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of which are polluted with raw sewage

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Even as a "national disaster" was declared in South Africa over a drought that has threatened to leave homes in Cape Town without running water, the African city remains far from the only place looking at a water crisis. Freshwater resources around the world were **already badly stressed** before heat-trapping carbon emissions from fossil fuels began to warm Earth's surface and affect rainfall. Pollution in many forms is tainting water above ground and below. By one estimate, the world will face a 40-percent water deficit by 2030 if climate change continues unchecked.

Closer home, the southern city of Bengaluru recently **came second** in a list of 11 cities that are facing the imminent threat of running out of water based on an UN-backed study, published by the BBC. And as with many disasters, the signs have been visible for some time.

In less than three weeks, Bellandur Lake, Bengaluru's largest lake, caught fire twice, on **19 January** and **1 February**, fuelling concerns over the environmental crisis plaguing the "City of Lakes". In the first instance, 5,000 army soldiers, apart from fire brigade personnel, were involved in dousing the fire, as smoke billowed into the sky. The latter was the fifth occurrence of frothing or a fire in the lake, which is spread across 906 acres, since May 2015.

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The debut edition of the International Ganesh festival will be held from 19 to 28 September in Mumbai, Pune, Ratnagiri, and Palghar. Organised by the state Department of Tourism, it is aimed at highlighting the state's heritage as well as showcasing India on a global stage



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The name of Shivraj Singh Chouhan – the BJP's longest-serving chief minister – has remained conspicuous by its absence from the

"A few decades ago, Bellandur Lake was a much cleaner water body, used essentially for irrigation. Rice paddy used to be grown near the lake," says S Vishwanath, a Bengaluru-based architect, water activist and director of Biome Environmental Solutions. The lake which was once used for agricultural purposes is today a stinking, filthy mass filled with heavy metal contaminants, sewage, construction debris, silt, macrophytes etc. The city generates around 1500 million litres (MLD) of sewage every day, of which nearly **500 MLD is pumped into Bellandur Lake.**

Civic officials believe the fire was the handiwork of local grass harvesters. But the unsettling question is that how could a water body catch fire at all?

"The cause of the fire is known. The lake is covered with a thick layer of macrophytes (aquatic plants such as water hyacinths). During this period, these macrophytes dry up. Apart from this, solid municipal waste is also dumped on it. Due to this layer on top of the lake, there is a lack of sunlight penetration and oxygen in the water body," says Dr TV Ramachandra, a scientist from the Centre for Ecological Sciences, Indian Institute of Science (IISc), Bengaluru. He further explains that this creates an anaerobic condition in the lake, which means there is an absence of oxygen, leading to generation of methane.

"So, naturally, when you burn something above that, the gas gets added to it and that's how the fire gets aggravated," Dr Ramachandra says. This means that if someone threw a cigarette or a lit match into the water, the methane in the lake made it flammable, thus igniting a fire.

How did Bellandur Lake reach this point?

Across its undulating terrain, the city has **three major lake systems**: Koramangala and Challaghatta valley (K&C valley), Hebbal valley and the Vrishabhavati valley. Bellandur Lake is part of the K&C valley system, along with Varthur lake, which is located downstream of the former. According to the Karnataka Lake Conservation and Development Authority (KLCDA), Bellandur Lake is one of several lakes in Bengaluru and is **under the custody of the Bangalore Development Authority (BDA).**

Over the years, the city's lakes have disappeared due to rapid urbanisation and encroachments. In the 1970s, Bengaluru boast of about 285 lakes; today there are just a little over 190, most of which are polluted with raw sewage.

But how did Bellandur Lake reach this point? Urban and scientific experts say there are a complex set of reasons behind it.

"The city has expanded dramatically. The population has grown as well. IT companies, industries, residential complexes have come up. So, the water which was earlier used from the lake for irrigation is now polluted. A major component of the pollution is domestic sewage and industrial effluents," says Vishwanath.

As per research by the Centre for Ecological Sciences, IISc, urbanisation in the city between 1973 and 2016 **increased by 1,005 percent.** Scientists now have grave concerns regarding the future of Bengaluru city. "69 percent of city was covered with vegetation in the 1970s but 78 percent of it is covered with concrete today. If this trend continues, then by 2020, 93 percent of the landscape will be just concrete. It is not a feasible proposition because the city is headed towards an oxygen and water deficit situation," says Dr Ramachandra. The region in the K&C valley saw 37.5 percent of the lakes disappear between 1970 and 2016.

Another factor that fuels the pollution crisis in Bellandur Lake is the raw, untreated sewage being released into the lake every day through the storm water drains (SWDs).

“The problem is not the lake itself. It is a part of the problem. Bellandur Lake is one of largest holding areas. Over six channels of SWDs flow into it. There is a huge amount of unregulated, polluted, raw sewage entering the lake at six points,” says Naresh V Narasimhan, a Bengaluru-based architect and urban planner.

Bengaluru has an **842 kilometre-long network of storm water drains** (SWDs) or raja kaluves. The function of these drains is essentially to carry harvested rainwater downstream into the lakes. Apart from this, the city has an over 90-year-old **sewerage network spread across 6,800 kilometres**. The SWDs are maintained by the BBMP, while the Bengaluru Supply and Sewerage Board (BWSSB) is responsible for the sewers in the city. In theory, domestic waste and sewage is not supposed to be released into SWDs but in practice, most of the waste water is released into the storm water drains daily.

“Right now, a lot of buildings are not connected to the sewage network and as a result, a large amount of the sewage flows into the SWDs. The sewerage network itself is old, so when the manhole overflows, the sewage flows into the SWDs. To prevent domestic sewage from entering the lake, a network of sewage pipes which are modern must be laid while ensuring every apartment in the catchment area is connected to the sewerage network,” explains Vishwanath.

At present, the BWSSB has only **14 established sewage treatment plants** (STPs) across the city with a combined capacity of treating 721 MLD of sewage. This is a shockingly low number for a city that generates nearly 1500 MLD sewage. Apart from this, most of the STPs function below their capacity. “Even after being treated, water quality that the government has submitted does not measure up to the prescribed standards of the pollution control board. So the question needs to be asked of the KSPCB and BWSSB as to why these STPs not being monitored properly?” says Sridhar Pabbisetty, CEO of the Namma Bengaluru Foundation.

Firstpost reached out to the Karnataka State Pollution Control Board (KSPCB) but did not receive any response.

comprehended by its absence from the party's candidate list. Experts say the BJP is attempting to make the best possible use of its senior regional leaders and counter anti-incumbency

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5,000 army soldiers, apart from fire brigade personnel, were involved in dousing the fire, as smoke billowed into the sky. PTI

Due to lack of proper regulation by KSPCB and release of untreated waste water and effluents, the Bellandur Lake has **lost its assimilative capacity**. A large component of the pollutants comprise nitrogen, carbon and phosphorus (from detergents used in households). A part of the phosphorus is absorbed by aquatic plants and rest is trapped with sediments at the bottom of the lake, reducing the depth of the lake. As more and more contaminants are released into the lake over a long period of time, it starts impacting the quality of groundwater as well. Untreated effluents composed of long chain hydrocarbons form a black oil-like layer above water, which increases the chance of the foam catching fire.

Biodiversity within the lake is also adversely impacted. "In the absence of sunlight, algae doesn't grow; without algae there is no fish growth. Over time, native species of fish in Bellandur Lake have disappeared," says Dr Ramachandra.

As this contaminated water, filled with heavy metals such as cadmium, lead, copper, nickel, cobalt, flows downstream, people from low income families use it for irrigation in agriculture. It has a direct impact on public health as well. According to Dr Ramachandra, instances of cancer and kidney failure has gone up in the city. A few years ago only one in one lakh persons would suffer from kidney failure. Today, the number has gone up to one in 5,000 persons in Bengaluru. "When you have heavy metals in the food chain, kidneys will have to do more. Naturally, they will collapse. When I visited Varthur lake a few weeks ago, I saw a girl who has lost both her kidneys. Her parents are from low-income families.

The day is not far off when everyone will have to have a dialysis unit in Bengaluru, if things continues like this," prophesises Dr Ramachandra.

Is there a way to salvage Bellandur Lake?

The answer to this lies 27.4 kilometres north of the Bellandur Lake: Jakkur Lake.

Spread across 160 acres in the northern suburb of Jakkur, the lake is one of the cleanest in Bengaluru. The reason? In 2004, the BWSSB set up a **10 MLD STP** to partially treat the raw sewage entering the lake. A seven-acre constructed wetland and an algal pond was also put in place to bio-remediate the treated water entering the lake. This was monitored by the IISc and has proven to be effective.

The purpose of the STP is to remove pollutants (carbon and solid waste) and make the water environmentally safe. Once the STP partially treats the wastewater, it is then released into the constructed wetland and algal pond for macrophytes to absorb the nutrients present in the sewage.

"Sewage is filled with high nutrients. A lot of the heavy metals are in it that are not good for you, but plants love it," urban expert Narasimhan says quoting Buckminster Fuller who said, 'Pollution is nothing but the resources we are not harvesting. We allow them to disperse because we've been ignorant of their value.' As mentioned earlier, sewage is rich in nitrogen and phosphorus, which are essential nutrients needed for plants to grow. The two elements also form a major component of fertilisers.

"Agriculture fertilizers essentially have nitrogen, potassium etc. When we have constructed wetlands, plants have the ability to absorb the nutrients. Thus, the nutrients present in the sewage is absorbed by the plants. Moreover, these plant has the ability to absorb heavy metals. That helps in remediation of water," explains Dr Ramachandra. "If the **Jakkur lake model** is implemented, Bellandur Lake will go back to his former state. In fact it requires lesser time to do that. People need to understand that. The Jakkur model is easily implementable. The only thing is that the government has to make up its mind," he adds.

"Bellandur is a much larger lake compared to Jakkur. There are 42 lakes upstream of

Bellandur. If each one of those 42 lakes is treated as individually like Jakkur lake, then by the time (water) reaches Bellandur Lake, ninety percent of the problem would be sorted out. Right now, that is not happening,” says Vishwanath.

Gap between scientific research and governance

In response to the 19 January fire in the Bellandur Lake, Bengaluru mayor R Sampath Raj said that the BDA and the Bruhat Bengaluru Mahanagara Palike (BBMP) would seek the assistance of the IISc to find the reason and chalk out steps to prevent any recurrence. However, it is interesting to note that a similar exercise was already conducted in 2016, when there was immense frothing in the lake leading it to catch fire at the time.

In November 2016, an 18-member expert committee submitted a detailed report to the Government of Karnataka, on how the Bellandur Lake could be rejuvenated, detailing the cause of the frothing/fire, short-term and long-term remedial measures. “The government has done precious little about it since then,” says Sridhar Pabbisetty, who was also part of the expert panel that authored the report.

Some of the measures in the report to mitigate the Bellandur Lake include regular harvesting of macrophytes (aquatic plants such as water hyacinths), prevent dumping of solid municipal waste, ensure surrounding residential apartments let out only treated water into the lake, stop dumping of construction debris, install additional sewage treatment plants (STPs) etc. “Out of this, the BDA has implemented just one: A one-time removal of macrophytes, which is now growing back,” says Pabbisetty. “The recommendation was ‘regular harvesting of macrophytes’, which has not happened. We don’t know or have any periodic updates of what is the status of achievement of these programs. So our demand is that the BDA show us the progress measuring month-wise and quarter-wise,” he says.



Toxic froth from the polluted Bellandur Lake is blown into the air by the wind in Bengaluru. Reuters

Dr Ramachandra and his team at IISc have been studying Bengaluru’s lakes for nearly two decades, since 1997. The measures outlined above were published long before instances of fire and frothing broke news in the last two to three years. The chasm between scientific research and civic governance is reflected in the environmental condition of the city.

“For any decision, there has to be application of scientific principles and research. If that is not there, the country is going to pay,” says Dr Ramachandra. “When we started researching in 1997, the Bellandur Lake was reasonably good. Today, we see the pathetic

result of the contamination. Despite scientific evidence, the government has done nothing,” he adds.

“Eighty percent of the sewage that goes into the lake is recoverable. The government should speed up and put invest in modern, sustainable sewage treatment plants. Treat the water and push it back into the lake. It’s okay, tertiary quality is more than enough. With tertiary water, oxygen demand will increase. Once you introduce plants and then allow some wildlife, fish will start breeding. It’ll become an ecosystem again,” says Narasimhan.

With this level of contamination, is Bellandur Lake past the point of no return?

Restoring the lake will be a Herculean effort, feels Vishwanath. “It will take lots of money and discipline to do that. I don’t see that happening in the next decade,” he says.

For Pabbisetty, if the government empowers the Karnataka Lake Conservation and Development Authority, Bengaluru’s lakes will be better off. “The best to solve this problem is to tap the KLCDA, empower them to fulfil the roles that have been prescribed in the KSCDA Act, define the standard mechanism to be implemented by any other agency, and oversee it,” he says.

However, Narasimhan is still optimistic. “It will emerge. All is not lost,” he says.

He gives the example of how the Hudson river in New York was revived. “In 1988, when I was in New York City for the first time, the Hudson River was a stinking black mass. I actually saw a upside down carcass of a dead, bloated pig, floating on the river. Today if you go there, people are fishing in the river and eating the fish too,” he describes.

“Nature has an infinite capacity to restore itself but somebody has got to start sometime. Bengaluru can easily be fixed if we focus on environment. Focus on water quality and air quality should be the front end agenda. Bengaluru can be rescued and recovered even now,” he says.

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