

## WATER WISDOM

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December 16, 2004  
Hixon Center for Urban Ecology – Final Report  
Originally Prepared for FES 583: Environmental Writing

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Lakhuben stood barefoot on her tiled porch in the village of Moti Marsal in the parched state of Gujarat, India, pumping water into a silver jug. Bangles dangled from her wrists and neck, and the red and black flowered cotton of her sari spilled forward as she gripped the blue handle of her household pump. Clear water poured out and she smiled, the gold stud in her nose sparkling. Lakhuben described the great lengths she used to go for water.

"I used to walk five or ten kilometers," she said, her words translated from Gujarati by a representative of the Aga Khan Rural Support Programme, a local rural development group. "I had to leave at two or three in the morning because there was so much competition. I would dig a pit in the dry riverbed and wait for water to fill it." Women in particular bore a heavy burden, journeying long distances with pitchers stacked on their heads to collect water for drinking, cooking, and cleaning. What little water the women could collect from the riverbed was saline and contaminated. "Our water quality was very poor," Lakhuben explained. The water was contaminated with fluorine, and villagers suffered from skin and stomach problems. The salt content was so high that "the milk would split in the tea, and the cooking would take longer." There simply wasn't enough fresh water.

Lakhuben was not alone. India's one billion people face the most acute water crisis in the world. Epic floods plague the northeast of the country, where villages are regularly destroyed by rising waters and mudslides during the monsoon season. Droughts strike western and central India year after year. Confronted with precipitous drops in groundwater levels, many farmers can no longer afford to pump the water needed to irrigate their crops. In the state of Andhra Pradesh, some have been driven to suicide as droughts led to crop failure and financial ruin. Nor have cities been spared. Untreated sewage and industrial pollution threaten overburdened drinking water sources and choke rivers, and only 31 percent of the population has access to proper sanitation.

The Indian government has poured billions of dollars into tackling the crisis. Ever since India's first Prime Minister Jawaharlal Nehru declared dams the "temples of modern India" fifty

years ago, the country's national development goals have emphasized construction of "big water engineering" projects – huge dams and irrigation canals. The Indian Supreme Court recently ordered the government to dredge up a twenty-year-old plan to link the country's major rivers – effectively rerouting the Ganges. According to former Indian Prime Minister Atal Behari Vajpayee, river linking would “free India from the curse of floods and droughts” by moving water from flood-prone areas in the northeast to drought-stricken regions in the south. The latest proposal calls for at least 37 huge dams and 30 canals stretching more than 6,000 miles, a staggeringly ambitious endeavor far greater in scale than China's Three Gorges Dam, which drowned three river valleys to create the largest hydroelectric dam in the world.

Beset by droughts, monsoonal floods, and plummeting groundwater tables, Gujarat is a microcosm of India's water woes. Gujarat, a glove-shaped state in western India that juts into the Indian Ocean, is one of the most drought-prone areas in India, receiving as little as 20 inches of rain a year, mostly during the monsoon. Determined to install a top-down solution to the state's water crisis, the Gujarati government is constructing a controversial network of major dams and irrigation canals on the Narmada River in eastern Gujarat. Politicians promise that the enormous Sardar Sarovar dam, the still-under-construction keystone of the Narmada project, will carry water to the arid Saurashtra peninsula, where Lakhuben lives, and the desiccated lowland flats of Kutch, a region in northern Gujarat.

But alongside the big government, big money, and big engineering of the Sardar Sarovar dam, an experiment in alternative water management is underway in Gujarat. Rural villagers like Lakhuben have taken matters into their own hands. They are tackling the water crisis from the bottom up, through a series of interventions designed to harvest the rain and restore the whole watershed – all the ridges, hill-slopes, and valleys through which rainwater flows to nourish a stream. These interventions, collectively known as "local water harvesting," are nothing new. For centuries prior to British colonization, Indians used traditional technologies steeped in local knowledge and geography to harvest and store rainwater. Now this ancient wisdom is resurfacing, and it is changing the way India – and the world – thinks about water.

The Sardar Sarovar dam rises out of the misty green hills of eastern Gujarat, an abrupt blast of big water engineering amid the tribal villages that dot the fertile Narmada Valley. Power lines march purposefully out of its northern flank like soldiers in procession. Behind the dam, the river

backs up to create a 133 mile-long reservoir – longer than the distance from New York City to Philadelphia – that stretches into the neighboring states of Madhya Pradesh and Maharashtra. Below the dam, despite the recent deluge of monsoonal rains, the river fills only a fraction of its original channel. Water gathers in pools, exposing the rocky riverbed. The mighty Narmada River has been tamed.

Standing on a bluff high on the riverbank, I stared across at the dam's massive concrete wall, trying to imprint the image in my memory. Guards had confiscated my camera as I entered the property of the Sardar Sarovar Narmada Nigam Ltd., the corporation, wholly owned by the Gujarat government, charged with building the dam. For more than twenty years, the Sardar Sarovar has been a flash-point for controversy across India and around the world. In an atmosphere polarized by conflict and permeated with distrust, accurate information about the dam's costs and benefits is as hard to access as the dam site itself.

I had come to the Sardar Sarovar to see first-hand the model of water development that has dominated India for the past five decades – big water engineering. I was in India working with a New Delhi-based environmental group called the Centre for Science and Environment (CSE) to research possible solutions to India's water crisis. India is home to the world's leading local water harvesting movement, and CSE is a major innovator, churning out books and articles that advocate "making water everybody's business." But to truly assess the potential of local water harvesting, I first had to understand the alternative. And where better to witness big engineering than at Sardar Sarovar, the most notorious dam in India?

A British entrepreneur first proposed damming the Narmada River in 1863, soon after the British Crown seized direct control of most of the Indian subcontinent. Colonization wreaked havoc on traditional methods of local water harvesting. The British levied heavy taxes on villagers to fund centralized water projects designed to irrigate crops for export to the colonial market. They abolished customary rights to water and land, driving many villagers into destitution. The social relations and physical structures that underpinned local water harvesting systems sank into disuse and disrepair.

Big water engineering skyrocketed under India's legendary bureaucracy after the country gained independence in 1947. Irrigation is big business in India, guzzling 92 percent of total fresh water withdrawals. Politicians promoted "major and medium irrigation projects" – bureaucrat-speak for large dams and canals – as the centerpiece of the new nation's development agenda. Plans

to dam the Narmada River proceeded in fits and starts until construction of the Sardar Sarovar dam finally began in earnest in 1987. The dam represents only one piece of the vast Narmada project; if completed, 30 major, 135 medium, and 3,000 small dams will block the Narmada River and its tributaries over the next 50 years.

Right from the start, the dam was more than just a repository for water. It became the repository for the dreams of Gujaratis to finally achieve freedom from drought – and the dreams of politicians seeking to ride this wave of hope to election victory. Brandishing brochures touting the Sardar Sarovar as "a ray of hope" and "a planned ecological harmony amongst men, water, land, and vegetation," the politicians set about convincing Gujaratis that the dam would be "the lifeline of Gujarat."

Many didn't buy the hype. More than 200,000 tribal villagers faced displacement as the reservoir filled up behind the Sardar Sarovar dam, submerging their ancestral villages in the Narmada Valley. They distrusted government promises to resettle the uprooted villages, and began to agitate against the dam. In 1989, national activists joined the fight and the Save the Narmada Movement was born. The movement engaged in *satyagraha* – a Gandhian form of nonviolent resistance – through the 1990s, holding mass rallies, hunger strikes, and protest marches. But construction continued, and the Narmada's waters began to flood lower-lying villages. Villagers stood under the thatched roofs of their huts, watching the monsoonal rains fall and river waters rise, reaching their waists and then their chins and eventually forcing them from their homes.

The movement won some victories. In 1993, the World Bank withdrew funding for the Narmada project after an independent review led by Bradford Morse, former administrator of the United Nations Development Programme, identified serious flaws and concluded that "benefits tend to be overstated, while social and environmental costs are frequently understated." But the dam was unstoppable. As the Sardar Sarovar grew taller, its stated objectives subtly shifted, molded like clay to suit the ambitions of crafty politicians. What was first pitched as an irrigation project morphed into a drinking water project. When one rationale didn't add up, politicians simply discarded it and found another.

In 2000, a judgment by India's Supreme Court quashed the last protest and cleared the way for the dam to reach a height of 443 feet. When I arrived, it stood at 360 feet and had begun delivering irrigation water to farmland in Gujarat. Many before me had come to the Sardar Sarovar seeking answers. The bitter controversy over the resettlement of hundreds of thousands of

displaced villagers still stew just beneath the surface, the Supreme Court verdict either a raw wound or a seal of approval, depending on one's allegiances. But I had a different question. Now that the rising waters lap high against the green slopes of the Narmada Valley, finally allowing water to flow into the main canal, I wanted to know whether the reality matches the rhetoric. Is the Sardar Sarovar dam really the answer to Gujarat's water woes?

I discovered that the dam isn't living up to the politicians' barest promises. In the rush to build it in the first place, the government of Gujarat neglected the basics of project design and management, undermining its own planning assumptions every step of the way. Researchers from the International Water Management Institute (IWMI) conducted a study in late 2002, visiting 40 villages to assess the situation on the ground. Government planners had said that villages would set up water user associations and build canals to deliver the water from the main canal to farmers' fields. The IWMI researchers found no canals and ineffectual water user associations. Government planners had promised that a sophisticated computerized system would track distribution of water to each village. The IWMI researchers found no such system in place, so farmers had no idea when the water would arrive or how much they were authorized to use. "Narmada is one of the most studied projects in the whole world, but even some first-level assumptions are wrong," Tushaar Shah, director of the IWMI-Tata Water Policy Program, told me when I visited his office in Gujarat. "So much potential is lost due to poor management."

Worse still, water from the Sardar Sarovar isn't even reaching the very people the politicians promised it to – rural villagers living in Gujarat's most arid regions, Saurashtra and Kutch. Himanshu Thakkar, director of the South Asia Network on Dams, Rivers and People, warned me that powerful interests are rushing in to claim the water, and "once they come in, it creates a vested interest and a lobby." The people who most need the Narmada water, he points out, live farthest from the dam, and it's not clear how much water will be left in the canals for them. Thousands of villages in Saurashtra and Kutch are slated to receive drinking water, but it is mainly Gujarat's big cities that are actually getting any. According to Shah, a "political economy of contractors and politicians wanting to take their cuts" has already begun to sprout up in the management vacuum. And despite promises that irrigation water would be carefully rationed, water-intensive sugar plantations are moving in close to the dam, threatening to guzzle the Narmada water before it ever has a chance to quench the thirst of drought-stricken villages.

By the time I met Lakhuben, she had already lost faith in the government's ability to supply drinking water. I arrived in Moti Marsal on a gray day in late July with a CSE colleague and a guide from the Aga Khan Rural Support Programme to see how local water harvesting had helped Lakhuben's village. We passed through a maze of mud and rock-walled houses before arriving at her home. Lakhuben and her husband greeted us shyly from a porch festooned with colorful tapestries. Offering us tea, they beckoned for us to sit. We removed our shoes and sat down on the cool tiled floor, sipping sweet, milky chai as Lakhuben recounted the story of her village's water journey.

It was the women of Moti Marsal who pressed for change. They were sick of their families suffering the health effects of contaminated drinking water, and they were tired of trekking long distances for water before sunrise to collect low-quality water from the riverbed. Lakhuben went to visit a relative in a neighboring village and saw a rooftop rainwater harvesting system that provided drinking water for the household. When she returned to Moti Marsal, she convinced her husband that it could work for them, too. "We must do this," she insisted.

They argued at first. Her husband doubted that it would work, and wanted to get on with building their new house. But she wouldn't yield – he had to install the underground tank for the rainwater harvesting system before laying the foundation. Finally he gave in, and their household became the first in Moti Marsal to supply its drinking water by harvesting rain from the roof. The Aga Khan program contributed most of the money for rooftop pipes and gutters to collect the rain and a good-sized cement tank to store the water underground for use throughout the year.

We were curious how the system worked. Lakhuben's husband climbed onto the roof and gestured towards the pipes, indicating how water flows down the side of the house and into the tank. Lakhuben explained how they keep the roof clean and filter the water with a cloth, and demonstrated how she uses a hand pump located conveniently on her porch to pump water up from the underground storage tank.

Lakhuben is thrilled with the results. Her family's income is up because she and her husband have more time to spend in the fields, she told us, and the children can attend school instead of spending hours every day collecting water. The whole family's health is better, and they even save on fuel costs because cooking doesn't take as long with less saline water. The other households in Moti Marsal were impressed – 140 of the 146 households in the village have already followed Lakhuben's lead, installing rooftop rainwater harvesting systems in their own homes even

though Aga Khan reduced its contribution and only paid half of the cost. The women of Moti Marsal are more organized too. They formed a women's group to work on rainwater harvesting, but now that nearly every household has a system, they have moved on to a new project: drying and selling farmyard manure. "Roles have reversed." Lakhuben smiled. "Now, if we need water from outside sources, we make the men go get it."

It was the combination of Lakhuben's enthusiasm and seed money from the Aga Khan program that brought drinking water to her village. But Aga Khan isn't stopping there. The group supports rural development projects all across Gujarat: watershed restoration, drought relief, micro-enterprise, animal husbandry, drip irrigation, horticulture. As Aga Khan representative Umesh Desai told me, the group follows some ground rules when intervening in rural villages – think long-term, build institutions, and understand the unique qualities of each village. Desai warns that projects "should not create dependency." Instead, the group strives to gradually withdraw financial support after three to five years. Then, the only evidence of their involvement will be one more prosperous village and one more watershed renewed.

Lakhuben showed me that Gujarat doesn't need big water engineering to solve its drinking water problem. Local harvesting of monsoonal rains – even in parched Saurashtra – can supply most rural households with enough water for drinking and cooking. But irrigation was another matter. How could farmers in Saurashtra and Kutch hope to irrigate their crops without the Sardar Sarovar project?

I went to the village of Rajsamadhiyala in central Saurashtra to find out. It was the last day of July, and the southwest monsoon had finally arrived, a month late. Overnight floods had turned the highways into turbulent rivers, and water submerged the wheel wells of the jeep I was traveling in with a CSE colleague. Men in white *dhotis* cowered under black umbrellas, their legs bare as they waded through knee-high puddles. Maize stalks huddled, bent in a uniform direction by pounding wind and rain. We climbed out of the jeep and gazed at the smart brick and stucco homes with red-tiled roofs that lined Rajsamadhiyala's paved streets. Hardev Jadeja, a slender man with a shock of black hair and a thin mustache dancing above a broad smile, greeted us. After beckoning an assistant to bring cups of chai, Jadeja began to explain how he became the architect of his village's transformation.

“Our water journey began in 1978 when we built the first percolation tank” to recharge the groundwater aquifer, he told us. As mayor of this 1700-person village, he first organized the villagers to form a committee to channel all government grants for drought relief and rural employment into watershed projects. The villagers built a series of small check dams to "check" the water running off the hills and hold it in percolation tanks, allowing it time to infiltrate into the ground. Starting in 1998, Jadeja began using satellite imagery to map lineaments – natural cracks in the bedrock – and identify potential locations to recharge the aquifer more efficiently. "It is a total scientific approach," Jadeja told us, pointing to a well-worn topographic map spread across the table. "I have excavated this area to the lineament so that water can enter."

Then Jadeja appointed a guide to take us into the fields for a look at one of the percolation tanks. We passed fields with orderly rows of peanuts and cotton bordered by shrubby cacti to prevent wandering animals from nibbling on the crops. An occasional well-head dotted the landscape, showing where farmers were pumping groundwater to irrigate the fields. Patches of broad-canopied trees stood on the hilltops. We scrambled down a muddy embankment and looked out over the percolation tank, a small pond of water, perhaps twenty feet across, located in a depression amid the fields. It looked like any other small pond – except that the villagers had built it themselves.

When we returned to the village, Jadeja invited us have lunch with him. As plate after plate filled the table – potato curry and sweet Gujarati dal, rice, cucumber raita, rotis, curd lassis, and fresh spicy eggplant and hot peppers from the garden – Jadeja finished recounting the story of Rajsamadhiyala's water journey. The secret to the village's success is careful oversight and maintenance of the watershed structures, he explained, telling us about the Village Development Council that oversees the village's watershed activities. "The village is getting richer due to higher discipline," he said. Lift irrigation is banned, so farmers cannot use pumps to irrigate directly from the ponds. Instead, they leave the ponds to recharge groundwater wells. Villagers remove silt from the ponds every year and make sure that the structures are in good repair. And every family in Rajsamadhiyala must plant a tree for each member of the family.

The results of the watershed activities are written on the landscapes and counted in villagers' pocketbooks. Twenty-five years ago, fewer than two thousand trees grew in Rajsamadhiyala and the rivers were bone-dry most of the year, flowing only during the monsoon. Now sixty thousand trees grow and the rivers flow year-round. Before, villagers relied on government tankers for

drinking water. Now, they get water from wells that are recharged by a network of small check dams and tanks. Before, villagers cultivated only one crop a year, but now they have enough water to irrigate two or three crops, and village income has doubled. And Rajasamadhiyala successfully weathered the crippling droughts that hit Gujarat in 2000 and 2001 – droughts that drove nearby villagers to migrate to the city, environmental refugees in search of work and food. "If you are strong as a person, prosperity comes to you," Jadeja told CSE's *Down to Earth* magazine in an interview in 2000. "Today, I lead a life of comfort and luxury in my own village along with my neighbors."

According to Ramaswamy Iyer, India's former Minister of Water Resources and one of the nation's foremost water experts, Lakhuben and Jadeja are not isolated rural village leaders – they are pioneers of a local water harvesting movement that can save India from looming crisis. Back in New Delhi, sipping chai in a café on tree-lined Lodhi Road, the intellectual heart of India's capital city, Iyer explained that a water-scarce country like India has no choice but to increase supply and store monsoonal rains for use during the dry seasons. But India can choose its methods, and the choice will define the country's journey toward water security – and may even teach the rest of the world something in the process.

One option is more big water engineering – huge dams and canals. Following the example of the western United States, where big dams like the Hoover and Grand Coulee transformed deserts into fertile fields, India plunged down the damming path at the time of Independence in 1947, and construction peaked in the 1950s and 1960s. But Iyer is suspicious of large infrastructure projects. Not only do they submerge a large area, causing huge environmental impacts and displacing people, he says, but the costs and benefits often don't add up. "A strong body of evidence says they may not be a good idea," Iyer told me, peering over his mug, "but official policy is to continue with big projects."

Despite the government's focus on building large dams and canals to capture surface water, India's Green Revolution – the explosion of Indian agriculture in the 1960s and 1970s with the widespread application of fertilizers and pesticides – actually relied heavily on pumping groundwater for irrigation. Even in Gujarat, where dams are big business, over 60 percent of irrigated land is watered by groundwater pumped by farmers themselves, not surface water from big water engineering projects. The problem, said Iyer, is that, since the Green Revolution, the country

has been "mining the groundwater." Farmers across India have pumped so much water out of underground aquifers that the rainfall can't come fast enough to replenish the supply.

Local water harvesting reverses the trend by recharging underground aquifers and storing rainwater in the watershed where it falls, Iyer explained. He spoke with the conviction of the converted. After a long career as a top government bureaucrat, Iyer is spending his retirement researching India's water crisis and writing books like *Water: Perspectives, Issues, Concerns*, a detailed analysis of water resource issues in India. Iyer believes that India should revive a rich pre-British history of community-managed tanks to expand local water harvesting across the country. He's not saying that big water engineering projects should never be built. But while the government now sees dams and canals as the first-choice answer to India's water problems, Iyer thinks they should be the last. "What I am saying," he declared vehemently, "is that they should be projects of last resort."

Making local water harvesting the first-choice strategy won't be easy. The "challenging and complicated – but critical – step is to scale up" a patchwork of isolated projects into a movement with institutional backing and major funding, Sunita Narain, the energetic director of CSE and a frequent commentator in the Indian news media, told me. And that sets up a paradox. For local water harvesting to succeed all across India, the very people who have invested the most in big water engineering must begin to pay attention – the politicians.

The government shows some signs of stirring, and is channeling more funds into watershed programs. India's National Development Plans began allocating funding to local water harvesting in the mid-1990s through initiatives such as the Drought-Prone Areas Program, National Watershed Development Project for Rainfed Areas, and the sardonically titled Integrated Wastelands Development Program. Even the government of Gujarat started a program to build small check dams across the state. But big dams and canals continue to receive the lion's share of funding. In Gujarat, the government spent nearly fifteen times as much on big water engineering as on local water harvesting from 1997 to 2002.

One promising model for government action is the Rajiv Gandhi Watershed Mission in the state of Madhya Pradesh, next-door to Gujarat. Madhya Pradesh is the only state in India to have created a high-level directorate to coordinate local water harvesting activities by collecting the hodgepodge of central government funds and redirecting them to watershed projects in villages

across the state. The brainchild of the state's former Chief Minister, the Mission's flexible approach cuts through the bureaucracy and gives local people back the power to manage their own land and water. The Rajiv Gandhi Watershed Mission provides one blueprint for backing local water harvesting projects with big government and big money without sacrificing their grassroots integrity.

Meanwhile, in Gujarat, the success of Jadeja's village has not gone unnoticed. "Earlier it was very difficult to convince the government machinery" to support local water harvesting, Jadeja explained. "They thought villagers were incapable of developing and utilizing funds properly." But now, he said, politicians are impressed by the villagers' active participation in building the check dams and are more willing to commit funds to local water harvesting projects. Neighboring villages are eager to invest in projects of their own. And Jadeja has taken a novel approach – he has become a politician himself. He was recently elected president of the district council, comprising 94 villages, and he has ambitious plans to replicate his village's model of local water harvesting across the region.

But still the dam-building juggernaut rolls on. This summer's devastating droughts and floods gave new momentum to the mammoth river linking plans. Prime Minister Manmohan Singh has been skeptical of the plans so far, calling for more technical and economic studies. He may not be able to stem the tide for much longer, as political pressures mount to take drastic action in the wake of the latest round of water disasters. And in Gujarat, politicians celebrated when the Sardar Sarovar dam reached the height of 360 feet. Ignoring a ban, they lit firecrackers outside BJP party headquarters, and the state's Chief Minister, Narendra Modi, proclaimed it the day the people of Gujarat had long awaited, "when their dream of harnessing the Narmada waters would become a reality." For the dam is finally tall enough to produce hydroelectricity. And as every crafty politician knows, if you don't need a dam for drinking water and you don't need it for irrigation, then there's only one rationale left – power.

As the summer swelter broke and the swollen clouds shed rain that August in New Delhi, I watched Hindu pilgrims hoist bright bouquets of red and gold flowers on their shoulders and clutch tight to flasks of water from the holy Ganges River as they trekked barefoot through the soggy streets. Their journey of hundreds of miles began in the Himalayan foothills, where the Ganges River flows down from the mountains, clear and unspoiled. When I encountered them, they had

reached the crowded capital, where sewage and refuse now choke ancient canals originally designed to deliver drinking water from the Yamuna River, a tributary of the Ganges. The pilgrims were on their way home, where the river's sacred water would bring good fortune to their families.

They reminded me of the great lengths India has gone for water. For fifty years, the Indian government promised that big water engineering would save India from the destruction wrought by droughts and floods. The politicians promised that canals would carry water to the farthest village; they promised that dams would make the desert bloom. They promised that the Sardar Sarovar project would be the lifeline of Gujarat. But still the country sinks ever deeper into water crisis, and the Sardar Sarovar stands as a massive monument to promises not kept and water not delivered to those who need it most.

Extraordinary individuals like Lakhuben and Hardev Jadeja, and effective groups like the Aga Khan Rural Support Programme, point to a different path. They are pioneers of the world's leading movement to solve water problems from the bottom up, by reviving traditional water wisdom in their own villages. Now the lessons they've learned "should be used to reform the state," says Narain, the director of CSE. For if the government doesn't follow through on the promise of local water harvesting, she warns, the movement "will go the way of other failed programs" that get "derailed and destroyed."

That would be a tragedy. Local water harvesting means that Lakhuben no longer has to journey ten kilometers each morning to retrieve low quality drinking water from a pit in the dry riverbed, and it means that farmers in Jadeja's village are no longer forced to become environmental refugees during times of drought, journeying to distant cities for work because they can't irrigate their crops. Indians have always been willing to go to great lengths for water. Local water harvesting means they don't have to. The water they seek is right overhead, falling from the clouds in monsoonal rains that renew rivers and nourish aquifers. With local water harvesting, the only pilgrimage Lakhuben needs to make is to the water pump on her front porch.