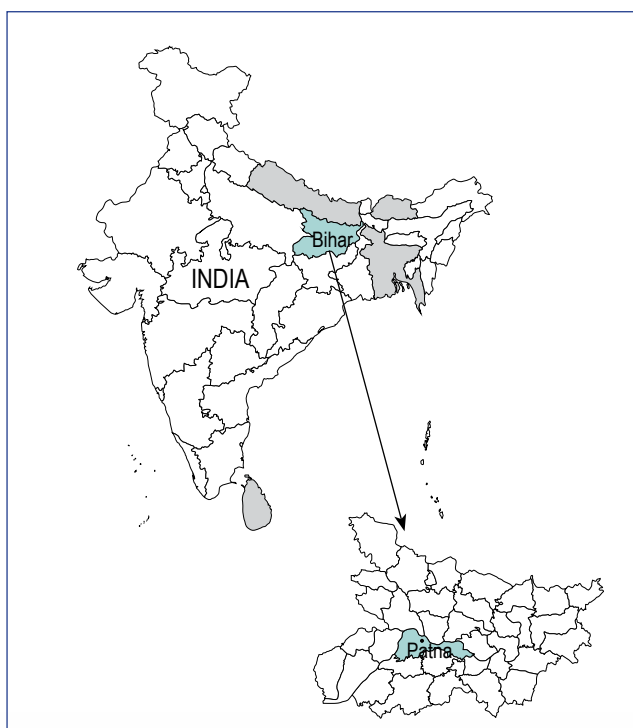


City Resilience Strategy: Patna

Patna, the capital of Bihar, is the second largest city in eastern India after Kolkata. The city is situated on the southern bank of the Ganga and is also traversed by four other rivers Ghaghara, Gandak, Punpun and Sone. The city has major historical significance, and is a pilgrimage site for both Buddhists and Sikhs. The current population estimate is around 1.68 million making it 19th largest city of India. The city is an important commercial centre with major commercial establishments located in it.

Patna has four distinct seasons viz. Summer, Monsoon, Autumn and Winter. It receives rainfall both from the Southwest and Northeast monsoons. Patna City is located in Seismic Zone IV, which is a high-risk zone. It also falls in the risk zone of floods and high wind damage.



Climate Risks

The two climate risks identified through the ICLEI ACCRN Process (IAP) for Patna are:

Changing Climate Conditions	Climate Scenario Summary Statements
High intensity rainfall 	Future projected change in June July August rainfall (cm) during 2011-2040 with respect to 1961- 1990 in RCPs of 4.5 and 8.5 scenarios shows a deficit of 5% in South and Western Bihar (where Patna is located).
Increased temperature 	Future projected change in the annual temperature (°C) during 2011-2040 with respect to 1961-1990 in RCPs of 8.5 shows changes of 0.8-1.9°C. Future projected change in Tmin (°C) in December-January during 2011-2040 with respect to 1961-1990 shows changes of 0.2-1.0°C.



Vulnerability Assessment

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

Fragile Urban Systems		Climate Fragility Statements
		May alter waste decomposition rate and will lead to a greater degree of health hazards as open dumping of waste provides a breeding ground for the spread of diseases.
		May lead to increased risks of ground and surface water contamination and unsanitary conditions, which impact health.
		Can facilitate the release of noxious gases and foul odour from stagnating sewage and allow for the proliferation of harmful microorganisms.
		May lead to overflow of existing sewerage lines and result in proliferation of water and vector borne diseases, particularly in lower income areas and slum pockets.
		Will affect the flow of storm water because of decreased capacity resulting from excess silt and solid waste. This increases the probability of flooding and combined sewer overflow during rainfall events.
		May lead to increased use of private vehicle in order to maintain comfort which may lead to more traffic congestion and more GHG emissions.
		May accelerate deterioration of road infrastructure (causing pot holes & loss of surface), contributing to increased maintenance cost and an increase in traffic congestion.

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 Patna city

Vulnerable Actors	Supporting Actors
- Low and Medium Income Group - Hotels/private offices - Tourist/pilgrims/floating population - Slum dwellers especially those on river bank and near major city <i>nallahs</i> (drains) - Hawkers - Patna Municipal Corporation (PMC)	- Bihar Rajya Jal Parishad - Patna Jal Parishad - Public Health Engineering Department - Public Works Department - Industries - Bihar State Sanitation and Water Mission - Bihar Urban Infrastructure Development Corporation Ltd. - Bihar State Road Transport Corporation

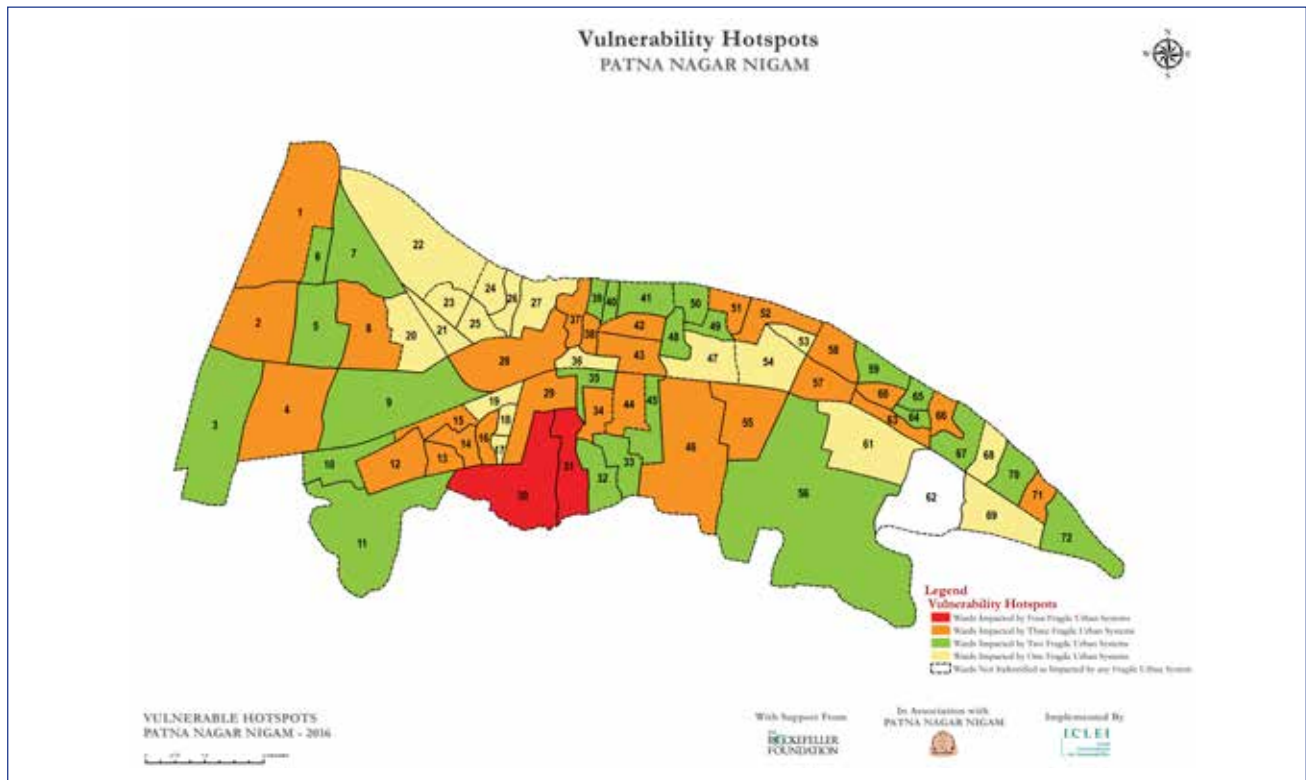
PMC, which is the administrative body of the city, scored low in the analysis due to a lack of financial resources and poor capacities for planning and management that hinder its ability to take relevant action on climate change.

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 Patna City

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

The vulnerable area assessment shows wards 30 and 31 as vulnerable to all four fragile urban systems (refer map). These are the third and second most populous wards in the city of Patna respectively.



Under solid waste management, infrastructural measures identified through the IAP, such as improvement of vehicles, use of efficient and clean fuels, better routing of vehicles, as well as decentralised treatment systems would be useful for the city. It is imperative that the city prepares a comprehensive integrated solid waste management plan through the critical assessment of the baseline situation. Decentralised systems for sewage treatment are also

recommended. Recycling and reuse of waste water would be very useful to the city. Transportation is a priority sector which is to be addressed to reduce GHG emissions. Introduction of a Compressed Natural Gas fleet, construction of non-motorized lanes, provision of dedicated parking areas and promotion of walking and cycling through better facilities are some of the initiatives that can be taken in this direction.



Key interventions identified for Patna city

Infrastructural Measures	Non-Infrastructural/ Policy Measures
Solid Waste Management	
Regular maintenance of solid waste management vehicles to ensure efficient fuel consumption and reduced emissions. Costs associated: Regular maintenance of a 3 MT capacity <i>ghantagadi</i> requires at least 20,000 INR per annum. Co-benefits: Overall savings in fleet management.	Preparation of a city-wide Integrated Solid Waste Management Action Plan. Costs associated (Cost of consultant, baseline information collection): INR 17-20 lakhs.
Sewerage	
Develop strategies for localised use of recycled water for non-potable & non-contact use. Costs associated (Developing bye laws for the re use of waste water and enforcement of the same. It would require regular training, capacity building for the municipal staff and awareness in general public): INR 5 lakhs per annum. Co-benefits: Reduction in demand for fresh water supply.	Strengthening institutional and technical capacity of city staff for effective operation and maintenance of sewerage system and for recycling and reuse of waste water for non-potable uses. Costs associated (Trainings for municipal staff): A three day training programme would cost approximately INR 2 lakhs. Co-benefits: Improved competence and technical know-how.
Storm Water Drainage	
Developing drainage networks in slum areas so as to reduce the exposure of the urban poor to water logging and related health impacts. Costs associated: Approx INR 16 crores per km. Additional data needs to be collected. Co-benefits: Improvement in living conditions in slum areas with livelihood benefits to the poor.	Public awareness campaigns to discourage the disposal of solid waste (including food waste) in storm water drains. Costs associated (Cost of IEC materials, publication costs, staff costs, training, meetings, logistics): INR 1.5 lakhs per awareness drive. Co-benefits: Can be used for other systems together; improved solid waste management; health benefits due to increased cleanliness.
Transportation	
Provision of pedestrian zones to encourage walkability in selected areas. Also to make few routes one way in order to channelize the traffic movement in efficient manner. Costs associated (INR 1,200 per square meter for tiles for the footpath. A 5 km long pedestrian zone to be developed as pilot.): INR 180 lakhs. Co-benefits: Improved quality of life of citizens.	Improved traffic management systems e.g. regulation of traffic flow to avoid congestion. Costs associated (Cost of doing a activity survey to know how pedestrians are navigating across the area, map based surveys to record the position of hawkers, pedestrian counts at major junctions, land use survey to know the demand or potential demand for parking, why and when there will be more demand etc.): INR 15 lakhs. Co-benefits: Public safety enhanced.

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