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{ CITIES AND WEATHER EXTREMES } PART 1 OF 3

Staying afloat: Lessons from flood-prone cities

Mitigation of and adaptation to weather extremes are a tall order for administrations at the local level because of unpredictability of climate variability, and their own constraints. Despite challenges, some cities are working to reduce vulnerability to these changes.

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NEW DELHI: Every time a major metropolis gets flooded the way Chennai did in early December, questions are raised about the inadequacy of the government's response or preparedness. There is consensus that Indian cities have grown rapidly and unplanned, swallowing floodplains, green spaces, and water bodies alike. This is coupled with the encroachment of stormwater drains or lack of adequate drainage — one reason for recurrent floods. Like the cause, the remedy, in the form of removing encroachments and blockages, building new drainage networks, and creating new blue and green spaces to decrease rainwater run-off, however inconvenient and cost-intensive, is also well understood.

But as the frequency of extreme weather events increases, cities are failing to catch up. Climate resilience experts suggest that while mitigation and adaptation efforts need to be sustained for longer

periods, cities must simultaneously respond swiftly once a disaster hits. "No city can be practically climate-proof overnight. There's a need to develop a swift response mechanism including early warning system based on weather predictions and readily available data and technology," said Victor Rana Shinde, who leads the Climate Centre for Cities at the National Institute of Urban Affairs (NIUA), under the ministry of housing and urban affairs.

In this direction, several Indian cities including Chennai are harnessing data and technology to predict, prepare for, and manage natural disasters by using their Integrated Command and Control Centres (ICCCs) commonly referred to as Smart City control rooms. Under the Union government's flagship Smart Cities Mission introduced in 2015, these ICCCs equipped with a network of cameras, sensors, and other interactive IoT (Internet of Things) devices were originally

introduced to increase transparency and efficiency in civic functions such as waste and traffic management, and policing. In the past two years, some of the designated cities have also started using these "smart systems" for disaster response, especially flood management. "The ability to adapt to emergent situations and be resilient in the face of crisis is a foremost quality for a city to be called a smart city," said Kunal Kumar, joint secretary at the ministry and mission director of Smart Cities mission, giving examples like these will act as models for other cities to follow.

Rajkot, in Gujarat, which narrowly avoided Cyclone Biparjoy in June when the storm changed its course, is one. "We were fortunate that we did not bear the brunt of the cyclone, but in the days leading up to the landfall, we made efforts to ensure that there were no hanging objects such as wires or tree branches on the roads, using nearly 1,000 cameras across 300 locations," said Chetan K Nandani, CEO of Rajkot Smart City. Nandani said sensors are placed at the Aji and Nyari dams as well as at elevated and ground-level reservoirs in and around the city. "Now, we receive clear, regular information regarding the quantity of discharge at each pumping station level, which



Hit by cyclone Michaung on December 4, Chennai received 470mm of rainfall in 48 hours, leading to a massive deluge. PTI

allows us to promptly identify if all the pumps are functioning properly or not. In the past, malfunctions could only be detected when the system became blocked at a particular location," said Nandani. "During times of heavy discharge from the dam, this real-time data proves invaluable for relocating people residing in slums on riverbeds and along canals."

Similarly, in Kochi, since the ICCC began operating, there has been smooth coordination among officials from various departments and their counterparts on the ground leading to better flood management, said mayor Anil Kumar. The city in mid-November installed sensors in five of its most flood-prone canals, as part of the

flood management expert Sakthivel Beemaraja said the "smart systems" proved useful, but only partially. "The active monitoring of the flooding situation in subways using the ICCCs helped save many lives. There were no instances of buses or cars getting submerged in the subways as seen in previous years."

Similarly, Krishna Mohan, chief resilience officer for Care Earth Trust, recalls that in 2015, the flooding disaster was exacerbated by the sudden release of water from the Chembarambakkam reservoir. This time around, he said, "Water levels in rivers and canals and reservoirs were being closely monitored, which has led to the release of water in a more well-informed and measured manner."

J Radhakrishnan, commissioner of the Greater Chennai Corporation, said using the granular weather prediction system of the ICCC, the administration issued warnings through public address systems and mass media almost on an hourly basis. "We evacuated people from low-lying areas using these data," he said. Another officer said distress calls to the helpline numbers were attended by 30 staff round the clock who in turn coordinated with officials on the ground. "All these helped in saving lives," the official added.

It was manageable up to a point, said officials, but as the

intensity of rains increased on December 4, the canals and drains carrying the rainwater reached full capacity. The situation was made worse by the sea pushing back floodwater under the influence of the cyclone, which stayed put off the Chennai coast, instead of moving north-east as expected.

Both Mohan and Beemaraja agree that the quantum of rainfall received by Chennai would have overwhelmed any city's drainage system and the immediate need was to reduce surface run-off. But Beemaraja pointed out that most of the rain gauges and flood sensors are concentrated in the city's core. An additional set of sensors and early warning systems that will be placed by next year in the upper catchment areas of the city is set to be deployed under the World Bank-funded Tamil Nadu Sustainable Urban Development Project, Beemaraja said. "The project was initially slated to be ready by October 2020. Once those sensors get synced with the existing system, it will help in better flood management."

Raj Bhagat, a GeoAnalytics expert, added that "short-term" forecasting can only add to the existing protocols for pre-emptive evacuation and rescue operations. "But they can't prevent harm caused to residences or livelihoods." Instead, he said, "there should be more emphasis on long-term forecasting using

the same set of tools that can identify areas that need immediate attention." Depending on the vulnerability, appropriate engineering, natural solutions or even rehabilitation should be planned in the long term. "That would be a more proactive approach of dealing with the problem rather than reacting to it," he added.

The Resilient Cities Index-2023 brought out by Economist Impact in November stated that despite the clear need for early warning systems, 33% of the entire population of the world lives outside such a system "with the most vulnerable disproportionately affected". To address inequalities prevalent in Indian urban areas, Jaya Dhindaw, executive director, sustainable cities at WRI India stressed the need to collect disaggregated data based on gender and socio-economic vulnerability. "A response road map can then be framed based on this information," she said, adding: "Cities that have ICCCs are accumulating substantial data. They are well poised to build use cases and use this data to analyse how conditions in an area have changed over time and as a decision-support system for policy inputs in the longer term."

In the face of the climate crisis, and with most plans catering to averages rather than extremes, this will be a challenge.



PICK OF THE DAY

The groundwater reality

Prima facie, the Groundwater Resource Assessment Report 2023, released early this month, presents a reassuring picture of the state of this vital natural resource, though its fine-print also reveals some disquieting aspects concerning its indiscriminate exploitation and quality degradation in several key agricultural belts and urban centres. The report shows that groundwater recharge and the amount of extractable water have increased while its withdrawal has decreased, thereby resulting in an overall improvement in the subsurface water regime.

This is a welcome indication, given that groundwater is the mainstay of irrigation and drinking-water supply in most rural and urban areas. It accounts for over 60 per cent of irrigation, 85 per cent of rural water supply, and 50 per cent of urban water consumption. Its extravagant use is making it scarce in many areas despite being a renewable resource. The replenishment of this aquifer occurs chiefly through rainfall; seepage from rivers, canals, ponds, and other water bodies; and the return flow of irrigation water. Measures being taken under various rainwater-harvesting and water conservation programmes, including the government's flagship Atal Bhujal Yojana, have also contributed to enhanced groundwater replenishment.

The Assessment Report, put together by the Central Ground Water Board with inputs from states, reckons the total water recharge in 2023 to be around 449.53 billion cubic metres (BCM), up 11.48 BCM, or 2.6 per cent, from 437.60 BCM in 2022. As a result, the amount of potentially extractable water has swelled from 398.08 BCM last year to 407.21 BCM this year. At the same time, the rate of water withdrawal has dropped from 60.08 per cent last year to

59.26 per cent this year, continuing the downtrend noticed since 2017, when it was 63.3 per cent.

On the downside, which is worrisome, groundwater in roughly 11 out of every 100 blocks is over-exploited. In some places, such as Jaisalmer in Rajasthan, and Sangrur and Malerkotla in Punjab, the withdrawal of groundwater is three times the annual recharge. On the whole, water extraction exceeds yearly replenishment in as many as 94 districts of different states, mostly in the major grain-growing tracts of the north-western, central and southern regions. Experts do not rule out the possibility of groundwater turning inaccessible in many of these areas in the foreseeable future.

Another report on groundwater, presented to Parliament by the standing committee on water resources in March 2023, has also highlighted several ills afflicting this resource. It pointed out that about 14 per cent of the groundwater assessment units across the country were overexploited while 4 per cent were categorised as critical. The

share of groundwater in irrigation is estimated by this panel at 80-90 per cent in at least 11 states, including Punjab, Haryana, Uttar Pradesh, Gujarat, and Rajasthan. Punjab leads the pack with this share being a massive 97 per cent. Water-guzzling crops, notably paddy and sugarcane, are predominantly grown in many of these areas. Heavy dependence on groundwater for meeting agricultural and domestic needs and the supply of free, or highly subsidised, power for irrigation are largely responsible for its excessive use.

That said, the dismaying fact also is that reckless tapping is not the only bane of the groundwater stock. Its contamination with toxic elements due to

geogenic (naturally occurring) and anthropogenic (caused by human activity) factors is also rampant. It has rendered groundwater unfit for drinking in many areas. Major health consequences have been reported from places where polluted groundwater is used for domestic purposes for want of access to clean water from other sources.

According to the parliamentary committee report, groundwater in 370 districts of 23 states has been contaminated with fluoride, while in 341 districts of 27 states, it has a high iron content. Besides, water in over 90 districts of 14 states has a menacingly high level of lead. In 230 districts of 25 states, groundwater contains highly hazardous arsenic. High salinity has also been observed in groundwater in 249 districts of 18 states. Significantly, the report names Delhi, Lucknow, Ahmedabad, and Hyderabad among the major cities affected by water pollution.

There is, indeed, no dearth of laws and regulations to promote sustainable use of groundwater and preserve its quality. The Centre has circulated a model Groundwater (Sustainable Management) Bill to serve as the guide for the states to amend their water-related statutes on the suggested lines. It provides for demarcating natural groundwater-recharging zones and the areas requiring special attention to deal with the problem of water salinity and toxicity. However, no more than 15 states have so far modified their local water laws. The need, therefore, is to enact and, more importantly, effectively enforce well-advised regulations concerning groundwater extraction and rainwater harvesting to improve the health of this vital natural resource. Also, the cultivation of water-intensive crops should be discouraged in the areas facing rapid depletion of groundwater. There is no room for any laxity on this front.

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FARM VIEW

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