GANGA:
AN UNHOLY MESS

Why successive efforts to clean up the holy river have failed, and what is needed to restore its waters

About *thethirdpole.net*

thethirdpole.net was launched in 2006 as a project of chinadialogue.net to provide impartial, accurate and balanced information and analysis, and to foster constructive debate on the region's vital water resources across the region. thethirdpole.net works in collaboration with partners across the Himalayas and the world to bring regional and international experts, media and civil society together for discussion and information exchange, online and in person.

We aim to reflect the impacts at every level, from the poorest communities to the highest reaches of government, and to promote knowledge sharing and cooperation within the region and internationally.

For more information, and if you are interested in partnership, or getting involved, please contact beth.walker @ thethirdpole.net or joydeep.gupta @ thethirdpole.net.

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UNDERSTANDING ASIA'S WATER CRISIS

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Introduction: The nowhere river

Joydeep Gupta

The revered Ganga has now become a river that is coming from nowhere and going nowhere

> *Devi Sureshvari Bhagavati Gange, Tribhuvana-Taarinni Tarala-Tarange*
> *Shankara-Mauli-Vihaarini Vimale, Mama Matir-Aastaam Tava Pada-Kamale*
>
> *O Devi Bhagavati Ganga, the Goddess of the Devas, You liberate the Three Worlds with the merciful waves of Your Liquid Form;*
> *O the Stainless Pure One Who resides in the Head of Shankara (Shiva), May my Devotion remain firmly established on Your Lotus Feet.*

With this mantra, millions worship India's holiest river every day. The trouble is, those merciful waves are absent for eight months of the year. The river that starts as the "stainless pure" in the Himalayas (imagined as the head of Shiva) becomes progressively stained as it flows through the Indo-Gangetic plains, till its faecal coliform count is a million times higher than would be safe for drinking.

In short, the Ganga has little water for much of the year, and the contamination of that little exceeds description.

All this is known, but successive attempts to clean the river through versions of the Ganga Action Plan (started in 1983) have failed. Namami Gangge, the current avatar of the plan, has proved equally futile so far.

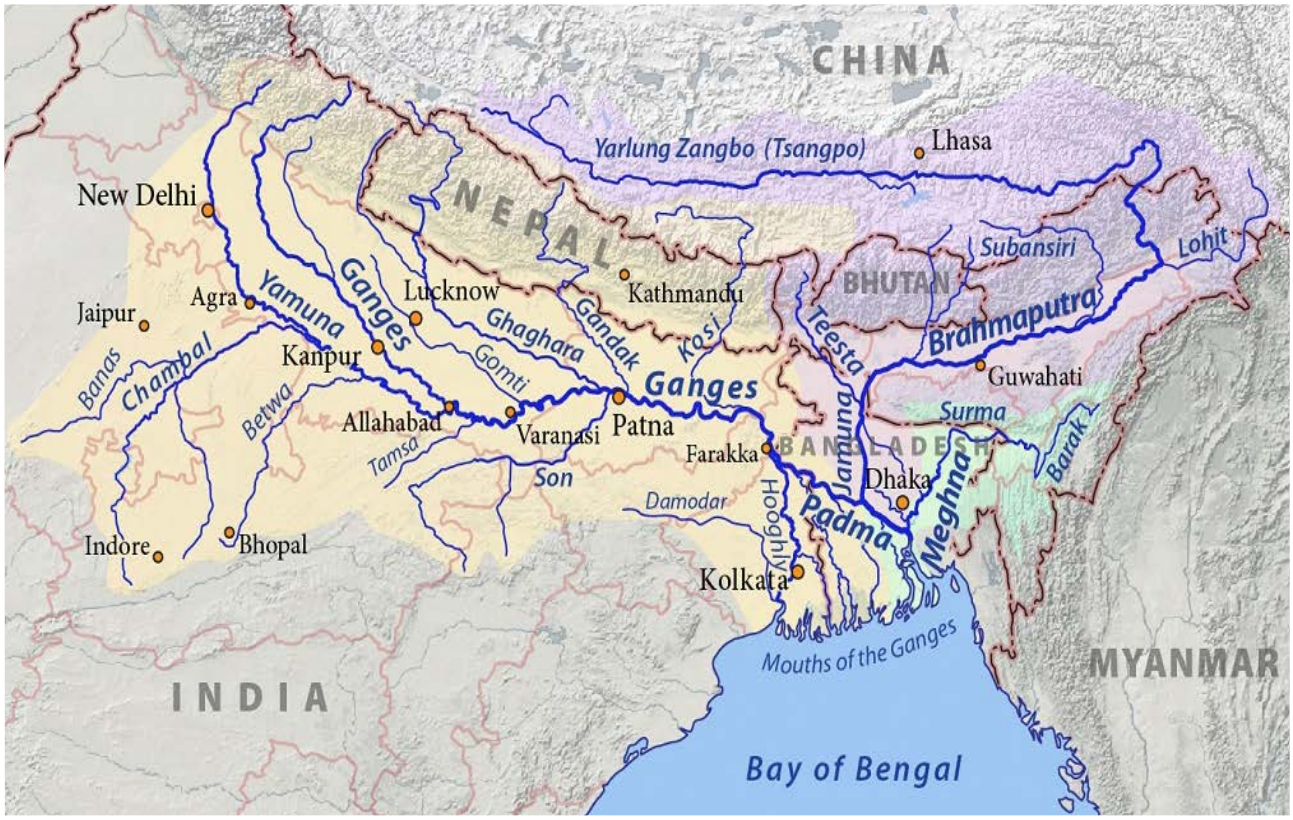
> ***A river is a river only when water flows through it. Except during the monsoon, the Ganga fails this basic test.***

There are two main reasons for the failure. The governments of the states, municipalities and panchayats through which the Ganga and its tributaries flow see little incentive to clean up. The result is billions sunk in sewage treatment plants, which either do not work or are unconnected to the main sources of sewage. The second reason is that during non-monsoon months, there simply isn't enough water to carry the pollutants away.

A river is a river only when water flows through it. Except during the monsoon, the Ganga fails this basic test.

This book shows you why. For seven years now, thethirdpole.net has been reporting on the state of the Ganga, the main river of the most crucial river basin in South Asia. Over 400 million people depend directly on the waters of the basin.

This book is a compilation of the most important articles on thethirdpole.net on the Ganga, from the source to the sea. It describes the sorry state of the Gangotri glacier, from whose snout



the main stem of the Ganga emerges. Like most other glaciers in the Himalayas and elsewhere in the world, the glacier has been retreating due to climate change. A recent report said the rate of retreat had gone down since 2008, and this was hailed as good news. But most media reports glossed over another part of the same scientific study, which said the base of the glacier was thinning rapidly.

From the glacier through the mountains, the streams and rivers that make up the Ganga run in a way described as the matted locks of Shiva's hair in Indian poetry through the ages. But now the other meaning of lock is coming into play, with dams on the rivers and more planned. Already, the water flow is diminished.

This becomes grievous in the foothills, where the Upper Ganga Canal diverts most of the water away from the river. From then, the Ganga becomes the kind of trickle that Eric Newby had so much difficulty navigating in the winter of 1963-64, and which led to his epic Slowly Down The Ganges. Cities and villages throw untreated effluents into this very diminished flow. That includes the infamous tanneries of Kanpur, a horror described in detail in this book.

By the time the Ganga reaches the holy city of Varanasi – around halfway through its journey to the sea and the parliamentary constituency of Prime Minister Narendra Modi – it is a river only in name. As reported in this book, to pray to the river, every day thousands stand neck deep in sludge and water that does not flow.

The river does get rejuvenated thereafter due to fresh water from tributaries that flow down from Nepal. But, as described in this book, some of these tributaries (such as the Koshi) already have serious problems, partly due to unplanned development. Others have dams planned on them. Then it all goes down to Farakka, where the barrage built to save Kolkata port has created many more problems than it has solved.

With Bangladesh complaining bitterly about the Farakka barrage reducing the lean season flow of the Ganga's main distributory the Padma, the transboundary nature of the river is now very much in focus. As described in a factual and dispassionate manner in this book, it is a problem that has been partially solved by the 1997 Ganges Treaty between India and Bangladesh, but much more remains to be done. And will the Ganges barrage planned further downstream in the Padma help? There are different points of view. The Bangladesh section of the Ganga delta has very serious problems, as reported consistently in thethirdpole.net.

There is one section of the river that is relatively neglected in the conversation around the state of the Ganga, and that is the Hooghly, the other major distributory, the one that flows past Kolkata. That is why this book lays special emphasis on the state of the Hooghly between the Farakka barrage and the confluence of the river with the Bay of Bengal. This is the tidal stretch of the river, so the lack of freshwater in non-monsoon months is not obvious till you notice the water hyacinth floating upstream twice a day.

This is also the stretch where the faecal coliform count goes off the charts, and there is almost no attempt to do anything about it. As also reported in this book, illegal sand mining in the Hooghly is carried out with impunity, from the middle of the riverbed, even as the central government starts to act on its plan to turn the whole stretch from the sea to Varanasi navigable. It has already named this stretch National Waterway Number One, though the only action so far has been dredging that has scared away the endangered river dolphin from its lone sanctuary on the Ganga.

Other violations of the river are so blatant as to be scarcely believable. A stretch of the Kolkata Metro is built on pylons in the middle of the original distributary, the Adi Ganga. All you can see there is garbage, if you can withstand the stink to get close enough. And soon after the last stop of the Metro, the river disappears altogether, with houses built upon it, as reported in this book.

At the confluence of the Hooghly with the Bay of Bengal, climate change effects rear their ugly head again. The rising sea regularly ruins homes and farms with salt water, as reported in this book.

It is an ugly chronicle of a river that was once beautiful and remains holy in the minds of millions. But restoring life to the Ganga is not rocket science. As explained through many reports in this book, what it needs is political will, a consequent enabling policy framework, and implementation.

The March 2017 assembly election results provide another chance to make this political will manifest. For the first time since the current Indian government took office in 2014, it has captured power in Uttarakhand and Uttar Pradesh, the two upstream states of the Ganga basin. For months, Uma Bharti, Union Minister for Water Resources, has been complaining of non-cooperation from the governments of these two states. She can no longer do so. It is time for her to deliver on her promise to have a clean Ganga flowing by the end of 2018.

Part 1: Pollution

Ganga an unholy mess at Kanpur

Juhi Chaudhary

Government initiatives to clean up the Ganga have failed to stop the dumping of toxic effluents and untreated sewage into the river at the industrial hub of Kanpur

Even a short visit to Kanpur, an industrial city in northern India, is enough to show that there is no respite yet for the Ganga from massive pollution despite the much-trumpeted Namami Gange initiative, the Narendra Modi administration's programme to clean up the holy river.

The 36 million litres daily common effluent treatment plant often performs below capacity — *image by Juhi Chaudhary*

Despite a plethora of government schemes, initiatives and campaigns, and various court orders, untreated sewage and toxic industrial effluents continue to make their way into the Ganga. The fact that the river is worshipped and revered by millions has not helped the cause of keeping it clean.

> ***The water that we get for drinking has also become very saline and has turned light yellow***

There's an overpowering stench at Dabka Ghat on the banks of the river in Jajmau area of Kanpur, which is compounded by the jarring sight of the blackish-grey sludge of chemicals flowing into the river. The eerie silence from the slow moving sludge having replaced the gurgling of clear flowing water adds to the deplorable scenario.

At Dabka Ghat a drain regularly carries toxic chemicals from almost 100 tanneries that are located close to the Ganga and offloads them directly into the main channel of the river without any check, adding to the already existing high water pollution.

"Fish often die in this stretch of the Ganga because of the water pollution. Biodiversity has been affected. Earlier we used to see peacocks here, but now they cannot be seen," 19-year-old Sarvesh Kumar, a resident of Jajmau who often visits the riverbank at Dabka Ghat, told thethirdpole.net. "The water that we get for drinking has also become very saline and has turned light yellow."

Kanpur, a city in Uttar Pradesh, is famous for its leather industry, with nearly 400 tanneries housed in the suburbs of Jajmau alone. The industry has become a bane for the Ganga as it contaminates it severely with a heavy load of toxic chemicals and heavy metals such as chromium, cadmium, lead, arsenic and cobalt, all of which have severe health implications.

How the Ganga Action Plan failed

The drain at Dabka Ghat is just one of the four main drains that carry toxic tannery wastewater from the tanneries of Jajmau. Under the Ganga Action Plan (GAP) phase 1 in 1986 (the oldest Ganga clean-up scheme), these drains were connected to the four intermediate pumping stations (IPS) that pump water to a 36 MLD (million litres daily) common effluent treatment plant (CETP) at Wajidpur in the city. This CETP plant has a capacity to treat just 9 MLD of industrial wastewater and 27 MLD of sewage.

Due to a lack of vision, the infrastructure that was put in place in 1986 catered to just 175 tanneries in Kanpur and can currently treat a maximum of 9 MLD tannery effluents. But the number of tanneries has more than doubled since then. Currently, up to 50 MLD of toxic tannery wastewater is generated daily, according to Central Leather Research Institute (CLRI), out of which only 9 MLD can be treated. This implies that almost 40 MLD of industrial effluents does not even reach the IPS for treatment and is dumped directly into the Ganga through overflowing drains like the one at Dabka Ghat.

It is estimated that Kanpur generates 450 MLD of sewage every day as well but the existing infrastructure can only treat around 160-170 MLD. The remainder goes to the river directly.

Rakesh Jaiswal, founder and executive secretary of non-profit Eco Friends, has been monitoring the Ganga for nearly 30 years in Kanpur. He told thethirdpole.net that no new functional infrastructure has been created since phase one of GAP despite the launch of GAP phase 2 and subsequently, Namami Gange.

"We dubbed GAP as a failed programme. All the treatment plants that are functioning currently were raised under GAP phase 1. And then, work started under GAP phase 2 and other schemes but none of that was ever completed. A 210 MLD sewage treatment plant (STP) is still under a trial run and is not even getting sufficient sewage," he said. "What is worse is that the entire sewage of the Sisamau drain (the biggest sewage drain in Kanpur) was to be treated by this 210 STP," unfortunately half of the drain's contents will continue to flow into the Ganga.

So Kanpur both has a huge treatment plant lying idle, and sewage flowing into the river – the worst of both worlds.

When Prime Minister Narendra Modi took an oath to clean the Ganga and launched a huge programme called Namami Gange, the issue of Ganga's revival came under the limelight again but environmentalists are not convinced.

"Initially we were also very hopeful. Now, the central government is thinking to augment the treatment capacity of tannery wastewater and construct a 20 MLD CETP and 5 MLD STP in Jajmau area to separate tannery wastewater from sewage," said Jaiswal. "But the thing is that it is only being talked about. Nothing has happened on the ground yet."

Passing the buck

The current 36 CETP plant is run in partnership between government agencies and tannery owners, which has only complicated matters. Both the costs and the treatment operations are divided. The tannery owners are required to give primary treatment before releasing the toxic water, while the government is responsible for the functioning of the CETP. This often leads to both the parties shrugging off their responsibility and blaming each other for the pollution mess.

"I think these industries are the polluters and so they should own the responsibility of treating their waste," said Jaiswal. "Why should the government own the responsibility to clean their waste?"

Time and again, there have been talks of shifting tannery units to another location, but leather manufacturers say they are being harassed and unfairly blamed.

"Every tannery has a primary treatment unit and we don't release water directly into the river. We pay nearly INR 1.4 million (USD 21,000) every month to run the CETP," Qazi Naiyer Jamal, General Secretary of the Small Tanners Association, Jajmau, told thethirdpole.net. "The focus rather should be on the other 49 drains that empty sewage into the river."

But there are gaps at each step of water treatment.

During a visit to an intermediate pumping station, Adarsh Pandey, an official of the Uttar Pradesh Jal Nigam (the state's water supply and sewage disposal authority), found many problems. "We get a lot of trash along with the tannery waste and the mesh of the pumping station keeps getting chocked," Pandey said. "We have to depute a person around the clock to keep clearing the mesh, which is very tedious."

Once a pumping station breaks down or underperforms, the whole chain gets further affected right till the CETP.

On visiting the 36 MLD CETP, which has the capacity to treat 9 MLD of tannery wastewater, officials said they were getting just 5-6 MLD of tannery wastewater from the four IPS. They also pointed out that the plant is quite old and is corroding at several places.

Multiple impacts

Pollution from the leather industry is not only polluting the Ganga but is impacting the groundwater and agricultural fields in a number of ways. One, there is no proper disposal system for the solid sludge that is generated during the treatment process and so it is often dumped in the open which can leach into the soil, and from there to the groundwater. Second, unorganised manufacturing units of cheap glue and chicken feed are mushrooming on the banks of the river. These use the waste from tanneries as raw material. These units are not just contaminating the soil and air but are also taking over agricultural fields of the local people.

At Piyondi village in Jajmau, due to heavy pollution, farm productivity has come down drastically. "We used to have rose plantations but due to polluted water and chromium in soil, roses have vanished from here in the last 15-20 years. Wheat productivity has also dropped by half," said Omprakash Yadav, a farmer from the village.

While there is a need for the government to act urgently, Jaiswal says it is important that we move beyond STPs to tackle the problem of water pollution. He says that under Namami Gange, more emphasis should be on restoring the ecological flow of the river, which is crucial for diluting toxins.

"In the upstream, all the original Himalayan water is diverted into various canals. I am not sure if even a few drops of real Ganga water reach Kanpur. We have hardly any water or flow in the river in Kanpur during the dry months. So pollution is much more visible," he said.

Juhi Chaudhary is special correspondent for thethirdpole.net

Ganga reduced to sludge in Varanasi

Ruhi Kandhari

Despite the Indian government's lofty plans, the water in the Ganga as it flows through Varanasi has reduced to a sluggish crawl with unacceptably high level of pollutants and untreated sewage

A boatman dips his oar into the Ganga at Varanasi, and up comes the black sludge — *image by Ruhi Kandhari*

He stopped rowing. The boat stopped moving. It just rocked gently. His frustration echoing across India's ancient city Varanasi, the boatman had successfully demonstrated that the Ganga does not flow any more.

Mallu remembers despairingly the Ganga of his boyhood, pristine and dynamic. He once had to use all his strength to row upstream to carry pilgrims and tourists across Varanasi's famed ghats but the mighty river now seems like a pond to him.

"If the government wants Ganga to be pure again, it needs its water, not schemes," he says with conviction.

The disappointment is evident. Varanasi, the ancient town of ghats and temples in India's Uttar Pradesh state, hit the national spotlight in 2014 when it elected Prime Minister Narendra Modi to the lower house of parliament.

On his first visit to the city after taking power, Modi had promised to clean up the Ganga. That is yet to see fruition with the slow moving river and the mounds of garbage testament to the fact that the government's multimillion rupee Namami Gange project, or Ganga Conservation Mission, is yet to really take off.

"All that the prime minister needs to do is sit in my boat, ride across the length of Ganga, stop each and every drain from falling into the river and more importantly stop each and every dam and barrage from withdrawing water from it," Mallu the boatman said.

On the one hand, the water in the river, revered by Hindus as sacred, has reduced and, on the other, pollutants have increased giving it a dark brown colour and a stench. The earliest recorded coliform bacteria count – an indicator of sanitary quality – in every 100 ml of water measured downstream of Varanasi was 14,300 in January 1988. This increased to 140,000 in January 2008 and to a whopping 2.4 million in January 2014.

Another indicator of water quality is biochemical oxygen demand (BOD), which should be less than 2 mg per litre of water as a drinking water source without disinfection. When the Ganga enters Varanasi, BOD is 2.8 mg/l and when it leaves, it is 4.9 mg/l – as recorded this April – indicating that large amounts of untreated sewage is discharged from the city. BOD is the

amount of dissolved oxygen needed by biological organisms to break down organic material. It is considered a measure to test the effectiveness of wastewater treatment plants or the amount of organic pollution like sewage in a body of water.

Expert view

But environment scientists consider increased discharge of untreated sewage into the river an inconsequential factor as compared to reduced water flow.

"Pollution in Ganga was last century's problem. In the last decade, the problem is that the water in the river is continuously decreasing, in turn increasing the concentration of pollutants in Ganga. If I mix 10 teaspoons of sugar each in a cup of water and in a big bottle of water, which one will be sweeter?" asked B.D. Tripathi, chairperson, Ganga Research Programme, funded by the National Ganga River Basin Authority, Central Pollution Control Board (CPCB) and the Banaras Hindu University (BHU).

Explaining the causes behind a stinking Ganga, Tripathi told thethirdpole.net that there are 5-10% more pollutants in the river since 1986, when the Ganga Action Plan (GAP) came into being. This is due to the increased flow of sewage and pollutants and reduced water.

In a parallel metaphor, U. K. Choudhary, former professor of civil engineering at Institute of Technology, BHU – the man who founded the Ganga Research Centre – refers to barrages and dams as a cancer. Higher water velocity, he stresses, would result in better water quality. Speaking to thethirdpole.net, he asked, "What can a doctor do when five out of six litres of blood is removed from the human body? Even if Modiji spends 20 lakh crore (rupees), the Ganga cannot be cleaned after the water is extracted."

In a letter to the Prime Minister, Choudhary has recommended that no more than 30% of the water should be withdrawn at the barrages, as troubles begin as soon as water levels fall. "At present more than 95% of water is withdrawn through these barrages, which results in drastic reduction in flow velocity, and fall in oxygen content, rise in biochemical oxygen demand load downstream and fall in level of ground water table in the basin and lack of water quantity in the root zone, resulting in fall in crop yield, and increase in salinity in the basin soil," he noted in the letter.

New promises

Last year, when Modi chose to contest elections from Varanasi, he had said, "*Mujhe Ma Ganga ne bulaya hai* (Mother Ganga has summoned me)." He made several promises to clean the Ganga during the election campaign. As soon as he was elected, the new government allocated INR 2,037 crore (USD 338 million) on the Namami Gange project and also opened a Clean Ganga Fund for voluntary contributions. A large part of these would be spent on building sewage treatment plants (STPs) on the banks of Ganga.

The government's subsequent announcement of an inland waterway project called Jal Marg Vikas, Waterway Development, allowing vessels to navigate a 1,620 kilometre stretch of the Ganga, has elicited criticism from scientists and religious leaders alike.

According to Swami Avimukteshwaranand Saraswati, the head of the Vidya Math sect at Varanasi's Kedar Ghat, the new government had built hopes of pristine Ganga but smashed them within a week of taking over when it announced that the river would be used for the transportation of goods and people. This would need barrages to maintain the water level and adversely affect its water quality and flow. "Blocking a river is the worst form of exploitation.

The practice is already turning Ganga into a pond, not a river, let alone a clean river," he told thethirdpole.net.

The seer is also critical of the government's focus on building sewage treatment plants as previous governments followed the same strategy of sewage treatment and failed to clean the river. "They are going to spend money on sewer lines, which is not for the Ganga but for urban planning. Why should any sewage be allowed to go into the river in the first place?" he asked.

Sewage treatment

Since 1986, sewerage treatment plants (STPs) have been set up in Varanasi with a total capacity of 102 mld (million litres per day). Since the early 1990s, however, the city's sewage generation has increased to 300 mld, with only a third of the city connected to treatment plants. GAP-II, which kicked in in 1993, sanctioned another STP and a sewer line. The STP was never built as land was unavailable and the lines remain unconnected to any of the STPs. Two parallel projects to set up STPs funded by the Japan International Cooperation Agency (JICA) and Jawaharlal Nehru National Urban Renewal Mission (JNNURM) have also been delayed.

All the STP projects in Varanasi are being managed by the Ganga Pollution Prevention Unit (GPPU). Project manager S.K. Barman, however, considers the name of the unit a misnomer. "It is a misconception that the Ganga Pollution Prevention Unit has anything to do with cleaning the Ganga. It does what water departments do in every city or town, which is provide sanitation and sewage treatment."

When union Urban Development Secretary Sudhir Krishna visited the city in June 2014, he also found that since the sewerage system was not connected to the STPs at many places, it was not cleaning the river. Similarly, when the Central Pollution Control Board (CPCB) inspected 51 existing STPs along the length of the Ganga in 2013, the team found that not even 60% of the capacity was being used and a third of them were not functioning.

According to Tripathi, STPs are not a solution for water pollution in Varanasi as certain small industries release effluents containing heavy metals into the sewage lines, which STPs cannot remove. A BHU study published in 2010 found heavy metals beyond permissible limits in waste water and in soil and vegetables in places where the treated waste water was used for irrigation. "Continuous application of waste water for more than 20 years has led to accumulation of heavy metals in the soil. Consequently, concentrations of cadmium, lead and nickel have crossed the safe limits for human consumption in all the vegetables," the study stated.

So both municipal and industrial waste flow into the river in Varanasi, largely unchecked. As the garbage collection system is unorganised or non-existent, large parts of the city spew waste into open drains that flow into the Ganga.

Harish Kumar Singh, 61, who was born and brought up in Varanasi and has been a guide to the city for over a decade, points to the Assi river naala or drain. The city was named Varanasi because it was located between Varuna and Assi rivers, both flowing into the Ganga. He once watched schools of dolphins at this spot as a boy. Now his eyes well up as he calls Assi a naala rather than a river.

"They (the politicians) make promises and cry for the sorry state of Ganga but to return Mother Ganga to its pristine glory does not need schemes or money, it needs genuine commitment," says Singh.

Ruhi Kandhari is a Delhi-based journalist

Pollution worsens in the lower Ganga

Beth Walker

Polluting coal-fired power station along the Ganga in West Bengal

The river is toxic in West Bengal, where it collects almost half its total waste from towns and factories along its banks

Chandannagar, a former French colony, sits on a moon crest bend of the Hooghly, a distributary of the Ganga River in West Bengal. The town's sewerage treatment plant doubles up as a "wonderland park" where visitors come to picnic among the green foliage and quiet backdrop of the trickle filter, waste pipes and sculptures of Hindu gods.

But the pleasant environment belies its larger shortcomings. The plant, set up under the government push to clean the Ganga, treats only 10% of the town's sewerage. Most households aren't connected to the sewerage system and so untreated raw effluents flow directly into the holy Ganga.

Just north of Kolkata, this is one of the most polluted stretches of the Ganga, but receives less attention than the iconic ghats of Varanasi and the toxic tanneries of Kanpur.

Over 7 billion litres of raw sewerage are dumped into the Ganga every day from hundreds of towns along the river and its tributaries, and almost half comes from West Bengal, says Kalyan Rudra, chairman of the West Bengal Pollution Control Board and a hydrologist who has been tracking the state of the river for many years.

The state contributes 48% of wastewater produced in the Ganga basin and only treats 42% of this – leaving 1,779 MLD (million litres a day) of untreated waste flowing from the 54 drains throughout the state.

In reality, the situation is even more dire: From the glaciers of the Himalayas the river flows over 2,500 kilometres through the plains of India into the Bay of Bengal, collecting the toxic waste from the half billion of people who rely on the river, to become one of the most polluted rivers in the world. The Central Pollution Control Board (CPCB) says only a tenth of the sewage produced along the main stream of the Ganges is treated at all.

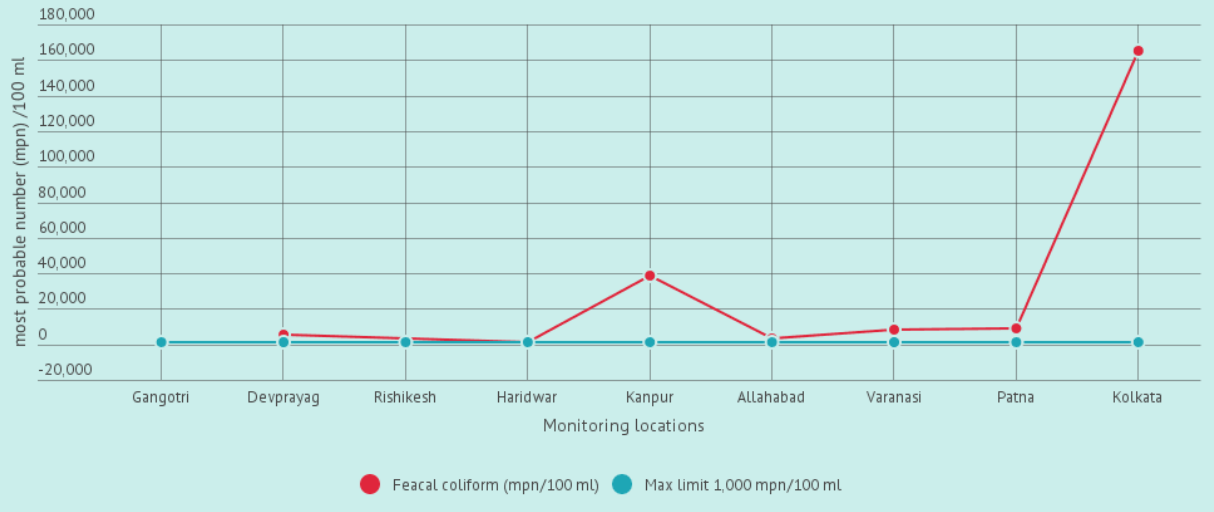
Illegal sand mining is a rampant problem in the riverbed of the Ganga and along its banks

"Untreated sewerage is the biggest problem," said Rudra, speaking at thethirdpole.net media study trip along the lower reaches of the Ganga from Kolkata. It accounts for about 85% of the pollution in the river. The rest comes from industrial heavy metals, pesticides from agriculture, solid waste, human bodies and animal carcasses.

At its worst in West Bengal, the river contains 160,000 faecal coliform bacteria per 100 ml, a clear sign of human excreta (the World Health Organisation puts the safe limit at 1,000 per 100 ml). The problem is more widespread. A July 2013 report from CPCB shows unacceptable levels of faecal coliform all along the Ganga, even in the relatively clean water of the Upper Ganga where Hindu pilgrims visit holy sites such as Rishikesh and Haridwar.

In West Bengal alone, Rudra estimates building the necessary sewerage plants would require an extra INR 13,467 crore (USD 2 billion) and another INR 100 crore (USD 15 million) a year for

Faecal coliform levels in the Ganga



repairs – money the state does not have.
In the past, the central government funded all the costs of setting up and running effluent treatment plants along the Ganga. Now, under the National Mission for Clean Ganga, it has decided the cash strapped state governments will have to take over.

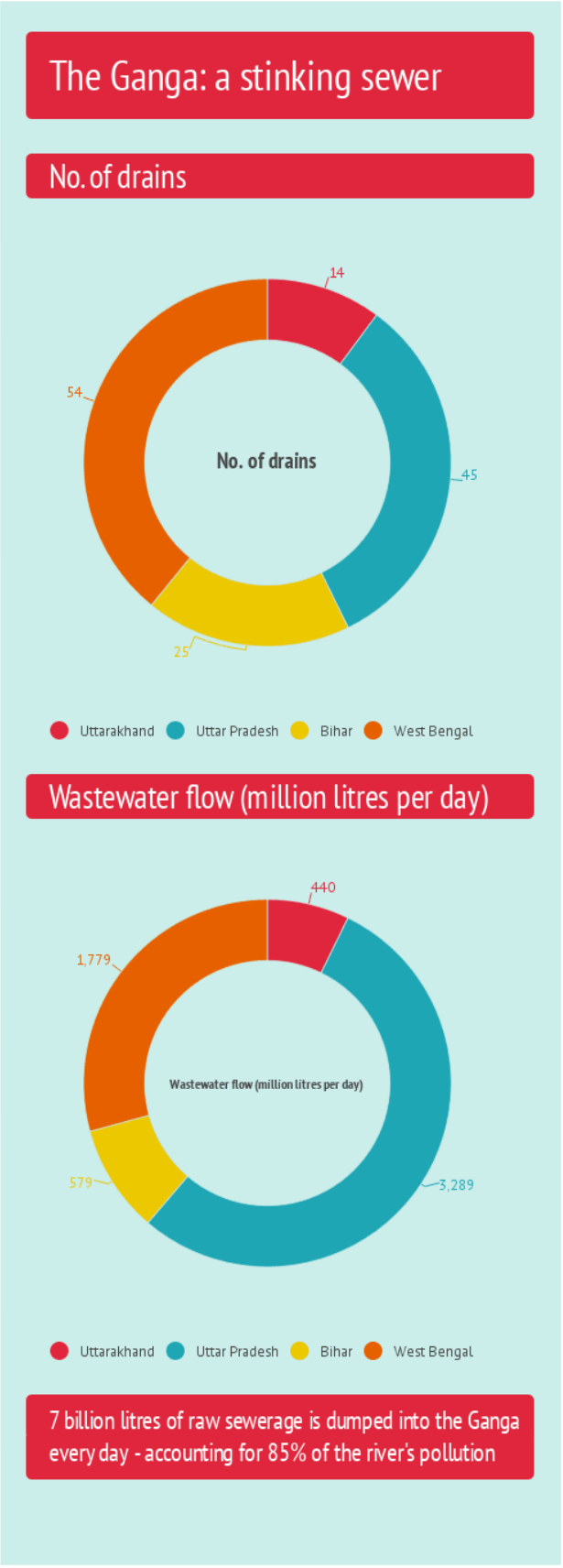
West Bengal has closed down 95 heavily polluting industries – along with the 94 shut down in Uttar Pradesh – but that has made little difference. Travelling up the Bhagirathi-Hooghly from Kolkata, a series of illegal cottage industries amid banana plantations, dirty brick kilns and coal-fired power stations can be seen pumping out waste into the river. Sand miners shovel away large chunks from both banks and pump it up from the riverbed, while officials bicker over how much of their activities are legal or illegal, who is supposed to lay down the law, who should implement it.

Past failures

The history of cleaning up India's largest and holiest river is littered with failure. Three decades of government action plans and billions of dollars of investment later, the Ganga is getting dirtier.

The first concerted attempt to clean the Ganges began in 1986, when Prime Minister Rajiv Gandhi launched the initial phase of the Ganga Action Plan with the aim of making the river pollution free. The plan was to divert all drains spewing wastewater into the river to sewerage treatment plants, treat and then reuse the water. The first phase focused on stretches of the main river, the second phase extended its reach to the tributaries including the Yamuna that flows through Delhi.
A revamped plan in 2009 sought to embrace the entire river system.

Since taking office in 2014, Prime Minister Narendra Modi has made it his personal mission to clean up the river by 2020, but new studies show pollution is getting worse.



Polluted water takes a huge toll on the health of children living along the river banks

Wrong approach

The focus on industry and sewerage treatment plants (STPs) has been misguided, says Rudra. It's not just that the plants installed along the river are not linked to the drainage system, or not functioning. Even if there was 100% coverage along the Ganga – as the current national plan envisages – it won't be enough to clean the water. Existing treatment plants do not have the advanced technology required to remove faecal coliform. Conventional technologies built under river action plans funded by the Centre since the mid-1980s serve primarily to meet standards for biological oxygen demand and suspended solids (produced by agriculture and industry), rather than faecal matter for sewerage.

Lack of flow

But the deeper problem is the dwindling flow of the Ganga, says Rudra. Over 90% of water is diverted for agriculture before the river reaches Kanpur about halfway through its journey, leaving it unable to flush out pollution or dilute the toxins. Activists agree the river's natural flow needs to be replenished, but ongoing construction of hydropower dams blocks the river's arteries upstream.

This year historically low river levels forced the Farakka coal-powered power station in West Bengal to shut down after the boats carrying coal were grounded coming up the river. Pumping of groundwater for agriculture across the basin has also reduced the amount of water percolating into the river bed from below. And the Gangotri glacier at the headwaters of the river in Uttarakhand is retreating 20 metres per year, further weakening the flow.

The latest version of the Ganga action plan merely plays lip service to maintaining water flow, say environmentalists, but provides no clear roadmap of how this will be achieved.

Health crisis

The health impacts are immense as people continue to drink, bathe and wash in its waters. The myth persists that the river has a self-purifying quality — but the toxic waters spread life threatening diseases in a country where a third of a million children under five still die each year from diarrhoea and countless people suffer chronic dysentery and parasitic infections.

People living along the Ganga are far more prone to cancer than anywhere else in the country. Studies by the National Cancer Registry Programme (NCRP) show there are alarmingly high rates of certain cancers in eastern Uttar Pradesh – and in the flood plains of West Bengal and Bihar, where cancer of the gall bladder, kidneys, liver, urinary bladder and skin are common. Women in Delhi show the highest rates of gall bladder cancer in the world.

There are wider health implications as well. Sewerage-borne waste spreads genes known as NDN-1 that associate themselves with bacteria to form "superbugs" highly resistant to most kind of antibiotics. They have been found in the Yamuna in Delhi and even in upper reaches of the Ganga around pilgrimage sites. Apart from a few localised studies by civil society groups or academics, the extent of the health crisis is unknown.

Colonial legacy

Many of the problems facing the Ganga are a colonial hangover, says Rudra. Under the British in the mid nineteenth century, India built hundreds of miles of canals to siphon water for agriculture, leaving the river ill equipped to cope with pollution and creating a legacy of use of water for irrigation downstream. The colonial rulers tried to tame the Ganga's naturally massive braided system that oscillates, depositing vast quantities of fertile silt across its plains. They saw flooding as a hazard and built networks of embankments. Initially this approach saved people from floods, but in the long term it led to a huge build-up of sediment and left people more vulnerable to high intensity floods. People failed to recognise the important role of low intensity floods for flushing out pollutants. After independence, the philosophy of river management borrowed from the West held strong. But the Ganga has a very different kind of hydrology.

Now people and industries have settled even along the intertidal parts of the river bed and major national rail and road infrastructure precariously skim along the banks of the unruly waters.

The only way forward, says Rudra, is to concentrate on ways to restore the flow of the Ganga and rejuvenate the natural processes and functions of the river system. River floodplains should be freed up to allow wetlands to act as natural filtration and give the river space to flood and flush out sediment and pollutants.

Beth Walker is UK editor and project director of thethirdpole.net

Part 2:
Running dry

Disappearing source of the Ganga

Vidya Venkat

The Gangotri glacier has retreated by 3 km in what experts say is an irreversible trend

Scientists say dwindling snowfall reduces the volume of water fed to the Bhagirathi, the main source of the Ganga.

Gaumukh, snout of the Gangotri glacier, surrounded by the Bhagirathi peaks of Garhwal Himalayas, at an altitude of over 4,000 metres — *image by Vidya Venkat*

After a four-hour-long trek from Bhojwasa, the final camping spot in Gangotri, we finally reached a brown pile of rocks. It was hard to believe that this was the mouth of the glacier from which the holy Ganga emerged, high in the Himalayas in India's Uttarakhand state.

Gaumukh, the snout of the Gangotri glacier, named after its shape like the mouth of a cow, has retreated by over 3 kilometres since 1817, says glaciologist Milap Chand Sharma of Jawaharlal Nehru University.

It was nearly two centuries ago that the retreat of the glacier was first documented by John Hodgson, a Survey of India geologist.

With ten Indian states now reeling under drought and the country facing a severe water crisis after two weak monsoons, the disappearing freshwater sources such as the Himalayan glaciers is worrying. And though a three-kilometre retreat over two centuries might seem insignificant at first glance, data shows that the rate of retreat has increased sharply since 1971. The rate of retreat is now 22 metres per year.

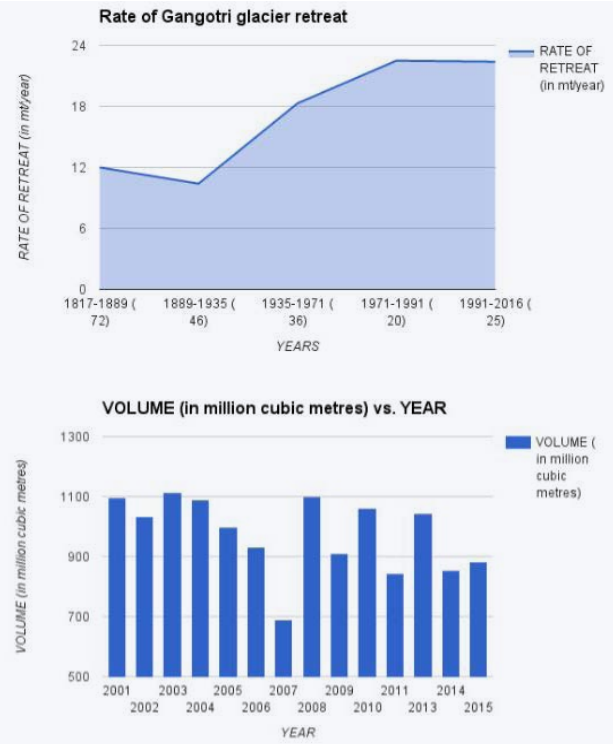
Less ice and snow

The glacier is in retreat because less ice is forming to replace melting ice every year, a process that is continuing, say scientists at the National Institute of Hydrology (NIH), Roorkee. "Winter precipitation is when the glacier receives adequate snow and ice to maintain itself. But last year Gangotri received very little snowfall. We have also observed more rainfall and a slight temperature rise in the region, both of which transfer heat on to the glacier, warming it," Professor Manohar Arora,
a scientist at NIH explained.

In summer, the melting glacier feeds the Bhagirathi River, the source stream of the Ganga. A week ago, when this correspondent scaled 4,255 metres to reach the glacier, the daytime

temperature was about 15 degree Celsius, and the Bhagirathi was swollen with water. However, dwindling snowfall has also reduced the volume of water (see chart below) in the river during the summer, compared to peak levels.

"Small lakes have formed on top of the glacier, as you go beyond Gaumukh towards Tapovan," eminent conservationist and mountaineer, Harshwanti Bisht, who won the Edmund Hillary Mountain Legacy Medal in 2013, told The Hindu. "It was the blast of one such glacial lake in Chorabari that led to the June 2013 flood disaster in Kedarnath," she said, adding, "If such a fast pace of melting continues, such disasters cannot be ruled out."



Data source: Milap Chand Sharma, Jawaharlal Nehru University

Caving in under tourism and tree loss

Earlier the Gangotri glacier appeared as a convex shape structure from Tapovan, the meadow at the base of Shivling peak beyond Gaumukh, but now the glacier appears to be caving in, Bisht added.

"In 1977, when I used to go for mountaineering training, two or three cars could be spotted in Gangotri. But now there are hundreds and thousands of cars and buses plying pilgrims and tourists to these places during the summer months," Bisht said.

"The Bhoj (birch tree) forests have disappeared in the region and though we are planting new trees now, their growth is very slow," she said. Since 1992, Bisht has been running a tree conservation programme "Save Gangotri" to help address the ecological crisis.

Irreversible melting

But the process of global warming and climate change could well be part of a normal natural cycle, Professor Milap Chand Sharma pointed out.

Reversing the process of retreat is impossible, he believes. "Stop people from visiting glaciers... you think this can happen... in India?" Sharma asked. "Or else, increase solid precipitation (snowfall) during accumulation season [when the glacier grows]... or put a tarpaulin cover over the Himalayas during ablation period [when glaciers melt]..." he said.

In the end, if expert opinion is to be believed, the melting the glaciers could well be irreversible.

Vidya Venkat is a reporter at the Hindu

Kumbh Melas start running short of water

Soumya Sarkar

Ramkund on the Godavari in Nashik — *image by Arian Zwegers*

The dark shadow of dying rivers lie over the Kumbh Melas as hasty interventions and climate change threaten to disrupt the largest human gatherings on earth

> ***The river at Ramkund in Nashik, the centre of the great pitcher festival last year, dried up in April for the first time in living memory***

"When I came to the Kumbh in my childhood, this was a beautiful river flowing with sweet water," Badal Nath, aged 64, reminisces on the banks of the Shipra river in Ujjain, central India. "Last time (12 years ago), it was a stinking drain, nauseating even to step into, let alone take a dip. The water we see now has been pumped from the Narmada. What have we done to our holy river?"

Most people did not share the lament of the elderly sadhu from Uttar Kashi. They did not know, or care. The Shipra flowed smoothly through the month long Simhastha Kumbh Mela held at Ujjain in Madhya Pradesh till the end of May, holding out the hope of salvation to 60 million pilgrims who gathered on its banks to bathe in its waters. But the clear signs of a dying river and interventions that worsen its condition can no longer be wished away.

The situation is starker in the headwaters of the Godavari, where a Kumbh Mela is held as well every 12 years. The river at Ramkund in Nashik, the centre of the great pitcher festival last year, dried up in April for the first time in living memory, jeopardising the ancient Hindu ritual of purification in flowing water.

Sinking aquifers and short-sighted public works, such as paving banks and even the riverbed in many places, has hastened the decline of Godavari, India's second longest river that starts at a spring on Brahmagiri hill, some 30 km from Nashik in the western state of Maharashtra.

Pitcher festival

The practice of Kumbh Mela, gathering for a holy dip in a river, goes back to the eighth century and is held at four places — Allahabad, Haridwar, Ujjain and Nashik — every 12 years. The largest congregation of people in the planet, the fair attracts the faithful in millions.

A kumbh is a pitcher. The full name of the festival held every 12 years is Poorna Kumbh Mela (full pitcher fair). The fullness of the pot symbolises the abundance of river water. The famous ritual baths during the Kumbh Melas reinforce the fact that it is essentially a water festival, to thank the gods for bountiful water. In a country where over 80% of the annual rainfall depends on the moods of the four-month southwest monsoon, water worship is as ancient as the birth of civilizations along rivers.

Clergy or laity, few of the millions jumping in for their ritual baths seem overtly conscious of the lack of flow in the rivers. But the organizers know the risk of massive public anger if the water is missing altogether. Hence the short-term solutions, which are becoming tougher to sustain.

Based on Hindu astrological calculations, the festival is not evenly spaced out. The Nashik Kumbh Mela was held in 2015, followed by the one at Ujjain this year. The next Kumbh at Haridwar on the Ganga is scheduled in 2021. Allahabad, considered the most important because of the confluence of the Ganga, the Yamuna and the mythical Saraswati, will host it in 2024.

Dimming prospects

The dismal sign of receding water was evident in Allahabad in 2013, where the banks of both the Ganga and Yamuna were wider than ever before, the water trickling sluggishly in a few shallow channels. Although the Indian government refuses to share data on flow of rivers that traverse international borders, the water in the two rivers was much reduced, according to several eyewitness accounts. Maintaining continuous flow of India's holiest river has become a challenge, according to a recent report by the Indian Institutes of Technology. The situation seemed less dire in the 2010 fair in Haridwar but the massive Tehri dam upstream has impacted water flow.

In Ujjain, the upper reaches of the Shipra carried just sewage a few years ago, when the Madhya Pradesh government of the Bharatiya Janata Party implemented an ambitious scheme to transport five cusecs of water every day from the Narmada near Omkareshwar to Ujjain Gaon 50 km away, where Shipra originates. Ujjain city is another 50 km downstream. The water was pumped through a concrete, closed pipe, lifting it 350 metres from Narmada to Shipra so that pilgrims to the Kumbh Mela were able to take their holy dip.

In Nashik, even the riverbed and the banks of the Godavari and the small streams that feed into it were paved over with concrete in many places to prepare for last year's Kumbh Mela, choking the aquifers that keep the headwaters alive. This, coupled with the long drought in central India, resulted in a situation where the municipal authorities were reduced to pumping groundwater into the river to keep up a semblance of flow in 2015.

In Allahabad, to keep the astounding 80 million who visited the festival in 2013 happy, special arrangements had to be made to release water from the Tehri dam in Uttarakhand. It would have been still inadequate without nature's help. The winter rains on the Gangetic plains were particularly heavy that year and the river benefitted.

This unheard of water scarcity at the Kumbh Mela at all locations is largely man-made, experts say, made worse by recent changes in weather patterns blamed partially on climate change. India, the world's second-most populous nation, is one of the most water-stressed. Two straight years of scanty rainfall have led to drought in many parts of the country, affecting over 330 million people.

Reservoirs are severely depleted, groundwater levels have sunk and many of the country's rivers are down to a trickle; even the perennial rivers are running dry in parts.

Hydrological mess

India is currently facing its worst-ever hydrological crisis, according to river expert Himanshu Thakkar. "Although the change in weather patterns and increasing rise in temperatures have contributed to it, our rivers are facing unprecedented deterioration today because of the way we have ill-treated them," says Thakkar, co-ordinator of the South Asia Network on Dams, Rivers and People, a non-profit.

A river basin cannot be seen in isolation, says ecologist Somnath Bandyopadhyay, and imbalances caused by human intervention driven solely with the intention of extracting water for irrigation and drinking are bound to lead to consequences that take decades to unravel. "Some of the projects implemented in the 1950s and 60s failed to take the long view, and have contributed to the present sorry situation of sick and dying rivers," says Bandyopadhyay, associate professor at the School of Ecology and Environment Studies, Nalanda University.

Thakkar is scathing about the government's river management. "The ecological ignorance at every level of governance is astonishing," he says. "How else can we explain pouring concrete over the Godavari riverbed in Nashik and paving its banks, choking off the very aquifers that replenish the river?"

Keeping up appearances

Instead of taking remedial measures, the authorities seem to be more interested in keeping up appearances, Thakkar says. The entire pipeline project from the Narmada to the Shipra is a result of skewed priorities that just wanted to keep the large number of expected pilgrims happy, he accuses.

Since the river waters in the Kumbh Mela are holy to the Hindus, it is they who should demand that the rivers are properly cared for, says Badal Nath, the ascetic from Uttarkashi. "Hindu samaj (society) has to take action," he says. "We need to take action to safeguard our religion and traditions."

Bandyopadhyay is sceptical. "The concept of the Kumbh Mela is purifying yourself through water, not rejuvenating or purifying the water. Every pilgrim is concerned about his or her personal salvation. It is doubtful if there will be any concerted action from the Hindus as a community to restore the rivers," he says. "We seem have learnt very little from the mistakes of the past. Unless there is a change in mind-set and approach, there is little hope that things will change for the better."

It is not an easy task to get religious institutions and government agencies to pursue a common agenda that results in positive action on rivers, Thakkar says. "We need to work towards raising awareness on the issues. Only then can we start deliberating on solutions."

For now, it seems that the serious harm to India's rivers will not be reversed anytime soon. The Ganga will yet flow, perhaps not so freely, in the next Kumbh Mela in Haridwar and then in Allahabad, but time is running out for the Godavari and the Shipra.

Soumya Sarkar is the editor of indiaclimatedialogue.net
This article first appeared there

Ganga disappears in West Bengal

Jayanta Basu

Rubbish at Tolly's Nullah on the Adi Ganga river — *image by Jayanta Basu*

In West Bengal stretches of the original channel of the Ganga have been completely submerged under rubbish, illegal buildings and a major metro line

Adi Ganga, the nearly 75 km long original channel of national river Ganga, has been hijacked at several places. Three centuries back, this was the main outflow of the Ganga to the Bay of Bengal. Today it is a sewer buried under garbage and the Metro rail network, encroached upon, converted into personal ponds and homes.

The destruction of the Ganga has been most rapid in the last three decades, the period when nearly INR 200 crore (USD 30 million) has been pumped into its 'restoration'. Not to mention that another project worth INR 600 crore is in the anvil – with the World Bank talking about funding Kolkata Municipal Corporation for "pollution abatement of the Adi Ganga"under the National Ganga River Basin project. This project, though, is behind schedule even before it has started.

The original Ganga

Innumerable ancient texts and maps say Adi (original) Ganga was the river's main channel around the last decade of the 17th century, when Kolkata had become a major port under the British Empire. It flowed (as the sewer does today) beside the famous Kalighat temple and then through Garia before ending up at Gangasagar, the confluence of the Ganga with the Bay of Bengal.

Around 1750 a canal was cut to connect the river Hooghly with the lower part of the river Saraswati near Sankrail in Howrah. That moved most of the water flow westwards, and the Hooghly became the main channel of the Ganga, as it is today.

In the 1770s, as the Adi Ganga started to recede, William Tolly supervised the dredging of a 15 km channel from Garia to Samukpota and connected the Adi Ganga to the Bidyadhari river which flows to the sea through the Sundarbans. Even today, this stretch is called Tolly's Nullah.

The river which earlier flowed through Boral, Rajpur, Harinavi and Baruipur – towns on the edge of the Sundarbans – was increasingly choked. But even in the 1940s, it was good enough to transport goods through non-mechanised boats. "Even in my childhood (around 1940s), it was a quite a big river and was being regularly used for navigating goods," wrote Rebati Ranjan Bhattacharya, the river crusader who fought for the resurrection of Adi Ganga till his last breath in 2005.

Others can remember that even in the early 1970s, honey gatherers from the Sundarbans brought honey and bamboo up the river in their boats, and tied up below the bridge that leads to Tollygunge, a busy suburb in South Kolkata.

> *"Such unhindered large-scale continuous encroachment is only possible because of local mafias being supported by political powers*

Killed by people, killed by railway

Apart from being used as a rubbish dump, the story of the Adi Ganga, especially in and around Kolkata, is one of encroachment. In 1998, the West Bengal government acknowledged in a report to the High Court that in the 15.5 km stretch from Hastings (the confluence with the Hooghly) to Garia (where Tolly's Nullah starts), there were 7,851 illegal structures with about 40,000 residents, 90 temples, 69 godowns (goods storage depots), 12 cattle sheds and others.

On April 24, 1998, the Kolkata High Court ordered that all encroachments be removed within a month. They are still there, as a recent state government report admits. The West Bengal Pollution Control Board and Kolkata Municipal Corporation have also admitted gross encroachments within the Adi Ganga in their recent reports to the eastern bench of the National Green Tribunal.

"Such unhindered large-scale continuous encroachment is only possible because of local mafias being supported by political powers," says activist Subhas Datta.

The six-kilometre expansion of the Metro rail from Tollygunge tram depot to Garia appears to have hit the last nail on the coffin in 2009. The 300-odd pillars supporting the rails rise from the middle of the channel. "There was a large public outcry and even a public interest petition was filed in High Court against the move, but nothing could be done as Metro rail got away showing a hundred years old norm which says that nothing can be done against a railway project," observed Mohit Roy of the NGO Vasundhara.

Stinking river

A team from thethirdpole.net recently travelled along the Adi Ganga, and found that encroachments were the norm rather than the exception. Concrete houses with foundations eating into the riverbanks have drains that release effluents directly into the river. In addition to that, in the Kolkata stretch alone, there are thousands of shanties on both banks, with makeshift latrines right on top of the water. All this is regularly interspersed by cattle sheds, small factories and even neighbourhood recreation clubs along the banks. Discarded polythene packets flutter around

Metro rail pillars and obscure the dark water wherever the water hyacinth does not do so. Nothing can obscure the stink.

Disappearing river

It gets worse beyond Garia. The river disappears.

For around three kilometres in Narendrapur and Rajpur-Sonarpur, there is no visible river. In its place, there are concrete houses, community halls and roads. Close by, there are a few elongated ponds whose names are a giveaway – "Karer Ganga" (Kar's Ganga), "Ghosher Ganga"and so on.

An elderly resident who declined to identify himself said, "Once the river flow had choked and habitation grew in the area, large-scale encroachment began on the river bed. This has quickened since the 1980s." Rajpur-Sonarpur is one of the fastest growing towns in West Bengal.

Reappearing river

> ***We have reason to believe that Adi Ganga is not dead and actually flows below the built-up areas***

The river resurfaces after its hijack. thethirdpole.net team tracked its then-southward flow till a point in Suryapur near Joynagar in south 24 Parganas district. Residents said this river joined the Piyali, which flows through the Sundarbans to join the Matla and into the sea.

There is some hope of resurrection, even for the stretch that has disappeared. "We have reason to believe that Adi Ganga is not dead and actually flows below the built-up areas," said Swapan Ghosh, secretary of a committee looking after the upkeep of Karer Ganga. A few years back, when we were trying to clean up the pond, we found there was a continuous flow of water from below."

Pradip Sikdar, a groundwater expert at the Indian Institute of Social welfare and Business Management, said this may well be true. "In an unconfined aquifer, the river water can merge with the water underground."

Dead river

But there seems little hope that the garbage and encroachments that have killed the Adi Ganga will be tackled in any meaningful way. Talking about the nearly 200 crore rupees already spent in supposedly cleaning it, environmental activist Subhas Datta said, "It's a major scam, it's a story of systematically murdering the river with encroachment, effluent discharge and all kind of possible degradation, under the obvious patronage of political powers." Dattahas recently petitioned the National Green Tribunal about the degradation of the Adi Ganga.

Biswajit Mukherjee, former chief law officer of West Bengal Pollution Control Board, agreed. "This is nothing but a scam," he said. "Not only in case of Adi Ganga but for the entire Ganga; under Ganga Action Plan projects, so much money has been spent but virtually no improvement of Ganga has taken place. Unfortunately in our country, environmental scams and crimes are hardly pinpointed."

Pollution control board data shows the dissolved oxygen level along most stretches of the Adi Ganga is zero, so no life can exist in it. The coliform bacteria count is between nine and 16 million per 100 millilitres of water. The national standard for water fit for bathing is 500 per 100 ml. Apart from the garbage, 57 drains containing untreated waste water flow into the Adi Ganga.

Reason for hope

Pollution control board chairman and noted hydrologist Kalyan Rudra feels the Adi Ganga should be restored as far as possible because it plays a very important role in drainage of its hinterland.

Activists Datta and Roy say the Adi Ganga can be brought back to life. "It is entirely possible if state and central governments take active interest in resurrecting the original end flow of the Ganga," Datta said."If they can spend hundreds of millions for various studies on the Ganga and so called beautification, why can't they take appropriate measures to rejuvenate the old channel?"

"There are various global examples where old and buried channels [in the UK and US] have been restored to undo previous mistakes. Why can't we replicate them?" asked Roy.

Jayanta Basu is a journalist based in Kolkata

Part 3:
Taming the river

Ganga floods Uttarakhand as ministries bicker over dams

Joydeep Gupta

The Himalayan rivers that join to form the Ganga are in spate this monsoon, flash floods are being worsened by abandoned dams, but some ministries still want them to be built

Flash floods have been devastating Uttarakhand — *image by Dev Dutt Sharma / Mountain Partnership*

After only six weeks of India's annual 17-18 week summer monsoon, Uttarakhand is reeling under a series of flash floods that experts blame at least partly on the hydroelectric projects that had been started in the Himalayan state and then abandoned under a Supreme Court directive following the huge flash floods of 2013.

The other big cause is climate change, which has led to fewer rainy days this monsoon, but more intense rainfall on those days. Glaciers are also melting faster as the average temperature in the Himalayas has gone up thrice as much as the global average since 1990.

Faced with this double whammy of climate change impacts and abandoned partially-built dams that have channelled rivers in new directions, residents of many Uttarakhand villages are now stuck behind multiple landslides, with food running out and their homes in danger of being washed away or buried under yet another landslide.

Here is a glimpse of the situation in mid-July in this cradle of the Ganga basin:

- Due to flash floods and landslides, the highway to the popular pilgrim spot Badrinath was closed;
- The road to Nand Prayag had been closed for a fortnight – residents were running out of food and their homes were under constant threat because boulders on hillsides had come loose, while road construction material had not been removed either;
- Heavy rain was keeping everyone indoors in the famous hill station Mussorie, while the road from state capital Dehradun had been badly hit by landslides;
- A bus had been swept off the road by flash floods between Haldwani and Chorgalia – local residents risked their lives to pull out 24 passengers;
- Landslides at Gulab Ghati were slowing down traffic between Kathgodam and the other famous hill station Nainital;
- Eight houses were swept away by flash floods at Thailisain village, near the popular Dhari Devi temple; there were cracks on the road to the temple, while the bridge to it was at risk from an Alaknanda river in spate (Alaknanda is one of the principal tributaries of the Ganga in the

Himalayas) – large trees had been uprooted and were rushing down the flooded river, battering the foundations of the bridge repeatedly;

- Landslides had made the roads to Gangotri and Yamunotri very risky – a group of visitors from Delhi had got out of their car to move some stones from a landslide-hit patch in Bhatwari on the way to Gangotri, when a boulder fell on their car and took it down the ravine; on the way to Yamunotri the weakened road collapsed under a fully-laden truck and all traffic was stuck for hours; on these roads, there have been two reported cases of landslides missing passing vehicles by a matter of a few metres;
- In almost all Uttarakhand towns including Dehradun, drains have not been desilted before the monsoon, so rainwater keeps flowing down the roads.

People suffer, ministries bicker

In such a situation, different ministries of the Government of India are quarrelling over the resumption of the stalled dams. The ministries of power and of environment, forests and climate change have told the Supreme Court that they want five of the hydroelectric projects resumed, while the ministry of water resources and Ganga rejuvenation has opposed any resumption.

The water resources ministry told the Supreme Court, "The three rivers, namely Alaknanda, Mandakini and Bhagirathi, and Ganga river from Dev Prayag downwards till Ganga Sagar should remain in their current condition without any further disruptions/interruptions or diversion." Alaknanda, Mandakini and Bhagirathi together make up the Ganga before it descends from the Himalayas to the plains. Ganga Sagar is at the mouth of the Ganga, where it flows into the Bay of Bengal.

Officials in the water resources ministry told thethirdpole.net that the Prime Minister was keen to ensure "sufficient" water flow in the Ganga to dilute at least the worst of the pollution it suffers from further downstream.

But the power ministry is finalising a fresh hydropower policy to give a push to the sector that has been virtually halted due to opposition on the ground from people likely to be displaced by the projects. Environmentalists have also been opposing the projects, and the situation in Uttarakhand gives strength to their arguments.

There were 24 hydropower projects under construction in Uttarakhand when the 2013 floods hit the state, out of the 70 that have been planned for many years. Together, these 70 projects are supposed to generate 9,000 MW, but the water resources ministry has now pointed out to the Supreme Court that this potential has been bandied about without any consideration given to the carrying capacity of the rivers, the minimum water flow required to keep the rivers alive (the so-called environmental flow or e-flow) or the needs of local residents. The ministry now wants a cumulative impact study, taking all the proposed projects into account.

The five dams that the other ministries want to resurrect are the 300 MW Alaknanda project, 24.3 MW Bhyunder Ganga project, 4 MW Khirao Ganga project, 171 MW Lata Tapovan project and 195 MW Kotlibhel 1A project. The government has recommended "considerable design modifications" on the Alaknanda and Kotlibhel 1A projects.

Opposing this and pointing out that rejuvenating the Ganga was one of its mandates, the water resources ministry has told the Supreme Court, "If the origin of the Ganga is compromised, then the rejuvenation of the river will be impossible."

The environment ministry had told the Supreme Court something similar in 2014 but has now changed tack. There are media reports that the change came after a meeting convened by the Prime Minister's Office.

New law for Ganga

While the Supreme Court has to deal with the conflicting stances of various arms of the government, the water resources ministry is going ahead with a bill meant to help clean the Ganga. Minister Uma Bharti has said she has obtained support for the bill from the states through which the Ganga flows: Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal. This is essential because various aspects of water resources are central subjects, state subjects and concurrent subjects under the Indian Constitution.

Retired judge Girdhar Malviya, now member of the National Ganga River Basin Authority, will head a team to draft the bill.

The ministry needs to show results under the Prime Minister's flagship National Mission for Clean Ganga, better known as Namami Gange – which is meant to clean the river, improve water flow and enable navigation by bigger vessels. The mission has an outlay of INR 20,000 crore (USD 2.98 billion) over five years, starting May 2015.

Bharti has been launching schemes in haste. She recently announced the simultaneous launch of 231 projects along the Ganga and its tributaries for modernisation and redevelopment of ghats (steps leading to and from the river) and crematoriums; development of sewage infrastructure and treatment; tree plantation; pilot and interceptor drains; trash skimmers; and conservation of biodiversity.

There are many more schemes, including:

- Four hundred villages along the Ganga to be developed as model villages, with 13 Indian Institutes of Technology adopting five villages each;
- Eight biodiversity centres to be developed at Rishikesh, Dehradun, Narora, Allahabad, Varanasi, Bhagalpur, Sahibganj and Barrackpore;Wildlife Institute of India has been asked to make a plan to conserve Gangetic dolphins, crocodiles and other species; the Central Inlands Fisheries Research Institute has been asked to improve fish stocks and variety;
- Of the 118 towns along the river, 59 have been surveyed and 27 reports prepared, mostly to improve sewage treatment;
- To control erosion, trees will be planted in 2,700 hectares along the river in the current financial year;
- Five automatic water quality monitoring stations have started functioning, in addition to 57 manual stations; the minister has promised 113 more automatic stations will be set up by next March;
- In Varanasi, the Prime Minister's constituency, water quality data from automatic real-time sensors will be displayed at various ghats;
- As for industrial effluents flowing into the Ganga, the Central Pollution Control Board has set up monitoring stations in 508 factories, and has ordered 150 factories to shut down.

While this list may be impressive, its impacts remain to be seen, while the problem is of a different magnitude altogether.

Joydeep Gupta is South Asia director of thethirdpole.net

Farakka barrage, engineers and hydropolitics

Nilanjan Ghosh

Near Farakka — *image by* Sarah Jamerson

Why the controversial barrage was built on the Ganga just upstream of the India-Bangladesh border, and what the construction has led to

The recent call by Nitish Kumar, chief minister of the Indian state of Bihar, to remove the Farakka barrage has added a new dimension to the ongoing debate on the utility of the barrage. Located in the Indian state of West Bengal, roughly 16.5 kilometres from the border with Bangladesh, the barrage was planned to enhance the flow of Bhagirathi-Hooghly branch of the Ganga to resuscitate the port at Kolkata (then Calcutta).

While the Farakka barrage has earlier been blamed for reducing water flow, causing salinity ingress and drying up of the Sundarbans delta, the problem with the management of sediments has recently taken an ugly turn with the floods in the Indian states of Uttar Pradesh and Bihar.

The government of Pakistan (which encompassed the present state of Bangladesh, created in 1971) was critical of the project. It had feared that by enhancing the flow into Bhagirathi-Hooghly, the barrage would reduce the dry season flow of the Ganga (known as the Padma in Bangladesh) downstream.

There were members of the Indian technocracy who also opposed the project, such as Kapil Bhattacharya, then chief engineer of West Bengal. He was singled out and marginalised. Since then, the construction of the barrage has been a crucial factor affecting Bangladesh-India relations and perceptions of transboundary environmental issues.

Short term solution

The Farakka barrage stands as a classic example of engineering solutions that looked at short-term economic benefits and ignored long-term sustainability concerns. This way of thinking was promoted during the British colonial period. This was the time when such large scale endeavours were being experimented with all over the world, with civil engineering being established as a discipline in the 19th century. The establishment of Thomason Engineering College at Roorkee (now theIndian Institute of Technology Roorkee) which began as a class for engineers in 1845, before being named after its founder, James Thomason, in 1854, provided young Indian students with training in the European knowledge of water engineering. This form of water management spread across engineering colleges in India over time.

This thinking dominates the Indian water engineering scenario even today, and has led to enhanced damage, livelihoods losses and eventually conflicts at both international and inter-state levels. The Farakka barrage is a classic example.

When the barrage was planned, knowledge about the complex ecology, hydrology and sediment flow of Himalayan rivers like the Ganga was either not available or ignored. So, the possible impacts of building a barrage were not perceived at the design stage.

The most significant knowledge gap in river engineering was and is related to the understanding and management of the sediments, which are integral parts of water flows. Without consideration of the sediments, the Bangladesh-India treaty of 1996 on the sharing of the dry season flows at Farakka turned out to be merely an arithmetical exercise on amounts of water to be shared, without looking at overall impact on the river systems.

Floods are regular phenomena in Uttar Pradesh and Bihar. From the perspective of natural science, floods are integral components of the eco-hydrological cycle. They cause damage, but also, as the floodwater recedes, it leaves behind rich silt and sediments, which have made the Gangetic plains the “rice bowl of South Asia”. The real problems start when the floods become severe, or when they start depositing sand instead of silt.

But what happens when the silt is blocked by a barrage? The Bihar chief minister says the sediment build-up upstream of the Farakka barrage has raised the riverbed, which is worsening the flood situation. It also diverts the water meant for the Bhagirathi-Hooghly branch of the Ganga into a narrow channel in Malda district of West Bengal, leading to bank erosion and flooding.

Without the barrage the river would have carried the sediment to the delta and flushed some of it out to the Bay of Bengal. The Bengal delta is built on the huge sediment load carried by the Ganga and the Brahmaputra. Now the Farakka barrage seems to have incapacitated the river’s potential to perform this function. The barrage and subsequent lack of sediment separation technology seem to have punctured the “soil formation” service of the river further downstream. The avowed purpose of resuscitating the Kolkata port has not been satisfied either.

Cure worse than disease

Nevertheless, the removal of the barrage may create other problems, and might escalate the conflict between states and between nations. There is no doubt that one benefit of the barrage is amelioration of the water problem during lean seasons in the densely populated areas of West Bengal, due to the flows through the Bhagirathi-Hooghly channel. The drinking water and sanitation problems of the burgeoning Kolkata metropolis seem to have been reduced

due to the Farakka barrage, which has not only resuscitated the surface water flow in the channel, but may have also ensured groundwater recharge. Removal of the barrage will negatively affect the populace and ecosystem services in this part of the state, leading to resistance, and possibly conflict.

But at the very least, the problems created by the Farakka barrage should inform new projects. There are good examples of how to build a barrage and use the sediments at the same time.

But at the very least, the problems created by the Farakka barrage should inform new projects. There are good examples of how to build a barrage and use the sediments at the same time. The Three Gorges dam on the Yangtze designed by Chinese experts helps in flood control, and also uses the peak flow to flush the sediments downstream for floodplain cultivation. However even Chinese officials admit the negative impact of this controversial project due to unintended build up of sediment behind the dam, and devastating landslides are becoming more frequent around the site.

While India needs to evolve better ecologically informed engineering, we also need to pay serious attention to the management of Himalayan rivers. Especially when discussing ideas of integrated river basin management, we need to consider river basin commissions with powers to mediate between states so as to avoid escalation of inter-state conflicts on river waters.

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Photo essay:
The nowhere people

Arati Kumar-Rao

The truly desperate take refuge on these chars. They "recognise" land lost in erosion in the chars, they parcel the sandbars mirroring the mainland, they give the chars names, and they till it and reap rewards till the river takes it all back, leaving them displaced, yet again.

It was 4.30am. The fog sat ghostly grey on the paddy fields and mango groves as we headed north from Murshidabad to meet the Ganga river where it enters West Bengal, in Malda district. On the edges of the highway, melting into the shadows of huts and coconut trees, heavily mufflered men idled beside bicycles piled high with wares, waiting for a break in traffic. At this point, India's border with Bangladesh is 20km away. Smuggling is common; on any given day, everything from cows, electronics, medicines, rice to fish and flesh, plays hide and seek with the Border Security Force personnel. We did not see the Ganga till we were upon it. Stuck in a jam behind a long row of trucks, we inched on to a barrage that pinched the Ganga at Farakka, in the northern part of the state.

The rise of silt, the fall of cities

The Ganga, meandering through 2,500km and draining a quarter of her land mass, reaches the Bay of Bengal in braided distributaries

These navigable distributaries allow the hinterlands to access the Bay of Bengal, and that means trade.

Himalayan rivers like the Ganga carry an important cargo: silt.

As she tumbles down from her lofty origins, the Ganga carts more sediment than most rivers in the world—almost four times as much as the Amazon. This sediment fertilizes the delta and the plains, and enables the growth of rice, millet, mustard and greens like coriander. Himalayan rivers wander in their deltaic reaches. They meander. They deposit silt in one channel here, block their own progress, and carve a fresh way out somewhere else. Swinging this way and that, fickle, wild, unpredictable, these muddy rivers move around, dumping their cargo of silt, creating deltas, making food-bowls. In Bengal, the Saraswati is an illustrative case study. It ruled the waterways for a few glorious centuries, but over time it also choked with silt.

In the 17th century, the British were wresting Bengal from the Mughals. A settlement on another distributary—the Hooghly—became the port of choice of the 18th century: Calcutta.

For the emerging British empire, the Hooghly was a gateway to Assam, a navigable waterway into the northern Gangetic plains. Trade reoriented itself away from Asia and in the direction of Europe. Calcutta on the east coast, and Bombay on the west became the Empire's two most important ports.

The Ganga, wild, brown, and strong-willed, had her own plans.

Through the 19th century, the Hooghly was gradually silting; by the early 20th century, ships wary of massive underwater shoals, had to wait for tides to turn in order to reach the port.

The port was in for a change and, so were the people of northern Bengal. The Calcutta Port Trust (now Kolkata Port Trust) tried (and continues to try, to this day) to dredge the river, with little success.

The river continued to lay it on thick.

The birth of a barrage, the decline of a land

In 1853, Sir Arthur Cotton, a British general and irrigation engineer, suggested interrupting the Ganga at Farakka. This, he theorized, would flush the Hooghly with the waters of the main channel of the Ganga. The Hooghly would become navigable, and Calcutta a buzzing port.

The British engineers failed to reach a consensus on a suitable site for the barrage, and the plan to resuscitate Calcutta lay dormant for over a hundred years—until 1957, when the Indian government revived the idea. They called upon a British expert, W. Hensen.

Hensen ratified Cotton's idea of a barrage at Farakka.

Between 1961 and 1975, when it began operations, a 2.24km-long barrage was built at Farakka, with a feeder channel that pushed water into the Hooghly. It did not work.

Hensen had not considered that the Hooghly was a tidal estuary. The tides push in 78 times the amount of water flowing down the Hooghly at the height of the monsoon. There was not enough water in the river to push out the sediment that the tides naturally sloshed back with greater force.

The Farakka Barrage thus failed in the task it was constructed for—flushing sediment and enabling travel sans hindrance. The port continues to silt up. The barrage now supplies water to the NTPC Ltd plant just south of the barrage, helps in some irrigation, and, as my guide would explain, has a rather sinister unintended consequence.

Landlords at night, beggars in the morning

Tarikul Islam would be my guide as I wandered upstream of the barrage. He was waiting for me outside his jewellery store in Bangitola, a settlement of erosion-affected people in Malda district.

After a few cups of *laal saa*, milkless, sweet ginger tea, we headed to the northernmost point of West Bengal.

The sun was beginning to dip as we climbed into a long, low country boat. Following a circuitous route that skirted shoals and new sandbar islands, we made our way to the ancient town of Rajmahal, in Jharkhand, where the river enters West Bengal.

Here the Ganga, pregnant with silt, comes around a bend and strikes the Rajmahal hills. Finding no purchase against the hard stone of the right bank, the river ricochets, ramming into the soft clay on the left bank.

What the barrage did to the river at this point was unnatural, and not pretty.

In rudely obstructing the natural course of the Ganga, the Farakka Barrage blocks the transport of sediment. With nowhere to take the silt, the river dumps it at the barrage.

Over time, these deposits accrete, raising the river-bed ever higher. Finding its progress checked, the river carves new channels out of the trap and often, these channels push into the land, eroding all that lies in their path.

As we stand at the ferry dock in Jharkhand, looking out over the Ganga as it courses into West Bengal, Tarikul points out the old channel and the new. "Everyone in this area of West Bengal has lost everything to the river—some lost homes and land eroded 17 times, lost completely to the river," he says. Tarikul has lost homes and land thrice.

Professor Kalyan Rudra, chairman of the West Bengal Pollution Control Board, has worked extensively on this problem and studied the geomorphology of the area. In a 2004 paper he explained the situation. He states, "Deltaic rivers have a tendency to oscillate widely. This 'swatch of meander sweep' is proportional to the discharge flowing through the river.

The case of the Ganga in West Bengal is quite different. The river in this stretch upstream of the Ganga is so clogged with sediment that it is compelled to alter course. The mighty river even threatens to outflank the Farakka Barrage and open a new route through the presently moribund channels of Kalindri and Mahananda."

The Kalindri today has no water flowing through it. It is lush with paddy fields. The Mahananda, on the other hand, flows thinly through the loud press of Malda town.

The dried up Kalindri river formed the eastward swing of the ancient Ganga. Today it is lush with paddy fields and dotted with settlements.

If the barrage forces the Ganga into taking these dried paths, it could destroy NH 34 and threaten nearly four million people in Malda district. Professor Rajiv Sinha of the Indian Institute of Technology in Kanpur has done an extensive study using remote-sensing technology and survey maps to tell the story of the land before and after the barrage. He believes the management of the barrage is an error. "You don't just build a barrage on a river like the Ganga and forget about it. This is not the Thames. The sediment flows we are talking about are enormous. Impede Ganga's progress as the barrage does, and the sediment has nowhere to go," he says. Professor Rudra puts the scale of the sediment problem in perspective: if a truck carries seven cubic meters of sediment, the number of trucks needed to dredge the Farakka Barrage could go around the equator 126 times!

The people of Malda are caught between the sediment and the wandering, eroding river.

Unlike earthquakes and floods, erosion is not considered a "natural disaster" in the calculus of bureaucracy. Thus, where governments are quick to announce "relief" in the event of a disaster, loss due to erosion is neither calculated, nor compensated.

"We lose our world," Tarikul says. "Everything goes into the river, leaving us empty-handed. And the government does not consider this a disaster—there are no allocations of funds for relief.

"Raat ko zamindar, savere ko bhikari (We go to sleep as landowners and wake-up as beggars)," he says.

Lost and found — and lost again

As the Ganga ploughs through the plains, it regurgitates the sediment and soil as sandbar islands known as *chars*. These *chars* are birthed by the river, and reclaimed, and birthed again elsewhere; they defy standard land/water classifications, and "belong" to no one.

These deposits of silt are rich, fertile; they yield bountiful crops; they tantalize with possibilities, but are too ephemeral to sustain planned lives and livelihoods. The truly desperate take refuge on these *chars*. They till them and reap rewards till the river takes it all back, leaving them displaced, yet again.

When the Ganga swung wildly eastward into the channel it occupies today, it threw up a large *char* just off the right bank. Homeless people from the lost villages on the river's left bank in Malda district made a new home here, and began to farm in Palash Gachhi. It is like most *chars*—fertile, unowned, and unserviced—with a disconcerting subtext.

When it appeared, it showed up on the wrong side of the Jharkhand-West Bengal border—which, unlike other state borders, is not fixed. For some inexplicable reason, the Survey of India demarcated a part of the border between the two states as "the path the Ganga takes".

The problem is that the Ganga adheres to no permanent path. It moves. A lot. And the border moves with it.

Neither side likes the idea; both dispute the border. Jharkhand claims this *char* (which has over time added more sediment and joined the mainland) as its own—but it does not claim the people who live on it. Thus the people of Palash Gachhi are nominally Bengalis living in Jharkhand—they fall between bureaucratic cracks and can avail of no services from either state.

They are the nowhere people—nowhere on any government's radar, living in the here and now, unsure of what tomorrow holds.

Dozens of children flock around us, eager-eyed and bright-faced. Reena, 12, says she wants to become a teacher. Gehul, 14, wants to be a *maulvi*. They are the exceptions—children who have some notional idea of a "future". Most others just return blank stares when I ask what they want to be when they grow up.Childbirth here is inherently hazardous. Rabha Bibi lost her daughter at birth because she couldn't reach the hospital in time, she recalls.When Rabha Bibi went into labour, four men carried her on a *khatiya* (a woven cot), 3km to the ghat. From there, a country boat took almost an hour to reach Panchanandapur village. From there, the men carried her another 4km to the hospital.

It was the nearest medical aid available, and the journey took a precarious 5 hours even as her labour intensified. The story plays out in a generational loop. Rabha Bibi's daughter has lost a child.

Anecdotal evidence supports the belief that infant and maternal mortality on these *chars* is inordinately high, for most births occur at home, with no proper medical oversight. State averages bury these local spikes.

Since it's difficult to make a living off the *char*, the men go looking for jobs elsewhere. Some leave home when they are only 12 for Mumbai.

When soil is livelihood, land is home

"See? The erosion doesn't stop at our doorstep, it gnaws its way in, eating through every family," says Tarikul. Almost every able-bodied man from the region now lives in Mumbai—and this is true not just of the *chars* but also of the villages on the banks.Tarikul was no exception. When his family lost their land to the river the first time in 1982, his father sold the door of his house so the family could eat. Tarikul bought a ticket to Mumbai. It cost him Rs.56. He slept on footpath—it's only for a day or two, he consoled himself. It took him years to garner enough goodwill to get permission to sleep inside a shop.

By day he sold tender coconut and earned Rs.80 a month. He did not drink, or smoke. He apprenticed at a jeweller's store in his free hours. Over a 10-year period, he managed to save enough money to return home in 1992.

Tarikul's friend, Mohammed Inamul Haque, teaches at Panchanandapur. He remembers the repeated devastation well. "There were once 628 shops in the market. A lot of trade would go through Panchanandapur when I was secretary of the market; it was famous. And I saw the river swallow it in front of my eyes." There were no banks in Panchanandapur. People stashed their savings at home. They lost everything. Businessmen and landlords were suddenly forced to beg for work and food. "This is not just my story," Haque says. "Everyone here has stories like this. Some people had 200 *bighas* (around 65 acres), others had 400."

Haque lost 100 *bighas*. He has endured the seismic effects of erosion seven times. After the last displacement, he put all his savings into a small piece of land 5km from the river and built a sturdy brick house. If he lost this too, he would be left with nothing. "While it was being built, I went to the roof and prayed hard."

The house has sheltered him for 12 years—long enough to nurture a sense of security. Except that, the river has crept up too—it's just 500m from his door.

This would be a ticket out of the desperation, Raza imagined. He lives on a char. A ticket to Bombay – better prospects, he thought. He now sleeps on the streets and works in the fruit bazaars of Bombay and sends $30 home a month.

Man proposes, government disposes

Malda has likely lost over 250 sq. km of land—more than half the size of the city of Chennai—to the river. Each of the swallowed *bighas* once employed people—sometimes all members of a family. Land sustains them—they grow, they eat; they lose their land, they starve and, often, migrate.

Besides agriculture, the only industry in the area is *beedi*-making, but the income is meagre, insufficient to sustain families of five or eight or 12. Rolling 1,000 *beedi*s takes two days and fetches Rs.100. If the *beedi*s the women make are surplus to demand, they are not paid.

Haque and Tarikul formed a committee in 1995 as fulcrum for the erosion-affected people. Their demands were simple then, and are the same today: They want the government to release information on vulnerable areas, acquire that land, pay the villagers at market rate, and rehabilitate them. They don't want the government to "sanction relief", they know from experience that it will be siphoned off by middlemen and functionaries. They would rather the government acquire the land at risk, and in return give them electricity, schools, hospitals, and a life away from the erosion.

The government, instead, has pumped crores into fortifying the banks with boulders to stem erosion. It costs over Rs.1 lakh to protect 1m of riverbank—and it doesn't guarantee against erosion, says Professosr Rudra. The river washes away the boulders too. Yet the effort continues. According to estimates, the government has spent several crores of rupees on futile fortifications.

"Often, they start this useless work in the monsoon, which is stupid. How can you work on fortifying the bank-line when the soil is already wet with rain?" asks Tarikul, who has seen it all before.

Professor Rudra agrees with Tarikul's assessment. In his 2004 paper, he quotes from a Comptroller and Auditor General of India report dated March 1999:"Implementation of anti-erosion scheme suffered all through from recurring weakness in planning, execution

A household with seven children makes a living rolling beedis. These people had a few bighas of land before the Ganga swallowed the whole village.

and monitoring at senior level of the Department and also the Government. Disregard of the recommendation of the Experts' Committee, absence of master plan, delayed tendering, non-testing of soil before execution of work, hasty execution of work, appointment of large number of small contractors and work during full monsoon in unfavourable weather condition resulted in frequent and repeated failure of the work leading to wasteful and unfruitful expenditure". There is thus consensus among the locals and experts. It is only the government that fails—or refuses—to see what is obvious or do the right thing by the people.

Haque knows the ground realities. He knows the genesis of this systematic destruction, and has witnessed its repeated occurrences. He understands the dynamics of apathy and its bedfellow, corruption. He explains it all to me like the teacher he is, a gentle smile on his face as he talks.

I interrupt. Are you not angry? I ask.

He laughs. He picks up a plate.

"How much can this plate hold?" he asks. "You can fill it only so much. After that, there's nowhere to go. My anger is like that. I could hold only so much. It overflowed, and then it disappeared. I am pushing 60. After seven losses, I still have a roof over my head.

"I don't know how much longer it will last—the river keeps pushing closer. But for now I have a roof, and I am grateful."

A grant from the Asia Foundation and The Third Pole to investigate issues on the Ganga enabled Arati Kumar-Rao to undertake this assignment. A condensed version of this story was first published in Mint, on March 28, 2015

Photo story:
Living on the edge of a rising sea

Anup Bhattacharya

Sea levels around Sagar island in the Ganga delta are rising almost three times the global average — *all images by Anup Bhattacharya*

Ghoramara Island in the Ganga estuary of West Bengal is slowly being submerged by rising sea levels, forcing people to migrate in large numbers

For people living on the islands in the Ganga estuary, climate change is a demon they battle every day. It has already transformed their lives and livelihood. Nowhere is this clearer than in Sagar administrative block in West Bengal on the edge of the Bay of Bengal. This area is part of the Sundarbans, the world's largest mangrove ecosystem, and one of the areas most vulnerable to climate change in India.

The Sagar block, which has a population of around 200,000, has to not only grapple with a rising sea level at a rate that is nearly 250% higher than global rate (8 mm per year compared with 3.23 mm per year, according to the school of oceanographic studies of Jadavpur University in Kolkata), but also stands exposed to increasing high intensity cyclones and storms. The rising sea has already submerged Lohachara island in Sagar block, eaten nearly three-fourths of Ghoramara island and severely affected the bigger Sagar island.

The story of Ghoramara shows that how climate change is changing the way people live — how it divides families, breaks social taboos and hastens forced migration. The largely poor people in the island (45% live below the poverty line) are under enormous socioeconomic stress that has upturned their lives.

Sagar Island (left) and Ghoramara Island (right) were attached in early 20th century. By the middle of the century older people say they could swim across from Ghoramara to Sagar during low tide in a few minutes. Today it takes about 40 minutes to reach Sagar Island from Ghoramara. The gap between the islands has increased mainly due to rapid erosion in Ghoramara.

Ghoramara Island, about 30 km north of the Bay of Bengal, has seen unprecedented erosion in last few decades. From 26 square km, it has shrunk to around 6.7 square km. The erosion has been rapid in past four decades with about half of the land lost to the Ganga during the period. The population, which once around 40,000, is now merely 5,193, according at the 2011 census. Lohachara, a neighbouring island, has totally vanished. The Khasimara area of Ghoramara is fast disappearing.

An elderly couple, Kumed Mondal in his eighties and Madhuri Mondal in her mid-sixties, live a lonely life in a mud house in Ghoramara. Their sons left long ago in search of greener and safer pastures and their daughters are married. “The river was originally far from our house but now it seems to be coming closer every day. Kumed Mandal says. This is the story of most families in Ghoramara, with elderly people or women staying behind to look after the vanishing property and hoping for some compensation from the government.

Nilmani Parua, in his forties, lives alone in his two-roomed hut. Parua would have been a sought after groom anywhere in West Bengal but not in Ghoramara. Climate change has wrought a curious social upheaval. Boys in Ghoramara struggle to get a wife unless she is from the same island. “Who will get his daughter married off to a family who live on a sinking island such as Ghoramara,” Parua ruefully says sitting in his bachelor den.

The post office in Ghoramara was the second to be set up in West Bengal after Kolkata. Once a two-storied building on 36 acres of land, it is now shifted to a single rented room. “Everything went under the water about 12 years ago and since then we have been working in this rented place,” says postman Abhimonyu Mondal. Now the post office closes around midday because there is very little work. “On average, 10 to 12 letters come every day. How much time do you need to dispatch them?” asked postmaster Srikanto Rana.

The human exodus outpaces the erosion in Ghoramara. While the island area has shrunk to about one-fourth of its previous size, only one-eighth of the population remains. The mass migration has happened because of a loss in livelihoods. The lucrative betel leaf cultivation (pictured) has taken a severe beating due to continuous intrusion of salt water. Increasing salinity has also affected the fisheries, the other major source of livelihood in the area. Many people have migrated to places like Kerala or Chennai to find work.

Mamata Bibi has been married into a family that had changed address five times, forced by the rising water. Now her family is searching for a new destination, preferably outside Ghoramara, as the present dwelling has come perilously close to the advancing river. “We do not know how long this house will survive. My brother-in-law, his wife and my husband have gone to scout for a piece of land outside Ghoramara,” says Mamata.

Dhoblat Sibpur in Sagar Island looks like nature is waging a battle against itself. The area by the sea has a few huts barely surviving alongside the trees. “This is our fourth house. Every time during the high tide, we fear being washed away,” says Liala Khatoon, tiptoeing carefully in ankle deep low tide water.

Sheik Istaq (left) and Sheik Mahmood, now in their sixties, left Ghoramara 45 years ago and now live in a resettlement colony within Sagar island, also called Ghoramara. Though life has become safer, it has become more difficult. “We had so much land in Ghoramara. When we were rehabilitated here 45 years ago along with 30 families uprooted from Ghoramara. Each family was given a small piece of land. It has now become extremely difficult to meet two ends,” Sheik Istaq says. “We still do not have electricity and other facilities which the sons of the soil from Sagar have,” says Sheik Mahmood.

Ghoramara has been sinking but there has been an effort stop the inevitable. Local lawmaker Bankim Hazra said he has taken steps to ensure the island still receives development funding from the government. "It's difficult, but we are trying to stop erosion as far as possible and save whatever is left in Ghoramara," says Hazra. The poster says, "We want to save Ghoramara."

Anup Bhattacharya is a Kolkata-based photojournalist
This article was first published on India Climate Dialogue

Part 4:
Life under threat

Life in the Ganga faces unprecedented crisis

Juhi Chaudhary

The smooth coated otter is one of the many threatened species in a polluted Ganga — *image by WWF-India*

Dirty water, toxic water, low water, no water — India's greatest river is increasingly becoming unliveable for the rich aquatic life it once supported easily

If you are a Jim Corbett fan, you will know that he loved angling for the Golden Mahseer just as much as he relished the challenge of putting down a man eating tiger. But if he were to cast his line in the Upper Ganga today, he would not find a nine-footer fish. Very soon, nobody may find a one-footer either.

Once fondly called the tiger of the Ganga, even a minnow-sized Golden Mahseer is now difficult to find in the streams and rivers of the Himalayan foothills that get together to form India's mother river. WWF-India estimates that over the last century, the percentage share of Golden Mahseer in the catch has declined from 40-50% to 5% in this part of the world.

With 60% of the Ganga waters diverted for hydroelectricity and irrigation even before the river reaches the plains, there is simply not enough water for the big fish. Even the small samples are staring at extinction if the new dams being planned stop their access to Uttarakhand's Nyar River, a tributary of the Ganga.

Suresh Babu, Director, River Basins & Water Policy at WWF-India, says inEnvironmental Flows Assessment in India: The Ganga Experience, "It is believed that the Nyar is the only tributary of the Ganga in which Mahseer (fish) breed in the monsoon period when the flow in the Nyar is conducive. The construction of dams and hydropower plants in the downstream reaches may change this situation, as the adult Mahseer may not be able to migrate upstream to reach the Nyar for breeding."

Plataniste or ganges river dolphin (platanista gangética) — *image by WWF-India*

This is one reason why experts want to preserve the environmental flow of the Ganga while taking up development projects on the river. The term describes the volume, timing and quality of water flows required to sustain the river's ecosystem and livelihoods of people dependent on it. But there are huge differences between hydropower project developers and environmentalists on what this volume should be.

"The government has the 'Namami Gange' programme and they are talking about aviral (free) flow, swachh kinara (riverfront development) and preserving the zoological and ecological integrity of the river, but where is the roadmap? When you talk about a free-flowing river, it doesn't mean free flow of water only. It means free flow of everything including nutrients, biota, and everything that's there in the river, including wildlife," said Himanshu Thakkar, co-ordinator of South Asia Network on Dams, Rivers and People, a non-profit.

River that was rich with life

With the main river flowing over 2,500 km, the Ganga and its tributaries are home to over 140 fish species, 90 amphibians and many birds, quite apart from the famous reptiles and mammals. And this does not include the biodiversity-rich delta, the Sundarbans.

Like all Hindu gods and goddesses, Mother Ganga is always depicted riding her vahana (animal vehicle). In her case, it is the Makara, the Ganga river dolphin. Now declared India's national aquatic animal, these blind dolphins – one of only four freshwater species in the world – continue to be under threat. But they are not the only ones.

The fish-eating crocodile species the Gharial (sometimes also called Gavial), otters, turtles, fishes, all the animals in the Ganga need clean flowing water, with sufficient depth for migration and spawning. With constant breaks due to dams and barrages, and due to drains discharging untreated effluents into the river, this simply does not happen anymore.

Several species are vanishing. For example, the Hilsa that once swam up most of the Ganga and the Yamuna from the Bay of Bengal up to Delhi has now vanished upriver of the Farakka Barrage at the India-Bangladesh border.

The Ganga river dolphin is still found in the river in Uttar Pradesh, Bihar and West Bengal. But these animals depend on echolocation to find their food. So they are highly vulnerable to changes in water flow and depth. Nowadays they have congregated in a few relatively clean spots

with adequate water. They have done the same along the Brahmaputra and its tributaries, where their main problem is lack of depth as the river keeps dumping more sand on its bed.

Ganga biodiversity — *image by Beth Walker*

Dolphin gauge

WWF-India is running a programme to conserve the dolphins while roping in local communities along the river in Narora, Uttar Pradesh. The NGO is trying to make people aware that presence of dolphins is an indicator of the good health of the river and helps in cleaning the water. The results are encouraging. In an estimation done in 2015 led by WWF-India at tandem with state authorities, it was estimated that the number of dolphins in UP was 1,272, up from 671 in 2012.

"Dolphins are found in pockets of deep water, and thrive in areas dominated by eddy currents for feeding," Said asghar Nawab, senior biodiversity expert in WWF-India. "They also disperse in monsoon period." With the any slight change in the depth of the river or the flow of currents, the animals can get severely impacted.

According to Nachiket Kelkar, a researcher from Ashoka Trust for Research in Ecology and the Environment, the negative impacts are already being felt in Bhagalpur, an industrial town in Bihar, close to the Vikramshila dolphin sanctuary.

"The water level in the river has really gone down. Earlier the deep pools used to be of 50 metres in depth but they have now reduced to 30 metres," Kelkar said. "With the reduction in the level of water, dolphins become highly vulnerable and often get stuck in the fishing nets."

According to Kelkar, dams upstream are releasing less water because they do not want to affect the building of bridges. Also, the entire river is being dredged downstream from Varanasi (in Uttar Pradesh) for the proposed National Inland Waterway Number 1. This has played havoc with the ecosystem, he said.

"Earlier 10-12 dolphins used to die every year but this time the number rose to 17-20. And due to dredging, not only the water levels and sediment level got disturbed, but we feel that the sound waves from dredging are also interfering with the echolocation of the dolphins." Changes in sound frequencies disorient dolphins, and they get caught in fishing nets.

Nowhere to go

Apart from its dolphin programme, WWF-India is trying to conserve gharials and turtles by involving local communities in Hastinapur Wildlife Sanctuary in Uttar Pradesh.

Gharials were once abundant in the Ganga and its tributaries. Now, only 1,200 of them are estimated to be surviving in the wild. Hundreds of captive-bred gharials have been released in the river by WWF-India in the last few years. Thanks to its awareness drives, fishermen who used to think of gharials as competitors have started conserving them instead.

But the big problem is sand mining, some of it under licence, most of it illegal. Like all crocodiles, gharials need sandy banks for basking and breeding. With the sand being carted away by truckloads every day, they have nowhere to go.

As for the three-striped roofed turtle, Indian tent turtle and brown roofed turtle, the awareness drives seem to have helped. Their big problem was farmers ploughing up their eggs on the riverbanks. Now many farmers report when they sight a clutch, and volunteers remove the eggs to safe locations.

Nawab said, "It is a painstaking process because eggs will hatch only if each egg in the clutch is kept in the same angle as laid by the mother. We also involve the farmers in releasing the hatchlings in the water."

Hastinapur resident Luvkush, 48, is now leading the WWF-India campaign there. "Earlier people used to kill gharials and even used to consume turtle eggs; but now people know that they help in cleaning the river. They also understand that gharials are not dangerous so people now release them back in the water if they get caught," said Luvkush, who uses only one name.

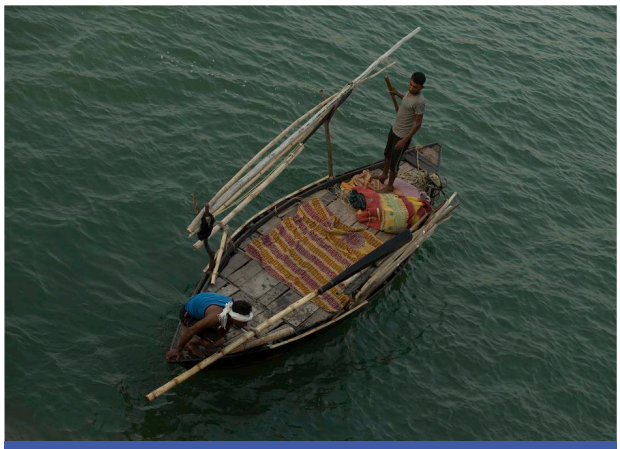
Apart from clean flowing water and sufficient depth, the beleaguered denizens of the Ganga can surely do with all the help they can get, especially from their human neighbours.

Juhi Chaudhary is special correspondent for thethirdpole.net

The dolphin, the fisherman and the holy river

Arati Kumar-Rao

There's the Ganga, the fishermen who catch no fish and the dolphins that cannot be found in India's only dolphin sanctuary



Fishermen on the Ganga — *image by Arati Kumar-Rao*

At first glance, the Ganga in eastern Bihar bears some resemblance to a beautiful, sacred river. Few places are as beautiful as the Vikramshila Gangetic Dolphin Sanctuary (VGDS). This is the only sanctuary legally designated for India's national aquatic animal, the blind, side-swimming, most ancient of all cetaceans: the endangered Gangetic river dolphin, Platanista gangetica gangetica. Stretching over 67 km of the river, the sanctuary lies between Sultanganj and Kahalgaon.

With me are researchers Nachiket Kelkar of the Ashoka Trust for Research on Ecology and the Environment and Subhasis Dey of Vikramshila Biodiversity Research and Education Centre (VBREC), who have been working in this area on the ecology of river dolphins and fisheries for over a decade.

The lower Ganga

As we coast along the river, a row of toddy palms comes into view on the distant south bank. A couple of decades ago, the river lapped at those palms; today the waterline is about half a kilometre away.

It is the first visual marker we get of the extent to which flows in the Ganga have been steadily reducing; this summer, before the monsoon rains, it is at an all-time low, the depth sensor tells us.

Tear-shaped diaras (silt islands) dotted with clumps of sedge and grass and local vegetation rise about a foot or two from the water. These islands that emerge from the river, only to be reclaimed by her, are full of life. Two bright-beaked skimmers perch on one edge; lesser whistling teals brown an opposite edge; open-billed storks forage in the shallows; a row of hard-shelled tent turtles basking in the sun plop back into the river in sudden alarm at the put-put of our boat.

Walls of silt rise up from the green waters on both sides of the river, pocked, like ancient computer punch-cards, with bank-mynah homes. The birds flit in an out, dipping and rising in a murmur.

A grave greater adjutant stork wades past us, its wizened face wary as it examines us. Two more display their massive black and white wingspans further out on the diara, and a fourth makes an awkward landing. This region of eastern Bihar has been a breeding site for the endangered species

Silt makes the Ganga a rich river for farmers — *image by Arati Kumar-Rao*

The greater adjutant stork makes for an imposing figure — *image by Arati Kumar-Rao*

(only the third area in the world where they breed), and there is reportedly a stable population of 300 individuals.

All along the Ganga-Brahmaputra-Meghna basin, diaras are claimed and 'owned', farmed and patrolled. The silt is as fertile as it gets, and the claim across the basin is that vegetables grown on these silt-islands are the tastiest in the world.

Silt transforms floodplains into food bowls. Silt makes deltas. Silt is the silent, unassuming hero of South Asia. And the Ganga is probably the siltiest river in the whole world, even more than the Amazon.

Tumbling down from the Gangotri glacier some 1,500 km to the north-west, in Uttarakhand's Himalayas, the Ganga begins its descent as Bhagirathi. Mixing Alakananda into itself at the multihued confluence of Devaprayag, the river cleaves the Himalayan mountains, picking up massive amounts of silt along the way, and hurtles down towards the plains. Its white waters roil past Rishikesh, placate at Haridwar, and flow down towards the floodplains of Uttar Pradesh.

The holy river turns putrid at Kanpur, and her water is so severely extracted that she is little but sand when she flows into Allahabad. Here, the waters of Chambal remake her flows via the Yamuna. Defying all scientific odds, her dark waters purify a million sins at Varanasi while taking into herself more foul foam and faecal matter, chemicals and cadavers.

Then she flows into Bihar.

After suffering the conurbations and confusions of modern civilisation, the river is renewed. The Ghagra, Gandak and Koshi rivers, coming down from Nepal, infuse the Ganga with fresh life. In Bihar it is the sum of its tributaries. The Ganga meanders now with fresh waters, and braids its way through the floodplains for another thousand kilometres, down to West Bengal and Bangladesh and then to the Bay of Bengal.

In search of the river dolphin

We are in the lower floodplains of the Ganga. Its swatch here is arced with ox-bows and punctuated with comma-shaped diaras — silt islands that are neither completely land nor water. Soon, the river will drink from the clouds, its flow will be largely fluvial, and it will try its best to erase memories of the abominations upstream.

From the lower observation deck of this dolphin survey boat, three pairs of eyes — two experienced, one novice — seek signs of the trademark arc of soft grey, of a beak-like snout cleaving the surface to breathe, of the gentle curve of the dorsal fin diving back in: the Gangetic dolphin.

We had spotted one when we had pushed away from the shore, but have seen none since. This, my researcher friends point out, is unusual – in this pre-monsoon season, 70-100 dolphin sightings is par for this short course.

We go past the four kilometre-long Vikramshila bridge at Bhagalpur, and past the open air crematorium. The Bhagalpur Engineering College hostel is in sight – the marker for the outer limit of safe passage along the river. Beyond is a stretch where men on horses roam the diaras with guns and black flags in hand, waylaying boats, looting, and occasionally even killing those who refuse to comply with their demands.

We turn around and return to Sultanganj ghat, traversing a stretch where 15-20 individual dolphins have hung around for years. Now, they are nowhere to be seen.

Where was India's national aquatic animal? Why was it not in the sanctuary?

Speculations abound in the team. Had they been hunted? Had they moved downstream? Had the dredging that is being done by the government in preparation for the National Waterways project disturbed them? Had they died of other causes?

There were no answers yet, only alarm and much concern.

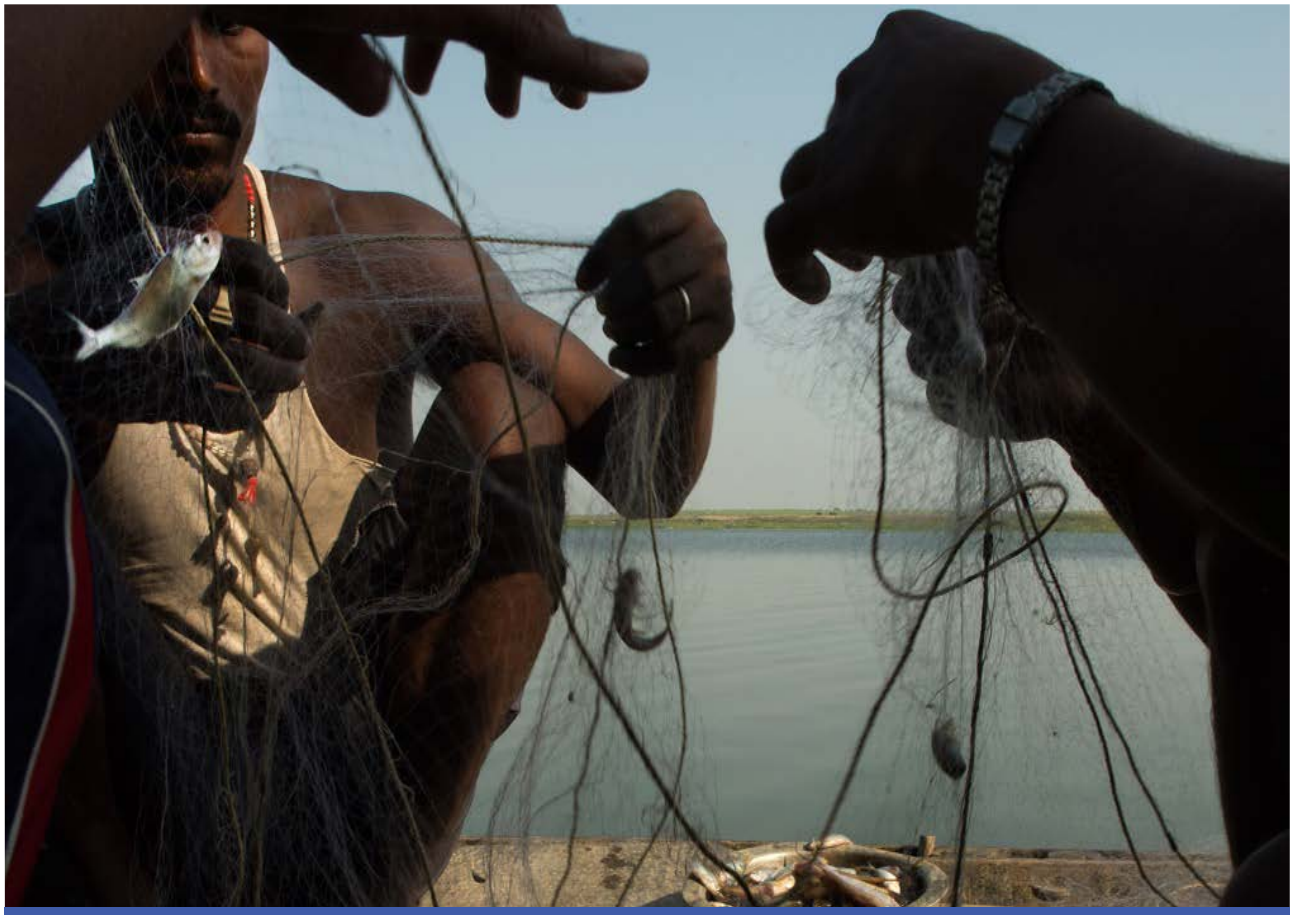
And where have all the fish gone?

On paper, the VGDS is a protected stretch of river, but in a heavily human-dominated landscape. The people all along the route, from Sultanganj to the eastern limit of the sanctuary at Kahalgaon, use the river for various purposes. There are around 3,000 fishing families in the area that depend directly on the river, as they have for generations.

Every morning of our time there, we headed to the market to see what fish had come in. That would be an indicator of the fish biodiversity in the river.

The Kahalgaon fish market is shaped like a sleeping 'm', lined with open 8ft x 10ft stalls, coloured in purples, sunshine yellows, pistachio greens, fuchsias and electric blues. In the doorway of each stall hangs a huge scale, the weights towering heavy beside it on the scratched, chipped, concrete floor. An ice crusher stands at the hump end of the 'm' and shudders into use every hour or so, its rhythmic crushing drowning our voices.

It is seven on a late May morning, and we are at Chandan's purple-painted stall. We perch ourselves on hastily gathered rickety plastic chairs and wait for the market to come alive. The catch should have come in by this time, Chandan says. Maybe the squall of the previous night,



The fishermen are left with almost no catch — *image by Arati Kumar-Rao*

where silt flew in from the diaras like white arrows, meant a bad night for the fishers, and they'd be late. We'd have to wait and see.

Chandan has never taken to the river to fish, but his father Dasharath, now pushing 70, is a veteran fisherman and well-respected village elder. "We've been here about 200 years, this is our hometown. Back then, my family would ferry cargo in much bigger boats. While we fished, we were not dependent only on fishing," the old man tells us. But fish was plentiful, he recalls. Bachwa (Clupisoma garua) would sell for a rupee or INR 1.50 (US 0.02) a kilo in the late 1960s.

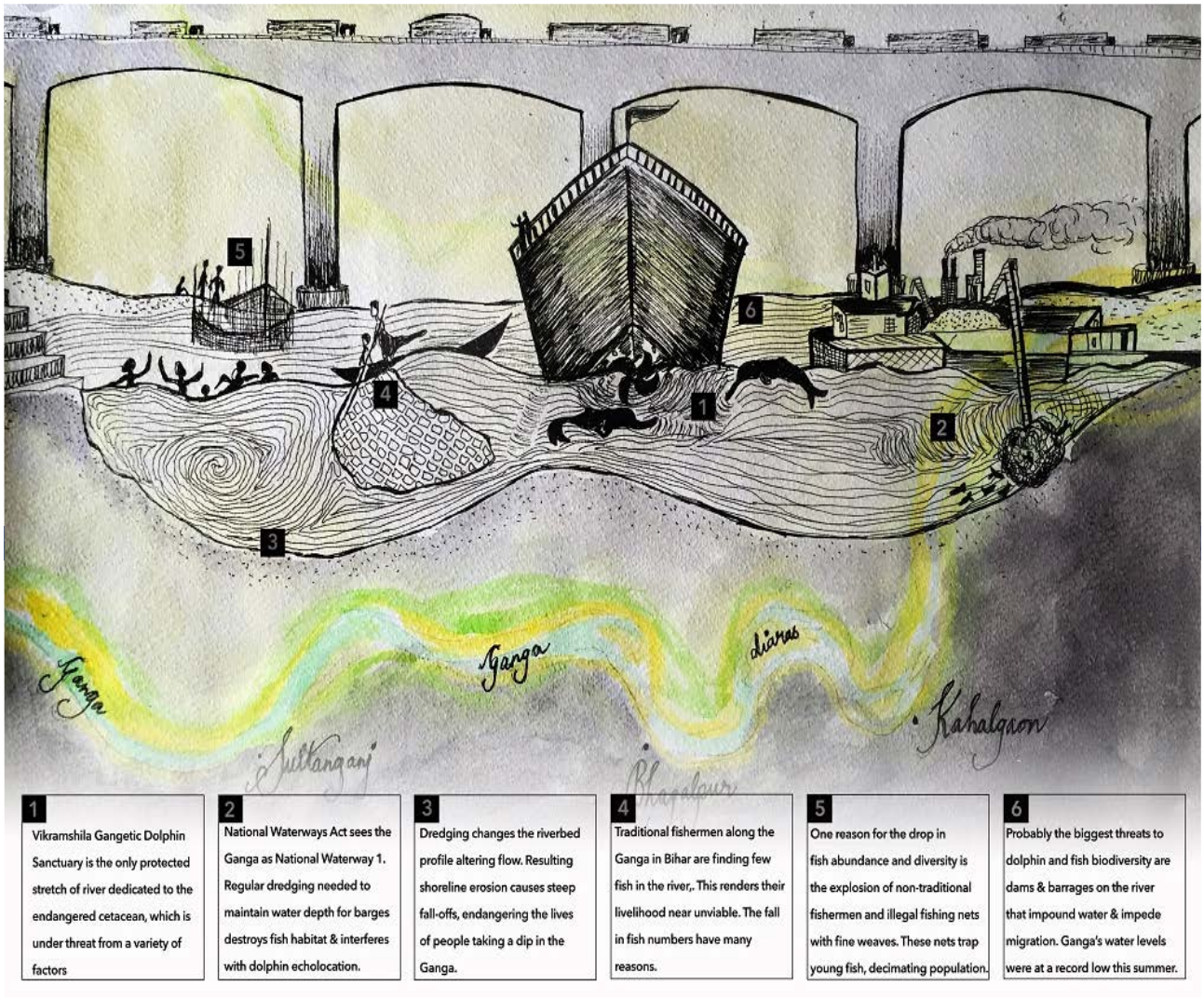
"We would fish one quintal from just putting out our nets from 8 a.m. to noon. Ice would come from Bhagalpur, and the fish would go by train to Nabadwip and Chunchura [in West Bengal]. One year, there was so much hilsa, so much hilsa!" His face breaks into a toothy smile at the memory. "It sold for just one rupee for a kilo, and still no one to buy! This was when I was a young boy." These days, hilsa caught in Indian waters sells for around INR 1,000 (USD 14.90) a kilo, the price for choice cuts rising as high as INR 1,500-2,000 (USD 20 – 30) in the festival season.

The river's stock of fish has depleted in both biodiversity and abundance, Dasharath says. Stocks have plunged 70-90% in the last 30 years.

What we saw that day at the Kahalgaon fish market was no aberration – the story repeated itself the next day, and the next, and the next. The massive weighing scales stayed dormant, unneeded.

For want of anything to do, two little fisher boys convert one stall into a recreation room and start up a game of carom. The other stalls, including Chandan's, waited for fish that never came.

An eerie quiet envelops fish markets all along the Ganga.



The bane of the barrage

"Ever since the Farakka barrage was built, hilsa, jhinga (prawns), pangas, bachwa, seelan, and other migratory fish are completely finished. They've disappeared from our tables and we don't ever see them anymore." Every fisherman, bar none, said this to us — in Kahalgaon, in Barari, in Naugachhiya, in Koskipur — on both banks of the Ganga, past the confluence of the Koshi.

Hilsa (Tenualosa ilisha), the queen of fish, the prized meal in any Bengali household, used once to swim up the Ganga, against the monsoon freshet, all the way to Allahabad and further to spawn. The young ones would then return to the sea, and repeat the spawning cycle come the next monsoon. When India built the barrage at Farakka in West Bengal, this changed. All anadromous, catadromous and potadromous fish stocks — hilsa, tiger shrimps and such, plunged to near zero upstream of the barrage. This was the beginning of the collapse of fisheries in the Ganga. Fishermen are quick to identify Farakka as the root of all their ills.

But the barrage does not explain the disappearance of non-migratory species. The blame for that lies elsewhere.

Fishers versus non-fishers

In 1991, the Ganga Mukti Andolan led the effort to free the Ganga from the 'panidars' — the feudal water lords who are the river-equivalent of 'zamindars' (landlords). They laid claim to stretches of the river and "owned" everything in that stretch, including the fishing and even the

use of the river. Fishers were free to choose whether to work or not. But if they worked, and refused to pay 50% of the fish catch (which was the norm), they were threatened.

The abolition of the feudal water-lords was much needed, but the freeing of the Ganga from oppressive contracts became a double-edged sword. Now, anyone could fish anywhere. While that seemed a win at first blush, it has proved disastrous for both traditional fishermen and the river ecology.

There is a simple way to tell the 'traditional' fishermen from the free riders. Those who know how to weave a net by hand, from thread are the real deal. If fishing in the Ganga were restricted to hand-made nets, the fishermen believe, the river would be fecund still. While reality may be a little more complicated, this nevertheless serves as a good starting point.

The "free for all" resulted in non-fishermen also taking to fishing, swelling the number of fishers on this region of the Ganga.

The fishermen of Kagzi Tola are agitated; they speak over each other as they rush to explain the destruction of their river as they see it.

"First a few [fishermen] came upriver from Bengal and put mosquito nets in the river, but only for three months. Now, instead of 10 fishers there are 100 fishers — and these include non-traditional fishermen too. They all set up mosquito nets across the river for all 12 months. Earlier, one boat cast one net. Now, with cheap nets available, each boat casts ten nets."

"Non-fishers can buy nets in the markets, but they do not know how to capture fish. Tying nets across the river catches everything. They kill quintals worth of stuff. We put the right nets for 12 hours, and still catch only 10-12 kg."

The problem with the mosquito net in common use, the fishermen explain, is that it catches everything – gravid fish, baby fish, yearlings, the lot. These baby fish – the next generation of riverine stock – die in the nets, and are tossed back into the river since there is no market for such small catch. Thus, entire generations of fish are killed daily, rapidly eroding the river's stock beyond the possibility of replenishment.

For the part-timers, fishing is not their primary business. They depend on their fields, where they grow vegetables. Thus, sustainable fishing practices are not top-of-mind for them, intent as they are on making a quick buck where they can. The traditional fishermen however have no land, no alternate means of livelihood. They have depended upon the river for almost 100% of their sustenance.

"If we don't allow the eggs to hatch, if we don't allow the fingerlings to grow, how can we expect to eat tomorrow?" This is a refrain we hear throughout among the traditional fishing communities all over the Ganga-Brahmaputra- Meghna basin.

The jump from frying pan to fire is complete with the rise of the river pirate along the "free" Ganga of Bihar. The oppression of the panidars has now been replaced by the predatory raids of armed dacoits. Marauding the diaras, these gangs on horseback regularly target fisherfolk. "They waylay us with our fish and force us to cook, and they take our fish away. If we don't comply, they could kill us," says Dasharath.

There are several such predatory gangs, all rivals, all armed, dangerous, and trigger-happy. The dolphin survey team has been caught in crossfire twice, an unwitting bystander in a gang war that never ends.

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No silver sheen in the Ganga

Jayanta Basu

The Hilsa that once swam from the sea to Agra and Delhi to titillate the palate of Mughal royalty now finds the Ganga so shallow and so dirty that it cannot swim upriver for more than 75km

Indian fishing boats now return largely empty — *image by Santanu Chandra*

As Nobo Borsho (New Year's Day) was celebrated in West Bengal, the traditional lunch should have started with Ilish Bhaja, Hilsa fried in mustard oil. In Kolkata homes today, that is legend.

Just as Hilsa has become history, well almost, in Baksi village, once known as Hilsa village. Just 55 km from Kolkata, Baksi on the banks of the Rupnarayan river got its nickname because just a majority of residents either caught that king of fish or sold it. But now Hilsa (Tenualosa ilisha) has all but vanished from the Rupnarayan, the tributary that joins the Ganga just before it reaches the Bay of Bengal.

"Previously out of nearly 650 families in Baksi, over 400 were exclusively involved in catching Hilsa," Bimal Mandal, secretary of Rupnarayan river motsojibi union; a platform of local fishermen, told thethirdpole.net. "However with the catch dwindling, now most have ventured into catching other fishes and a few have even changed profession. The story is almost same in all the villages in Howrah district as Hilsa is hardly found in Rupnarayan river now."

Fishing boats lie upturned on the banks. The non-appearance of the silver-sheened Hilsa in Baksi is now a rule rather than the exception in West Bengal. According to the Central Inland Fisheries Research Institute (CIFRI) and the state government's fisheries department, the Hilsa catch has come down from 77,912 tonnes in 2000-01 to 9,887 tonnes in 2014-15; a decline of close to 90%.

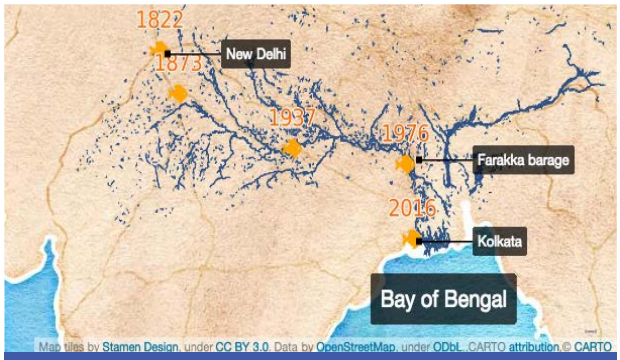
"The decline has been quite consistent, apart from 2010-11, when there was a bumper crop," Utpal Bhaumik, former head of riverine ecology and fisheries division of CIFRI, tells thethirdpole.net.

No entry

The data shows the catch decline is more pronounced upriver than in marine waters. From 2000 to 2015, the catch off the West Bengal coast has gone down 80% (44,810 to 8,900 tonnes) while the inland catch dwindled nearly 97% (33,102 to 987 tonnes).

Slowly the Hilsa has retreated back to the Bay of Bengal

"The inland Hilsa catch data clearly reflects how its upriver migration has been affected over the years," says Bhaumik. "There are a number of reasons for the trend, the most important being the sedimentation and lack of adequate depth in the Ganga, including at the estuary."



Slowly the Hilsa has retreated back to the Bay of Bengal

The Hilsa wants a water depth of around 40 feet in the river mouth before it will enter from the sea. For years now, the depth at the mouth of the Ganga has been no more than 30 feet, often less during the lean non-monsoon months. High sedimentation at various points upriver adds to the problem.

The Hilsa actually assemble near the mouth of the Ganga but then most find the water too shallow and move towards Bangladesh and Myanmar, explains Bhaumik. And this is despite the fact that upriver migration — for spawning — happens during the monsoon.

Apart from lack of water, the reason for the vanishing catch is overfishing, of course.

The ban

The West Bengal government has now banned Hilsa fishing during the peak breeding season — around the full moon in October.

Three stretches on the Ganga have been declared Hilsa sanctuaries — Godakhali near Diamond Harbour; Hooghly Ghat near Triveni; and Lalbag-Farakka.

This follows the Hilsa management model that has been such a success in Bangladesh, but in West Bengal the restriction has remained mostly on paper.

Fish for royalty

A study by the International Union on Conservation of Nature (IUCN),Migration, Spawning Patterns and Conservation of Hilsa Shad in Bangladesh and India, reports, "Earlier studies indicated that in the past (before the Farakka barrage was built in 1974), the Hilsa of the Ganga river system used to migrate up to Agra, Kanpur and Delhi in years of excessive abundance, while in normal years, the fish used to migrate up to Allahabad, where maximum abundance was observed up to Buxar region."

The report — by a joint team of experts from Bangladesh and India — also points out that the Hilsa no longer moves up the river in shoals. The migration is now largely restricted to Diamond harbour, around 75 km from estuary; with a small fraction going further upstream during the monsoon.

Chroniclers of Mughal royalty in the Middle Ages report that the emperors — with their capitals Agra and Delhi around 1,500 km upstream of the mouth of the Ganga — relished the Hilsa and looked forward to its arrival every monsoon. British historians record 19th century sightings in Delhi — on the banks of the Yamuna, the largest tributary of the Ganga.

Why has that become history? The IUCN report says, "Overexploitation, siltation in river beds, decrease in water flow from upstream, fragmentation of river in dry season are identified as major human and physical effects on migration of Hilsa." Increasing pollution in the Ganga from industrial and domestic sources is also said to be a spoiler.

The problem now

After the decimation of the Hilsa in the inland Ganga basin, the problem has spread to the estuary and the sea.

"Overfishing in the bay is a major cause of declining Hilsa catch. Almost non-existent enforcement of laws and poor surveillance adds to the problem," Sugata Hazra, director of the School of Oceanographic Studies at Kolkata's Jadavpur University, tells thethirdpole.net. "The ban on Hilsa fishing to protect the juvenile and brood fish should be imposed strictly."

Hilsa also used to migrate upstream through other mouths of the Ganga in the Sundarbans and spawn there. But now the water in the Sundarbans — the world's largest mangrove forest — is turning more saline. This is partly due to sea level rise caused by climate change, and partly due to less fresh water flowing down the river. The Hilsa cannot lay eggs in highly saline water.

Hazra says, "The Hilsa yield on our side of the border will improve if the non-monsoon salinity can be brought down to 14 parts per thousand (ppt). Monsoon salinity in the Meghna is less than 2ppt which explains the much better Hilsa yield in Bangladesh." Presently the salinity in the Sundarbans area of West Bengal during non-monsoon months is around 30 ppt.

Obey no law

Like Bangladesh, India also has rules banning the gill net, the net with small (38-51 mm) mesh that traps all fish, including juveniles. But almost any time, around 8,000 trawlers using one-kilometre-long gill nets are spread over a 35 km stretch of the Ganga estuary, in Sagar and Namkhana areas. The Hilsa has little chance of moving up or down the river.

Little wonder that Hilsa aficionados are looking beyond the Ganga. There are many other rivers flowing into the Bay of Bengal and the Arabian Sea from the Indian peninsula, and the Hilsa does migrate up some of those rivers to spawn. A sizeable population migrates up the Mahanadi in Odisha, the state that adjoins West Bengal along the coast. It is a highly prized fish there.

But just as in the Ganga, the annual migration of the Hilsa has been greatly affected by barrages and dams on the other rivers as well. Having studied these migrations, Bhaumik says in the Mahanadi, Godavari and Krishna rivers, the fish migrate less than 100 km from the river mouth, when they reach the first dam and cannot go up any more. In the Cauvery, they reach the first dam as soon as they swim a little over 50 km upstream. Bhaumik wrote a paper on this, published in the International Journal of Current Research and Academic Review last November.

Other Hilsa populations live in the Arabian Sea, and two of them migrate regularly up the Narmada and Tapi rivers. In the Narmada Hilsa migrate upstream for about 100 km, after which the water flow is too strong for them, Bhaumik explains. Migration up the Tapi has been affected by the Ukai and Kakrapara dams in Gujarat.

Over much of India outside West Bengal, the Narmada has become the main sources of the fish. Most of the Hilsa sold in the markets of Delhi or Mumbai are from the Narmada. Expatriate Bengalis buy them eagerly, though they always insist the Hilsa from the Ganga used to taste better.

But outside the Ganga and Meghna basins, if there is one Hilsa whose memory can still make old timers salivate, it is the Hilsa of Karachi. Indians have not been able to eat that since the partition of the subcontinent into India and Pakistan in 1947. But those who had it before cannot forget the taste, though they have forgotten the name.

Part 5:
The tributaries

The Koshi: Hazards in the high mountains

Ramesh Bhushal

Tamakoshi river seen from Charikot in Dolakha district of Nepal. Tamakoshi is one of the seven major tributaries of the Koshi river — *all images by Nabin Baral*

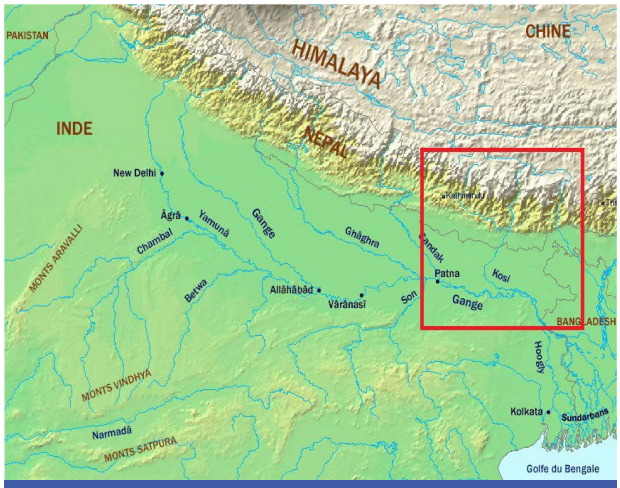
Landslides, earthquakes, melting glaciers and deadly floods make life precarious on the Nepal-Tibet border

From the high Himalayas to the plains, one of the largest tributaries of the Ganga has the power both to unleash disaster and to transform the region's economy. This is the first in a four part series. thethirdpole.net's Nepal Editor Ramesh Bhushal and photographer Nabin Baral travelled along the tributaries of the Koshi River from near Tibet to the Indian border to report on the challenges faced by people living in the region.

In Nepal's Sindhupalchowk district, close to the Tibet border, fast flowing water emerges beneath a huge pile of debris left by the landslide that devastated the village of Jure in 2014.

Once the busiest highway between Nepal and China, the road was disrupted for months after the landslide. After the debris was cleared, and the highway re-opened, Nepal was hit by the massive earthquake in April last year, which caused numerous landslides along the highway, shutting down the highway again.

More than a year later, China has still not opened the border because of the high risk of landslides in the future, despite repeated requests from the Nepal government. Instead, China is focussed on clearing a road via Rasuwa — another district bordering Tibet that lies northwest of Sindhupalchowk — equally devastated by the quake. There are suggestions that China does not want to open the Sindhupalchowk border, and that it would rather link up with Nepal through the Rasuwa district which borders Kerung — the city to which the Qinghai-Tibet rail network is planned to be connected by 2020. However, the Chinese government has said that geological risks are the reason for not opening up the border.



Area in red marks the Kosi river basin — *image by CC BY-SA 3.0*


At Sindhupalchowk district in Nepal, a man waits for a bus on the debris of the 2014 Jure landslide on the Bhotekoshi River

> ***On average about 12,000 small to large scale landslides hit Nepal every year, killing more than 300 people***

The 2014 Jure landslide swept away an entire village killing 156 people. Almost two kilometres of the highway collapsed, disrupting road travel for months. Even now you see only a few local buses and trucks carrying sand and boulders from the Sunkoshi river drive across piles of debris on the road. Climbing atop massive boulders, you can see the meandering Sunkoshi River below. The river originates in Tibet as the Poiqu and then flows down as the Bhotekoshi before meeting the smaller tributary called the Sunkoshi — one of the seven tributaries of the Koshi river.

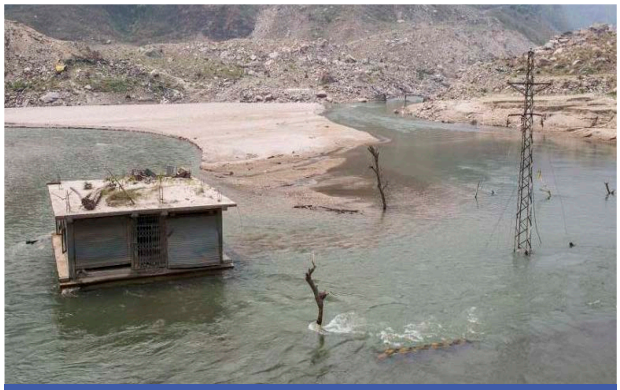
The Sunkoshi changed its course after the Jure landslide. The river was blocked, and formed a huge temporary lake that inundated several houses on the highway and submerged two multi-storey buildings and an electricity transmission tower.

Seventy-year-old Jit Bahadur Tamang recalled the horrible night of the landslide. He heard "a big sound like an exploding bomb in the middle of the night [which] continued. Everything was dark. People from villages on the other side of the river shouted 'run, run' but where to go? We didn't know it was a landslide. Thank God we ran north along the highway and then climbed up to reach another village."

Since the deadly landslide claimed the lives of many of his relatives and fellow villagers, Tamang has been living in fear in a small hut a few metres above the riverbank. Last year's earthquake made his life even tougher. "Living with what is left is the only way for me and the upcoming monsoon may bring more troubles," said Tamang as he whetted his sickle to cut bamboo.

Landslides are frequent in Nepal, where 85% of the country is mountains and hills. On average about 12,000 small to large scale landslides hit Nepal every year, killing more than 300 people.

"Large landslides have the potential to block rivers. It has happened in the past and it's likely to increase as intense rainfall patterns are predicted due to climate change," says Narendra Raj Khanal, professor at the Geography Department in Tribhuvan University, Kathmandu.



A house and an electric pole under the water due to the dam created by the Jure landslide in Bhotekoshi River in 2014 at Sindhupalchowk, Nepal

Those who can have left the villages, but for most people there is no way out. Twenty-two-year-old driver Lanka Lama has no job since the traffic along the once busy road has dried up. Business was picking up after the landslide, when the earthquake struck leading to the closure of the Chinese border, a few kilometres north of his village. "There are hundreds of youth like me in the villages who are having a really tough time. We are jobless and also landless," said Lama who has lost his niece, many friends and relatives in the disasters.

Although landslides are common in Nepal, experts are more concerned since the 2015 earthquake, which is said to have induced more than 3,000 landslides. The Koshi basin was one of the worst affected. The basin is the country's most vulnerable region, with 40% of the area above 4,000 metres and 30% on steep slopes of over 30 degrees.

"It has a high risk of big landslides and there is an urgent need to have a holistic landslide risk management plan, as landslides are complex phenomena," says Deo Raj Gurung, a remote sensing specialist at the International Centre for Integrated Mountain Development (ICIMOD) based in Kathmandu.

Many experts blame both the government and local communities, neither of whom listened to multiple warnings, for the high human casualties in the Jure landslide. "The area was categorised as a high hazard area in the 1970s and there were small landslides in the same area multiple times before it completely collapsed in 2014," adds Gurung.

Less snow, more floods

This is not the only place so affected. Trouble is brewing in the mountains from which rivers like the Sunkoshi flow. Glaciers are melting faster due to increasing temperatures, various studies show. Last year, an international team of scientists published the first detailed study on glaciers in the Dudhkoshi river basin — one of the major tributaries of the Koshi. The Dudhkoshi flows through the Mount Everest area. The scientists warned that almost all of the glaciers in the Everest region may disappear by the end of the century.

The altitude of freezing level is also shifting higher, increasing glacier melt and decreasing the amount of snow accumulation, the researchers said.

Lead researcher Joseph Shea compared this to a personal bank. "You gain money and spend money over the course of a year. At the end of the year, if you've earned more than you spent you'll have a positive balance. Glaciers can be treated the same way. Glaciers gain mass in the form of snow and lose mass mainly through melt. The annual sum of mass gained and mass lost is the 'net balance'."

Tsho Rolpa Glacial Lake: an example of the potential threat behind the beautiful glacial lakes in the Rolwalling valley, Nepal. Tsho Rolpa is one of the high priority potentially dangerous glacial lakes in the Nepal Himalayas. As a result of climate change and fast retreat of the glacier, the lake expanded from 0.23 square kilometres to 1.53 square kilometres between 1960 and 2010, according to Pradeep Mool of ICIMOD. The fast retreating glaciers and adjoining glacial lakes increase the threats of glacial lake outburst flood (GLOF). GLOFs most likely would cause extensive damage to people and property downstream. This image was taken on May 10, 2010

Sherpa fears

Thousands of tourists come to Nepal every year to get a glimpse of Mount Everest and other high peaks in the Himalayas. But what would happen to the majestic beauty of the mountains if the snow and ice vanished? These mountains are also the source of water for millions of people living downstream who depend on them for their lives and livelihoods.

> *"I can't leave this place as I don't have any other way to feed my family*

This is what worries Apa Sherpa — who has climbed the Everest 21 times. He wants to galvanise the global community to save these mountains. In 2012 he trekked about 1,600 kilometres through the mountains of Nepal for about three months, as part of a team, to show the world the impacts of climate change on the ground. "The most worrying issue is that the mountains are holding less and less snow and I can feel it when I climb Mount Everest. It's not a normal phenomenon," he says.

Growing glacial lakes, increasing threats

We travelled along the Sunkoshi River which has been identified as high risk for Glacial Lake Outburst Floods (GLOF). Sixteen of the 24 glacial lake outburst floods recorded in Nepal's mountains occurred in the Koshi basin, according to ICIMOD — including three devastating ones.

The Zhangzambu glacial lake in the Poiqu river basin in Tibet is the origin of the Sunkoshi. The lake burst in 1981, releasing 19 million cubic metres of water in an hour. The flood destroyed several houses, damaged 12 bridges and 27 kilometres of road and also one of the gates of theSunkoshi hydropower dam.

Ovidhoj Karki from Pangretar village on the banks of Sunkoshi River witnessed the 1981 flood. The villagers have been warned many times since that it might happen again. Glacial lakes are high up in the mountains, but the chances of villages and fields being swept away is growing because these lakes are expanding faster due to faster melting of glaciers, say researchers. "We don't know what's going on up in the mountains but we have lost several hectares of our paddy field in the last few decades due to floods," said Karki.

Glacial lakes of Nepal

GLOFs are highly unpredictable and often disastrous, but their impacts can be mitigated to some extent. "One possible way is to install early warning systems down the river to alert communities. But the long term solutions are to discourage settlements in flood prone areas and relocate villages to safer places," says Narendra Khanal. He has done extensive research in the area.

Though Karki knows about the threats, he has no choice but to live with it. "I can't leave this place as I don't have any other way to feed my family."

The government has taken some steps to reduce risks, but not nearly enough. Nepal's Department of Hydrology and Meteorology has installed a water gauge a few kilometres upstream in Bahrabise, which can alert people once the water level in the river rises above normal. However, when we visited it was in dire condition and had not been maintained properly.

Ramesh Bhushal is Nepal editor for thethirdpole.net

Explore the full series – The Koshi River: a journey down the lifeline of Nepal – at: https://www.thethirdpole.net/koshi-basin/

Photo story:
Delhi's worshipped and abused Yamuna river

Juhi Chaudhary

Collecting plastic bottles and packets from the Yamuna for recycling — *all images by Dilip Banerjee, a photojournalist based in Delhi*

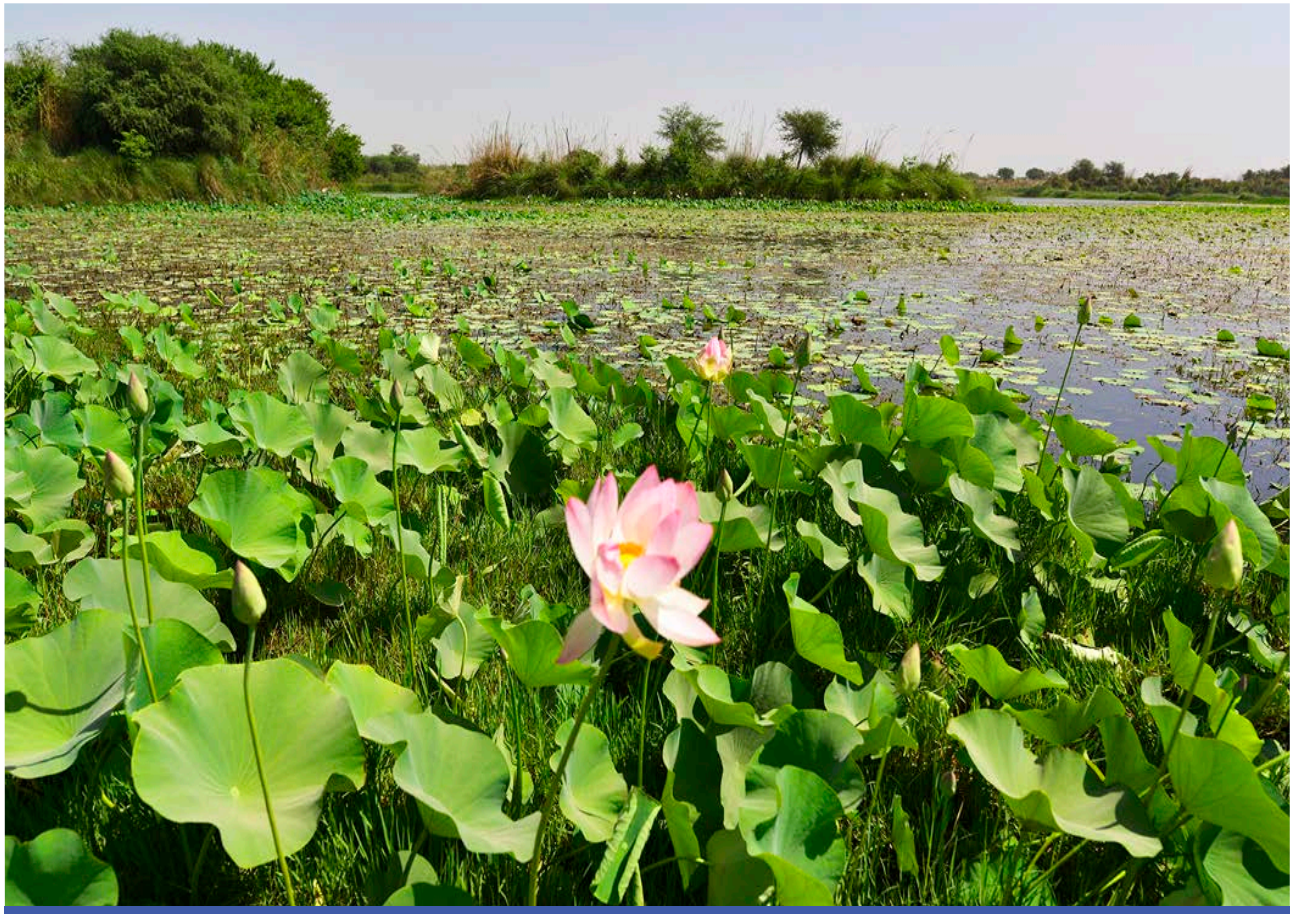
After the controversial Art of Living event on its floodplain, a photographer's journey down the Yamuna in Delhi captures the extent of abuse and encroachments

In Hindu mythology, Yamuna is the sister of Yama, the God of Death. Two days after every Diwali, millions of women pray to her to safeguard their brothers, while it is the manifestation of the goddess in the Yamuna River that they abuse through the year.

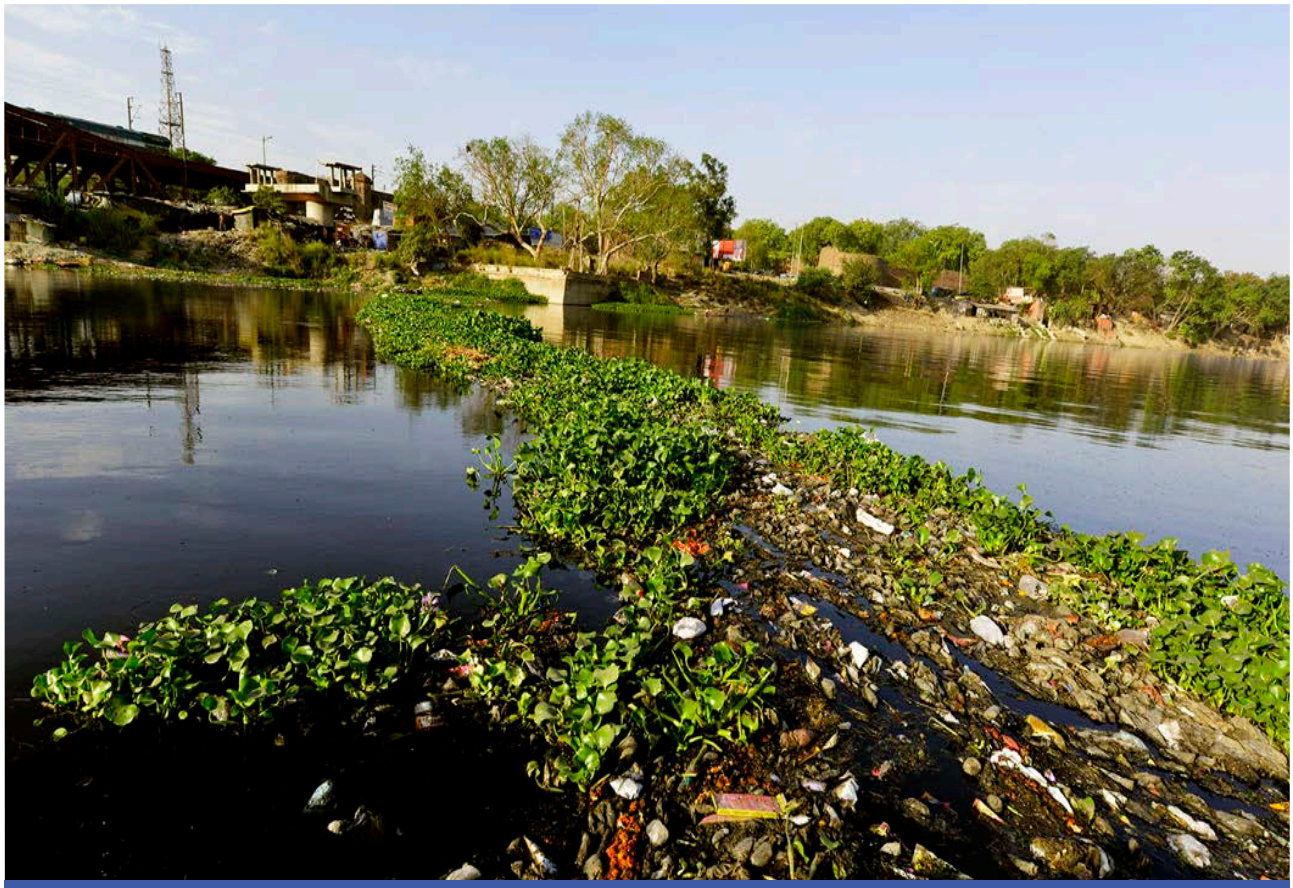
The abuse is at its worst in India's capital. Except in a good monsoon, the authorities take all the fresh water as the Yamuna reaches Delhi. For most of the year, when the river leaves Delhi 20 km downstream, it only has drain water.

The water channels of the Yamuna take up 1,600 hectares in Delhi; another 8,100 hectares are designated as its floodplain. This has been encroached upon by government and private agencies alike, of which the Art of Living Foundation festival was only the latest example. The crucial functions of the floodplain — groundwater recharge and flood control — have been seriously compromised.

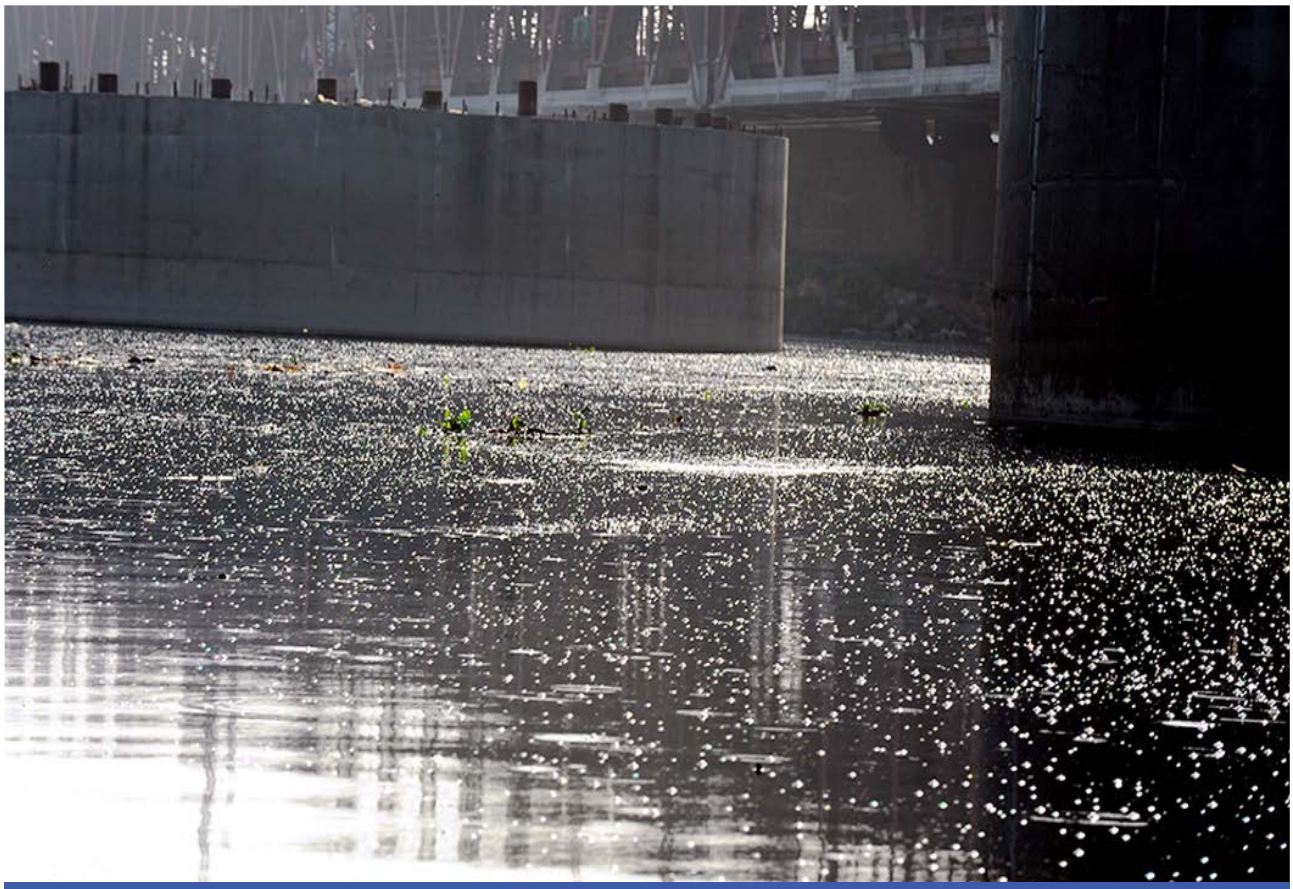
A pristine Yamuna is a life-giving river, as can still be seen in the stretch before its water is appropriated. From there, thethirdpole.net travelled 20 km along the river within Delhi to document how the Yamuna is changed to an encroached-upon drain.



It is still a living river at the Yamuna Biodiversity Park, located where the river enters Delhi



Downstream of the Wazirabad barrage, it is all drain water, as seen at Qudsia Ghat here. Water hyacinth and garbage combine to produce a nauseating stench



Methane bubbles from the water near Qudsia Ghat. An estimated 80% of Yamuna's pollution load comes from the 18 drains that empty into the river as it passes Delhi

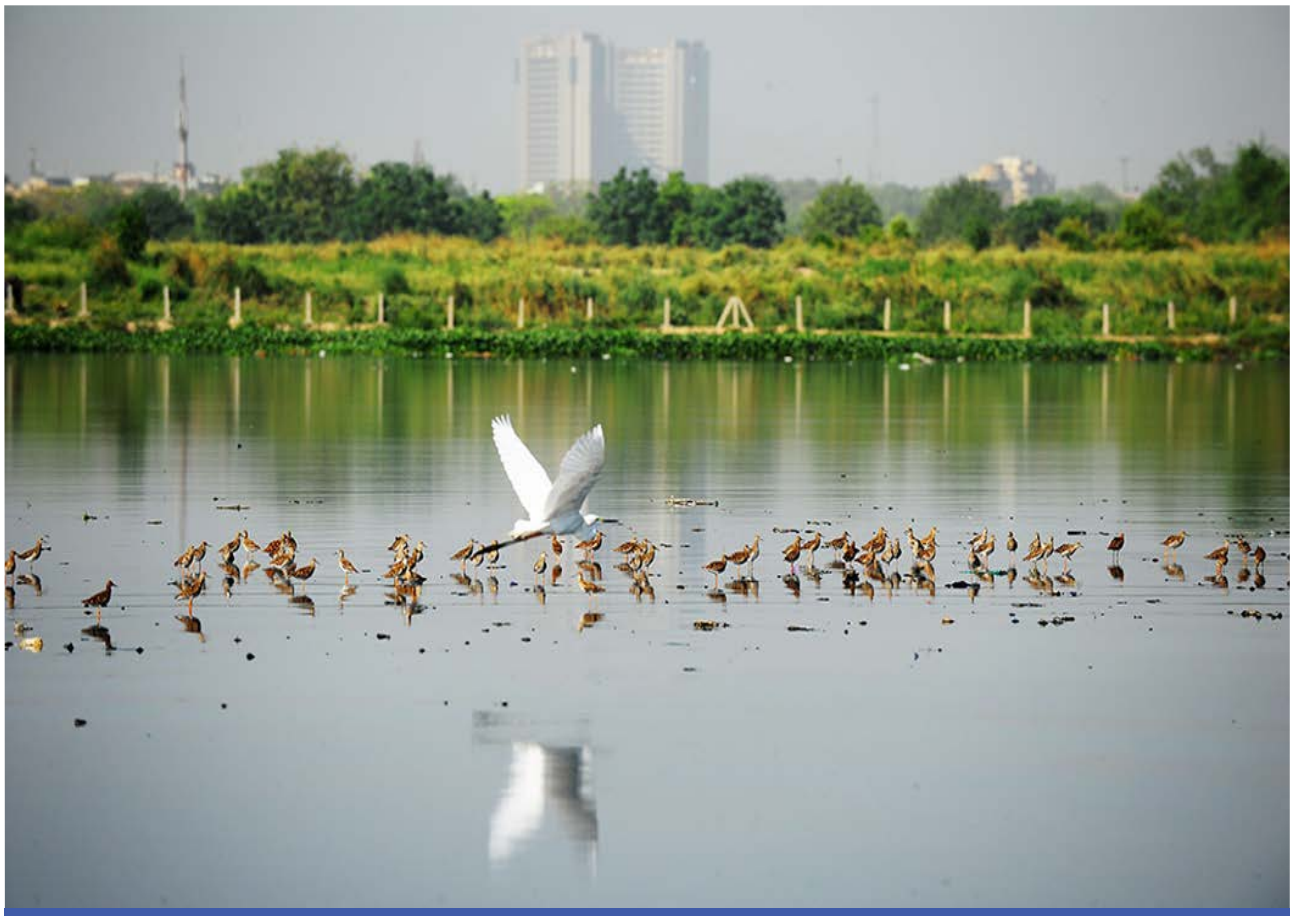
At Nigambodh Ghat, Delhi's busiest crematorium on the bank of the Yamuna, it is common for mourners to throw into the river ash, bones, flowers, pots and anything else used during prayers. Since there is hardly any water next to the crematorium, mourners often hire boats for the purpose

This building is coming up right now on the Yamuna floodplain near Nigambodh Ghat. The builders say it will be a ten-storey charitable eye hospital. There are conflicting claims on whether the Delhi Development Authority or anyone else in a position of power has given permission

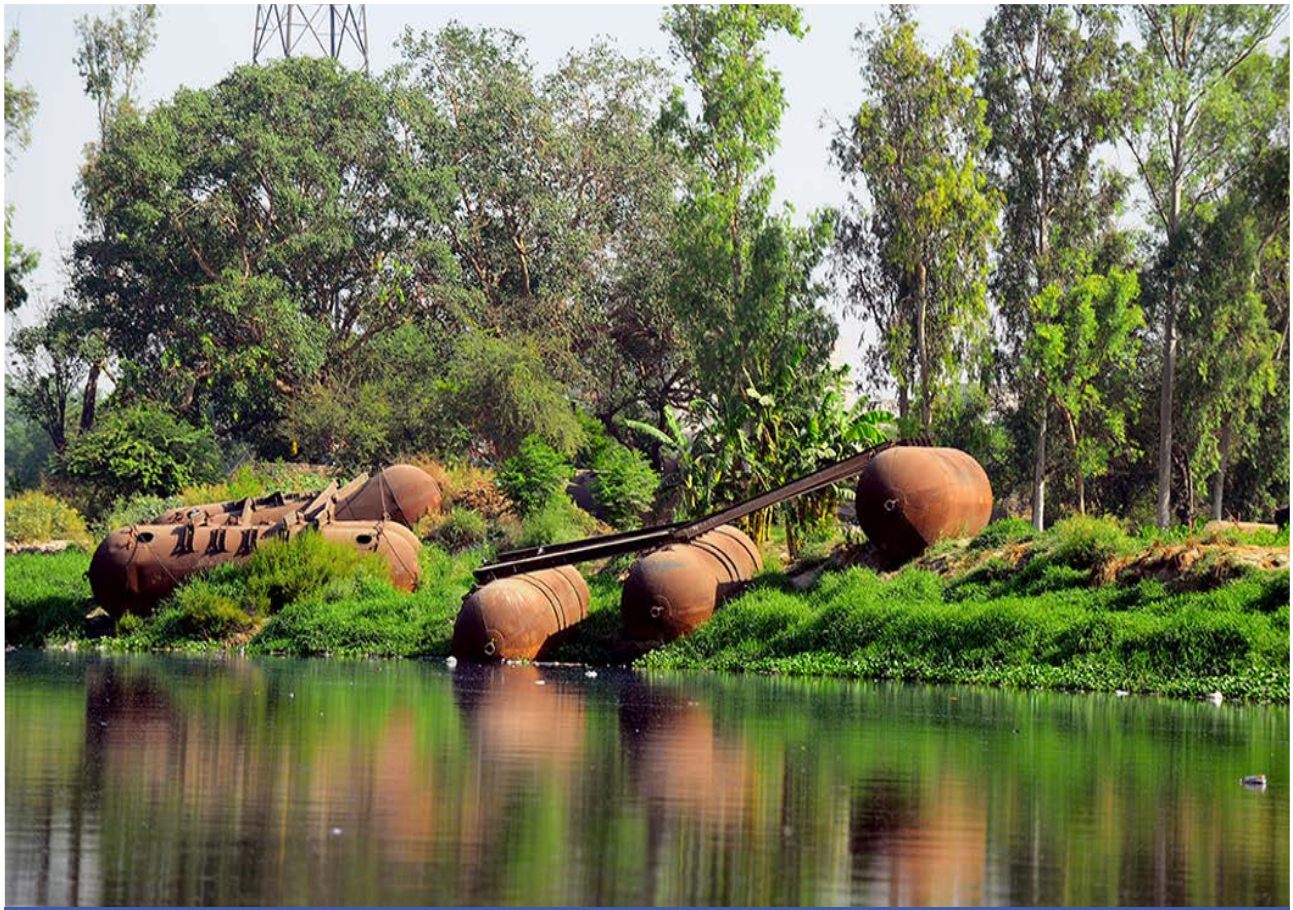
The Akshardham temple has been a Delhi landmark since it was built on the floodplain in 2005 despite strenuous objections by environmentalists

The government encroached on the Yamuna floodplain to build the athletes' village for the 2010 Commonwealth Games, and the courts permitted this despite litigation by environmentalists. Together, the Commonwealth Games Village and the Akshardham temple next door occupy around 150 hectares of the riverbed

The government encroached upon another 20 hectares on the floodplain to build a bus parking lot before the 2010 Commonwealth Games. The authorities told the court it was a temporary measure, but there is no sign yet that it will be pulled down. This year the Supreme Court once again rapped Delhi Government for not having moved the parking lot out of the floodplain yet



However polluted, the Yamuna is still home to many birds



These parts of a pontoon bridge have been rusting at the riverbank for over a decade

That is a cinema hall on the Yamuna floodplain. When it is not showing movies, it screens cricket match telecasts

A dairy on the Yamuna floodplain, on land declared to belong to the Delhi Development Authority, near Sonia Vihar

The Yamuna floodplain has always been farmed during the lean season, and there was a time when much of Delhi's fruits and vegetables used to be grown there. In January 2015, the National Green Tribunal banned farming on the floodplain after it was found that vegetables grown there had high levels of arsenic and heavy metals, toxic for human health. Farming on the floodplain continues, though on a smaller scale

Collecting plastic bottles and packets from the Yamuna for recycling

Part 6:
Regional cooperation

The Ganga Treaty: Even states in the same country fight over a river

Kamran Reza Chowdhury

On the twentieth anniversary of the signing of the historic India-Bangladesh Ganga Water Sharing Treaty, one of its architects speaks about its past, present and future

On 12 December 1996, Dhaka and Delhi signed a historic treaty on sharing the waters of the Ganga that travels from Nepal and India and then into Bangladesh. Until the signing of the Ganga Water Sharing Treaty, the withdrawal of water in India caused huge environmental, social and economic consequences for Bangladesh, especially after the commissioning of the Farakka barrage in 1975.

On its twentieth anniversary, Ainun Nishat, a noted Bangladeshi environmentalist and one of the architects of the treaty, spoke to Kamran Reza Chowdhury about the hopes from the treaty, what has come about, and what needs to be done for the future.

Professor Ainun Nishat was one of the architects of the Ganga water sharing treaty

> ***A treaty is the strongest international legal deal between two countries***

Kamran Reza Chowdhury (KRC): Can you tell us about sharing the waters of the Ganga?

Ainun Nishat (AN): First of all, you have to understand a transboundary river to understand the gravity of the Ganga water sharing treaty. A river crossing more than one independent country is called transboundary. It is common that there would be conflicts over the sharing of waters of the transboundary river among the countries involved. Even states in the same country fight over common rivers. For instance, the Indian states of Telangana and Andhra Pradesh have been fighting over sharing the waters of Krishna and other rivers. Andhra is the lower riparian like Bangladesh and Telangana is the upper riparian like India.

Andhra fears that Telangana will not give it water from the common rivers, especially because water storage is possible in Telangana. On the other hand, the demand is higher in the lower part— the valley, agricultural land, settlement and city. Another problem is the sea is in the lower part. If the fresh water supply is reduced, then you will have increased salinity, and that will affect the ecology and the environment. So, the opportunities are in the upper riparian—you can store the water, you can produce hydropower, and you can maintain the navigation in the entire river. If a river crosses through two independent countries or two provinces of a same country, none of them are interested in accommodating each other's requirements.

Added to this is the increased demand of water due to the rapid growth of population in the world. We need huge quantity of water for irrigation and agriculture. Another fact is sometimes there is too much water [leading to flooding] and sometimes too little water [leading to drought, and people not wanting to share water].

KRC: How did the treaty come about?

AN: Based on ideas from British times, in 1951 India published its plan to construct the Farakka barrage along the Bangladesh-India border. The aim of the barrage was to maintain navigability of the Kolkata port in the state of West Bengal. Between 1960 and 1970, officials of India and Pakistan (when Bangladesh was part of Pakistan) discussed the issues that arose out of building the barrage, but they failed to thrash out an acceptable solution.

In December 1971, Bangladesh emerged as an independent country. In April 1975, India formally sought Bangladesh's consent to go for a test run of the Farakka barrage—to see whether the barrage was constructed properly. In August 1975, Bangabandhu (Sheikh Mujibur Rahman, the founding leader of Bangladesh) was assassinated. In 1976, India went for total withdrawal of the Ganga waters causing serious problems in areas of Bangladesh including the southwestern region, which hosts the Sundarbans, the world's largest mangrove forest in the Bay of Bengal.

In 1977 Bangladesh and India signed a five-year agreement that stressed that the two governments "need to cooperate with each other in finding a solution to the long term problem of augmenting the flow of the Ganga during the dry season". After the expiry of the 1977 agreement, Bangladesh and India signed a Memorandum of Understanding (MoU) on 7 October 1982 for one year. Another MoU for water sharing between 1986 and 1988 was inked. The second MoU being over, there was no agreement on sharing of the Ganga waters from 1989 to December 1996 when the 30-year Ganga water treaty was signed.

You have to understand that in 1996 we convinced India to sign a treaty—not a MoU or agreement—on sharing the Ganga waters. A treaty is the strongest international legal deal between two countries. This is historic, though the treaty has some limitations.

KRC: Why is the treaty 'historic' and what are the limitations?

AN: Historic because India had not agreed to sign a treaty before; all the previous deals were for short terms. We do not face water scarcity during the rainy season—June to October, but during the dry season, particularly between January and May, the flow reduces drastically. So, the Ganga Water Treaty, signed by the prime ministers of Bangladesh and India, guaranteed a fair deal between Bangladesh and India. I will come to the limitation later on.

KRC: So, would you call it a good deal on water sharing?

AN: Yes, this is a fair deal. The treaty has been working, more or less, very well. I quote, "Subject to the condition that India and Bangladesh each shall receive guaranteed 35,000 cusec of water in alternate three 10-day periods during the period March 11 to May 10". So, Bangladesh has been getting the benefits of the treaty. Of course there is room for improvements.

KRC: What are the limitations of the Ganga water treaty?

AN: One of the main problems or limitations of the treaty is the deal is for 30 years; this is not fair. For example: if you and your brother inherit a piece of land from your father, would you share it for 10 or 20 or 30 years? You will share it forever. What would happen after 30 years? The time-bound treaty will give India an upper hand in the negotiation in the long run. So, the treaty should have stated that 'the treaty would be in place unless replaced by another treaty'.

Another problem is that we are sharing the residual flow at the Farakka point. The other upper riparian states such as Uttar Pradesh, Madhya Pradesh and Bihar have been withdrawing waters in the upper portion. Bihar and West Bengal have been fighting with Bangladesh, but they are not talking about withdrawal of waters in their upper portion. In the future, I fear that the Indian central government may not be in a position to ensure the minimum 70,000 cusec of water at the Farakka point for sharing with Bangladesh.

The Farakka barrage is a central government project; so the Indian central government must intervene to ensure equitable share of waters of the Ganga.

KRC: Why did you limit the treaty to 30 years?

AN: The previous deals were for short terms—from one year to five years. When we got 30 years, we thought it a big achievement.

KRC: What should Bangladesh do to amend the Ganga water sharing treaty?

AN: Bangladesh should immediately start negotiation with India on signing a better and perpetual treaty on sharing the waters of the Ganga. This is because such negotiation will take at least five to six years. But I do not see any initiative from the Bangladeshi side in this regard; the issue is yet to get importance at the decision making level. We have the experience of what happens when there is not any deal. In the past, we lost at every level of the negotiation.

KRC: Do you see a friendly approach in the future talks?

AN: Yes. Bangladesh and India have been discussing augmentation of flow of the Ganga in Nepal since 1974. In 2011 India and Bangladesh agreed to manage the Ganga basin wide. This is a big step forward to make every country understand the benefits of basin-wide management of the Ganga. We have 57 trans-boundary rivers; so this is a very vital issue for us.

At present, Bangladesh needs some honest, capable, dedicated, technically sound and patriotic experts who can devise a good Ganga water sharing treaty in future.

In the line of a good Ganga treaty, we can agree with India to sign deals on other common rivers.

Kamran Reza Chowdhury is a journalist based in Dhaka

Bangladesh seeks Indian cooperation to build $4 billion Ganges barrage

Pinaki Roy

Much of Bangladesh's salinity problem seems to be linked to the Farraka barrage, which went into operation in 1975
— *image by Arati Kumar-Rao*

Bangladesh seeks to build a massive barrage to reverse the damage of rising salinity in the Ganga basin

The Bangladeshi government has reached out to India to help build the Ganges barrage on the Padma river – the main distributary of the Ganga in Bangladesh. The barrage will be a 165 kilometres long reservoir running from Pangsa Upazila in Rajbari to Pangkha in Chapainawabganj district, with a depth of 12.5 metres. It will hold a phenomenal 2.9 billion cubic litres and cost BDT 314 billion (approximately USD 4 billion). The barrage will retain the water of the Padma in Bangladesh during the monsoon and feed small rivers during the lean season. This will reduce salinity, a major threat to public health and agriculture in Bangladesh's southwest.

The high costs of salinity

Much of Bangladesh's salinity problem seems to be linked to the Farraka barrage, which went into operation in 1975. The barrage is situated in the Indian state of West Bengal, approximately 30 kilometres upstream of where the Ganga enters Bangladesh. After the construction of the barrage there was a drop in the water flow of the Padma. As water levels dropped across the southwest of Bangladesh soil salinity increased, including in the Sundarbans, the largest mangrove forest in the world.

The downstream effects of the proposed barrage are uncertain, and there are worries among fishermen at the confluence of the Meghna with the Bay of Bengal (pictured here). The Padma is called the Meghna after it is joined by the Brahmaputra — *image by Arati Kumar Rao*

Approximately 0.83 million hectares of land were affected by salinity in the coastal area in 1973, two years before the Farakka barrage went into operation. The area has now increased to 1.05 million hectares, covering more than half the coastal land mass in the Ganga floodplain in Bangladesh. Over 6,200 hectares of farmland (equivalent to 7,140 football fields) are affected on an average annually. In the worst affected areas, the salinity level is 25 parts per thousand or higher – equivalent to 25 grams of salt dissolved in one kilogramme of soil or water. At such high levels, no crops can grow in the soil. This had a catastrophic effect on agriculture and wildlife, and put the health, livelihood and food security of millions of people in 18 coastal districts in jeopardy.

After the signing of the Ganga Waters treaty between India and Bangladesh in 1996, Bangladesh began receiving water during the extreme dry season, from January to May, but this did not reverse the damage that increasing salinity had done. Bangladeshi experts have long advocated the building of a Ganges barrage as a complement to the Farakka barrage since the 1960s but work on a feasibility study only began in 2009, and a design was completed in 2014.

Once the project is implemented, the feasibility study says, the soil salinity level in the areas surrounding the south-western rivers, including the Gorai, Modhumati, Chitra, Nabaganga, Chandana, Mathabhanga, Atai, Bhairav, Betna, Kobadak, Sibsa and the Baleswar will reduce significantly in the lean period. The feasibility study suggests that the annual incremental benefit will be BDT 73.4 billion (USD 0.94 billion), which would mean the barrage would pay for itself within five years. On top of that, nearly a third of the Sundarbans will be converted from a high salinity zone to a low salinity area.

Regional cooperation is a must

Anisul Islam Mahmud, the Bangladeshi minister for water resources, said Dhaka has already sent a proposal to India seeking cooperation. "The Ganga flows through both Bangladesh and India. So, the project would not be successful without India's cooperation," the minister said, emphasising that regional cooperation is needed to manage transnational river basins.

It is not yet clear how exactly the countries would work together. They have never worked on any major mega-projects before, although there are increasing efforts to do so. In 2010 the prime ministers of the two countries signed a joint communique when the Bangladeshi Prime Minister, Sheikh Hasina, visited India. As part of the communiqué, Bangladesh received a USD 1 billion soft loan from India, with a special focus on the development of railways and waterways. In 2012 India and Bangladesh also signed an agreement to jointly build a 1,320 MW coal-fired plant in Bangladesh under the aegis of a joint company called the Bangladesh-India friendship company. Although there have been environmental concerns about the power plant, the Bangladeshi government has said that these fears are overstated and it is committed to pursuing the project.

A role for China?

In this context of increasing joint projects there is particular hope for cooperation in the construction of the Ganges barrage. Although India and Bangladesh share 53 trans-boundary rivers, the Ganga is the only river for which these two South Asian countries have a formal water sharing agreement, which was signed in 1996. As of now Bangladesh seems to have only asked for Indian help in the actual construction of the project, and it is unclear where the funding will come from.

In 2014, Sheikh Hasina had also travelled to China to discuss soft loans for major infrastructure projects. Interestingly China had also agreed to work on a 1,320 MW coal fired plant in Bangladesh, much like with India. Depending on how both these issues – that of the Ganges barrage and the power plant – move forward, it is quite possible that India and China may end up cooperating to help Bangladesh deal with its current problems of energy and environment.

Pinaki Roy is a journalist based in Dhaka

Tourists may now be able to cruise within the Sundarabans

Abu Siddique

A deal to allow cruise ships to pass between India and Bangladesh in the world's largest mangrove could open the way for deeper cooperation between the countries along shared rivers

Spotted deer in the Sundarbans — *image by gordontour/Flickr*

The governments of Bangladesh and India are planning to sign an agreement to run cruise ships between the two countries. This will give tourists from both countries the opportunity to navigate the Sundarbans, the world's largest mangrove forest, in a single trip.

The two countries have already signed a Memorandum of Understanding (MoU), and the deal is expected to be signed during the upcoming visit of Bangladeshi Premier Sheikh Hasina to New Delhi in April 2017, a Bangladeshi official working in the Shipping Ministry told thethirdpole.net.

> ***This will ultimately force the governments to cooperate with each other on ensuring the flow of the rivers in the region***

"Now we are discussing the Standard Operating Procedure (SOP), under which the cruise ships as well as the routes will be operated," said Md Rafiqul Islam, additional secretary of the Shipping Ministry, Bangladesh.

Quoting from the MoU, he said that the ships will take passengers to different points of the forest in Bangladesh and India, but the passengers will not be allowed to disembark from the ships during the entire tour. They have to enjoy the beauty of the forest and its flora and fauna from on board the ships, which will be operated by private companies from both countries.

Routes and destinations

The route of the entire tour, fixed from the Kolkata port in India to the Mongla port in Bangladesh, is already being used by cargo ships under the Protocol on Inland Water Transport and Trade. Bangladesh is keen to extend the route all the way to Saint Martin's Island in Cox's Bazar to make full use of the opportunities of water based tourism.

There are a number of details that have as yet to be negotiated before this initiative becomes a reality. "Several important matters including the ports of call in the countries as well as the number, type and frequency of the vessels are yet to be finalised," the additional secretary said.

Water experts and environmentalists are happy

Atuar Rahman, a professor of Water Resources and Management Department at Bangladesh University of Engineering and Technology, believes the initiative could precipitate deeper cooperation on water between the two countries. "Gradually, this type of cooperation will lead to running regular water vessels with passengers in both countries, which was very common in the region, once upon a time. This will ultimately force the governments to cooperate with each other on ensuring the flow of the rivers in the region, for the sake of ensuring navigability," he said.

He did caution that measures to protect the forest from disturbances created by tourist vessels as well as the tourists had to be put in place.

"Before signing the agreement, both the government should consider the possible threats for the forests like excessive sound pollution to avoid hurting biodiversity."

The forest and its inhabitants are already suffering from frequent shipping disasters from the transport of coal and oil along its rivers, including the disastrous sinking of a coal laden ship in early January 2017.

The Sundarbans and tourism

The Sundarbans stretches for almost 10,000 square kilometres, with about 60% in Bangladesh and the rest in India. The mangrove forest is home to a number of species including the Bengal tiger, the Gangetic and Irrawaddy dolphins, the Indian fishing cat, the Indian otter and spotted deer. It also harbours 334 species of trees, shrubs and plants and 269 species of wild animals.

The Sundarbans is a very popular tourist destination for Bangladeshis, and in India, particularly for those from the Indian state of West Bengal. Nevertheless, since the forest is divided by a border between two countries, tourists can experience only part of its beauty in a single trip.

Existing protocols for navigation

The governments have already have signed two agreements and protocols to run vessels inside the other country's waterways and use coastal points for transporting goods. The Protocol on Inland Water Transit and Trade has been active since 1972. It permits the movement of goods by medium and large water vessels along eight specific routes between India and Bangladesh.

Under this protocol a total of 2,651 trips took place between the two countries in 2015-2016, according to Bangladesh Inland Water Transport Authority (BIWTA), with ships carrying goods such as fly ash, coal, steel coil and iron ore.

Another agreement, the Costal Shipping Agreement, was signed in 2015 during the official visit of Indian Prime Minister Narendra Modi to Dhaka. Under this agreement Indian and Bangladeshi ports would be able to support travel to and from India's north-eastern states, helping Indian connectivity.

When the Bangladeshi Prime Minister visits Delhi an agreement allowing India to use Bangladesh's two major ports Chittagong and Mongla might also be signed.

Abu Siddique is a Dhaka based journalist. He can be contacted at: siddique.aab@gmail.com