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Centre for Public Policy

# Prof. MR Krishnamurthy Memorial Lecture:

## ‘Bengaluru and its Long-term Engagement with Water Security’

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*The XX International Conference on Public Policy & Management was hosted by the Centre for Public Policy (CPP) from August 19 to 21, 2025, at IIM Bangalore. One of the highlights of the conference was the Prof. M R Krishnamurthy Memorial Lecture by Vishwanath Srikantaiah, water activist and urban planner, on: 'Bengaluru and its Long-term Engagement with Water Security', held on August 21, 2025. The lecture transcript is provided below.*

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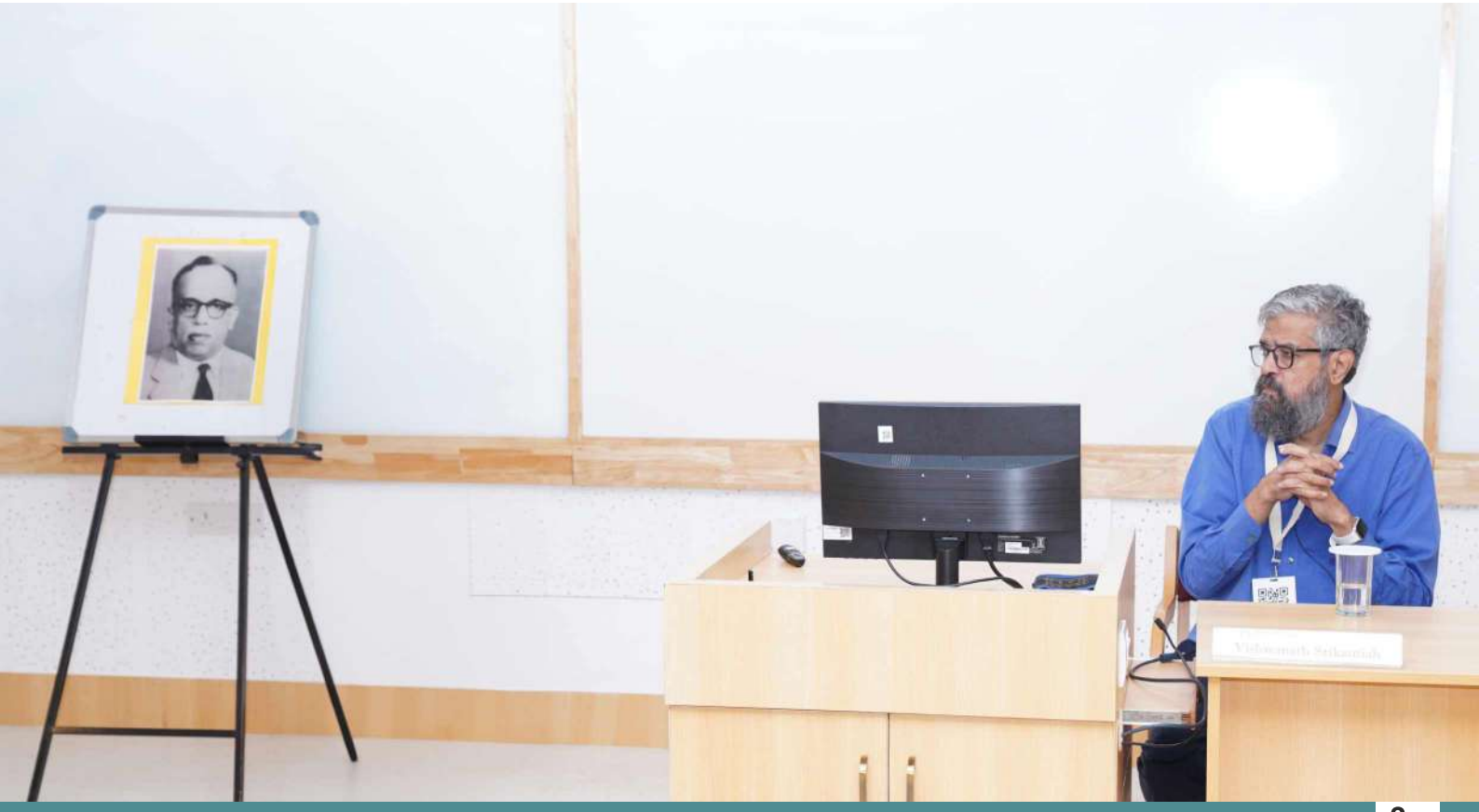
It is always a pleasure to be invited to IIMB and thanks for getting me here, and thanks to the family for seeing it fit that I should be speaking at this particular memorial lecture. IIMB is held personally in really high esteem by me as a civil engineer, and also as a Kannadiga. It is always a pleasure to be here as part of the Krishnamurthy memorial, and I am particularly happy to see that his whole family is here today for the lecture. It is a great honor and privilege.

I hope to take you through a brief personal intellectual journey, which is also a bit of a practical journey, to the issue of water and Bangalore. One reads that Professor Krishnamurthy cherished Bangalore city. He would be astonished to see that the city has transformed from a pensioner's paradise to what is now a megalopolis – a slightly dysfunctional megalopolis. So, as a 'Mysorean' from Vidyaranya and as a 'Bangalorean' from Vidyaranya, it's been a sort of personal journey to get into the water situation of Bangalore city, to examine it professionally, be an adviser to the Bangalore Water Supply, the Sewerage Board and the Government of Karnataka at certain points of time, teach about it at Azim Premji University, and work with communities in trying to solve some of the community-level problems related to water.

In a strange way for me, the exploration has been that geology is destiny. It's a very politically loaded word, but geology is destiny at a country scale and at a city scale. Particularly for Bangalore, what you figure out is that a ridge line runs through it. For most cities, they take great pride that a river runs through it. But in this case, a ridge line runs through it. The only river was a non-perennial stream called the Vishwabharati, which is now the Vrishabhavathi with all the sewage in it, but we didn't have a perennial river. We had 920 meters



above sea level as an advantage for us, and that's the geology. What this map here shows are the three major valleys of Bangalore which determine how water flows in the city once it falls as rain, but also where it doesn't flow, which causes water logging and flooding.

From a geological perspective, it's always fascinating that a sixth standard education in geography still keeps one going in terms of understanding water. The continental drift, the sinking of the Indo-Gangetic plain, talking at an all-India level. The Himalayas rose and they are the youngest mountains we know about - they cause the monsoon winds to occur and the monsoon winds bring all the rain that India gets. June to September, the four months deposit 75% of the rain or water that the Indian continent has. As for India and as for Bangalore, there's a slight bit of variance. This water is what we need to store for the rest of the eight months for it to become available to us for human use. That's the basic problem. We need it for agriculture, we need it for urban areas, we need it for domestic consumption, and we need it for industrial use.

Where do we store the water? We store the water in our forests, old growth forests. We store it in soil moisture. We store it in aquifers. And we use it. So, this disruption of storage and usage and a balance between them is always the big challenge for the country as a whole, and also for the city in particular. What's fascinating about the Indian subcontinent is that when the Shivaliks and the Himalayas rose, the part called the Indo-Gangetic plains sank, and the monsoon winds as well as the rains brought all the silt from the Shivaliks and the Himalayas, depositing it all the way to Bangladesh, and that's the Indus Valley which goes to Karachi. This particular tract of land with the soil and clay deposited over millennia is perhaps the most fertile and fecund part of the world.

But this fecundity, as it urbanizes, as the lifespan of citizens grow due to better health, better water and better sanitation, becomes a challenge for a nation to manage. The city of Bangalore has a population of around 14 and a half million people. Pretty soon, in the next 30 years, about 50 million of us will have to learn to manage. Can we manage with the transport, with the garbage, but dominantly - with water? Because we can live with garbage, we can live with traffic jams, but we cannot live without water. Therefore, that's the big challenge: does this growing city have sufficient water? Will it be sufficient in the future? What can we learn from the past and what do we need to do in the future for it to at least give the bare minimum?

The other advantage with India is that though it's one-third the land mass of USA and China, in terms of arable land, agricultural cultivable land, it's more or less the same. One of the reasons why this arability of land has come is also because of the Indo-Gangetic plain. However, it has come at the cost of forests and jungles. We have converted forest to agricultural land. So, one of the first environmental disasters at scale can be blamed on agriculture. Settled agriculture is a destroyer of natural resources and forest.

Considering this geological destiny, we're lucky that in Lalbagh we get to see rocks which are 3,000 million years old. These rocks which lifted themselves up to 920 meters above sea level act as the base platform on which the city grows. This base platform has weathered some places up to 20 feet, some places up to 100 feet. In that weathered lateritic kind of soil, lies water which is held as groundwater and which becomes available to us. In the hard rock itself, we drill 2,800 feet to get water. But that hard rock water is scarce, limited, generally of bad quality, and quickly runs out. So, there are two aquifers that we have.

What this peninsula has also done to Bangalore is lifted it up to 920 meters above sea level and caused the rainfall pattern which is reasonably well distributed, unlike the rest of peninsular India. When it's sweltering in April and May and the hot summer winds are blowing, Bangalore generally gets the April and May showers, and the evening showers. So, this well-distributed rainfall - is it an advantage that we can tap into to make our city liveable? That's a question that our forefathers asked, and therefore they started to modify the landscape to what's called the *kere-bavi* system or the tank and well ecosystem.

If you note the landscape itself, this was supposed to be the land of a thousand lakes, the city and its

surrounds. Not just lakes, but keres and kattes. The kattes were for cattle, the keres were for agriculture. So, this was a landscape dotted with water bodies, all artificially created, for which we have a history. There are researchers who are looking at the inscription stones, and the inscription stones are dating some of these keres to a 1,200-year history. So, it was even predating Kempegowda. Even before Kempegowda came in, there were people who had built keres. The Cholas had come, the Gangas were there, and they had built all these things and left inscription stones to tell us about their history.

It was a simple act of putting a small earthen bund across a valley. Clouds came to the hills, cascaded as water, rain, and then it came and an earthen bund was put in. The earthen bund was lined with stones and one had to hold on to the water. The characteristic was that this water was above ground, not generally below ground as lakes are imagined to be, because they're on valleys generally. Therefore, there's a bit of scooping of the earth, but majority of the water was held above the ground and the bund was what was holding it back.

The bund had what was called a waste weir or an overflow weir, a kodi in Kannada. The kodi was generally stronger because it had to overflow, and the whole system was described as a catchment where the rain fell, kaluves or channels which brought water to the kere, the kere holds the water. If it overflows, it goes via the kodi. When the kere holds the water, through the thobu or the sluice gate you distribute the water in the hakkallu or the command area and grow paddy.

This is the kodi, and what we famously call the rajakaluves of Bangalore are actually the kodikaluves. The misnomer has come and everybody refers to rajakaluves, as if there are some great channels which take water and which are deliberately constructed. Not so. These were kodikaluves which were overflow weirs, and this usually overflowed only twice or thrice in 10-year times. They had cycles and this took the water from one tank to the next tank through the valley itself. Nothing great about it. If it spilled over, it went to the paddy fields, so there was no problem at all because paddy could tolerate the water logging for three to four days. Once you urbanize, then you have a problem.

This was the kere and bavi landscape of Bangalore, with fishing activities there. This modified human landscape was a feudal construct. This was pre-democracy time, so there was a great deal of forced labour, but also communities which originated started to develop around it. The Neeragantis, for example, were responsible for the distribution of water in the command area. The farmer had simply to come and plant the paddy, and they would then come the second time just to harvest the paddy. The distribution of water was not in the farmer's hand. It was with the Neeragantis, and the Neeragantis would make sure that every field had water. So, there was a societal construct around it. The Neeragantis were paid with rice paddy which they had harvested or cultivated.

When the kodi overflowed, there was a festival to Gangamma, the local water deity for the tank or kere. Gangamma meant that every family in the village contributed grains, goats, sheep, and therefore there was a village festival and things were shared. It's a cultural construct. What was remarkable was, this was a land of paddy. Paddy got a bad rep these days as a water-guzzling crop. Everybody wants to shift to millet and eat millets. But paddy is one of the best converters of physical water to virtual water. Though it takes 3,000 litres of water to make one kilogram of paddy, roughly, paddy can be stored for three years. Water cannot be stored. The sun is the enemy of water - the sun evaporates the water. Most tanks would dry up in the year. They would have water for only three to six months. The sun is the biggest enemy of water because of its evaporative force. So therefore, you convert it into virtual water, and paddy was the crop of choice. It was also gender-driven in the sense that most of the work of the paddy field was done by women.

If you go to Kolar now, you would see the Bangalore of 200 years back. If you go about 80 kilometres to 100 kilometres to Mulbagal, you'll see a rocky landscape and rice terraces even now. There is a seasonality to it. There are crops, typically one crop is what you would get from a kere. But if you designed the kere well and if the rainfall was good, you would get two crops and sometimes three crops. So, it depends on the

seasonality of the rain.

In the rice paddy field, you'll see that you needed dry land also for the paddy to be threshed. So, it was not that you wanted everything to be submerged and wet. You needed dry land, and then you see the well also there that is full. This became important because when you flooded the paddy fields, you also recharged the shallow aquifer. Typically, paddy fields would go from one kere to the next kere, and all the submerged land would also recharge the aquifer so that when the kere dried up, the bavi had water for you to tide over the dry days, the summer days and the droughts.

This was important, and now this is the 80 feet or 100 feet of shallow aquifer where you hit hard rock, where you then dug these beautiful old open wells. Groundwater was the bavi. This work was done by a community called the kaluwadis who specialized in cutting stone, and the manuwadis who dug the earth, and then both of them got together to do dry stone masonry to get water. They had the architecture of the bavi - not the glorious Gujarat stepwells or Rajasthan stepwells, but more prosaic, more democratic, more in the farmer's field kind of wells. Equally beautiful structures without any cement or lime. So, this was the tradition of water management in the city, and it provided, in a strange way, drinking water security because you would locate the well close to the kere. The water would go into the aquifer, and when the kere dried, the bavi had water for a long time depending on the depth of the bavi and how much water you would draw from it.

One thing to remember here is that water is a common pool resource - not a state resource or a private resource. It's a common pool resource for the community to manage the tank and the bavi, and to take the waters. There were caste considerations there - it was not all benign. Bavis were designated for particular castes. But still, groundwater was a common pool, and that's now transformed itself.

One other beautiful artifact in this part of the world - when we go to Sarve's farm in Chikkarapur, we see the bavis there. There's a beautiful stepwell. There are two small wells, the bavis, which are now dry because the landscape is a bit dry. But as you go on the way to the farm, you see something called the kalyanamantapa, a beautiful construct of this part of the world. Four granite blocks put together with a small hole and a stone stuck to the hole as a spigot. You take it out to drink water. This is usually placed next to a kind of vertical horizontal stone, that's where you put your head load. Sit and drink the water. Below the shade of a tree, there's a shrine. You can rest, generally on pilgrim routes. Put the head load back on your head, because if there's nobody around, if it's a very heavy thing, you need to shift it, and then there's water.

It was an act of faith of the community to fill these kalyanamantapas with water because it was an act of punya. Nobody asked you to do it - you did it because it got you punya. The kalyanamantapas were part and parcel of the landscape, which are fast disappearing, unfortunately. Perhaps as a tradition we need to revisit

this heritage and work on it.

The point here is that water in itself has no great value. Water is what water does. There is something called social hydrology. This is the way to look at water - as to how the benefits of water are delivering justice, equity and access. Is it universally available? Is it available to all? And does it draw benefits for them? Just to give you an example, some of the work that we do with lakes and tanks - you desilt a tank with a JCB and a tractor. You take the silt out, lot of rain comes and the tank is full of water. Who benefits?

When you ask the question, "Who benefits?", you figure that those who have land in the command area benefit the most from the water. If you don't have land, what does water mean to you - nothing. So, water can actually increase inequities if not designed to deliver justice and equity. From a policy perspective, those who are grappling with it, the policy goal is not merely the functional availability of water. It's the use of rights to water which should be accessible to the weakest in the society. That should be the goal.

In a sense, with environmental romanticism, sometimes we forget the social injustices that water has caused in the past and the necessity to make things better. Therefore, when you revive a tank or a water body, you ask the question: Who should revive it? What should be the process of revival? How should you ensure that water is available to those who don't have land?

In some simple ways, for example, Dalit families usually have goat and sheep. So, one-third of the water of the tank can be reserved for goat and sheep through the summer months so that the water is available to those who have livestock. Or the fishing rights of the water can be given to those who don't own land, and therefore they have access to a means of livelihood as well as nutrition. But this has to be carefully crafted by the institution managing the revival.

Remember, the tank now is in a democratic gram panchayat-based ecosystem. It's no longer the feudal construct. Therefore, the way we do the process of revival of water is as important as the final finished product. This is an example from a tank or a lake. But this is a question to be asked at a metropolitan scale, at a city scale itself. The usual cry is that Bangalore is running out of water, therefore, let's build a dam on the Cauvery. But this can drown wildlife sanctuary.

But then the question that one has to also ask is: Who will this water reach and who will it benefit? And is there actually a scarcity of the resource, or is there a distributive justice scarcity? Is it that the network needs to expand to cover everybody and get universal coverage, or should you put more water in a leaking dysfunctional pipe? These are sort of stark choices that policymakers have.

One of the dominant impacts on water systems in Mysore state especially, was the drought from 1876 to 77-78. There are records to show that about 90,000 people died in the city of Bangalore alone, because they had come here for food. In Mysore, maybe 12 and a half lakh people - that is 25% of the population of Mysore kingdom - would have died for want of food and water. So, all the glorious 1,000 tanks of Bangalore could not support a population of one and a half lakh people, because there was continuous failure of rain for three years.

Therefore, when we eulogize the tank and demand its restoration, we must also recognize its limitation. One of the reasons why Bangalore city has water, is because of gold. If we had not found gold in KGF, we would not have had water in Bangalore. It's a very strange coincidence.

In 1888, mining operations started in KGF. At that point in time, the Champion Reef and the mines of KGF were the deepest mines in the world. Once you hit about 100 feet, the mine started to get flooded with groundwater. You had only steam engines to remove the water out, and the steam engines used firewood at that point in time and coal - bad quality coal - and they could only be effective at about 200 feet or 250 feet. You couldn't lift water out. The extent of water coming into the mines at KGF was five million litres per day.

Therefore, the operations of KGF, which was one of the biggest revenue exchangers for the state, demanded modern technology and hydroelectricity. The first plant, the hydroelectric plant of scale, was Shivanasamudra. The first line from Shivanasamudra goes to KGF. The other line goes to the Maharaja's palace, then the other line finally comes to Bangalore. But it goes to KGF, to remove water from the mines so that the miners could go deep and mine more gold.

Now, mine operations start in Shivanasamudra; but in summer months, the Cauvery flow is not enough to generate the electricity needed for KGF. Therefore, the cry goes up that we want more regular power, for which there must be regular flows in the river. Therefore, we need a dam. Hence, the origin of the KRS dam, Sarve's brainchild, for regulating the flow of the Cauvery so that power could go to KGF. The need of the dam is actually hydroelectricity. But once you're starting to build the dam, then you build it for irrigation and other purposes. But it starts with the gold in KGF.

Remember that later on, as things go along, the KRS becomes the store for the Cauvery which then allows regulated flows to come down the Cauvery, and we then draw it from Torekadanahalli and are able to pump currently - designed for 2,250 million litres per day. Without the KRS dam, there would be no water. Without the KRS dam, there would be no electricity, and without that electricity, we wouldn't be able to pump water to our city. So gold is at the heart of Bangalore's growth. Later on, follows IISC and the public sector units, etc., but without water you can't survive. Remember, 90,000 people had died. So, these historical serendipities around water are something to remember and to think about.

In 1894, we start with steam engines to pump water to the city because the tanks and lakes are not good enough. We go to Hesaraghatta and use engines from Manchester, where Prasad Krishnamurthy had gone to study. We bring engines and pumps and motors from Manchester. We put them in Hesaraghatta and we pump the water to keep the city going. Two lakh fifty-five thousand population is the estimated population. Fifty-five litres per capita, per day is the estimate. So, technology is going on in its own strange way.

The city actually has just three taps and four drums to manage itself. The three taps are: piped water supply which comes from the Cauvery in this particular case, the second tap is rainwater which is slightly underutilized, and the third tap is treated wastewater. Cities or urban areas are non-consumptive users of water. Unlike agriculture, where you put water to a sugarcane field or a paddy field and it evaporates or evapotranspires in the plant growth, in a city you have a bath, you wash your clothes, you do the dishes, you flush the toilet - the water comes back as used water. We have the technologies now to pick up that used water, clean it, and then recycle it and reuse it.

There's one other point that I wanted to make to the policymakers and others, just as a matter of thought: if we capture the true ecological cost of water - what's the ecological cost of water? It's the cost of water when you return it to nature at the same quantity and quality at which you appropriated it. I take 100 litres of fresh water from the Cauvery. I return to the Cauvery 100 litres of equally clean water at the same spot that I took it. It costs me 95 rupees per 1,000 litres. I have the technologies for it. I have the money if I choose to. I have the money for it because this is a city of billions of dollars being generated as economic revenue.

If we do that, if we capture the true price for water and return it to nature in the same quantity and quality, think of what happens. There's no scarcity of resource. This is the neoliberal golden dream which is there. But there is no pollution. All our rivers, lakes, areas and wells are clean because we've picked up all the wastewater and we've treated it before we release it to the environment. So as a goal for policy, one would say that we should work towards capturing the true value of water and generate the resources to invest in it, so that we don't have any problem of pollution. If we free up our city from pollution, there's enough and more fresh water available locally for it to be used productively, and then we can focus on the distributed justice. So that's one of the points.

These are the three taps and four stores that we have where we store water, and that's demand management because we can't have unlimited consumption of a resource. We need demand management, but we need water as a human right, distributive justice first, so that everybody has access to it, and then we have economic use or demand management to come in.

In the process, the city has built a set of institutions to manage water. All of them 20th century, except for one which is 21st century - the Karnataka State Natural Disaster Monitoring Centre. You can call it a 21st century institution. Bangalore Water Supply and Sewerage Board, created in 1964, was the first parastatal in India. So, we realized, and the governance realized, that we needed specialized institutions capable of delivering water and managing sanitation, and we created it. It became a model for others.

The question to ask now is: Do we need 21st century institutions? Do we need more well-rounded institutions? And what kind of institutions should govern our water? Is the 20th century institution of supply enough? We need to do that, and we remember some instances like the then later-on Prime Minister Lal Bahadur Shastri coming in 1964 and inaugurating the integrated urban water management plan, which was the first time a state government had persuaded the Planning Commission to invest 20 crore rupees for a water supply project. No other city had been capable of doing that, and Bangalore did it. So, there was this concentrated governance approach to try and create institutions, but also to try and bring in money needed for these kinds of operations to occur.

The first step is the river Cauvery from which we get water. One of the things to remember is many a time we think that a city is a net usurper of water from a river, that this water should actually go to rural areas or go to agriculture, that city does not deserve water. The metaphor used was that of Bakasura recently. But then the question that one can ask is, is the citizen of Bangalore not entitled to a human right to water because I'm part of the river basin? Am I entitled to some water from the Cauvery because I'm part of the Cauvery basin? And is my entitlement of 135 litres per capita per day any lesser than the two crore litres per hectare that a sugarcane farmer needs? And how do you then balance it?

A slum dweller in Devanahalli who needs 135 litres per capita per day; a rich farmer in Mandya, just to contrast, who needs two crore litres for one hectare of sugarcane. The sugar grown from that sugarcane causes diabetes, or it then is translated to alcohol which has several problems. What then is the right or the justice between these two sets of demand? Is there a difference at all and should they be differentiated?

My argument is that a city has equal right to the water as much as any citizen in the river basin, including the rural people. Water for life precedes water for livelihoods, but both go hand in hand. So, life, livelihoods and then commercial use of water - that should be the hierarchy of needs that we go through. Let's remember: Bangalore city supports 40% of the population of Karnataka in the Cauvery basin – 40 to 50% – and takes

currently 11% of Karnataka's allocation of waters. With just 11% of Karnataka's allocation of waters, you support 40% of the population, but you also support 60% of the GDP.

If Bangalore gets responsible with its wastewater, makes sure that it is treated and does not pollute, and then is given to farmers, as we will come to that, in that sense, Bangalore just becomes a pit stop for the Cauvery water on its journey from the river to the farmer's fields. I would argue that urbanization and metropolitanization actually gives us an opportunity to solve the water problem instead of actually creating it, because of the fiscal muscle, the governance muscle, the technological muscle, added with social insights. If we are able to bring that together, then we have perhaps solutions for our water crisis.

Therefore, we are monitoring these reservoirs. Four, five, six, seven become critical to us in Bangalore: Harangi, Hemavati, Kabini and KRS - these big four reservoirs which are at play to get water to the city. As we speak today - this is an old figure - all of them are overflowing, and this is August, nearly September. Remember, we need 30 tmc of water - 30,000 million cubic feet of water - and the storage capacity of these reservoirs is roughly 114.57. So, it's not significant, but then we don't have a right to it. It depends on the mercy of the Water Resources Department to release the water into the river and from there to be picked up by the BWSSB. We need some more formalization and recognition of the urban right to water also at the basin level.

There's a huge dependency on groundwater. Groundwater is 800 million litres, as mentioned in the latest report from IISC, 500,000 borewells which have gone to a depth of 1,800 feet. There's been no state control on borewells and groundwater. Anybody who can drill a borewell is allowed to drill one. Some would argue, luckily, because if the state had intervened, you would have created a crisis. But because it's in private domain, it's allowed - the economic engine to function and water to be given to everybody.

Here's one particular challenge with the borewell. Suppose the state does not give you water - you built a house or an apartment in the periphery of the city and the BWSSB is not giving you water. Can it prevent you from drilling a borewell? One would argue that it's your right to life, and therefore you would drill that borewell for your right to life and you would go ahead with it. But if the state gives you water, then it may have some legitimacy in controlling your exploitation of groundwater.

The question then is: How often should the state give you water? Is once in a week enough? One hour in a week, is it enough? Or should it be 24/7? And what should be the quality of water that the state delivers to you? Should it be a minimum quantity? And then, can the state control your right to life and livelihood with a borewell? So, this is a complex part of the policy and lawmaking which causes problems.

Of course, then there is the paradox of flooding, water logging and scarcity. The second tap here, not the third tap, is rainwater harvesting. So, what has the state done as part of policy? It's made a law mandating rainwater harvesting for every house and every building. The law is also very technical. It says 60 litres of storage per square meter based on the rainfall pattern and 30 litres per square meter of paved area. So, it encourages unpaved area. It encourages you to store water.

Ideally, if every citizen in Bangalore were to do rainwater harvesting, there would be no flooding. There would be no groundwater shortage. But we don't live in ideal worlds. The question to ask is: why is rainwater harvesting not being implemented the way it should be? And why is there no citizen uptake at scale? Many people are doing it - storing rainwater in rain barrels and using it as a supplement to water.

One of the other things is now groundwater management, and there we are doing something called shallow aquifer management. We're differentiating between the deep borewells and the shallow open wells because the shallow wells can be refilled more easily as compared to the deep borewell. So, can we bring that shallow aquifer into play? One set of solutions is to revisit the old dug wells of Bangalore, which was dotted with dug wells. Years of muck has jammed in there. Take it out. The well-digging community takes it out, and then you

bring it into play as a community asset. Free water for people to take, essentially for non-potable purpose.

There is one HP motor and there is an overhead tank, and usually it's done very informally by the community paying for it or the government paying for it. Many wells are now being rejuvenated because the wells are getting revived. If you regenerate lakes, the wells get revived. Then you turn this community asset back, you decorate it, you make it part of the community feature so that people don't dump garbage into it and there is some respect and reverence to it.

This revived dug well on the way to Bangalore airport, for example, provides one lakh litres to the town municipal council. It's part of the distribution network and it gives you that extra water merely because the lake upstream has been revived and the shallow aquifer is functional. Here, when you talk to the women, they come up with some incredible lessons. One of them said, "Don't put a pump to this well. Please clean it up. Put two taps, but don't put a pump. If you put a pump, the water will go to these hotels, restaurants and apartments. The well will dry up. We will have no water. If all of us draw just four pots of water - 75 families here - we know that the well will have water throughout summer. Don't put a motor."

So, demand management, resource availability, living within means - everything comes when you consult the community and you listen to the wise words of women, because they're the bearers of water. Now the question is: is this drudgery or is this choice? And is the choice a forced choice or is it a democratic free will exercise? But for the moment, sub optimally, you respect the women's words, and this well was cleaned up and two taps put and disinfected. In the crisis of 2023, when for 181 days Bangalore didn't get any rain, this well had water at 10 feet and it had potable water.

The other argument that they put was, “It takes me five rupees for 20 litres of RO water. This well water we know for a century is as good as RO water." Or "Bisleri gas is 20 rupees saved in a day. In a month, 600 rupees saved for me." Six hundred rupees saved in a month - the most important thing for them was that, "We go out to work. When we go back home, we should be mentally secure that there is water for us to have a bath, to do the dishes, to bathe our child, to give it to the cow. That mental water security, that peace that we have when we know that there's a well waiting for us with water, is much more than any money or anything else for our wellbeing that you can do."

This is again a community asset - water is being revived as a community asset. The question is: can we keep the 10,000 wells of Bangalore full of good clean water for the community to choose when to use it? We're doing a lot of investment in private water supply, such as Jal Jeevan Mission, get a tap to every house, 55

litres per capita per day. We haven't focused enough on the community aspect of it. We should do both. Water should be available at the doorstep - 55 litres, no doubt about it, which should be good clean water, drinking water. But also, the well should be available when we need it as an emergency and for other uses.

What do we do at a gated community level? We need units of intervention where there's an institution and a legal framework at play from a policy perspective. Institutional oversight and legal oversight is essential for good governance to kick in. Without both, good governance doesn't kick in. For us, the ideal - 73rd, 74th amendment - can play itself out in so many words. But actually, what works is the residents' association.

Suppose, in a gated community, a rich community, a homogeneous community, with 360 sites. What would have happened? Every one of them would have drilled a borewell. A borewell goes to about 1,000 feet. It costs 4 lakh rupees. So, 360 multiplied by 4 is 14.4 crore rupees. The implication is, 14.4 crore rupees - 360 straws in the same glass tumbler, each competing with the other. Pretty soon, all of them dry and the glass gets empty. So, competitive drilling is a race to the bottom, literally and financially.

How do you reverse it? You could say, "No private borewells, only three community borewells." Hence, 14.4 crores becomes 12 lakhs. Now you're down to 12 lakhs. You're saving money. With the money saved, you'll put a distribution network, a meter. Make sure that every family gets its fair share of water. Whatever the three borewells get, you'll price the water so that if you consume more than 25,000 litres a month, you will pay 120 rupees per kilolitre. That money goes to your own association. It doesn't go to a private player or to the state or any place. It goes to your association.

You'll collect the money and invest it in a sewage treatment plant. You'll make sure the treated sewage is of high quality, that there's no pollution there. You'll give the treated wastewater to every household free for garden use and non-potable use so that the freshwater demand comes down further. Once you communitize an asset, what you then find is that borewell water actually starts to rise and that there is enough water for the entire community.

Now this is the challenge for us at a city scale, at a national scale. How do we create the institutional framework, the legal framework and good behavior to treat groundwater as a sustainable resource? That's the groundwater challenge from a policy perspective. Many gated communities are working on it. You need to figure out what the rainfall is, what the lowest rainfall is, and how to balance the water demand.

Then again, with the revival of lakes, the question that we ask in our city is: what is that end goal of a revived lake? Is it a performative use where you go around walking, cycling, jogging? Is it recreational? Is it aesthetic? Or is it livelihood-based? Is it livelihoods for the fisherfolk or for the grass cutters? Is it biodiversity, flood control, recharge? It could be a combination of all. But sometimes some of them are in conflict with each other. The performative or the aesthetic could be in conflict with ecological. You may not want to do boating or motorboating in a place because the bird biodiversity is high. So, those choices have to be made, and who makes the choice becomes a critical component of it.

I'll give you one example, which is Jakkur Lake in the north. The BWSSB had set up a 15 million litres per day wastewater treatment plant. Treated wastewater comes in through this constructed wetland to the lake. The interesting thing here is, the wastewater treatment plant is completely funded by the power plant at Yelahanka. It gives you the capital money and it gives the BWSSB the operations and maintenance cost, to run it. It takes 13 million litres of water for itself and it gives 4 million litres for the lake.

This kind of partnerships between commercial and community-based infrastructure has also to start to kick in. The sludge is taken 300 kilometres by farmers and used in areca nut and coconut fields. It's free of heavy metals. It's good to be used. The wetlands as part of the design, it's been remodelled again, becomes a bird habitat spot. It polishes the water. The fishers have to be involved as part of the cleaning and the maintenance of the lake because of their livelihoods, and they are the key stakeholders, not just the middle class who run

around or walk around the lake.

Therefore, you need to integrate livelihoods of fisherfolk, biodiversity - all together, with treated wastewater. You recognize that there is grass to be cut. There is kitchen garden herbs to be taken from the lake. All these are part of the lake's design and activities. Then the birds can come back and are part of the city's fabric. Then there is aquifer rejuvenation because treated wastewater has now become groundwater. You can take water from the well, treat it, and use it for drinking purpose.

What the city needs and what the city is trying to do, and struggling to do because there's so much sewage flowing in the environment and solid waste there, is to transform wastewater as a livelihood resource, as an ecological resource, and then as a functional resource. So, how do you then scale it up?

The city's again doing a major experiment. The second largest of its kind in the world, next only to Mexico City, where every one of the sewage treatment plants in the city, which should be 61, treating 2,000 million litres per day, will be used to pump and fill a thousand lakes in Kolar, Chikkaballapur and Anekal. Already about 300 to 400 lakes are being filled. There are challenges there in terms of the quality of treatment, in terms of secondary contamination, in terms of farmers' perception, etc. But we have the technology to be able to deliver good quality water to fill the lakes.

This would then become the influence zone because the new Bangalore is not within the boundaries of the BBMP. The new Bangalore is going to be Devanahalli, Tumkur, Ramanagara and Magadi - eventually 8,000 square kilometres. We have now start to worry about the water security of this region. One of the ways that we can address the water security issue is by protecting all those lakes outside in the periphery and making sure that they're linked to rainwater, and that the catchments are clean to receive rainwater. In years where they don't receive rainwater, they get high-quality treated used water to keep them full.

So, this is the plan now - 1,462 million litres filling about more than a thousand lakes. It can increase because the demand for this treated wastewater increases, and so it's being transferred to a long distance - 100 to 120 kilometres - being pumped up to fill it. This is how the lakes are being filled, and the water is not being allowed to be used directly. It is allowed to recharge the aquifers, and the quality is being monitored so that it can then grow the vegetables.

If you do this well, the farmers have water security - about 64,000 farmers will have water security and

therefore livelihood security. They'll be able to grow 365 days a year and 366 every leap year. The food they grow will come back to the city, completing the circular economy and giving food security into this city, water security and livelihood security to farmers, plus biodiversity enhancement, if we do it well. This is how these projects are rolling out.

The future of Bangalore is also technologically driven as was in the past. Technology is one imagination and one drive that is part of the DNA of the city, tempered with social justice frameworks. This will be the way that India will address its metropolitan regions in the future. Hence, fisheries can exist, bird habitats can exist, open wells can be filled up, you can bring in drip irrigation to make sure that water is efficiently used and more products are grown.

I'll end the story with the last imagination that we have with water. This (*pointing at a map*) is Devanahalli, where the international airport is located. The town has 45,000 people, and what you see as red dots are 110 deep borewells, which is the only source of water for the town. They get water once in 10 days. Very saline water, salty water. If they have water for drinking, it has to come from RO plants. So, what do you do there?

The town then decides to revive its local lake next to the fort, which is from 1554. So, the lake is revived. This is how the lake was - absolutely dry for 17 years - not a drop of water, not linked to the catchment. It was a *maidan*. The lake was desilted with the town municipal council and with NGOs as well as CSR funding. This is how the lake looks like right now. This is both rainwater and treated wastewater from the city of Bangalore. It's full throughout the year.

That's how the well next to the lake was - full of garbage and a tree growing in it. That was cleaned up. That's how the well looks like now. There are turtles in it, swimming in it, and fish swimming in it. Then you set up a water treatment plant. You take the water from the well, clean it, make it potable, good enough as BIS 10500 drinking water standards, and you supply it to the town.

What you then get is really cost-effective water. It costs only one rupee and fifty-four paisa for 1,000 litres of drinking water. Plus, from a climate perspective, it requires one-28th the energy from borewells and therefore one-28th the carbon emissions. So therefore, it's climate-resilient water. It's climate-mitigating water if you revive your local lake, local well, if you reuse treated wastewater and use rainwater wisely. If you're able to scale it up, the opportunity then is there for every town to be water secure. This is what we need to figure out.

Talking about policy nudges, we have to think of integrated urban water management. The two ideas and notions which are driving us include One Health, where we recognize that human health, animal health and environment health are all tied together, and One Water, which means that all forms of water - rainwater, treated wastewater, groundwater - comprise just one unit. We need to make One Health and One Water talk from the inclusive lens.

The first lens that we must use is social access, gender inclusiveness, participation and recognizing that the informal sector should be at the heart of how we design our hydrological systems. Then we can get the technical, institutional, financial, legal and environmental systems to support that goal, which is universal access to water for life and livelihood from an urban and a regional perspective.

I'll leave you with the last slide. The overall goal is the imagination of the city as a water and fertilizer factory. Not as a consumer of water, but as a net producer of water with One Health, One Water and One Community as the perspective. Thank you all.

*Vishwanath Srikantaiah's lecture was followed by a Q&A session, the details of which are mentioned below.*

**Question 1:** Who built the rajakaluves? The rajakaluves, they were built by the Neeraganti community, is it not? But then, they are long distance and connecting various ways. So how can a community do that?

**Vishwanath Srikantaiah:** It can be done. Every kere has its own kodikaluve and rajakaluve, and every kere is responsible for that kodikaluve and rajakaluve. If you come to Kolar now, you'll be able to better see it, and it's all done by the local community. Now actually women in the local community build the rajakaluves and the kodikaluves.

**Follow-up:** How does the water go up to that level?

**Vishwanath Srikantaiah:** There is a sloping slab of granite or small steps that people take water and fill it up. It's not an overhead tank. It's a ground level tank.

**Question 2:** About the supply of Cauvery water by the state, in some areas, water is turned on and off once every two days. Hence everyone builds a sump to store, and a lot of water is wasted in such sumps. That's a disadvantage. Also, the RERA Act, does it include gated community, single borewell?

**Vishwanath Srikantaiah:** Unfortunately, not.

**Question 3:** RO is banned by the WHO – can you please say something about that?

**Vishwanath Srikantaiah:** It's not really banned by the WHO. However, it's not recommended that you drink RO water from a health perspective.

**Question 4:** Should we rethink urbanization?

**Vishwanath Srikantaiah:** I have a personal opinion about this. There's no country in the world which has not urbanized, given the current economic paradigm, to the extent of 85% staying in urban areas. So, we have got to either face the reality that we will get urbanization and therefore we should work very hard to make our cities liveable, or we can live in the paradise that there will be this rural spread-out population which will do well.

**Question 5:** I have a question about the Koramangala-Challaghatta Valley project. Do you think it lived up to its promise? What I remember is that once the treated water started going to farming communities, people felt it was dirty water being sent to rural communities from Bangalore. This issue relates to the drive towards equity and water sustainability.

**Vishwanath Srikantaiah:** It was true to a large extent because the Minor Irrigation Department did not do a proper job. During the first set of water that was pumped from Vrishabhavathi-Arkavathi, it actually pumped untreated water to the tank, and therefore there was a case. The case went to the High Court and the Supreme Court. The Supreme Court created an oversight committee. Thanks to the case and thanks to the committee, the whole system was cleaned up, which led to more attention being given to the treatment and the quality of water being pumped.

We have the opportunity to design and communicate good things, or we can make a blunder at a mega scale without any sense of ownership. The BWSSB was responsible for the treatment of wastewater. The lift irrigation was with the Minor Irrigation Department. Once it landed in the lake, it belongs to the zilla panchayat, and once it gets to the aquifer, it's a farmer's problem. So, it's a classic institutional niche problem without any ownership that created it, and the farmers were right to say that they got bad quality water.

We don't have a mechanism or a system by which we open up communications or dialogue and convince the farmer that we're doing a good job and that the water being supplied is good. The state's inability to be a good communicator, to be nuanced in its arguments, is catastrophic. Therefore, we have to build 21st century institutions which are well-rounded - the opportunity is there. The farmer's fears are also genuine.

**Question 6:** Out of the thousand lakes that were, how many are surviving? And more importantly, there are

so many lakes that have been filled up and apartments have been built, and half the lake is gone. What are your views on that?

**Vishwanath Srikantaiah:** We have 186 lakes which are live lakes, which have the potential to have water, of which 183 are with the BBMP, the Bruhat Bengaluru Mahanagara Palike. There's an effort from the BBMP to invest a lot of money in cleaning up and retaining these lakes. As of yesterday, about 120 lakes had water to at least 50% or more. Some realization has come and there's this effort, but it's a very difficult effort. Flooding is a problem, one of the challenges of low-lying areas.

But there's also a history to some of the lakes being filled up because malaria was a big challenge in the '60s and '70s, and various malaria committees suggested that some of the lakes and tanks be filled up because they were breeding grounds for anopheles.

**Question 7:** My question is about who should be managing this. As you said, BBMP is in charge of most of the lakes, BWSSB (Bangalore Water Supply and Sewerage Board) needs to be providing the water. But in the kere system, the community has to take charge and ownership. Do you think we need new legal frameworks or legal innovations for better accountability?

**Vishwanath Srikantaiah:** Absolutely. We have not done a great job with creating the Karnataka Tank Conservation and Development Authority, which is in theory supposed to be designing and approving projects for lakes. The ownership of the land is with the Revenue Department. We need to clean up our institutional and legal framework, especially for urban water bodies.

**Follow-up:** How would you define communities relating to this issue?

**Vishwanath Srikantaiah:** You cannot - it's a fractious thing. There's no such thing as community. There are only entitled individuals right now. The community is a very notional concept, it's a sociological trap.

**Follow-up:** Once you create a kere system, who then gets access if there's some restriction?

**Vishwanath Srikantaiah:** What you need to do is to recognize these rights in the beginning and create the equivalent of a tank user group which is in charge of the tanks, with the gram panchayat as the legal base for their work. However, most of them work on informal understandings. There's no formal recognition for many of these systems, which is a challenge indeed.

**Question 8:** In Ahmedabad they tried to have one organization in charge, what is your view?

**Vishwanath Srikantaiah:** It failed and the lakes are all in bad shape. They've created a riverfront which is a concrete front, which did not work, but it's a model as a riverfront for the rest of India.

**Question 9:** An observation is, in gated communities usually, judicious use of water is not encouraged. There is hardly any penalty for extra use. People also leave the tap open.

**Vishwanath Srikantaiah:** Therefore, we need to create that institutional framework which takes responsibility for wise use of water, and puts in metering and pricing systems. The community itself has to come together and decide on that, and we need a legal framework which allows the community to be able to take those decisions. Currently, if someone wants to drill a private borewell, they cannot be stopped. But if you want to make water sustainable, you need to make it a common pool resource.

**Question 10:** Has anyone taken the government to court for filling up Kempambudhi?

**Vishwanath Srikantaiah:** You can't take them to court - these are all fait accompli.

**Question 11:** How should IIM communities and citizens get involved?

**Vishwanath Srikantaiah:** IIM is a public policy think tank - their words count like gold in governance circles and people are waiting to listen to them. If they frame policy with social goals in perspective, that will be welcomed by all citizens, and governance clearance would be easy. Hence, we have to build narratives and streams of thought, and set out to achieve specific goals.

One of the most difficult problems confronting our societies is that the problems are so complex that taking effective action becomes extremely time consuming. So, we need to set overall goals for ourselves as a society, as institutions, and create policies which will drive ourselves to that goal. And that goal is universal access, being consistent, self-monitoring, and better behavior from communities and citizens along the way. Thank you for having me here.

# About the Speaker:

Vishwanath Srikantaiah is a Civil Engineer and an Urban Planner. He has 39 years of experience in the water, waste-water and sanitation sectors, helping design rainwater harvesting, aquifer recharge, wastewater recycling and ecosan systems. He has been a member on various committees, including the rainwater harvesting bye-law for Bengaluru city and the wastewater reuse policy for Karnataka state.

He was a visiting faculty and taught a course on the theme, 'Water' at the Azim Premji University, Bengaluru, India. He wrote a weekly column titled, 'Waterwise' in The Hindu for 12 years.

He is a Trustee with the Biome Environmental Trust (www.biometrust.org ).

He is a technical committee member with the Bangalore Water Supply and Sewerage Board, and with the Rural Development Engineering Department, Government of Karnataka for the Jal Jeevan Mission scheme.

Vishwanath Srikantaiah is an Ashoka Fellow and also the recipient of the Namma Bengaluru Foundation award.

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