landslides.



Climate Risks

The two major future climate risks identified through the ICLEI ACCCRN Process (IAP) for Dehradun are:

Changing Climate Conditions	Climate Scenario Summary Statements
High intensity rainfall	The annual rainfall in the Himalayan region is likely to vary between 1268±225.2 mm and 1604±175.2 mm in 2030s. The projected precipitation is likely to increase by 5% to 13% in 2030s with respect to 1970s. It is also projected that there will be an increase in intensity of rainfall by 2-12% in the Himalayan region by 2030.
Increased temperature	The mean annual temperature is projected to increase from 0.9±0.6°C to 2.6±0.7°C in the 2030s. The net increase in temperature ranges from 1.7°C to 2.2°C with respect to the 1970s. Temperatures also show a rise in all seasons.

Photo credits: ICLEI South Asia

Vulnerability Assessment

The fragile urban systems and their corresponding climate fragility statements for Dehradun are:

Fragile Urban Systems	Climate Fragility Statements
	• Increased demand of potable water and depleting fresh water sources may lead to further water stress.
	• May alter waste decomposition rate and leachate production rate leading to the spread of infectious diseases.
	• Will result in water logging, leading to the proliferation of water and vector borne diseases particularly in lower income areas and slum pockets.
	• Will lead to the increased chances of landslides, floods and water logging within the city. These will have significant repercussions on the water table, infrastructure and health within the city, especially in areas with poor drainage infrastructure.
	• May accelerate deterioration of road infrastructure (causing pot holes and loss of surface) and increased maintenance cost.
	• People may be discouraged from using overcrowded, limited, public transport, leading to greater usage of private vehicles and greater traffic congestion. This is likely to increase impacts of pollution as well as discomfort during summers, especially for two wheeler passengers.

Through the vulnerability assessment, the adaptive capacity of the key actors identified in the IAP was scored based on three parameters: capacity to organize and respond, availability of resources, and access to information. Actors who receive a low adaptive capacity score are classified as vulnerable while those who receive medium and high scores are classified as supporting and can aid the local government in resilience building activities. The table below presents an overall analysis of actors across the different fragile urban systems.

Actor Analysis for Dehradun City

Vulnerable Actors	Supporting Actors
• Slum Population • Sanitary workers • *Kabadiwalas* • Small Shop owners • Uttarakhand Transportation Department • Town and Country planning • Ward Councillor • Tourists	• *Swacchta* Committee • NGOs • Urban Development Department • Asian Development Bank • Uttarakhand Pey Jal Nigam • Uttarakhand Jal Sansthan • Public Works Department • Regional Transport Office • Traffic Police • Transportation Department

Dehradun Nagar Nigam the municipal body scored both as a supporting and a vulnerable actor across different urban systems. It mostly suffers from poor manpower and resources.

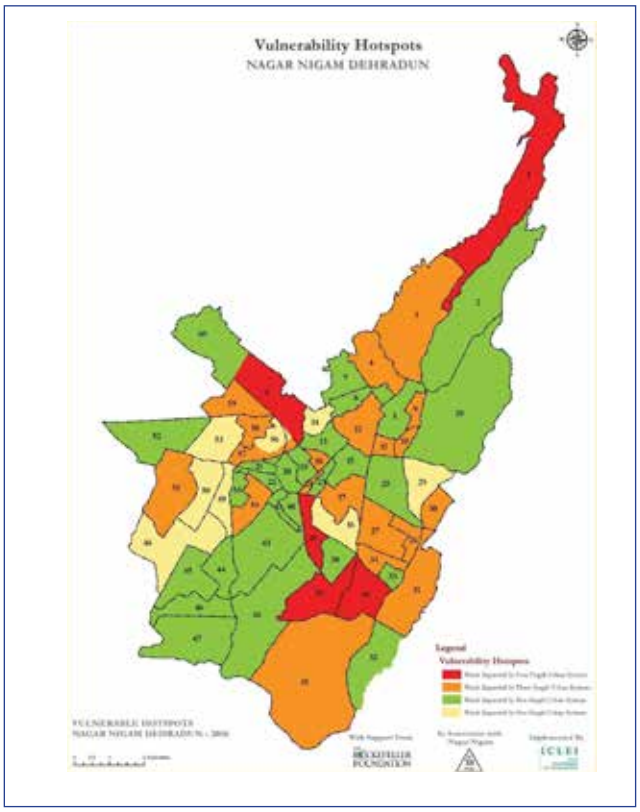
The adaptive capacities of the fragile urban systems are assessed on the basis of five broad categories – economic, technology/ infrastructure, governance, social, and ecosystem services. Each of these five categories was rated as high/medium/low and averaged across all the urban systems to generate an overall score for each parameter in the city as detailed in the following table.

Overall Adaptive Capacity of Systems in Dehradun City

Adaptive Capacity Parameters	Adaptive Capacity Score		
	Low	Medium	High
Technological/ Infrastructural			
Economic			
Governance			
Societal			
Ecosystem services			

Although the vulnerability assessment shows that a large proportion of the city is vulnerable to all five urban systems, it was decided through a discussion with the climate core team and stakeholder committee that wards 36, 37 and 39 are the most vulnerable to all five fragile urban systems due to the varied topography representations and the vulnerable populations (refer map).

Among the softer and policy interventions identified through the IAP, awareness generation activities on water conservation, management and disposal of solid waste, and prevention of littering in drains could be taken up, along with policy changes for taxing private vehicle use to promote public transport use. In case of infrastructural measures, improvement of water treatment and distribution systems, decentralized systems of rain water harvesting, solid waste collection and disposal, waste water treatments were identified as important. Rejuvenation of natural springs and regular maintenance of drains were also identified as important interventions for the city's natural resources. Promotion of non-motorized transport and electric vehicles were among the measures identified to improve the condition of local transportation in the city.



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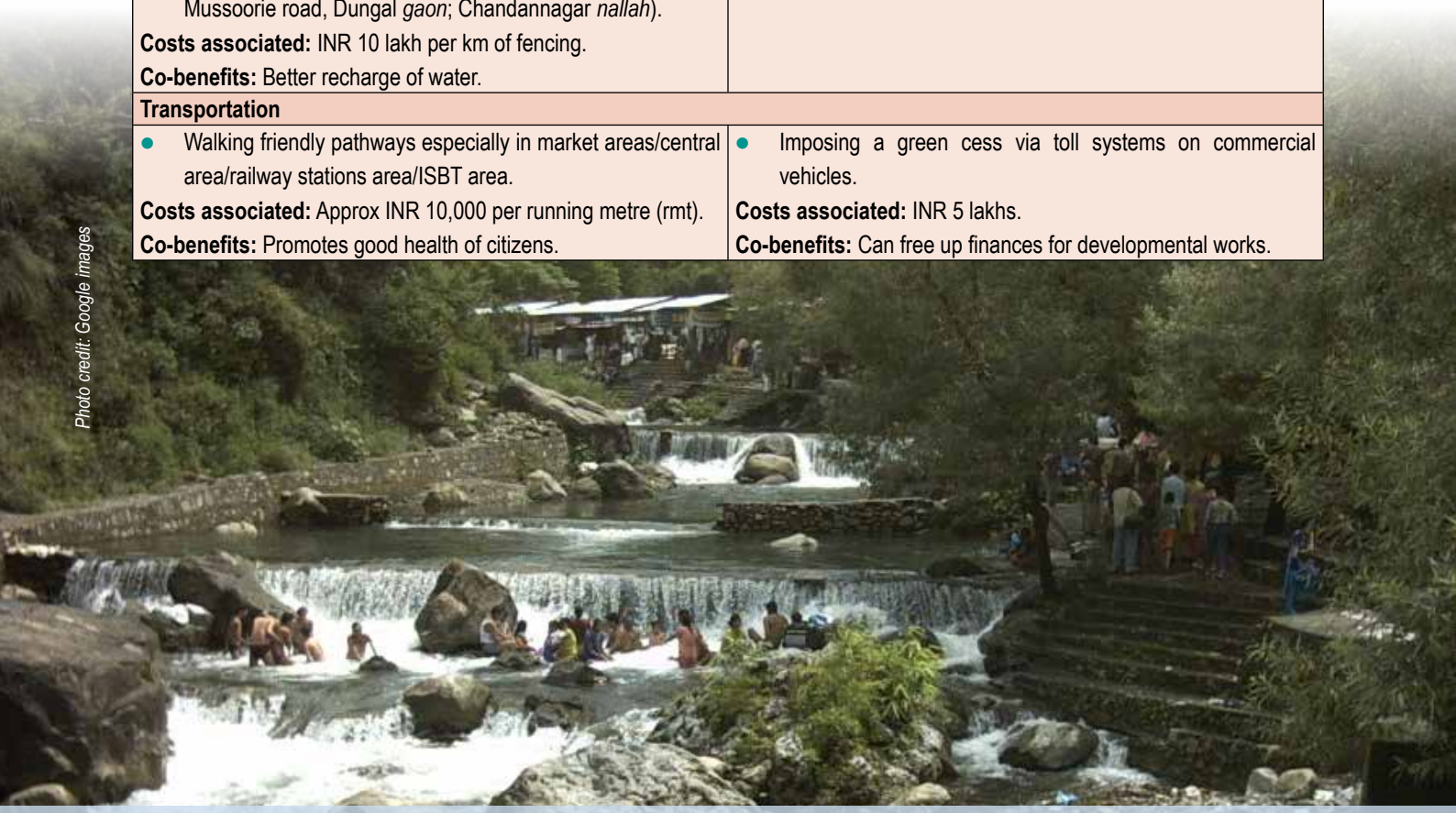
Key Interventions Identified for Dehradun City

Infrastructural Measures	Non-Infrastructural/ Policy Measures
Solid Waste Management	
• Adoption of decentralised waste management system for inaccessible areas. Segregated wet and dry waste can be collected every alternate day using a waste bag/basket carried on the back of the sanitary worker from each household. Organic waste and recyclables can be processed insitu. **Costs associated:** INR 10 lakhs per unit. **Co-benefits:** Livelihood options.	• Setting up community based mechanisms as a means of enforcement of the solid waste management rules, 2016. Community (students, volunteers, retirees) reports mal practices (littering, dumping and burning and segregation) to the authority. **Costs associated:** INR 5 lakhs per community - for training and materials. **Co-benefits:** Better governance.
Water Supply	
• Rejuvenation of natural water springs (*Khuls*). **Costs associated:** INR 10 lakhs per *Khul.* **Co-benefits:** Better soil conditions with water conservation.	• Byelaw passed to ban the construction and use of individual bore-wells. **Costs associated** (enforcement of the law will need monitoring, which will entail staff costs): INR 5 lakhs per year.
Sewerage	
• Biodigester toilets in inaccessible areas where a central sewerage connection not possible. **Costs associated:** INR 1 lakh per toilet. **Co-benefits:** Livelihood options, reduced pollution of water.	• Septage management guidelines to be developed. **Costs associated** (Cost of consultants): one time cost of INR 5 lakhs.
Drainage	
• Fencing of open khals(example ward 1- Sanshi ashram, old Mussoorie road, Dungal *gaon*; Chandannagar *nallah*). **Costs associated:** INR 10 lakh per km of fencing. **Co-benefits:** Better recharge of water.	
Transportation	
• Walking friendly pathways especially in market areas/central area/railway stations area/ISBT area. **Costs associated:** Approx INR 10,000 per running metre (rmt). **Co-benefits:** Promotes good health of citizens.	• Imposing a green cess via toll systems on commercial vehicles. **Costs associated:** INR 5 lakhs. **Co-benefits:** Can free up finances for developmental works.



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