

## Bengaluru: Pointers in plenty

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Excessive rain can be a water asset, stored for later use. For that, here's what government, community and individual must do

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Bengaluru's residents are unlikely to forget the dates of August 14 and 15, 2017, anytime soon. Unrelenting waterlogging and sewage flowing into houses are not experiences that are easily forgotten. The woeful state of the city's infrastructure is obviously a given, but there are lessons to be learnt as well.

The terrain

The city actually has a geographical advantage when it comes to floods. Bengaluru is located on a ridge straddling the river basins of the Cauvery and the Dakshina Pinakini, so it is not on a floodplain. There are three distinct valleys—the Vrishbhavathi valley, the Koramangala-Challaghatta valley and the Hebbal valley. Rainwater from the latter two forms the Dakshina Pinakini river which flows into the Bay of Bengal.

In the past, these valleys were dotted with 'tanks', artificial water bodies created by throwing an earthen berm over a narrow section of a valley. Each tank would overflow into the other through channels or *rajakaluves*. These brimming tanks were a prominent feature of the city. The tanks breached in times of heavy rainfall, but did not affect habitation built on higher land. Now, due to the pressures of urbanisation, many of the former tanks are filled up or diverted to other land use, often by the government. An example is the Sampangi Tank, which is now a stadium.

Urbanisation

The city has expanded dramatically both in population and size over the past few decades. T.V. Ramachandra and Bharath H. Aithal of the Indian Institute of Sciences have said that "urbanisation during 1973-2016 (100% concretisation or increase of paved surface) has had a telling influence on the natural resources, such as decline in green spaces (88% decline in vegetation), wetlands (79% decline), higher air pollutants and sharp decline in groundwater table."

Rapid urbanisation coupled with lax oversight has driven this encroachment on tanks and other low-lying areas. City waste has ended up in low-lying areas, choking stormwater channels and lakes, increasing the propensity for floods. Lack of adequate solid waste management, especially construction waste, has meant that many low-lying areas are now filled up. The command areas of tanks used for agriculture have now almost disappeared.

The rainfall

Urbanisation has also led to an increase in rainfall intensity, perhaps due to heat island effect. The Karnataka State Natural Disaster Monitoring Centre has 96 weather

The recent rains, for example, were concentrated in the south-central part of the city, while the north received much less rainfall. Is there a pattern to this? Are some areas more vulnerable to excessive rainfall? These questions can be answered robustly by the flood modelling currently being carried out by the Indian Institute of Sciences and KSNDMC together. The model, however, is still at an experimental stage and far from accurate. August's rainfall that caused severe flooding in certain areas of the city was not foreseen by the model.

#### Rainwater harvesting

The city requires every new home to be built on land above 1,200 square feet to mandatorily harvest rainwater. The rule requires storage of 20 litres for every square metre of roof area, and 10 litres of storage for every square metre of paved area around the house. The minimum storage depth of the tank is prescribed as three metres. This means that 20 mm of rainfall can be managed at the household level itself..

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