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IIT-B'S SYSTEM TO MONITOR FLOODS THIS MONSOON

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MUMBAI: Researchers at IIT-Bombay's Interdisciplinary Programme in Climate Studies will, during the coming monsoon, pilot a real-time flood monitoring and forecasting system for the city. Titled 'Urban Flood Risk Map: Monitoring and Modelling', the project aims to provide citizens with a granular, locality-wise picture of waterlogging, similar to instantaneously checking the air quality index of a particular neighbourhood at the touch of a button. →P3

IIT-B to test real-time flood warning system in monsoon

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"In 2005 and 2017, the city saw debilitating floods. While the civic administration's overall flood management has improved, Mumbaiites still do not have any actionable information which they can use to make important, or even life-saving decisions, like leaving their vehicles at home or shutting down schools. We see that people tend to rely a lot on FM radio as a way to know which parts of the city are waterlogged," said Subimal Ghosh, institute chair professor, dept. of civil engineering, IIT-B and convener, IDPCS. "Our aim is to generate more reliable data in real-time, which citizens will be able to access via a dedicated web-portal."

The project aims to provide Mumbaiites with locality-wise picture of waterlogging. HT ARCHIVES

To this end, at least nine 'reflection-based flood sensors' will be installed at key locations in the city, such as Bandra-Kurla Complex and Hiranandani Complex in Powai, to collect empirical data on waterlogging. Based on the success of the project in its first year, the network of sensors can be expanded to include dozens more across Mumbai. Citizens will also be asked to share anecdotal information on social media using the hashtag #MUMBAIFLOODDATA, along with geo-tagged pictures.

"For example, if someone says there is 'waist-high' or 'ankle-deep' water in a particular area, we can ascribe a numerical value to these general terms, and using rainfall information and a digital elevation map of the city, tell people with reasonable certainty how risky it will be to venture there. We can identify which other nearby areas may be waterlogged. Using data on drainage and hydrological models, we can estimate how soon the waters will recede. There are many possibilities we are trying to explore," added Ghosh, who is also a lead author (Working Group 1) of the recently concluded Sixth Assessment Report of the Intergovernmental Panel on Climate Change.

A second facet of this project deals with higher-resolution forecasting, in that it will use macro-level rainfall warnings for Mumbai, issued by the India Meteorological Department (IMD) and translate those into area-level warnings using artificial intelligence and machine learning models, so people will know ahead of time which areas to avoid during periods of heavy rain. Considering the spatial variability of rainfall across the city, which has been well documented in scientific literature, researchers said that such 'downscaled', hyper-local warnings are the need of the hour.

"It doesn't have to be a particularly wet monsoon for flooding to occur. Even during a deficit season, there is a likelihood of isolated extreme weather events, which have been increasing in frequency. When the IMD issues a 'red alert' for the city, it doesn't tell people living alongside the banks of the Mithi River whether or not they need to evacuate their homes. It doesn't tell a hospital located in a flood-prone area whether patients need to be evacuated," said Raghu Murtugudde, visiting professor, IIT-B and professor of earth system science at the University of Maryland.

Murtugudde added, "We hope to downscale the official forecasts to a street-level resolution so that such decisions can be taken in real-time. For someone living along the banks of the Mithi River, ankle-deep water has a very different meaning than it does for someone living in a high-rise in BKC.

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Safer Water

India's water quality is poor — it ranks 120th among the 122 nations. Maintaining water quality conforming to the specifications prescribed by the Central Pollution Control Board has, therefore, become a challenging job, because unsafe water has severe implications for human health. Countries, especially developing countries, need to adopt water management policies to reduce the harm caused by water pollution to human health

Water is as old as human civilization. Ecological needs of water as a scarce natural resource and as an essential commodity fundamental to life, livelihood and human survival have, of late, been recognized by all concerned agencies. In this backdrop, a person of wisdom would want to know the impact of water pollution on human health and the importance of clean drinking water, which is an important ingredient concomitant to sustainable development.

World Water Development Report, 2022 released by UNESCO, reveals that global use of freshwater has increased nearly eight times over the past hundred years and has been growing by about one per cent per annum since the 1980s. From the same report, we come to know that India's water quality is poor – it ranks 120th among the 122 nations. Maintaining water quality conforming to the specifications prescribed by the Central Pollution Control Board (CPCB) has, therefore, become a challenging job, because unsafe water has severe implications for human health.

To begin with, one would like to know the magnitude and intensity of the impact of water pollution on human health for understanding its gravity. The type of diseases emanating from polluted water that affect human health can be broadly divided into three categories, namely, gastrointestinal diseases, skin diseases and cancer. Diarrhea is a common symptom of gastrointestinal diseases and the most common disease caused by water pollution.

The source of gastroenteritis, dysentery, diarrhea, and viral hepatitis is the water pollution due to coliform bacteria. Enteroviruses exist in the aquatic environment. More than hundred pathogenic viruses are excreted in human and animal excreta and spread in the environment through groundwater, estuarine water, seawater, rivers, sewage treatment plants, insufficiently treated water, drinking water, and private wells.

Skin disease is the most common clinical complication of arsenic poisoning and caused by water containing excessive arsenic, in other words above the threshold level. There is a correlation between arsenic concentration in biological samples from patients with skin diseases and intake of arsenic contaminated drinking water. Studies have shown that swimmers are about four times more likely to report skin diseases than non-swimmers. It has also been clinically proved that fall of hair is less for the people drinking low-arsenic content water.

Coming to the issue of cancer from the perspective of water sources, findings of seminal research studies reveal a high association of occurrence of cancer with presence of arsenic, nitrates and chromium in the drinking water consumed by patients.

Ingestion of arsenic from drinking water can cause not only skin cancer, but also kidney and bladder cancer. The risk of cancer in the population from arsenic may be comparable to the risk from tobacco smoking and radon in the home environment. However, individual susceptibility to the carcinogenic effects of arsenic varies. Studies have also shown a synergistic effect of smoking and intake of arsenic in drinking water in causing lung cancer. Exposure to high arsenic levels in drinking water is also associated with the development of liver cancer.

Nitrates are a broader contaminant that are more closely associated with human cancers, especially colorectal cancer. A study con?rmed a signi?cant association between colorectal cancer and nitrate in men, but not in women.

Intake of drinking water containing hexavalent chromium has the potential to cause human respiratory cancer. Presence of trihalomethane (THM) in drinking water causes bladder and brain cancers in both men and women. Kidney cancer in men is positively correlated with levels of THM content in drinking water.

The World Water Development Report lays bare the economic losses of waterborne diseases outbreak. According to the 2022 report, it is estimated that around 38 million Indians are affected by waterborne diseases annually. Nearly 1.5 million children under the age of five are estimated to die of diarrhea alone and 73 million working days are lost due to waterborne diseases each year. The economic costs of waterborne diseases are estimated at USD 600 million annually. Worldwide, child deaths constitute about thirty per cent of total deaths. Poor water quality, sanitation, and hygiene result in the loss of about 31 million disabilities-adjusted life years in India. The annual economic loss is estimated at around Rs 120 crore.

DILIP DATTA
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The World Health Organisation estimates that about ninety per cent of the waterborne diseases are attributable to unsafe water supply, sanitation and hygiene. Parasitic worms present in unpurified drinking water, when consumed by human beings, cause diseases.

Reports based on scientific studies reveal that treated water from water treatment facilities is associated with a lower risk of diarrhea than untreated water for all ages. Households without access to piped water have a five times higher risk of infant death from diarrhea than households with access to such water.

To sum up, it can be said that the impact of water pollution on different diseases is mainly reflected in the following aspects. Firstly, diarrhea is the most lethal water-borne disease, mainly transmitted by enterovirus existing in the aquatic environment.

The transmission environment of enterovirus depends on groundwater, river, seawater, sewage, drinking water, etc. Therefore, it is necessary to prevent the transmission of enterovirus from the environment to people through drinking water intervention.

Secondly, exposure to or use of water polluted with high levels of arsenic content, and heavy metals, is associated with a risk of skin diseases.

Thirdly, arsenic, nitrate, chromium, and trihalomethane are major carcinogens in water sources, which cause cancer.

Finally, water pollution is an important cause of children's diseases. Contact with microbiologically infected water can cause diarrheal disease in children. Malnutrition and weakened immunity from diarrheal diseases can lead to other diseases.

In response to these research conclusions, countries, especially developing countries, need to adopt corresponding water management policies to reduce the harm caused by water pollution to human health. What steps need to be taken by the government?

Firstly, there should be a focus on water quality at the point of use, with interventions to improve water quality, including chlorination and safe storage, and provision of treated and clean water.

Secondly, in order to reduce the impact of water pollution on skin diseases, countries should conduct epidemiological studies on their own in order to formulate health-friendly bathing water quality standards suitable for their specific conditions.

Thirdly, in order to reduce the cancer caused by water pollution, the whole process of supervision of water quality should be strengthened; that would include the purity of water sources, the scientific nature of water treatment and the effectiveness of drinking water monitoring.

Fourthly, each society should prevent and control various sources of water pollution from production, consumption, and transportation. Fifthly, health education should be widely carried out. A regular programme should be practiced for awareness of environmental issues and disposal of sanitary water in order to enhance public health awareness.

Besides, public health expenditure in India should be at least five per cent of its GDP. Farmers should also be trained to avoid overuse of agricultural chemicals that contaminate drinking water detrimental to human health.

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'Indus treaty with Pak world's holiest, we are honouring it despite 3 wars'

JAL SHAKTI Minister **GAJENDRA SINGH SHEKHAWAT** recently returned from the United Nations Water Conference, where he showcased India's initiatives in water and sanitation sector and had bilateral meetings with other countries. He spoke to **HARIKISHAN SHARMA**. Excerpts:

What are the key takeaways from the conference?

Organised after 46 years, it was basically a brainstorming conference. Knowing that water is a finite resource and the way population is growing, climate change impacts are being observed, and simultaneously, the economy is growing, lifestyle is changing, the demand for water all around the world is increasing. In countries, especially where water is being harvested through underground resources, the challenge is even bigger. Glacial melt is again creating another point of botheration.

What were your suggestions?

I requested Csaba Kőrösi, president of the UN General Assembly, to bring different bodies dealing with water-related issues under one umbrella, just like PM Narendra Modi integrated ministries, departments and divisions by creating this Ministry (of Jal Shakti). In the UN, almost 24 organisations are dealing with different aspects of water. Kőrösi accepted my suggestion and mentioned it during his concluding speech. On the lines of India-WRIS platform, Kőrösi said they too are thinking of making a global platform where all water-related information will be available in public domain… I also mentioned about Mission LiFE…

One of the themes was 'water action decade'. What did India commit?

Our commitment in the sector is the maximum. Our investment of $240 billion is globally the highest… This is just the public sector investment… Simultaneously, we have taken initiatives of providing drinking water and supplying tap water to every rural household by 2024…

THE EXPRESS INTERVIEW

WITH GAJENDRA SINGH SHEKHAWAT

UNION MINISTER OF JAL SHAKTI

To ensure the good quality of drinking water, we have established over 2,000 laboratories, provided testing kits and training to almost 2 million women. We have also developed a sensor-based, IoT based capacity, which we are now promoting…

Another theme was 'water for cooperation'. As per the UN, transboundary rivers, lakes and aquifers are shared by 153 countries around the world. What is India's stand?

There are two things — sharing of data for early flood forecast and managing water resources. We are actively engaged with all our neighbours — China, Nepal… In Bhutan also, we have telemetry systems from where we get information smoothly. As far as transboundary water disputes or cooperations are concerned, I told the member countries that there are two types of transboundary corporations within the country, because water is a state subject. More than 150 MoUs are being implemented smoothly in India, barring a few issues. The Indus Water Treaty with Pakistan is the world's holiest. Despite three wars, we are still honouring it.

In a report, a parliamentary standing committee urged the government to consider defining e-flow for the Yamuna on the lines of the Ganga to maintain its health.

As on date, the Yamuna faces crisis during non-monsoon season and the water it draws from the upstream is stored in Wazirabad barrage for further supply to Delhi. There is not enough water that can be used to maintain the e-flow. So, to ensure the e-flow, we first have to construct reservoirs on upstream of Yamuna, which we have already started. The tender process for two projects — Lakhwar and Kishau — is already on..

The water quality is quite bad.

It's just sewage. Not a single drop of fresh water flows post Wazirabad up to Agra.

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