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RITESH SHUKLA/NURPHOTO/GETTY

The Ganges is one of the world's most polluted rivers.

GEOGRAPHY

Indian scientists race to map Ganges river in 3D

Digital models of the river and settlements will help authorities to reduce pollution.

BY LOU DEL BELLO

Scientists and engineers are about to begin the monumental task of mapping the vast stretch of the Ganges river that runs through India, in unprecedented detail. They hope to get started on the work before the monsoon brings bad weather that could delay the project.

Their goal is to create the most comprehensive picture yet of the topography of the river and the human settlements that surround it, to track sources of waste and help authorities clean up one of the world's most polluted waterways.

"It's a race against time," says Girish Kumar, who heads the national surveying agency, the Survey of India based in Dehradun in the Himalayan foothills, which is leading the project.

Although the mapping is expected to take about eight months, the team is eager to get started in case the monsoon season, which began in June, forces them to ground the planes that will be doing much of the work.

A fleet of small aircraft equipped with lidar instruments will soon start scanning the 2,525-kilometre stretch of river that passes through five Indian states — one metre at a time. Lidar is a technique similar to radar, in which instruments bounce laser pulses off the ground. The researchers will use it to produce digital elevation models of the watercourse and the hundreds of thousands of buildings that sit up to 10 kilometres either side of the riverbank.

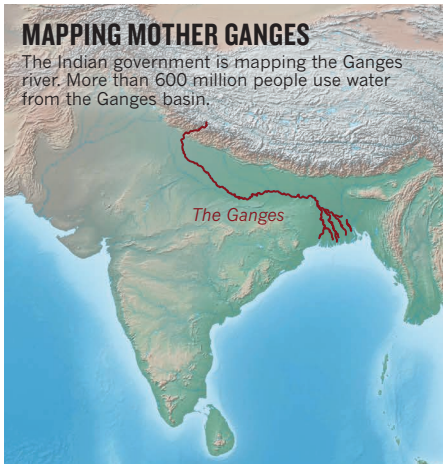
If the schedule goes to plan, the 3D maps should be available by the end of next year.

The project will produce high-resolution ▶

maps of the drainage systems of major cities along the Ganges — the network of discharge outlets that release sewage and commercial waste water into the river. An estimated 600 million people live in the Ganges basin, and rely on water from the river for drinking and bathing. The Ganges is sacred to the country's large Hindu population, who view the river as an embodiment of the goddess Ganga and use its waters in religious rituals.

Although some sources of waste in the Ganges are well known, detailed models of how pollution enters and moves along the river will enable officials to design more-effective reduction strategies. Environmental engineer Vinod Tare of the Indian Institute of Technology in Kanpur says that many current government interventions, such as diverting raw industrial sewage away from the river, are implemented without sufficient information to assess whether they are working. "Right now, we do not even have a simple topography of the basin," says Tare, who has been involved in Ganges-management research for more than three decades.

Government officials also hope to use the maps to improve understanding of how cities develop along the riverbank, and of how the bank is being eroded. This will help local governments to manage risks such as floods. "We will have a better idea of what industries and human settlements will be most affected," says Kumar.



The mapping project (see 'Mapping Mother Ganges') will cost 870 million rupees (US$12.7 million). "It is expensive, but compared to what we will be spending to address the pollution problem, it is hardly anything," says Tare.

But water-quality researcher Abed Hossain says the benefits of detailed monitoring will go unrealized if researchers cannot access all the information and use it to develop models and interventions. If the mapping doesn't go as planned, the government could become worried about negative publicity and restrict access to some of the raw data, says Hossain, who works at the Bangladesh University of Engineering and Technology in Dhaka. In south Asia, he says, "governments are edgy about failures".

Kumar says that the government has issued guidelines for data sharing and will share the information collected for the project.

The mapping is part of the Indian government's renewed push to use technology to monitor and clean the Ganges. In 2015, the government approved the 200-billion-rupee National Mission for Clean Ganga, a wide-ranging effort that includes improving the treatment of sewage and reducing industrial pollution.

But as the deadline of 2020 approaches, the government is still a long way from meeting many of its targets. Last year, the independent auditor-general found that the clean-up effort had been delayed by financial mismanagement and poor planning and implementation.

The management of the river is shaping up to be a central issue in the lead-up to the general election next year. Kumar says that the maps will be a crucial resource for future interventions. "Before planning anything, we need a map," he says. ■

POLICY

Trump finally nominates a science adviser

Meteorologist Kelvin Droegemeier would lead the White House science office.

BY SARA REARDON & ALEXANDRA WITZE

US President Donald Trump has nominated meteorologist Kelvin Droegemeier as his government's top scientist. If confirmed by the Senate, Droegemeier would lead the White House Office of Science and Technology Policy (OSTP).

Trump, who took office 19 months ago, has gone longer without a top science adviser than has any first-term president since at least 1976. He announced his pick on 31 July.

"My initial reaction is, wow, they found someone," says Kei Koizumi, visiting scholar at the American Association for the Advancement of Science in Washington DC and a former assistant director at the OSTP under president Barack Obama.

Droegemeier would be the first non-physicist to serve as White House science adviser since Congress established the OSTP in 1976. "I think he is a very solid choice," says John Holdren, who led the OSTP for eight years as Obama's science adviser. "He is a respected senior scientist and he has experience in speaking science to power."

An expert on extreme-weather events, Droegemeier has been vice-president for research at the University of Oklahoma in Norman since 2009. Last year, Oklahoma Governor Mary Fallin, a Republican, appointed him as the state's secretary of science and technology. The meteorologist has also served on the National Science Board (NSB), which oversees the National Science Foundation, under presidents Obama and George W. Bush. Droegemeier led NSB committees on hurricane science and research administration, among other topics, and was the board's vice-chairman from 2012 to 2016.

"He combines a lot of qualities in somebody you'd like to see in public service," says Roger Pielke Jr, a political scientist at the University of Colorado Boulder who has studied the history of US science advisers and who worked with Droegemeier in the 1990s and early 2000s. "He is, in the most positive way, a nerdy meteorologist who loved working on weather technology. And he also has a knack for administration and working his way around the system."

If confirmed, Droegemeier will take control of an office radically reshaped by the Trump administration. The president has reduced the number of OSTP staff members to about 50, well below the 130 employed by Obama. The Trump team has also placed greater emphasis on technology issues, and has repeatedly sought to cut or eliminate high-profile science programmes — including a public-health-preparedness fund at the Centers for Disease Control and Prevention, climate-change