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Issues and Ideas for Indian Agriculture

India's irrigation challenges 16

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Cover Picture
Mateusz Stachowski

Going against the grain

For an ancient civilization that has evolved down the centuries, with scientific agricultural practices always ahead of their times, it is not a little curious that India today stares at a food crisis. Radical changes in mindset and policy are being called for to get the country out of the declining agricultural trend rut and into a 4 per cent to 5 per cent growth mode. Yet action on the ground is far from convincing or reassuring. The Bharat Krishak Samaj, a non-political, non-sectarian association of farmers, has been serving as the voice of India's agrarian community for 55 years and helping to create an understanding around the fundamental issue of food security in India. Today, it has revitalized itself as a unique advocacy platform that not only educates and informs the Indian farmer about all farm-related developments but advances all farmer and farm-related causes that would help India achieve its agriculture mission.

Farmers' Forum is a public platform, as it were, to encourage voices of wisdom around agriculture to deliberate, discuss and determine what India's agricultural strategy should be so that food is a matter of universal availability; the farming community, irrespective of the individual farmer's plot, is well served by an inclusive policy; and that the policy itself is a holistic one and executed with some modicum of cohesion between the many arms of India's official agriculture machinery.

LACK OF COHESION HAS BECOME THE SALIENT FEATURE OF INDIAN AGRICULTURE STRATEGY FROM RESEARCH TO POLICY MATTERS.

Indeed, this lack of cohesion has become the salient feature of Indian agriculture strategy from research to policy matters. In the final analysis, the sectoral performance will depend upon how much the country invests and how the farmers are incentivized to deliver. A simple example will drive home the point. The total budget of the Indian Council of Agricultural Research is around $300 million, half of which is possibly spent on its bureaucracy. No more than $150 million is available for research (compared to $8 billion for MNREGA and between $12 billion and $20 billion for food subsidy). Given the systemic sloppiness in the country, the returns can only be ignoble even in a critical area like agriculture research. Significantly, it is the

Photo: Vasant Dave

private sector that is investing billions of dollars in research every year and that is where the technological breakthrough is expected. Regrettably, for want of any other option, it will be from the successful private sector research fare that the country will choose technology. That may not necessarily be what the country actually needs.

Certainly then, Indian agriculture's worst enemy seems to be a fundamental lack of co-ordination amongst the many policy-making wings of the government that impact on every aspect of farming – from seeds and fertilizer to water and marketing and the implementing agencies. Possibly, agriculture being a state subject has aggravated the incipient dissonance between the Ministry of Agriculture and the different states. It may be time to consider bringing agriculture into the concurrent list and ensuring a better co-ordinated approach to agriculture taking all stakeholders on board. It would also be interesting for India to consider the Brazil initiative towards such co-ordination.

BETWEEN 1991-92 AND 2007-08, THERE HAS NO ADDITION TO NET IRRIGATED AREAS BY CANALS FROM MAJOR AND MEDIUM IRRIGATION PROJECTS DESPITE RS 1,42,000 CRORE HAVING BEEN SPENT.

President Luiz Inacio Lula Da Silva has created the position equivalent to a National Food Security Advisor who coordinates 43 different programmes spread over 11 different ministries. India would be well advised to consider such a position that would coordinate, monitor, assimilate and ensure that different agriculture initiatives by various ministries, departments and the central programmes are dovetailed into one another so that there is efficient delivery where it is needed. This is especially important because the budgetary allocation for the Ministry of Agriculture is rather meagre; less than half of what is being spent on the Commonwealth Games that, at the point of writing this, is threatened by the overflowing waters of the Yamuna. This forces attention to the use of India's water resources that are the lifeline not just for the farming community but for the nation as a whole.

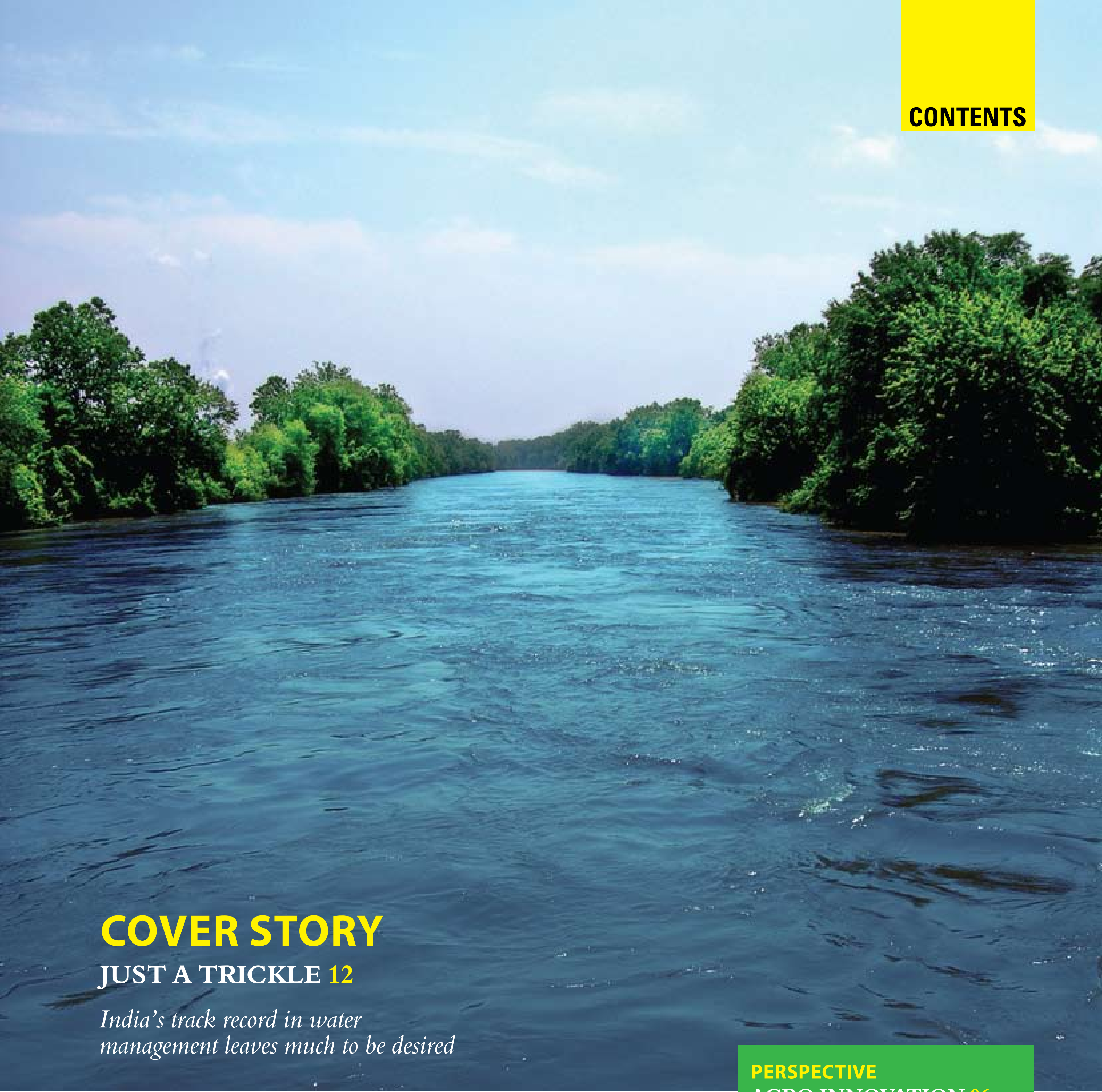
Nevertheless, since 80 per cent of India's fresh water is used for agriculture, Farmers' Forum believes water use should top the agriculture agenda in that wasteful ways of water use and inefficient investments must be stopped forthwith. A single statistic would prove the point. Over 1991-92 to 2007-08 (the latest year for which figures are available), there is been absolutely no addition to net irrigated area by canals from major and medium irrigation projects as per official data from the Union Ministry of Agriculture, based on actual field surveys from the states, despite around Rs 1,42,000 crore ($ 31.21 billion) having been lavished on it for the sole purpose of increasing canal irrigated areas.

Can India accept such a squandering of both its liquid and cash wealth?

Ajay Jakhar

Ajay Vir Jakhar
Editor

CONTENTS



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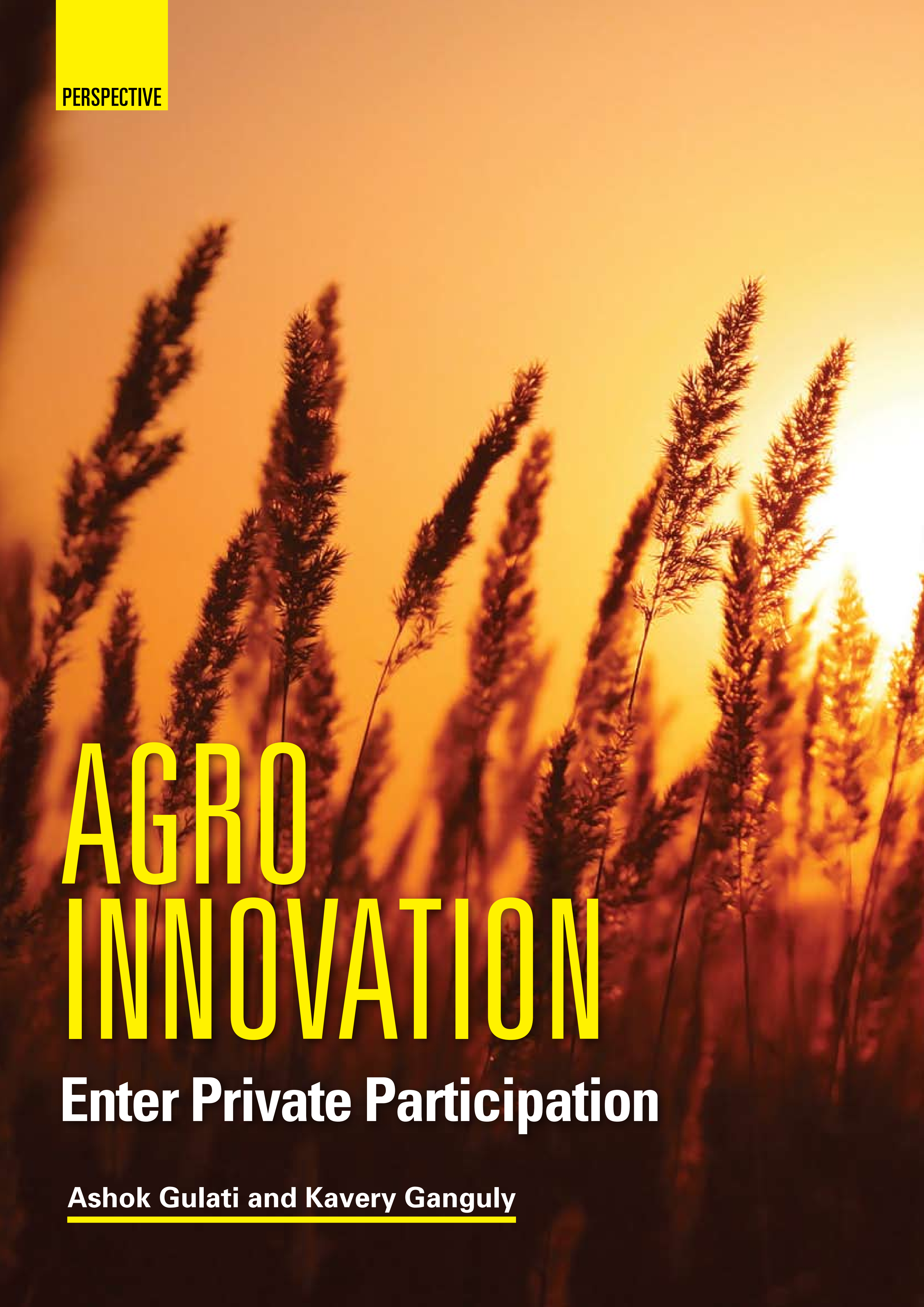

PERSPECTIVE

AGRO INNOVATION

Enter Private Participation

Ashok Gulati and Kavery Ganguly


Photo: Yarik Mishin

The import of 18,000 tonnes of high-yielding variety seeds of wheat, Sonora 64 and Lerma Rojo from Mexico, during the spring of 1966, ushered in the Green Revolution in India in 1967. The sudden increase in wheat production in Punjab, which was like a 'cloudburst of grain', took many by surprise as there was not enough modern storage capacity to hold this grain. Primary schools had to be shut down and classrooms became wheat godowns to store wheat! It was an almost similar experience with rice (IR-8), though not as dramatic as wheat. India, which was heavily dependent on PL 480 food aid and dismissed as a basket case by experts, bounced back, becoming almost self-sufficient in grains by early 1970s. Since then, barring a few years of commercial imports in between, India has largely remained relatively self-sufficient in basic staples of wheat and rice. This is very well known in agri-circles not only in India but around the world. What is somewhat less known is that between 2000-01 and 2008-09, India exported more than 48 million tonnes rice and wheat. This is the real force of technology that turned India from a large net importer of staples to a net exporter of staples.

Technology has played an important role not only in the evolution of Indian agriculture beginning with the Green Revolution in the 1960s but also in the recent innovations in biotechnology in 2000s, especially in case of cotton. The underlying effort has been to enhance the productivity of crop and livestock sectors, with institutions and markets playing a complementary role. What has dramatically changed over the past five decades, however, is the leadership role that has steered these revolutions, moving from rigorous public sector interventions to increasing entrepreneurship of the private sector. While in late 1960s, the government played a proactive role and partnered with "not-for-profit" institutions like the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and International Rice Research Institute (IRRI) in Philippines, in the 2000s, the crop revolution in cotton is led by private firms like Mahyco-Monsanto Biotech that basically operate on "for profit" principles. Yet Indian agriculture has seen some unprecedented changes in cotton.

In 2006, the area under Bt cotton tripled to 3.8 million hectares and India overtook China in area under Bt cotton

The case of Bt cotton in India

Between 2002 and 2009, the area under Bt (Bacillus thuringiensis) varieties increased from 50,000 hectares to 8.4 million hectares, a 168-fold increase in eight years. Nearly 87 per cent of the 9.6 million hectares under cotton was Bt in 2009 (James 2009). The most spectacular growth in area was observed in 2006 when the area under Bt cotton tripled to 3.8 million hectares as against 1.3 million hectares in 2004; perhaps the highest increase on a year-on-year basis for any country planting biotech crops in the world in 2006. The same year, India surpassed China in the area under Bt cotton (3.8 versus 3.5 million hectares). In 2007, India had the largest hectarage of Bt cotton in the world. With the introduction of Bt cotton, overall cotton yield increased from 302 kg/ha in 2002-03 to 567 kg/ha in 2007-08; an 87.7 per cent increase in five years. Production in India doubled from 15.8 million bales in 2001-02 to 31.5 million bales in 2007-08 (Cotton Advisory Board, 2009).

Photo: Fernando Weberich

Cotton exports increased from 1.2 million bales in 2003-04 to 8.5 million bales worth $1.9 billion in 2007-08 and with this, India emerged as the second largest exporter of cotton, overtaking the US.

Nevertheless, cotton in India is linked with unfortunate farmer suicides, which perhaps have little to do with the technology per se and more with the prevailing conditions (irrigation, pest management practices and such others). Cotton is grown predominantly in nine Indian states; with 71 per cent of the production coming from the states of Gujarat, Maharashtra and Andhra Pradesh. While more than 44 per cent of the cotton area in Gujarat is irrigated and 21.3 per cent in Andhra Pradesh, as little as 3.3 per cent of the area in Maharashtra is irrigated, which perhaps explains the plight of the farmers in Vidharbha region. The number of farmers adopting the technology increased exponentially, from 50,000 in 2002 to 5.6 million farmers in 2009, largely small and resource-poor (James 2009). The income gains are attributed to higher yields and reduced costs of production; share of cotton pesticides as a percentage of total pesticides declined from 30 per cent in 1998 to 18 per cent in 2006 (Ibid). Based on a meta-analysis of the existing studies, it is observed that Bt cotton reduces the number of pesticide sprays by 32-40 per cent, reduces pesticide costs by 30-52 per cent, increases the total costs of production by about 15 per cent, has no clear effect on cotton seed prices, increases yields by 34-42 per cent and raises net returns by 52-71 per cent (Gruere, Mehta-Bhatt, and Sengupta 2008).

The success of Bt cotton in India is ascribed to Maharashtra Hybrids Seeds Co. Ltd. (Mahyco)-Monsanto Biotech (MMB), a 50:50 joint venture between Mahyco and Monsanto, which markets Bt cotton technologies in India and has co-licensing agreements with several Indian cotton seed companies to reach Bollgard to Indian farmers. Mahyco received regulatory approval in March 2002 although farmers in Gujarat adopted it in 2001 before the official approval came by. The number of Bt cotton hybrids and the companies offering these increased dramatically from three hybrids and one company in 2002 to 522 hybrids and 35 companies in 2009. What makes the cotton story so unique in the Indian context is the pioneering role of the private sector amidst much opposition and protests. However, this is not to advocate the role of the private sector or Bt as the panacea for Indian agriculture but to highlight the increasing role that the private sector (domestic and multinational) has played and is likely to play even more in the years to come. What is needed to harness the energy and entrepreneurship of the private sector for society's welfare is a set of clear rules of the game, especially in terms of regulatory processes, be it the issue of intellectual property rights (IPR), price policy or food safety concerns. There is need for greater transparency in setting the rules of the game and, more importantly, in implementing them.

Bt brinjal

It is well known that the commercial release of Bt brinjal has been stalled due to lack of clarity in such rules of the game. Nevertheless, several other technologies are likely to make an impact in the years to come. Hybrid maize varieties have helped increase maize production from 12 million tonnes in 2000-01 to 19.3 million tonnes in 2008-09. Hybrid rice in India is also making in-roads in eastern India and has a good opportunity to get scaled up in the near future under the Second

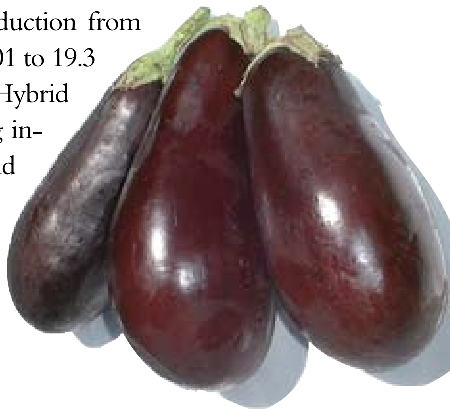

Photo: Felix Atsoram

Green Revolution programme of the government. Also, Golden Rice, rich in vitamin-A would be useful in addressing the burden of malnourishment in India. As the pressure on land for non-agricultural uses builds up, technologies that bring about productivity gains will become very critical. This requires large investments in agriculture research and development (R&D) on a sustainable basis.

Trends in agri-R&D investment

There are concerns over the declining support for agricultural R&D and infrastructure development by international agencies such as the World Bank, Asian Development Bank and hence that of the Consultative Group of International Agricultural Research (Zeigler & Mohanty 2010). Agricultural research lending of the World Bank decreased from a peak of $400 million in 1998 to less than $100 million in 2007. As for the CGIAR, the funding has increased in nominal terms but remained more or less flat in real terms, although the number of centres increased from four to 15 over the last 50 years (*figure 1*). If the world has to ensure food security on a sustainable basis, there is no option but to invest more in agri-R&D. Interestingly enough, while the governments around the world and multilateral agencies have been somewhat slow in realizing this, the private sector has gone ahead much faster. Take the case of Monsanto, for example.

Monsanto, one of the leading agricultural companies, spends a considerable part of its sales in investments in R&D. In 2009, it posted net sales of $11.7 billion and invested nearly $ 1.1 billion in R&D in 2009, accounting for 9.4 per cent of its net sales (Monsanto 2009). This is perhaps the highest private sector expenditure in R&D for developing new technologies. Compared to other leading market players such as DuPont, BASF and others, Monsanto records the highest expenditure on seeds/traits (*figure 2*).

Interestingly, just one company in the world spends almost double of what the entire group of 15 CGIAR centres spend together. In India, public expenditure on agricultural R&D accounts for a meagre 0.6 per cent of agricultural GDP (2007). No wonder, the future technologies are increasingly in the hands of these companies working on "for profit" principles. Hence the issue of welfare of the masses, especially those who are at the bottom of the economic pyramid may get neglected.

The global food price hikes in 2007-08 and now again in case of wheat in 2010 should be taken as a wake-up call by country governments and multilateral agencies to increase funding for agri-R&D for the benefit of poor at large and ensuring global food security on a sustainable basis. Increased investments should also be matched by institutional reforms of publicly-funded agri-research organizations, domestic and international, to bring greater transparency in their functioning, incentivizing scientists and making them more accountable to clients. ●

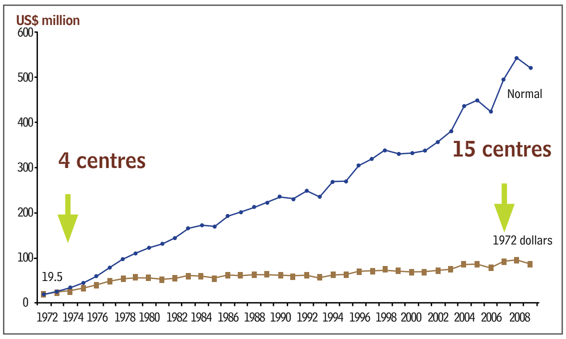

Figure1: CGIAR funding trends in nominal and 1972 dollars
Source: Zeigler and Mohanty 2010

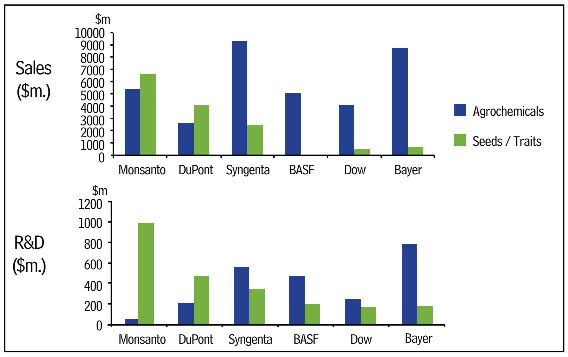

Figure 2: Comparing Sales and R&D Expenditure across major companies: 2008.
Source: Phillips McDougall-Agri Futura

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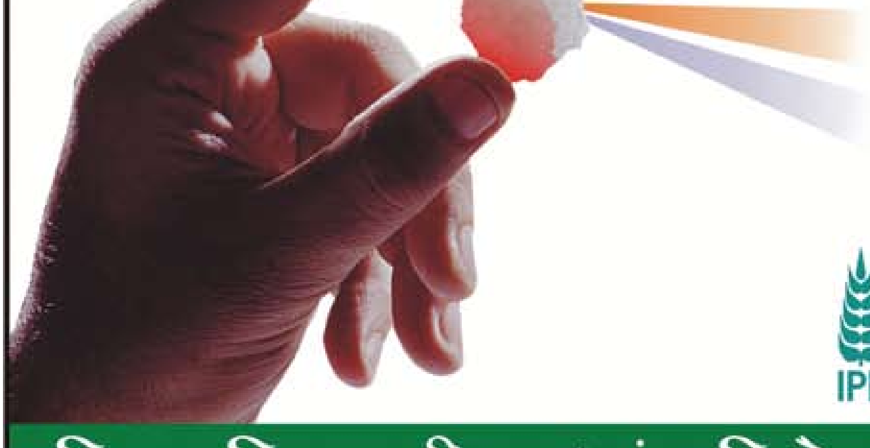
स्थाई कृषि समृद्धि हेतु समेकित समाधान



- समर्पित एवं प्रशिक्षित कर्मियों द्वारा नवीनतम फार्म प्रौद्यौगिकी का प्रचार सुनिश्चित करना।
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JUST A TRICKLE

As the heavens opened themselves upon the Indian capital in the third week of August, images of Delhites wading to work waist-deep in water, amidst serpentine automobile queues on the capital's roads, were a clear testimony to India's inability to manage a vital resource that it has been receiving gratis. That is, however, just the tip of the iceberg. There is the far more sinister, quiet, unreported and yet humungous waste of water resources. India's annual precipitation of a handsome 4,000 cu km gets slashed into an effective water availability of no more than 1,123 cu km (utilizable water resources 690 cu km and utilizable ground water 433 cu km). These figures vary from source to source but one is going by the government of India's figures here.

Significantly, no more than 28.3 per cent of rainwater is utilized, thanks to India's creaking water management infrastructure, lopsided policies, illogical spending patterns on large irrigation projects that pay poor dividends and a comprehensive lack of perspective that haunts the water scene. Somewhere, there is a lack of realization that water has an economic value in all its competing uses; that it should be recognized as an economic good and supported with professional planning for tapping and allocative efficiency.

India, which is expected to win the 21st century with its technological prowess, is still grappling with the art of harnessing this finite resource that is critical for life, agriculture and for sustaining a billion plus people. Yet this is no rocket science. India's indigenous knowledge base provides excellent lessons and practices on effective and participatory water management that are largely ignored, save for pockets of excellence where its practice has dramatically changed the landscape. India spends billions of rupees on its water infrastructure with neither proper planning nor understanding. The country also has vast bodies of vested interestes that dominate its policy-making mechanism, prompting huge misinvestment, misappropriation and misuse of water resources. This is further vitiated by inter-state disputes over scarce water.

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The pages that follow deal with some of the very obvious issues around water management in India, from the historical perspective of socio-culturally sound management processes and practices to current misadventures with water investments that have meant money down the drain. They also focus on the resultant shortages of water and the ensuing disputes; and, finally, talk about remedial measures and simple solutions around micro irrigation. Magsaysay award winner, Rajendra Singh talks of the heritage community participation route to effective regeneration of the water regime; Himanshu Thakkar focuses on why India's major irrigation projects end up as abysmal failures; Bhavarlal H. Jain explains the virtues of micro irrigation while Ramaswamy R. Iyer explains the recurring inter-state water disputes in the country with its complex

India:Precipitation and water availability	(cu km)
1. Annual Precipitation (Including snowfall)	4000
2. Average Annual Availability	1869
3. Per Capita Water Availability (2001)	1820
4. Estimated Utilizable Water Resources	1123
(i) Surface Water Resources	690
(ii)Ground Water Resources	433

Source: Ministry of Water Resources
http://mowr.gov.in/index2.asp?slid=412&sublinkid=290&langid=1

India saves only 30 days of rainfall compared to an average of 900 days for other countries. India is already a water stressed land. Against a safe level of 1,700 cubic meters of water availability per person, India will have only 1,100 cubic meters by 2050.

water laws and ownership ideas. Haryana's Randeep Singh Surjewala provides the state's perspective on the Sutluj Yamuna Link controversy and Punjab's Manpreet Singh Badal provides the perspective from the land of the five rivers.

Between them they give an idea of the character of India's water crisis. The World Bank's report on India's water economy has earlier talked of a rising demand-supply gap for water to about 50 per cent by 2030 with demands doubling from current levels of 700 billion cubic metres to around 1,498 billion cubic metres and supply at only 744 billion cubic metres. These drastic projections do not seem to have moved the government into acting judiciously; large parts of the country resort to indiscriminate exploitation of groundwater; others suffer from severe shortage and water pollution while farmers the country over complain both about the quantity and quality of water available.

Clearly there is need to consider some fundamental changes in the government's agriculture strategy, from pricing to financing. Since drip management of irrigation has been established as a critical resource for efficient water management, there is a strong case for including drip management under the infrastructure lending regime. Since the need to cultivate a composite culture for agriculture management has been talked about and water is an integral part of such a regime, there is an equally strong case for the Water Resources Ministry to be restored to its original position as a part of the Agriculture Ministry. Equally, since micro irrigation has come to assume such an important position in the water management scenario, there is need to accept it as principal security not just collateral security. As pipes are embedded three feet underground, they need to be accepted as immovable property for loans up to Rs 1 lakh.

A human needs four litres of drinking water a day while water required to produce his daily food varies from 2,500 litres to 5,000 litres. A farmer improving water use by one per cent, on an average, gains 2,00,000 litres of water per hectare. This is the crux of water economics in a scarcity era that India needs to understand but consistently ignores. The country saves only 30 days of rainfall compared to an average of 900 days for other countries. India is already a water stressed land. Against a safe level of 1,700 cubic meters of water availability per person, India will have only 1,100 cubic meters by 2050.

The problem is compounded by the lack of cohesion between the governments at the central and state levels. Consider the simple case for drip irrigation. The central government frames the guidelines for a subsidy scheme but neither the guidelines nor funds are made available to the state governments on time. The state governments, in turn, take their own time to formulate guidelines that change from year to year and from crop to crop.

Industry sources refer to some major obstacles in the smooth functioning of otherwise well-intentioned plans. Even after the guidelines and central funds are allocated, the matching contribution by the concerned state governments have to be arranged and transferred to the implementing agency, which are different in each state. It could be the department of agriculture or the department of horticulture or state corporations or other agencies. This rather complex set of circumstances means an absence of uniformity and a time frame for the necessary steps to be completed for funds to finally get to the beneficiaries. Then comes the next set of problems.

The subsidy proposal requires some 16

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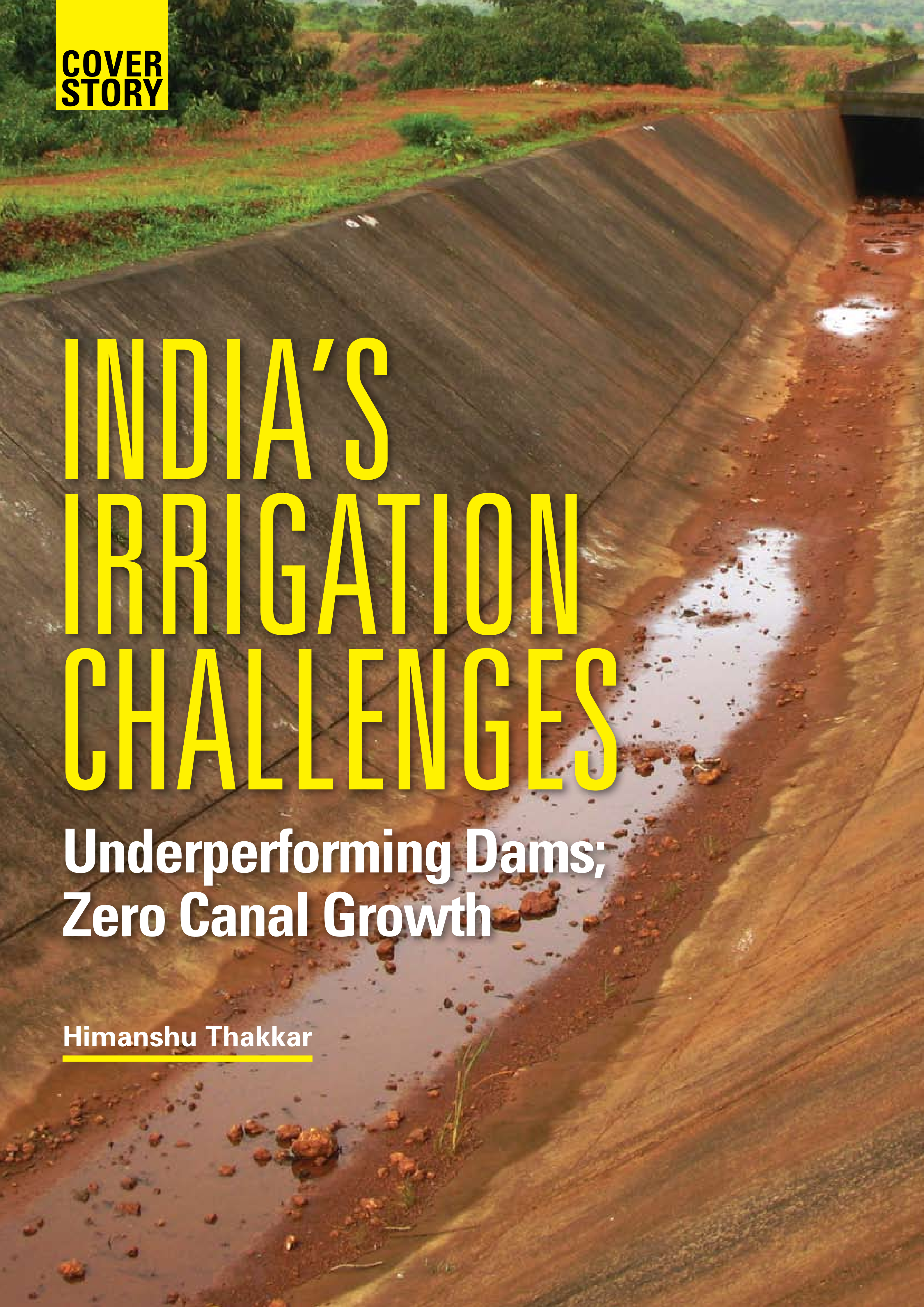
Agriculture accounts for nearly 80 per cent of India's water use but not even 40 per cent of the country's net sown area has access to water.

documents for the authorities to be able to consider it. This entails more delays because the transfer of the papers from village to the designated level is time-consuming and often involves greasing of palms. Again, some state governments have their own schemes for special subsidies for a given crop, which may not permissible under the central subsidy guidelines, further compounding the confusion.

Also, as industry points out, subsidy payment by the states to the farmers or their nominees such as the manufacturers or suppliers is inordinately delayed; by as much as six to 15 months. Then again, states often divert the central subsidy for other purposes and are not in a position to provide matching contribution or are simply unable to fund the schemes. These cause major constraints vis-à-vis the scale and administration of drip subsidy schemes and stymie even well-considered plans. An unholy mess is made of a simple matter of promoting drip irrigation.

Agriculture accounts for nearly 80 per cent of India's water use but not even 40 per cent of the country's net sown area has access to water. This situation is aggravated by low irrigation systems efficiency and fast-depleting aquifers. The agriculturist is further charged with producing extra for India's growing population that is expected to need about 450 million tonnes of food by 2050. The current production is in the range of 200 million tonnes.

The big question: How is the farmer to step up production without affordable and regular supply of adequate water? How is India to ensure food security without this key resource? ●



COVER STORY

INDIA'S IRRIGATION CHALLENGES

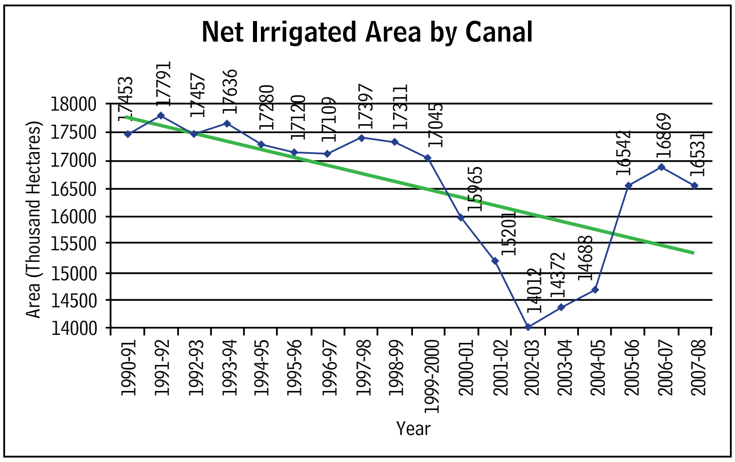
Underperforming Dams; Zero Canal Growth

Himanshu Thakkar

Consider some damning facts about the Indian irrigation scene:

- India had 346 large dams in 1950; there are over 5,000 now; more than 95 per cent of them are irrigation projects
- From April 1991 to March 2007, the country has spent over Rs 1,42,000 crore on major and medium irrigation projects with the objective of increasing canal irrigated areas
- Yet there has been zero addition to net irrigated areas by canals from major and medium irrigation projects as per official data from the Union Ministry of Agriculture
- 66-80 per cent of India's water sector budget goes for big projects. This trend was carried into the 11th Five Year plan (2007-12)
- This is to the exclusion of rain-fed farmers, local water systems, groundwater recharging, repair and maintenance of created infrastructure
- New ways are being attempted to push big projects. Some recent instances include:
  - Accelerated Irrigation Benefits Programme (AIBP) started in October 1996;
  - Interlinking of Rivers (ILR) that shot into headlines in 2002;
  - Advocacy to increase storage capacities (pushed by the World Bank);
  - Climate change (National Water Mission under India's National Action Plan on Climate Change advocates for big storages);
  - Hydropower (questionable claims of hydro-power being clean, green, cheap, renewable);
  - National projects (started in 2006-07);
  - The use of the 'China' bogey.

No one seems to question the actual performance of big irrigation projects. An assessment would, therefore, be in order. The performance over the last 16 years from 1991-92 to 2007-08 (the latest year for which figures are available) shows a zero addition to net irrigated areas by canals from major and medium irrigation projects as per official data from the Union Ministry of Agriculture, based on actual field data from the states. Shockingly, from April 1991 to March 2007, Rs 1,42,000 crore have been spent on major and medium irrigation projects with the objective of increasing canal irrigated areas. Outcome, zero!



Performance shocker

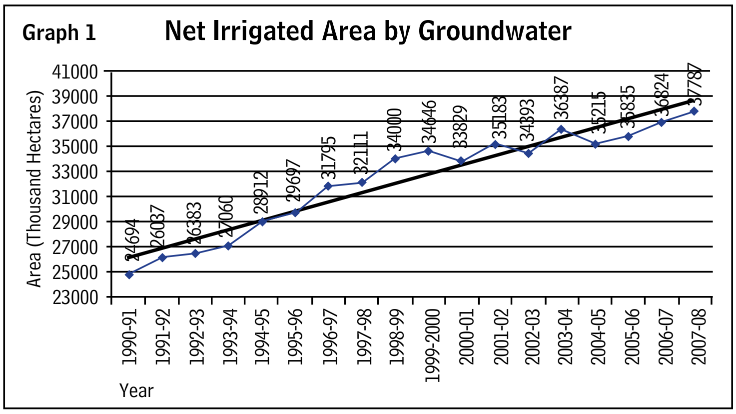
Three years back the cover story in the September-October 2007 issue of Dams, Rivers & People presented the picture as it had been running for 12 years, ending in March 2004. Since then information received, under the Right to Information Act from the Union Ministry of Agriculture, confirms that the trend continues (see graph on net area irrigated by canals). The official data confirms that the gargantuan Rs 1,42,000 crore and more spent have not led to any addition in the net irrigated area by canals in the country for the entire 16-year period. In fact, the areas irrigated by such projects have fallen by a massive 1.26 million hectare during this period.

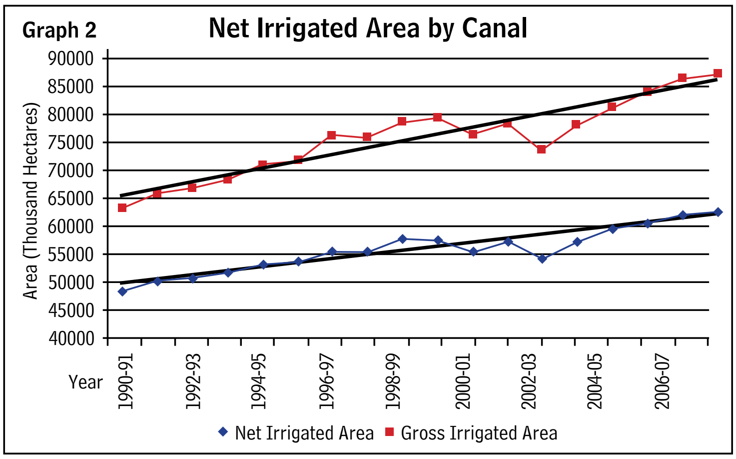
This should be cause for some very serious concern and the Ministry of Water Resources (MWR), the states and the Planning Commission should look for answers to some difficult questions. The more worrying question is whether the MWR, the Planning Commission and all the other official agencies have realized the folly of continued investment of the bulk of India's water resources finances in big irrigation projects. About two-thirds of all five year plan budgets under water resources development continues to be used for M&M irrigation projects, including those under the 11th Five Year Plan.

11th Plan mid-term appraisal

The mid-term appraisal of the 11th Plan by the Planning Commission, approved by the National Development Council on July 24, 2010, supports these conclusions. Para 21.7 says: "The area irrigated by canals and tanks has actually undergone a decline even in absolute terms since the 1990s". This was exactly the conclusion of the SANDRP analysis in May 2010. In this period (as per the MWR and other information), the country created additional irrigation potential of 10.5 million hectare and had an additional utilization of irrigation potential of 7.82 million hectares, something controverted by official data from the ground. The MWR has been using such claims to push for more allocations for investment in M&M irrigation projects, proposing an allocation of Rs 1,65,900 crore in the ongoing M&M irrigation projects during the 11th Plan that, according to proven performance records, will possibly result in a total waste of public money.

The net canal irrigated area in the country was 17.79 million hectares in 1991-92. In all the years thereafter, till 2007-08, the latest year for which the data is available, this area has not only been lower than 17.79 million ha but the overall trend continues to be on the decline (despite some rise in recent years from the bottom reached in the drought year of 2002-03), as evident from the trend line in the graph on net and gross irrigated area. The net irrigated area by all sources increased from 48.02 million ha in 1990-91 to 62.28 million ha by 2007-08, as plotted on the graph.





1 (*http://www.sandrp.in/drp/Sept_Oct2007.pdf*)
2 See website: *http://dacnet.nic.in/eands/LUS-2007-08/Summary/3.pdf*
3 2010 . (see *http://www.sandrp.in/irrigation/Failure_of_Big_Irrigation_Projects_and_Rainfed_Agriculture0510.pdf*).
4 Working group report on water resources for the 11th Plan

Photo: Saleem Taqvi

Similarly, the gross irrigated area from all sources has been increasing during the period as in graph. This increase in all-India net and gross irrigated areas has been possible due to the increase in groundwater irrigated area from 24.69 million ha in 1990-91 to 37.79 million ha in 2007-08 (graph). In fact, the increase in groundwater irrigated area has helped the MWR suppress the reality of non-performance of the big dams. In most years during 1991-2008, rainfall has been normal or above normal (*chart on Page 20*) obviating the possibility of attributing this trend to low rainfall.

Why this decline

Some reasons for this situation are: siltation of reservoirs and canals, lack of regular and proper repair and maintenance of the irrigation infrastructure, inadequate allocation of resources for repair and maintenance, water-intensive crops at the head reaches, not building canals, over development (beyond the carrying capacity) of projects in a basin, water logging and salinization, diversion of water for non-irrigation uses, increasing exploitation of groundwater. Another reason cited by some researchers is increased rainwater harvesting in the catchment areas. In some cases, the additional area added by new projects is not reflected in the figures as the area irrigated by older projects is declining on account of the neglect outlined earlier.

Indeed the World Bank's 2005 report, "India's Water Economy: Bracing for a Turbulent Future", showed that annual financial requirement for maintenance of India's irrigation infrastructure (which is largest in the world) is Rs 17,000 crore but less than 10 per cent of that amount is available and most of it does not result in physical maintenance of the infrastructure. In some over-developed basins, the new projects are like zero sum games, since they would be taking away water from some of the downstream areas. Optimistic hydrological projections, which are almost universal in big irrigation projects, would mean that, in any case, there will not be sufficient water in the basin to provide the projected benefits.

The implications

These findings have grave import. First, they very clearly expose the wastage of several thousands of crore that India spends on big irrigation projects without any result. Second, the real increase in irrigated area is only because of groundwater irrigation, which is the lifeline of irrigated agriculture. Third, this raises many accountability issues. Who is responsible for deciding on these wrong priorities and what are the consequences? It is clear that the country would have been better served had this money been spent on proper repair and maintenance of the existing infrastructure, instead of being wasted on new major and medium irrigation projects. It is far more important to reduce siltation of reservoirs, concentrate on rainwater harvesting, groundwater recharge, regulation, demand-side management, water-efficient cropping methods like the system of rice intensification and on rain-fed areas. On the groundwater front, the top priority should be preserving the existing groundwater recharge systems and augmenting them.

Measuring storage capacity

There are several ways of assessing the performance of India's big reservoir capacity for irrigation but the authorities seem to have ignored them even as they have hankered for more storage capacities through big projects. There can be no case for doing so unless a credible assessment is made of the current performance of the existing infrastructure and ways and means identified to enhance it.

The Central Water Commission, the apex technical organization of the Government of India in the water sector, publishes weekly updates of the storage levels in some selected big water dams of India; the number of projects thus monitored currently stand at 81 with total live storage capacity of 151.77 billion cubic meters (BCM). The table on reservoir capacity assessment shows how much of the reservoir capacity was filled up before the monsoon and how much remained idle or empty at the end of the filling period in various years. It establishes that even in years of monsoon rainfall above 100 per cent of normal, the reservoir capacity remains significantly idle. This translates into underperformance or idle investment.

The justification for creating such capacities is that they will enable storage of monsoon rainfall and make it available in the post-monsoon months. If a significant part of the capacities remain empty at the end of the monsoon, year after year, it shows that the intended benefit has not been achieved. This has major implications:

- On an annual average, about 35.86 BCM (equivalent of six Sardar Sarovar Projects) of storage capacity, out of the monitored storage capacity only, has not been filled up for the last 16 years.
- That means that, on an average, an investment of Rs 34,886 crore has remained idle in each of the last 16 years.
- In 10 of the 16 years, the rainfall was almost average or above. (*Figures in brackets in column 2*)

Should one not try to understand why this is happening? How can the existing storage capacities play the useful role that they are supposed to? Why push for more storage?

High pre-monsoon water storage

Another way to assess the performance of big storages is to see how much water has remained in the live storage capacity before the onset of monsoon. This shows the extent of under-utilization of stored water in the previous year, reflects the non-optimal use of the stored water, and has further implications for the following year. First, because the live storage space that has remained filled from the water from the previous year will not be available for storing water in the current year, much of the monsoon runoff cannot be stored this year. Second, the live storage space would get filled up faster in the following

Reservoir Capacity Assessment

	Year (Annual monsoon rainfall)	No. of reservoirs monitored	Monitored capacity (BCM)	Capacity filled up (BCM)	BCM Idle Capacity	% Idle Capacity
1	1994 (110%)	63	125.14	112.63	12.51	10
2	1995 (100%)	63	125.14	98.44	26.7	21.34
3	1996 (103%)	63	125.14	89.53	35.61	28.46
4	1997 (102%)	68	129.4	101.2	28.2	21.18
5	1998 (105%)	70	130.6	106.1	24.5	18.76
6	1999 (96%)	70	130.6	97.6	33.0	25.27
7	2000 (92%)	70	130.6	82.66	47.94	36.71
8	2001 (91%)	70	130.6	87.49	43.11	33.01
9	2002 (81%)	70	130.6	69.25	61.35	47.09
10	2003 (105%)	71	131.28	78.76	52.52	40.01
11	2004 (87%)	71	131.28	85.1	46.18	35.18
12	2005 (99%)	76	133.021	109.695	23.326	17.54
13	2006 (99%)	76	133.021	120.451	12.430	9.34
14	2007 (105%)	81	151.77	124.150	27.62	18.20
15	2008 (98%)	81	151.77	114.262	37.508	24.71
16	2009 (77%)	81	151.77	90.48	61.29	40.38

Photo: Benjamin Earwicker

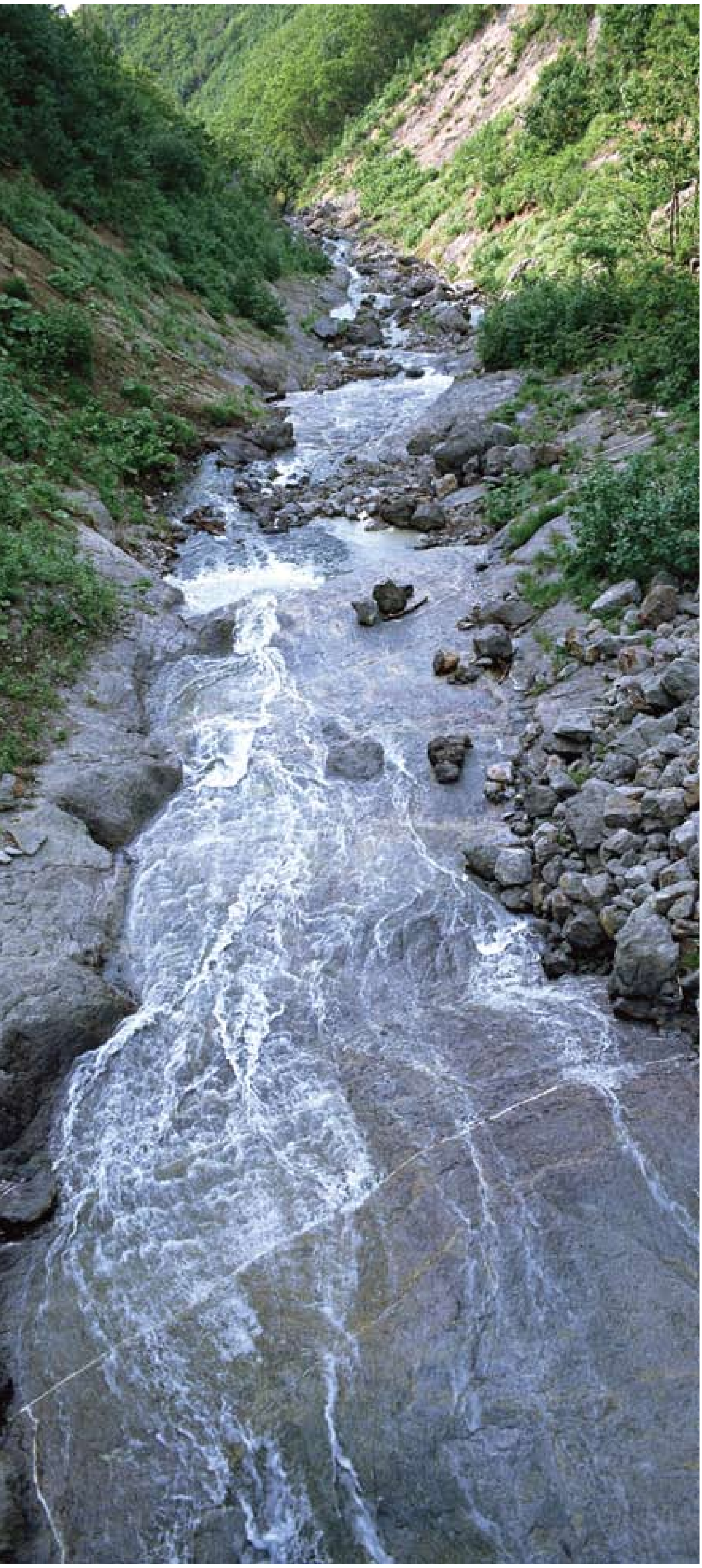
year, possibly before the end of the monsoon, which could lead to the reservoir having to release waters during the monsoon and create floods in the downstream areas, as has happened with several dams. The bottomline is that such water storages before the monsoon reflect non-optimal use of storage space created at huge costs. This is not to advocate emptying of the reservoirs before the monsoon but to ensure optimal use of the storages created. Some water could be kept in the storages as an insurance against failed monsoons but this has to be based on clearly defined transparent norms and other options for using that water explored. In any case, it is imprudent to store water beyond five per cent of the live storage capacity before the monsoon for very large reservoirs and more than 10-15 per cent in others in most cases. The basic problem lies in there being no reservoir capacity analysis being done, no effort to identify where there is room for improvement, no idea of where decisions have been wrong, who is responsible for such decisions and what actions could be taken in such cases.

Recent instances of such stored water before the monsoon in India include:

- The Economic Survey says that 31.12, 29.495 and 17.5 BCM of live storage capacity remained filled before the monsoons in 2007, 2008 and 2009 respectively, out of the CWC monitored capacity of 151.77 BCM (average for last 11 years: 20.92 BCM).
- Instances of high reservoir water storage before the 2009 monsoons: Mahanadi: Hasdeo Bango: 40 per cent, Gangrel: 35 per cent of live capacity; Krishna: Srisailam: 1.173 BCM, Nagarjun Sagar: 0.812, Koyna: 1.142 BCM in live capacity; Tapi: Ukai: 1.323 BCM; Mahi: Kadana: 48 per cent; Damanganga: 61 per cent
- Instances of high reservoir water storage before the 2005-06 monsoons: Nagarjunsagar 47 per cent, Naryanpur 44 per cent, Dharoi 42.6 per cent, Kadana 40.7 per cent, Jayakwadi 28.33 per cent, Mahi Bajaj Sagar 28.2 per cent, Tawa 22.6 per cent, Panam 19.4 per cent, Srisailam 17 per cent.

Fast-silting water storage

- The National Commission for Integrated Water Resources Development (Government of India, September 1999) says that about 1.4 BCM of existing storage capacity is getting silted up every year.
- At today's rates, creation of 1.4 BCM storage capacity would cost Rs 1,448 crore.
- Calculations, based on CWC reports of siltation for 27 dams, show the loss at 1.95 BCM per year.
- That means that on an average, each day India loses Rs 4 crore worth of storage capacity through siltation.



- There is no serious attempt to stop this.
- Not even the required Catchment Area Treatment for Bhakra was done. The story with other projects is the same or worse.

Reality check

It can be nobody's case that nothing has been achieved.

- However, the impression being created that big dams have helped achieve India's food security is a myth. The government has never assessed the contribution of big dams to India's foodgrains production.
- While net irrigated area has increased to 62.26 million ha, the lands irrigated by large dams stand at 17.79 million ha at peak, the rest is by groundwater and small systems. This means that only about 12 per cent of the net cultivated area of 141 million ha of NCA get benefits from large dams.
- India's foodgrains production that was 50 MT in 1950 has reached 216 MT in 2006-07 and 233 MT in 2008-09.
- The contribution of large dams is 10 per cent to 12 per cent according to two independent assessments done for the World Commission on Dams. This is the gross contribution; the net contribution would be much lower.
- In the process, India has precipitated an agrarian crisis and an ecosystem crisis (dried and polluted rivers, decreasing ground water level that is polluted as well).

  Is that good enough?

Agrarian crisis and large dams

- Everyone, from the Prime Minister and the President down to the farmers, agrees that India's agriculture is facing a serious crisis. Farmers are committing suicides in thousands every year. Agriculture growth rates are down to 1-2 per cent; yields are stagnating or declining and canal irrigated areas are decreasing in several states
- Everyone agrees that every farmer would benefit from better water management
- India continues to be blessed with a bountiful monsoon, which can be a great resource for every farmer if put to use through local water systems
- Ground water is India's lifeline and with every passing year the dependence on that lifeline is only likely to grow. That lifeline is in serious crisis
- The only way to sustain the lifeline is through local water systems, recharging ground water on the one hand and serious regulation of ground water use on the other

Large dams exclude the needs of the poorest. They are indicated by aggregating demands of a large number of people but do not address the specific components of those aggregate demands, particularly those of the poorest and the weakest.

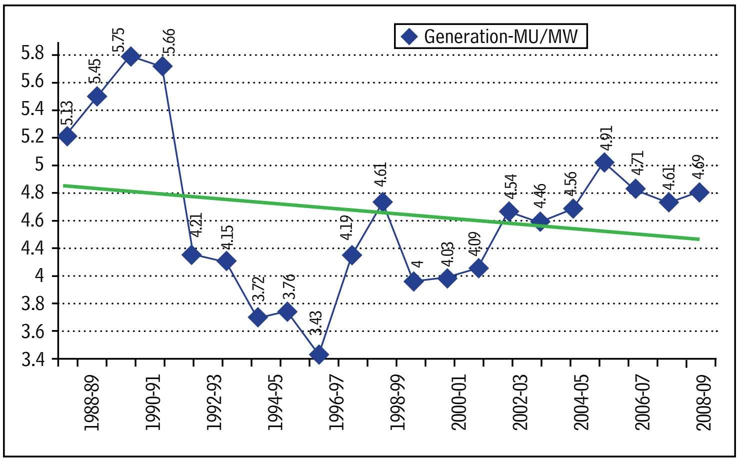
- The big dam dominated WRD will not allow that
- Unfortunately every crisis is being used to push for more big dams. About 70 per cent of the funds allocated in PM's Vidarbha package was for big irrigation projects. The single largest investment proposed in Rahul Gandhi's package for Bundelkhand includes the flawed Ken Betwa link project. The climate change crisis is used to push for more storage projects.

Large dams; broad issues

- Large dams generally tend to be undemocratic. They do not come out of the framework of planning and decision-making process like the one suggested by WCD. If they were to come from such a framework, they would certainly be more acceptable.
- Large dams exclude the needs of the poorest and the neediest. They are indicated by an aggregation of demands of a large number of people but they do not address the specific components of those aggregate demands, particularly those of the poorest and the weakest.
- Large dams involve tradeoffs at the expense of the poorest and benefit the relatively better off.
- Large dam developers are unaccountable. There had been no credible post-facto evaluation of performance of the projects as against the demands they were set out to satisfy and as against the benefits they were to deliver. Instead, they create huge social impacts, which are seldom addressed, thus creating more problems than solving existing problems.
- Large dams are poor performers. Performance appraisal of India's large projects show diminishing generation from large hydro projects; large hydro projects not providing peaking power; large storage capacities remaining unutilized; stored water remaining unutilized; creation of unviable storage capacities; high costs of irrigation from large projects when less expensive options exist and large dams facilitating hardly 10 per cent of the food grains production, when other options could have provided greater output.

Implications of big dam advocacy

- Islands of seeming prosperity, unsustainable practices, farmers in debt trap
- Waves of investment/subsidy for specific areas:
  – Big irrigation project investment/ repair, renovation, modernisation
  – Fertiliser subsidy (recurring)
  – Pesticide, seeds subsidy (recurring)



  – Food procurement system subsidy (recurring)
  – Downstream infrastructure development
- Neglect of rainfed farming
- Damage to soil fertility, environment, equity, future
- Neglect of drainage, increase in vulnerability to floods
- Large canal networks, when inadequately maintained, can actually create greater flood disasters as could be seen in the Ghaggar basin in Punjab and Haryana in July 2010.

As the Planning Commission starts the work on the approach paper to the 12th Five Year Plan, a golden opportunity presents itself to make radical changes in India's water resources development plans. The combined impact of the wrong priorities pursued so far and global warming will otherwise lead to India having neither the water required for the people or the economy, nor the resources to maintain and sustain the existing benefits. This much even the 2005 World Bank report has said. ●

The author is associated with the South Asia Network on Dams, Rivers & People (*www.sandrp.in*)

COVER STORY

INTEGRATED WATERSHED MANAGEMENT

From Micro Watershed to Micro Irrigation

Bhavarlal H. Jain

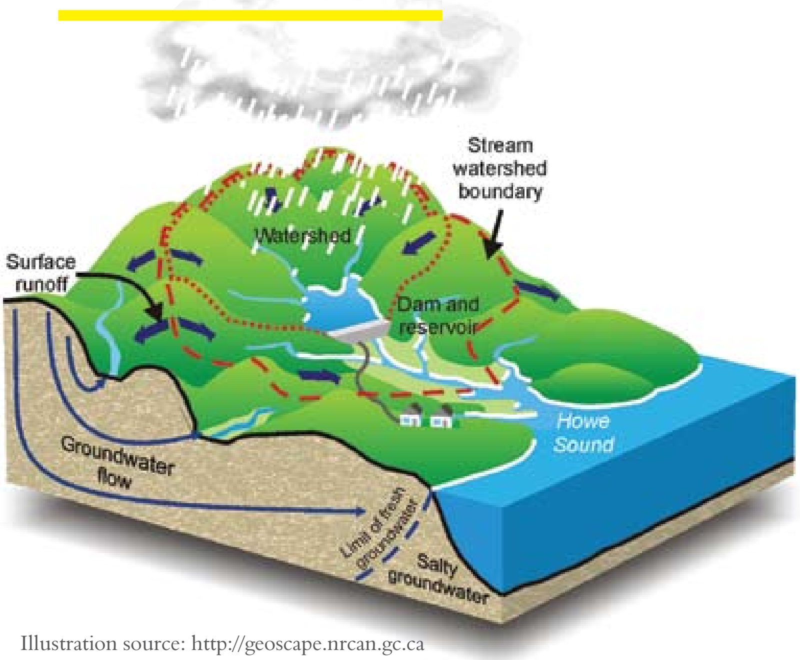


Illustration source: http://geoscape.nrcan.gc.ca

Earth and its resources are neither to be seen as an ecosystem to be preserved untouched nor as quarries to be exploited for mindless human greed and short range economic reasons. The relationship needs to be a "creative partnership" that does not seek to maintain status quo for its own sake but gives birth to a new set of values. The changed value system must satisfy and sustain human progress and be synergic with development of ecosystem's own potentialities. Water management is critically vital for human progress as well as economic development.

The sharp depletion of water, a critical input for Indian agriculture, has focused attention on the sustainable use of water. More than 78 per cent of the fresh water available in the country is used for agriculture. In spite of best efforts though, irrigated agriculture cannot go beyond 40 per cent of the agricultural land and the remaining 60 per cent land will have to depend on the vagaries of monsoon. Sustainable agriculture demands optimum utilization of water through integrated water management techniques and improved crop cultivation technology. Integrated water management seeks to address some important issues and problems faced by the irrigation industry, authorities and the users.

At the micro level, the problems are around the need for greater equity in distribution, economy in creation of storage, conveyance and distribution, necessity for higher productivity per unit of water and long-term sustainability of any given system. Integrated water management also seeks to improve the ecology and protect environment as these have emerged as its primary social obligations. The concept is based on local area specific total land and water use planning as opposed to current command area crop-specific water-use planning. It assumes closer community involvement in all aspects of the land and water use management including planning, execution and maintenance of the systems. It also assumes liberal technical, financial and administrative assistance from the authorities but assigns only a secondary/supportive and counseling role for the state authorities.

Administrative structure

The unit of planning under this system will be a village or group of villages covered in a watershed area. The planning takes into consideration the work so far done by Ground Water Survey & Development Agency (GSDA), soil conservation, remote sensing agency, irrigation, agriculture and rural development departments under various state and centrally sponsored schemes and provisions prior to preparing an integrated map for land and water use in the area covered by a watershed.

Maharashtra has been divided into about 1,500 watersheds by the GSDA for assessment and status of ground water potential and its exploitation. Since the mainstay of watershed development (WSD) works is groundwater exploitation, it would be convenient to treat each watershed as an 'unit' for perspective planning. Consequently, 1,500 integrated maps will be required for detailed planning and implementation of the concept. Compartmentalization of the administrative structure and piecemeal management approach has been the main hurdle in integrated development of land and water resource use here. There is, therefore, need to integrate the activities of various departments, agencies and boards so that one can embark on successful implementation of the model advocated in this paper.

Geomorphology of watersheds

A study of the geology and geology-morphology of the watershed is very important because it indicates the possibility of seepage of conserved water in recharging the groundwater. Taking into consideration the agro climatic and geo-physical conditions of the given watershed, proper type of location-specific water harvesting structures for harnessing of rainwater on and below the surface will have to be planned, designed and executed in the areas delineated in the status map (*see box*).

The art of water harvesting

As a first step, a status map of each watershed will have to be prepared by superimposing the following information:

(a) Command areas of completed, in-progress and planned state sector and local sector irrigation projects.
(b) Locations of completed, in-progress and planned percolation tanks and village ponds.
(c) Contour bunded area and remaining bundable area.
(d) Deep black soil area, area with very steep slopes and rocky area (where bunding activity is not possible).
(e) Forest area (where WSD activity is not possible).
(f) City area and industrial area.
(g) Sub-watersheds where WSD works are completed, in progress or are planned.
(h) Isohyetal lines.
(i) 20-meter contours. This map will indicate the scope, area and the extent to which WSD activities can be carried out.

Watershed development measures include:

- Soil Conservation Measures: Contour bunding, land leveling, contour farming and such others to prevent and arrest sheet erosion of topsoil.
- Water Conservation Measures: Engineering structures constructed to prevent free and unchecked flow of rainwater by conserving it wherever possible so that it permeates into substrata and recharges the ground water in the entire watershed area. Similarly, 80 per cent of the used domestic water can be used for irrigation, groundwater recharge or recycled for domestic use after proper treatment.
- Biomass Generation Measures: Planting of trees,

bushes and grass along steep hill slopes, waste lands, field boundaries and so on to prevent soil erosion and meet fuel and fodder needs of people and cattle. Biomass generation is equally important even for development of catchment area.

Engineering structures

Engineering structures such as percolation tank, village pond, masonry *bandhara*, check dam, underground *bandhara* will have to be designed to suit observed rainfall intensity, substrata met with at site, availability of engineering material in the vicinity and availability of local labour and artisans. Essentially, developing a particular basin/watershed area, may require the construction of a suitable engineering structure such as gully plugs in upper reaches of streams, trench-cum-mound construction on shallow soils with steep slopes, contour bunding of cultivable land having flatter slopes, *nalla* bunding in the middle reach, construction of gated/non-gated *bandharas*, underground *bandharas* and percolation tanks in the lower reaches. Surplus, if any, will then be stored in minor dam.

Watershed benefits

The watershed development measures will help greater infiltration of rainwater into the soil, reduce run-off and increase soil moisture. Together, these steps and structures will restore ecological balance; they will also improve environmental conditions and local micro climate. Most watershed development works essentially cater to the needs of the local population for meeting the domestic needs (human and live stock) and provide some irrigation for otherwise rain-fed land owners.

It is possible to develop such watersheds in the upper reaches of the stream where soils are shallow and less retentive and people are unsure of getting even one monsoon crop. The existence of dryland farmers is precarious. Watershed development guarantees their survival needs because it harnesses rainwater where it falls and/or facilitates and increases the quantum of seepage into the underground aquifers. This means that the irrigated area may increase by between 20 per cent and 30 per cent and get water through recharged wells for Kharif or Rabi or both. In certain areas this could even mean a 100 per cent increase in production/productivity

A district which receives more than 500 mm of rainfall should have about 30,000 tanks, each measuring 100m x 100m x 10m = 10 cubic hectare metres in volume. In areas where the annual rainfall averages 800 mm – assuming a collection efficiency of 50 per cent over a catchment area 30 times the tank's size and an annual evaporation loss of 2 m – each tank will store water to a depth of 10 m. In areas of 200 mm rainfall, it will store to a depth of 8 m. The cumulative harvest of water would add up to 90 mham, almost equal to 25 per cent of the total annual rainfall and more than all the surface water considered usable today. However, since construction of tanks is location specific, the availability of suitable site is often the main constraint, at least in Maharashtra. In the past 25 years (1971-96), no more than 15,000 percolation tanks and village ponds have been constructed under various schemes.

On a socio-economic plane, watersheds provide good scope for employment to the local population, prevent migration to cities and also use locally available material and thus create purchasing power in the hands of rural people.

Given the unreliability of monsoon, seasonality of surface water source and exceptionally high expenditure that has to be incurred for providing water from long distances by lift irrigation schemes and such others, there appears to be no alternative to water-harvesting structures that provide immediate and sustained benefits to those not covered by command area or other dam-like works. WSD comes as a solace to those located in upper reaches of the stream.

Watershed management

The greatest difficulty with watershed management is the need to ensure community involvement at every stage including planning, execution and maintenance. This is vital for its success and sustainability. However, the dire need for WSDs will give rise to local awareness and leadership: both individual and institutional.

It is suggested that planning be done by the state and competent authorities and the execution be entrusted to NGOs, who would do so professionally as time-bound programmes under direct supervision of the *gram panchayat*. The pricing, revenues (at least


Photo: Sudip Dutta

A thousand sand-filled gunny bags are sufficient to construct a dam capable of irrigating 10 hectares with MIS and also recharging eight wells by increasing the water table by up to five feet. If water can be stored for about three months after the monsoon, the water table in the wells will not normally decline till about February-March. This will enable the cultivator to take at least a second crop in Rabi under MIS. The recurring expense of this is about Rs 3,000 a year.

Watershed limitations

- The cost of one unit of surface or sub-surface water storage through watershed development is higher than large reservoirs and gravity irrigation works. During the years with few wet spells of high intensity, the watershed works are less effective and the run-off is much higher (Most of the country receives rain for just about 100 hours every year and about 50 per cent of this quantity is received in about 20 hours).
- WSDs do not conserve much water leading to less recharge during drought years.
- Traditional watershed systems are location specific, management intensive and heavily dependent on local community participation. Today they demand major investments in training and human resource development.
- Topography apart, socio-economic and political environment are factors that need to be considered for the ultimate and continued success of watershed development.
- These structures would reduce total water flowing to dams.
- These are just not sufficient for today's needs.

80 per cent) shall vest in the *panchayats* and so also the responsibility for maintenance. Proper guidelines and legal framework and administrative, technical and financial assistance will have to be provided by the state.

Minor dam irrigation

Water flowing through large streams and rivers having good base flow or those receiving replenishment in summer due to snowmelt can be diverted by constructing barrages, weirs, *bandharas* or anicuts. However, water from non-perennial rivers can be stored in reservoirs and used for agricultural irrigation and other purposes by planned canals/conveyance and distribution systems. This is why such dams have come into being and have become synonymous with development and prosperity of the command areas irrigated through them. Relatively speaking, the land/soil on banks of major rivers are found to be a lot more fertile and as such irrigation adds greater value to them. In Maharashtra, however, the outlays for the minor projects as percentage of major and medium projects together have increased from nine per cent during 1951-69 to 15 per cent during 1969-92 and to 26 per cent during 1992-97. This is notwithstanding the cost of storage and conveyance per unit of water

Photo: Roy Mattappallil

being the least for major projects and increasing with the reduction in the reservoir size.

Consequently, medium and minor projects, though costlier and providing lesser dependable water, are being preferred because they dispense the benefit to the more needy land, they have shorter gestation period and are comparatively easy to manage. Relative to the major dams, they are more equitable in dispensing the benefits.

Dam limitations

The truth is that not more than 16 per cent of the total farming community has benefited from the surface structures, whether major, medium or minor. Affluent farmers raise water-intensive crops. Thus, in Maharashtra, there is the spectre of a small percentage (about three per cent) of land covered by sugarcane which consumes about 60 per cent of irrigation water. This situation has given rise to social tensions and concentration of economic and political power in the hands of few wealthy persons who receive the benefits at the cost of the state. According to V. M. Dandekar, the percentage of the rural people below poverty line in Maharashtra has increased from 61 to 82 from 1961 to 1993 though the Maharashtra government puts this figure at 72 per cent.

Worse, the beneficiary farmers have started going deeper in search of water and have thus reduced whatever chance other farmers, not covered by command area, had of using even the underground water in the command. The area irrigated by groundwater source has increased four times in past years but has given rise to a glaring disparity. Moreover, excessive and continued flow irrigation has given rise to increase in salinity in command areas.

Even the minor irrigation works and canals have become somewhat burdensome because of siltation, seepage, disuse and weeds. Considerable quantity of water released at canal head is lost due to seepage till


Photo: S. Brumley

MIS Benefits

Essentially, MIS saves water, doubles the area under irrigation with the same quantity of water and improves yields and quality, while saving on labour, energy and crop-protection costs. It also deals with problem soils and terrain. It is much more than merely a method of applying water. It is a total plant support system and a management tool that rewards good design and careful management with high production, reduced cost and premium quality. With the advancement in software and hardware, it has become a preferred management tool for the progressive farmer. It also provides greater justice in distribution of water as a vital resource.

it reaches the field. In some cases, it is as high as 25 per cent to 40 per cent. Unlined conveyance from the major project causes about 35 per cent to 40 per cent seepage loss and deep percolation in the fields. It is also acknowledged that about 15 per cent to 20 per cent of surface storage water gets evaporated.

To add fuel to the fire, the socio-political compulsions have authorized unplanned construction of medium and minor projects on the upstream of major projects. Consequently, the major projects are facing water shortages and do not get filled up, in many cases, to their rated capacity half the time/years. Besides, there is the deforestation, which occurs in the initial stages in many cases and which causes significant damage to the local ecology and environment. Moreover, the woes of those people displaced by such dams have become horror stories. Rehabilitation has proved to be an unending and painful exercise.

In case of major projects, "people get nothing back, no irrigation, no water, no increase in production, no help in their daily lives for periods as long as 10 to 20 years". Multiple delays, ever increasing monetary costs, losses, attendant environment and ecological problems, displacement and uprooting of locals and such socio-economic damages add up a huge cost per unit of water storage created.

This is not to suggest that major dams are a curse to the society. The problem lies in the manner that they have come to be created and funded and the way that they are functioning, which leads to the creation of disproportionately large distributional problems compared with the small dams and/or WSD structures.

Enter micro watersheds and irrigation

Since Independence, the priority for surface irrigation schemes has gradually shifted from major to medium to minor to micro watershed development works and, more recently, to micro irrigation systems. The idea is to begin with watershed, grid the small watershed of individual villages and integrate minor projects into the scheme and further use available water in dams and canals only through MIS. Briefly put, the micro watershed will represent backward integration of the present dam-led irrigation practices and micro irrigation will be its forward integrating plank. Together they will form a modern irrigation package representing a balance amongst mini WSDs, minor dams and micro irrigation methods. It has to be a healthy mix/matrix, linked to each other coherently.

The big challenge is to accept this realization as a matter of strategy, necessity, policy and philosophy.

Under micro irrigation, water is applied at low pressure over a long period, at frequent intervals, directly into the plant's root zone through a network of main lines, sub-mains and lateral lines with emission points spaced along their lengths. The emitter/dripper/orifice applied precisely controls uniform water, nutrient and other growth substances. Soil moisture is maintained slightly below field capacity. Thus, with combined forces of gravity and capillarity, moisture and nutrients are replenished immediately and the plant never suffers from water stress and/or water overdose.

- It, therefore, promotes uniform and optimum growth resulting in higher yields (30-100 per cent) and lowers consumption of water and fertilizers.
- By creating a more favourable root zone, it increases tolerance to salinity and improves disease control.
- It brings under use undulated, hilly and problem terrain/soils.

- It achieves 95 per cent water use efficiency because it does not suffer from seepage, run-off, deep percolation and/or evaporation losses through leaves and soil.
- Water requirement varies with crop age and it is only through MIS that controlled quantity can be applied.
- It conserves energy because, compared to furrow/flood, less quantity is pumped.
- It saves on labour and cultivation costs.
- It also saves on crop protection costs because there is considerably less weed.
- It gives the grower a better control over his crop. He can apply more or less fertilizer and irrigation to hasten or delay maturity to get better prices in the market.
- The most outstanding feature of MIS is that it is not at all location specific and is capable of distributing the benefits completely, evenly and equitably like no other system of irrigation can do.
- It is not crop specific and is suitable for almost any crop.

China is reportedly taking even rice on MIS that can work through lift irrigation from canal or reservoir or through well water. In Maharashtra, districts with large number of irrigation wells with higher density of groundwater exploitation also have the most area under MIS such as Nasik, Jalgaon, Nagar, Solapur, Sangli, Aurangabad and Nagpur. With the advancement in software and hardware, it has become a preferred management tool for the progressive farmer. It also provides greater justice in distribution of water as a vital resource.

Watershed development, creation of minor dams and adoption of micro irrigation must not be seen as competitive or alternative methods of farm irrigation but as different links in the same chain.

Further optimisation

It is time to actively think of selecting plant species that consume less water, particularly grains and millets, pulses and oilseed crops that could tolerate drought or semi drought conditions. Research institutes should formulate research programmes for breeding varieties that consume less water.

Newer planting techniques, particularly for horticultural crops, geared towards water saving such as ultra high density planting of such crops as mango, citrus, guava should be developed.

The farming system bases on zero tillage can also be worked out in some of the crops that could save water and other agri-inputs and bring down overall cultivation cost.

It is possible to save the water by manipulating planting period and reducing in-harvest period by hastening the maturities for a given crop to avoid peak water requirement during summer. Also, better monitoring and control over water use efficiency by way of application of instrumentation and electronics to assess moisture level with each and every horticultural crop and/or moisture content in the given area of plot should be resorted to. Finally, vertical farming technology for high-value crops that can also help in saving water and land use efficiency should be actively considered.

Irrigation cohesion

It is, therefore, suggested that the conjunctive surface and groundwater use planning should begin with micro watershed, get integrated, where needed, with minor irrigation dams and further be complemented by a micro irrigation network. Watershed development, creation of minor dams and adoption of micro irrigation must not be seen as competitive or alternative methods of farm irrigation but as different links in the same chain.

This approach will ensure greatest benefit to the largest number at sustainable cost. The integrated approach can address and answer problems of grave and glaring disparities. Only thus can the irrigation potential of Maharashtra be increased from the present maximum envisaged level of 35 per cent to at least 50 per cent of the area under cultivation.

Notwithstanding the fact that Maharashtra has poured enormous sums of money (about Rs 30,000 crore at current prices) for creating irrigation potential over the past over 40 years, the total number of people below the poverty line remains unacceptably high. On the one hand India has 19th century laws and administrative mindset; on the other it clamors for 21st century environmental ethos and social equity concerns. This is not an easy disbalance to resolve. Harnessing modern technology with bold policy initiatives can solve the problems. The approach needs to be total and not piecemeal: from micro watershed to micro irrigation. ●

The author is Chairman, Jain Irrigation Systems Limited

COVER STORY

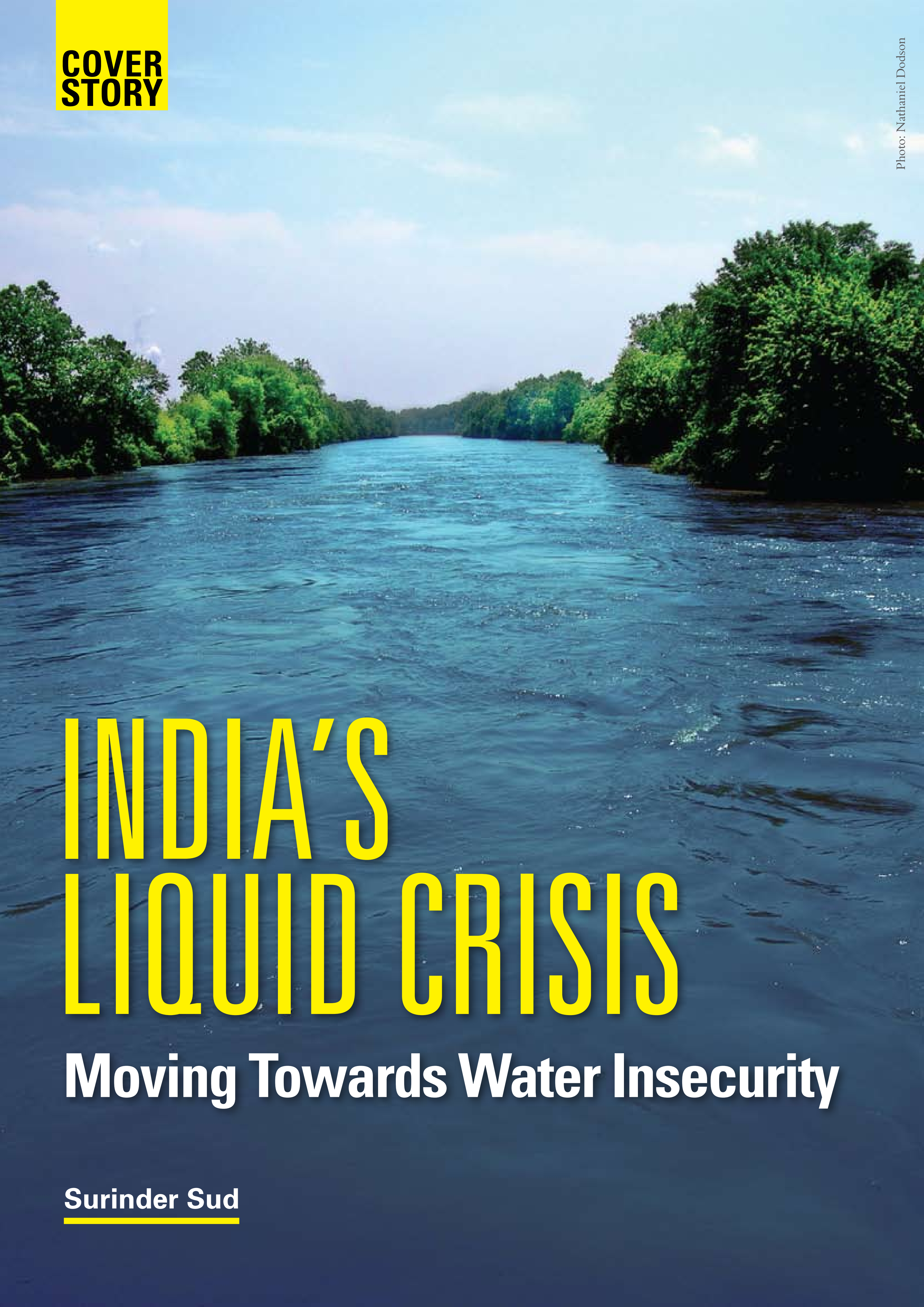


Photo: Nathaniel Dodson

INDIA'S LIQUID CRISIS

Moving Towards Water Insecurity

Surinder Sud

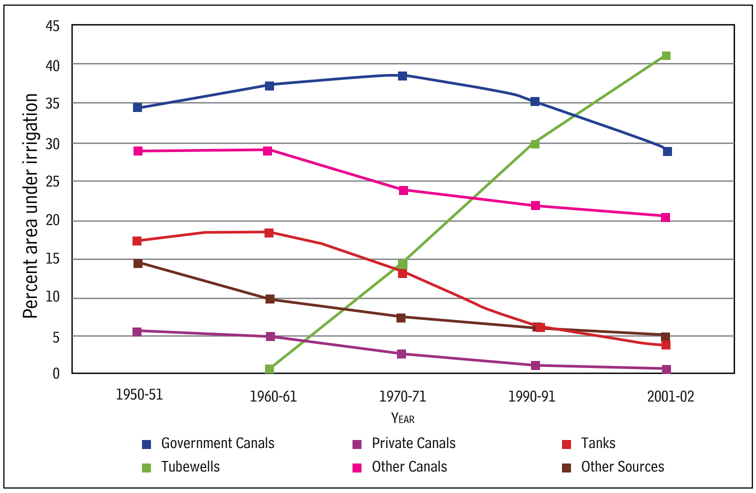
As India starts the process of concretising its 12th Five Year Plan, it would be worthwhile to examine how it has performed around one of the most critical areas of its infrastructure: water for irrigation. The 10th Plan experience provides a useful pointer: on paper, an additional irrigation capacity of 8.8 million hectares was created during the plan at an estimated investment Rs 96,720 crore by both the centre and the states. Yet the Planning Commission confessed in the approach paper to the 11th Plan that the additional potential created in the 10th Plan was not only 50 per cent short of the target but also that it did not show up in the land-use data that recorded no net expansion in the total irrigated acreage. The Planning Commission attributed this in part to the created potential not being actually utilised and to some existing irrigated area going out of the net because of poor maintenance or decay of the irrigation system. The state of the irrigation projects is, indeed, a reflection on the resource crunch faced by the irrigation command authorities, which limits their ability to maintain and operate irrigation networks.

Consider this critical issue from another perspective. The country adopted a National Water Policy in 2002, which recommended that water charges be levied to make users realise the scarcity value of this resource but with subsidy for the disadvantaged well directed. The sane counsel has remained on paper.

Consider this issue from the historic perspective. The Indian irrigation sector was a net revenue earner for the British who levied realistic charges for irrigation water that the farmers gladly paid because there was value for money.

Wasted water

Clearly then from every worthwhile perspective. India, among the world's most water-rich countries, is misusing its water resources amidst widespread and worsening water scarcity. The country receives around 4,000 billion cubic metres (BCM) or 4,000 cubic kilometres of water annually through rainfall and snowfall. This is far in excess of the total water demand for agriculture, domestic and industrial sectors as assessed by the Ministry of Water Resources at between 555 BCM and 654 BCM in 2010.



Though water demand is projected to swell progressively in the years to come, it is unlikely to overshoot the average annual inflow in the near future. The ministry has projected a spurting of demand to between 727 BCM and 881 BCM by 2025 and to between 958 BCM and 1,411 BCM by 2050. Even at that level, the total water requirement will be less than half the yearly water input.

The problem really arises because

- Rainfall is not evenly spread – nearly 80 per cent of it comes in the four-month monsoon season from June to September
- A sizable part of this water is allowed to flow down wastefully to the seas, eroding precious soil on its way.

India needs to conserve this water for year-round use by storing it either in the surface reservoirs or in the sub-surface (underground) water aquifer. None of this is happening to the required extent. The surface water storage capacity created in India through major and medium reservoirs and millions of small ponds, tanks and other water bodies is insufficient to hold enough water to meet the annual needs of the country. This is in sharp contrast to a country like the USA which has water storage capacity good enough to meet three to five years' requirement.

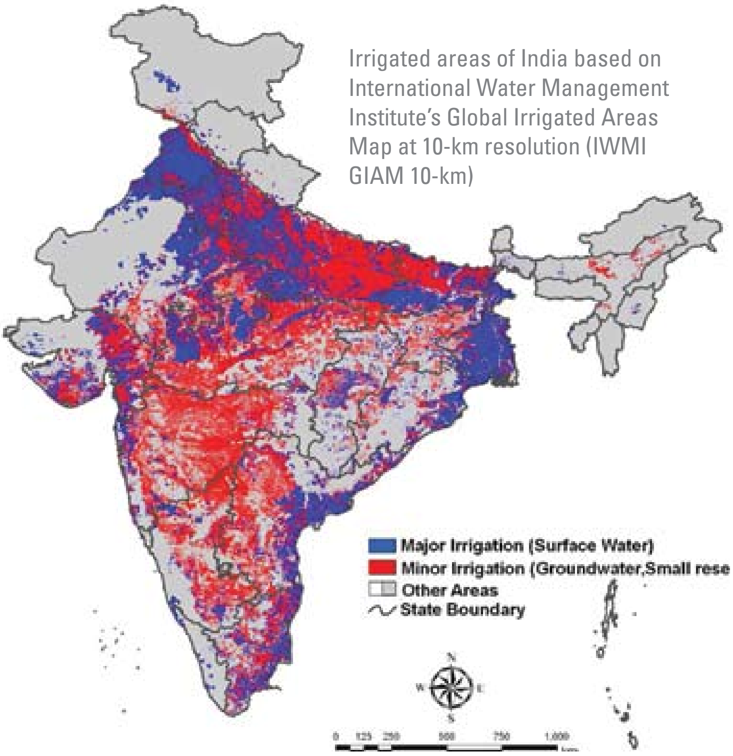
Irrigation potential

India's irrigation potential from all available sources of water, earlier estimated at 113.5 million hectares, has been revised to 139.9 million hectares. Of this, 58.5 million-hectare potential is exploitable through major and medium irrigation projects (surface irrigation) and 81.4 million hectares through minor irrigation works (largely through wells for extracting groundwater).

Till the end of the 10th Plan (2006-07), the irrigation capacity of about 42 million hectares was created in the major and medium irrigation sector and 60.4 million hectares in the minor irrigation sector, making for a total of 102.4 million hectares. Over 37 million hectares of irrigation potential, thus, still remains untapped.

Woeful under-exploitation of irrigation potential apart, there are hordes of other problems that tell upon the efficiency of both surface and groundwater irrigation. Where surface irrigation is concerned, there has been a perceptible slowdown in the creation of fresh irrigation potential. No new medium or major irrigation project has been taken up for over a decade. More importantly, even the existing potential created at a heavy cost has not been adequately utilised for want of infrastructure needed to carry water from the source to the fields. Worse still, the gap in the creation and gainful utilisation of irrigation potential is steadily widening, thereby, turning the massive investment unproductive.

Ironically, during the period of the Raj, the irrigation sector, now a drain on the exchequer, was a net revenue earner. The irrigation authorities levied realistic charges for irrigation water not only to recover the operational and maintenance costs of irrigation works but also to have a profit margin. Notably, the farmers paid these charges because the timely and adequate supply of water enabled them to gather bigger harvests and higher income to more than compensate them for the money spent on it.



Irrigated areas of India based on International Water Management Institute's Global Irrigated Areas Map at 10-km resolution (IWMI GIAM 10-km)

If the same kind of quality service is assured to the farmers now, they may not mind paying for it but that is not the case today. Water conveyance system in most irrigation command areas is in a shambles resulting in substantial wastage of water through seepage that could, otherwise, be gainfully used for raising crops. This also results in denial of full water quota to the farmers having land towards the tail-end of the water channels.

Non-uniform pricing

Besides low water rates, there is also no uniformity in the pricing of water across states or irrigation projects. Water rates have not been revised for years in most states for want of political will. Leave alone the recovery of the cost of laying down the irrigation networks, even the day-to-day operational and maintenance costs are not recovered through water pricing.

The present water pricing policies are also contrary to the National Water Policy adopted in 2002. The policy minced no words in pointing out that water charges should be such as to make the users realise the scarcity value of this resource. It specified that the revenue generated through water use charges should at least cover operational and maintenance costs and, subsequently, a part of the capital cost. Significantly, the policy stated that the rates should be linked directly to the quality of service provided. The subsidy doled out to the disadvantaged and poorer sections should be well directed, it said. There seem to be no takers for such advice.

Indeed, what is really worrying is that the unrealistic water pricing is proving counterproductive as it encourages overuse and wastage of water. This is happening as much in the canal irrigated areas as in the fields irrigated by ground water. In fact, the consequences of such indiscriminate use of water are far more disquieting in the case of ground water, which now supports around 60 per cent of the irrigated agriculture, than for surface water.

Pressure on groundwater

India has emerged as the world's largest consumer of ground water with an estimated total extraction of 230 BCM a year. This is more than one-fourth of the world's total consumption of ground water. The cause for concern is that the consumption of ground water is growing rather rapidly for a variety of reasons.

- Ground water is a relatively more convenient source of water over which the user has full command in terms of timing and extent of its use.

- Though it results in relatively better crop productivity, it also leads to excessive water withdrawals.
- Besides, ground water is governed by an archaic law that gives the owner of a piece of land the right to extract any amount of water (as also other resources) from underneath it.

Statute error

This statute, obviously, disregards the fact that water is a dynamic common resource in an aquifer that normally extends beyond a field or even a village or district. Over-extraction at one site can affect water availability at other sites. Though several states have subsequently legislated ground water use, most of the statutes do not fully reflect its nature as a common resource belonging to the entire community.

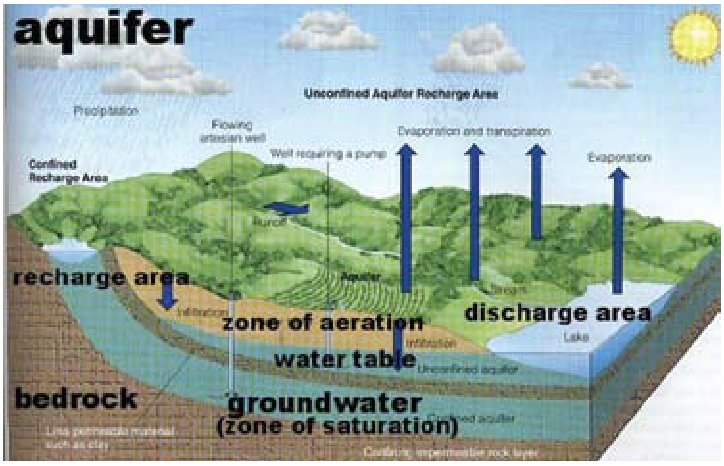
The net result of this indiscriminate use of ground water is that the water table in most areas is receding fast, requiring deepening of the wells and the use of sophisticated and costly pumping equipment to draw it. In many areas, the situation has turned critical because of the lowering of the water table to inaccessible depths.

The Central Ground Water Authority has issued regulatory directives for over 100 ground water blocks. A report on India's ground water scene, issued by the World Bank in March 2010, has warned that if indiscriminate exploitation of ground water continues unabated, as many as 60 per cent of all the ground water blocks will be in a critical condition by 2025. This warning needs to be taken seriously.

The situation is most worrisome in at least six states – Gujarat, Haryana, Maharashtra, Punjab, Rajasthan and Tamil Nadu – where, taken together, about 54 per cent of the ground water blocks has been tapped excessively. Continued use of ground water is becoming unsustainable in such states, the World Bank report has pointed out.

The solution to this menace lies in restricting the extraction of ground water to the extent of its annual recharge through rainfall and other means. This needs elaborate studies to estimate the level of recharge and work out the amount of water that can be allowed to be extracted from each well. This is easier said than done. Most states lack resources and personnel needed to monitor and regulate water off-take of each well.

As pointed out in the World Bank report, electricity authorities in many states had stopped metering power supplies to wells in the 1970s because the costs involved in doing so for the then existing 12 million water pumps was higher than the revenue generated. Today, it would be even more so as the count of such wells has mounted to over 20 million. That virtually rules out pricing of ground water, though such a measure may be desirable and in the long-term interest of the farmers as well as those who would not want their wells to go dry.



Over-pumped aquifers lead to falling water tables and reduced harvests
Source: Lester Brown (06.18.08)

Surely however, there are other means of curbing excessive withdrawal of ground water. In Punjab, where the rate of receding of ground water had shot up due to growing tendency of transplanting paddy early – in May – rather than in June after the arrival of the monsoon – the government had passed a law to ban this practice. This worked and the water table actually began to rise. Haryana also took a similar step with good results.

Community control

The communities, which are the real custodians of this natural resource, should be allowed to decide how to regulate its use. They can either put a price on water or fix timings for extraction or take collective decisions to suitably change the cropping patterns or even take measures for ground water recharge.

Gujarat has introduced a system of separate power supply for agriculture to ensure limited (eight hours) but quality supply of electricity according to a pre-announced schedule. The electricity department as well as the farmers seem to be comfortable with this kind of an arrangement. Such systems can serve as models for devising ways and means of curbing excessive use of water; the state governments, on their part, should gradually build up their capacities to supervise the use of ground water as well as surface water. Unless effective measures are put in place to ensure sustainable exploitation of water, the availability of this vital and life-supporting natural resource will be in jeopardy. ●

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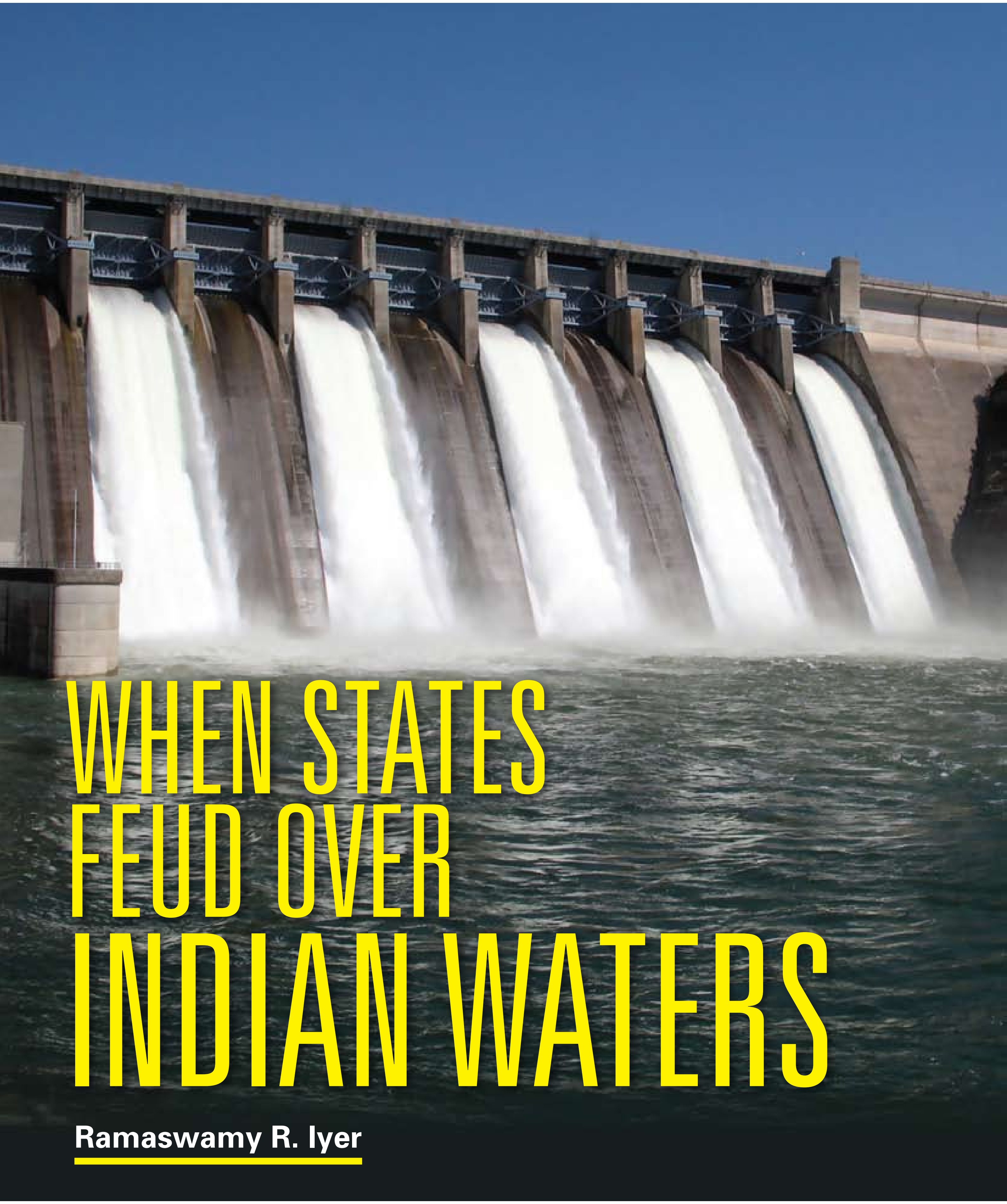
COVER STORY



WHEN STATES FEUD OVER INDIAN WATERS

Ramaswamy R. Iyer

Photo: Robert Linder

Inter-state river-water disputes loom large in the public consciousness and figure prominently in the media. In particular, the adjudication process relating to them has attracted a good deal of adverse comment. This article is about such disputes but it must be noted that they constitute only one category of conflict forming part of the larger class of water-related conflicts, arising from a wide range of factors and between or among many different parties (agriculture versus industry, rural versus urban, drinking water versus irrigation or industry and so on). While water-related conflicts in general are governed by the ordinary laws of the land and (where necessary) go to the courts, there are special constitutional and statutory provisions and mechanisms for the resolution of inter-state river-water disputes. Despite these, however, they are among the most difficult, contentious and intractable disputes.

The following questions arise:

- Why do inter-state river-water disputes arise?
- What are the underlying factors?
- Why do they become so contentious and intractable?
- Is it not possible to obviate the emergence of such disputes and, when they do arise, is it not possible to settle them without letting them proceed to the adjudication stage?
- When adjudication becomes necessary, is it not possible to manage it better? Why is there such general dissatisfaction with the adjudication process? Are there ways in which it can be improved?

I propose to take these questions in the reverse order, proceed from the specific to the more general or from the legal and procedural to the deeper and more fundamental.

The basis of the adjudication process is (a) article 262 of the Constitution, which enables Parliament to legislate for the adjudication of inter-state river water disputes and to bar the jurisdiction of the courts in the case of disputes so referred to adjudication and (b) the Inter-State Water Disputes Act 1956 (ISWD Act) enacted by Parliament in pursuance of that article (and amended in 2002). Several tribunals have been set up under the ISWD Act over the years, and the provisions seemed to be working well enough but the machinery has run into serious difficulty in the Ravi-Beas and Cauvery cases. Right from the beginning there were many criticisms of the adjudication process and these have become stronger in recent years. The main criticisms are about:

(a) the unsuitability of adjudication as a means of settling such disputes;

(b) judges not being the best people to deal with such complex and technical matters;

(c) serious delays at every stage, from the establishment of a tribunal through the protracted hearings to the final order and even beyond;

(d) court-like adversarial proceedings that are divisive in spirit, with no exploration of possibilities of composition of differences;

(e) the absence of finality even after the award, with no effective means of enforcing the award; and

(f) one or more parties being left with a feeling of grievance and injustice.

The short answers to those criticisms are as follows:

(a) Article 262 and the ISWD Act do not preclude negotiation, conciliation or mediation, nor do they compel any party to seek adjudication; they merely provide the possibility of adjudication as a last resort.

(b) Judges do deal with technicalities and complexities in all kinds of cases and not merely in cases relating to river-water disputes; their function is to rule on questions of law and provide justice. In the absence of tribunals under the ISWD Act, river-water disputes would have gone to the courts anyway.

(c) Serious delays at every stage were certainly a major problem in the past but the 2002 amendments to the ISWD Act have largely taken care of this problem by prescribing time-limits at various stages. (Two more time-limits may be needed, one for extensions of time for the tribunal's further report on clarificatory petitions; and the second for the notification by the Government of India of the tribunal's orders in the gazette.)

(d) The adjudication proceedings do not have to be court-like or adversarial; the tribunal's style of functioning can be changed. It can function in a committee-like, consultative, exploratory, solution-seeking style. (It may also be necessary to change the composition of the tribunal to make it a multi-disciplinary body presided over by a judge.)

(e) The 2002 amendments include one to the effect that the tribunal's award has the status of a decree of the Supreme Court. That may lend greater finality to the award.

(f) The need for finality and, at the same time, the importance of avoiding a sense of grievance or injustice on the part of one or more parties can both be met by amending the ISWD Act to provide for an appeal to the Supreme Court against the tribunal's Final Order in partial modification of the bar on the jurisdiction of the courts.

Those brief statements will not be elaborated further in this article.[1] The point that is being made is that when attempts at an agreed settlement of a dispute have failed, an adjudication provision is necessary as a last resort; and that the existing mechanism for adjudication can be made to work better through a few more amendments to the ISWD Act, a change of style on the part of the tribunals, and a change in their composition.

However, it is not necessary to proceed to adjudication in every case. Efforts need to be made through various means (constructive negotiations in good faith, good offices of eminent persons, conciliation, mediation and such others) to bring about an agreed settlement of differences before they become serious disputes; if a serious dispute does arise, to resolve it before recourse to adjudication becomes unavoidable; and, if it goes to arbitration, to continue to explore possibilities of agreed settlement even as adjudication is proceeding. Formal recognition of these possibilities and the establishment of the necessary institutional arrangements would be of great help. Facilitating such efforts and providing a platform for inter-state talks on river-waters at official and non-official levels should be among the important activities of the Inter-State Council, a constitutional body. A few years ago, the ISC began some initiatives of this kind but they seem to have petered out.

In the Cauvery case, a non-official initiative to bring the famers of Tamil Nadu and Karnataka together to dispel misperceptions and promote mutual understanding has been remarkably successful in bringing about much goodwill and an appreciation on either side of the problems of the other, though it has not resulted in agreed proposals, which could be placed before the tribunal. This initiative, now known as 'the Cauvery Family', has elicited much international interest. Efforts on similar lines need to be made in all cases.

A point to be noted in this context is that such informal groups and indeed water-users, such as farmers, industries, citizens and people likely to be affected by a water-resource project, have no legal standing in the adjudication process. For the purposes of the ISWD Act, 'State' means 'State Government'. Only the governments can appear before a tribunal. Even if the Cauvery Family referred to above manages to arrive at an agreed formula for water-sharing, it will have no *locus standi* before the tribunal or the Supreme Court. This needs to change. An inter-state water dispute affects the people – farmers, industries, urban or rural citizens getting water from water supply agencies – and they should be heard in the adjudication process.

Efforts need to be made through various means to bring about an agreed settlement of differences before they become serious disputes…

Let us proceed to the next question: why do such disputes become contentious and intractable? The answer in one word is 'politics'. This can be elaborated as two inter-connected points: (i) the importance of water for life and livelihoods, and its potential for rousing emotion and (ii) the propensity for water disputes to get politicised in the wrong sense. Water is essential for sustaining life; it plays an important role in many livelihoods; it is particularly important for agriculture; a river, say the Cauvery, Godavari or Ganga, is an integral component of the landscape familiar to a people, an ineluctable part of their history and culture and bound up with their very sense of identity; and it has a sacred dimension, being often worshipped as a deity. All disputes relating to a river are, therefore, apt to evoke strong emotions among the people.

Photo: Vivek Chugh

For that very reason they are bound to become important in politics. That by itself is not a bad thing. However, when political parties make such a dispute an issue in elections, compete with one another in making irresponsible promises about river waters to the people and present themselves as saviours of the people of a state in its dispute with another state, then water gets 'politicised' in the wrong sense, making rationality difficult and compromise impossible. In each disputant state, the ruling party (whichever party it might be) is afraid of being accused by the Opposition and other parties of failing to safeguard the interests of the state and, therefore, considers it necessary to play the role of a stout defender of those interests, take strident positions and make maximal claims. Cynical rhetoric at the level of political parties generates chauvinism at the popular level, with film stars and others joining in, and that chauvinism gets reflected in media reports and seeps into the thinking of even academics and intellectuals (or some of them). This is what has happened in Tamil Nadu and Karnataka in the Cauvery dispute and in Punjab and Haryana in the Ravi-Beas dispute.

We now come to the crucial question: why do such conflicts arise at all? What triggers them? The causes of conflict vary from case to case. Not all disputes relating to a river are riparian disputes in the strict sense. The Cauvery dispute is a classic case of a dispute between upper and lower riparians. The Ravi-Beas dispute is not a riparian dispute; it is a dispute *sui generis* arising out of the sub-allocation to the states by the Government of India of the allocation of Indus waters obtained by the country under the Indus Waters Treaty 1960 with Pakistan, and a further sub-allocation necessitated by the reorganization of Punjab into Punjab and Haryana. The Mullapperiar dispute between Tamil Nadu and Kerala is again *sui generis:* Tamil Nadu's claim over Periyar waters is not a riparian right but a right arising out of a century-old Agreement between the Madras Presidency and the princely state of Travancore, under which waters flowing to the Arabian Sea were diverted eastwards to certain water-short districts of Madras Presidency. Kerala has many grievances over that old agreement, which it holds to have been wholly unfair to Travancore (now Kerala). Leaving that aside, what is currently under dispute is the safety of the century-old dam and the wisdom of raising the water-level in the reservoir from the present restricted limit to the planned capacity.

Thus, the issues vary from case to case. However, broadly speaking, there are two basic factors: first, the general phenomenon of lower-riparian anxiety, and second, competing claims for water.

[1]For a fuller discussion the interested reader is referred to the last chapter of *Water and the Laws in India* (ed. Ramaswamy R. Iyer, Sage Publications, 2009).

Given the importance of water for life-support and for livelihoods, a sense of insecurity in relation to water can loom very large in the consciousness of the lower riparian. That anxiety is in some cases triggered or accentuated by upper riparian plans to build structures (dams, barrages). Let us imagine a hypothetical instance of an inter-state river in which there has been no human interference with natural flows. In such a case, an inter-state conflict is hardly likely to arise. However, as soon as a state begins to think in terms of constructing structures across such a river, a dispute may emerge. It is not a coincidence that conflicts over river waters, whether inter-country or intra-country, often arise in the context of large projects. Large projects are indeed foci of conflicts because (a) they tend to alter geography and hydrological regimes, sometimes drastically; and (b) they involve issues of control. They increase the dependence of the lower riparian on the upper riparian and, therefore, the vulnerability of the lower riparian.

Leaving aside the question of insecurity or vulnerability, a conflict can arise because of competing claims over the waters of a river, together adding up to more water than is available in the river. In this kind of calculation, irrigated agriculture accounts for the major part of the claim (more than 80 per cent). We have now reached the heart of the matter. The most important element in inter-state river-water disputes is the water 'demand' for irrigated agriculture.

I have put the word 'demand' in quotes because in relation to water the very language of 'demand' and 'supply' seems questionable. This is not a quibble about words: the terminology assimilates water to the general run of consumer and industrial goods and reduces it to a commodity subject to the market forces of supply and demand. Without entering into an elaborate discussion on that issue, let me venture the following statement: the usual approach prevalent in the case of consumer or industrial goods, of projecting a future demand and bringing about a supply-side response to meet that demand, will be inappropriate in the case of water; instead, reversing that approach, we must start from the fact that the availability of fresh water in nature is finite, and learn to manage our water needs within that availability.

However, accepting current usage, the important point is that the 'demand' projections need to be stringently reviewed. In every kind of water-use, major economies are desirable and possible, though undoubtedly difficult. This is particularly important in the case of agriculture, the largest user of water and also an extremely inefficient user. There are three problems here.

Water-use efficiency under major/medium irrigation projects is low; it is put at around 35 to 40 per cent by the National Commission on Integrated Water Resource Development Plan (1999). Yields in irrigated agriculture in India are quite low. Even the NCIWRDP projects a modest yield of only four tonnes per hectare in 2050. Substantial improvements in efficiency in water-use in agriculture (in conveyance systems, crop-water requirements, irrigation techniques, yields) are needed and, if achieved, could sharply cut down the agricultural demand for water. An important point is that supply creates demand and necessitates more supply. The availability of irrigation water leads to the adoption of water-intensive cropping patterns (paddy in Punjab where it was unknown earlier, multiple crops of paddy in the Tanjavur delta in Tamil Nadu, sugarcane in Mandya in Karnataka, sugarcane again in Maharashtra) and to the extension of this kind of water-intensive irrigated agriculture to water-short and even desert areas, where it is inappropriate. More water is needed even to continue with this kind of agriculture; and, of course, there is a desire to expand that agriculture, creating a demand for still more water, until the demand becomes unsustainable. There is always a demand for more water and still more water.

So far, the response to this kind of persistent and escalating 'demand' for ever more water has been to build more supply-side projects, which generate new conflicts, apart from displacing people and causing severe environmental impacts. Alternatively, there is an attempt to bring additional water from another river-basin that is presumed to be 'surplus'. The state concerned will of course deny that there is a surplus and the stage is set for a conflict between the two basins. This approach is simply not sustainable. We have to get away from this kind of competitive, unsustainable demand for water. This is 'greed' in Mahatma Gandhi's terminology (keeping in mind his distinction between need and greed).

One is not minimising the importance of food security for a growing population. (Some check on that growth is necessary but that subject is not within the scope of this article.) One is merely arguing that the desired food security has to be (and can be) achieved without making unsustainable demands for irrigation water. Lessons can be learnt from efficient and economical use of water in agriculture in other countries, for instance in Israel. Methods such as system of rice intensification (SRI), said to reduce water requirements and at the same time increase yields significantly, must be tried and adopted as extensively as possible. Changes in cropping pattern can be considered. These are merely illustrations. The important point is to accept the limited availability of water and to base agriculture on that realisation.

The important point is to accept the limited availability of water and to base agriculture on that realisation.

What is needed is a transformation of agriculture. It is often said that there is need for a new Green Revolution now. Yes, indeed, but it must be a different kind of GR that moves away from a centralised, water-intensive, energy-intensive, chemical-intensive, monoculture kind of agriculture to a decentralised, low-input, low-energy, self-sustaining, regenerative agriculture. That theme cannot be gone into in detail here; one can only draw attention to the work of the late K. R. Datye.

The competitive, unsustainable demand for water ('greed') that has led to inter-state conflicts over river waters also creates conflicts between agriculture and industry, between rural and urban areas, between groups of people, between human beings and other species, between humanity and nature, and (potentially) between present and future generations. Greed lies at the heart of what we call 'development'. The transformation of agriculture has to be part of a transformation of our ideas of 'development' as a whole. That, however, is a large subject that will need a separate paper.[2] ●

[2]Please see *Towards Water Wisdom: Limits, Justice, Harmony*, by Ramaswamy R. Iyer, Sage Publications, 2007.

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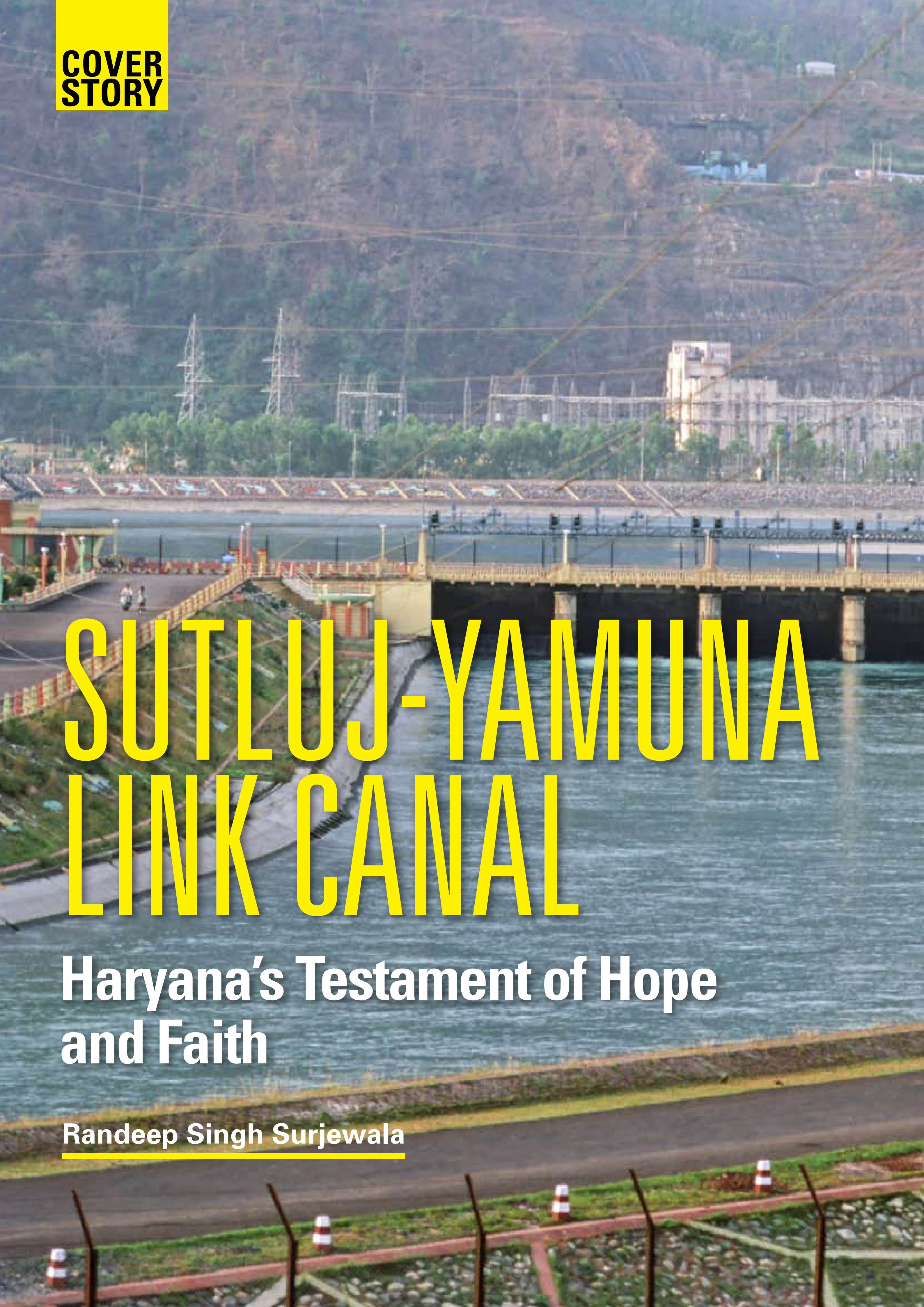

COVER STORY

SUTLUJ-YAMUNA LINK CANAL

Haryana's Testament of Hope and Faith

Randeep Singh Surjewala

Water' and 'air' are life itself. Water is a 'national' resource; more importantly, a 'human' resource. Mankind's fate depends on continued access to abundant water, nutritious food and clean air. Of the three, equitable availability of water is the most important; the other two, food and air, are corollaries. Do Indians always respect these positions in their water management, especially around its equitable distribution?

India uses 90 per cent of ground water for agriculture that requires constant irrigation. Available ground water in India, reportedly at 600 cubic kilometer per annum in 1997 (and enough to meet its demand then) will be no more than about 100 cubic kilometer per annum by 2050. By then the annual demand will rise to 1,200 cubic kilometer. The corresponding surface water availability in 1997 was 300 cubic kilometer per annum that is projected to fall to 50 cubic kilometer per annum by 2050. Alongside, the projected increase in demand for water, by domestic, industrial and agriculture sectors by 2050, is 1.4 trillion cubic litres, when the population is slated to be a staggering 1.6 billion (160 crore). Needless to add, this simple challenge of equitable availability of clean water will be the principal challenge for the nation state over next decades.

Water questions?

This being the background, there are certain fundamental questions around water that one needs to ask.

- Can people argue that each drop of water flowing through their soil is theirs?
- Can one control water?
- Can one own water?
- Can one divide water?
- Can one refuse to share water?
- Can one claim proprietory rights over water?
- Can one claim royalty for water?
- Can there ever be exclusive ownership of this life-giving natural resource?

These are questions that states and individuals claiming right of ownership over water must answer for themselves as also for the future generations of this country. The future of our children lies in looking within and giving a sincere yet simple answer to these questions made vexed by Machiavellian machinations of myopic political interests. Sharing of water and inter-state water sharing disputes – whether around the Yamuna Link or the Narmada and Cauvery or similar projects have to be viewed through the prism of these premises.

Consider the historical injustice meted out to Haryana by the persistent denial of its share of water in Punjab rivers – known in popular parlance as sharing of the waters of the Ravi-Beas rivers – by constructing the Sutluj-Yamuna Link Canal. Rhetoric is free and truth is a casualty in politics but facts are facts:

(i) The Indus Water Treaty of 1960, signed between the then Indian Prime Minister, Jawaharlal Nehru and Pakistan President, Field Marshal Ayub Khan, affirmed the rights of India (including Joint Punjab) over Punjab rivers. Post-partition, on the demand of the people of the Haryana region of Punjab, several committees were constituted by the joint Punjab government and the Government of India to provide water to the areas now comprising the state of Haryana. The committees that recommended a substantial share of water for the Haryana region from Punjab rivers included the Food Committee on Land and Water Use in Punjab, constituted on

January 12, 1965 and the Haryana Development Committee, constituted on January 20, 1965. They recommended 4.56 million acre feet of water for Haryana areas in joint Punjab.

(ii) Haryana was carved out of the state of Punjab on November 1, 1966. Section 78 of the Punjab Reorganisation Act, 1966 made special provisions with regard to the rights and liabilities of successor states, including those around sharing of the waters of Bhakra, Ravi and Beas. Yet there were disputes that did not get resolved and Haryana approached the Government of India on October 21, 1969 for a decision on the water dispute under Section 78 of the 1966 Act. In accordance with Section 78 of the 1966 Act, the Indira Gandhi government of the time took an initiative to allocate water vide order/notification of March 24, 1976, popularly known as 'Indira Gandhi Award'. Haryana and Punjab were allocated 3.5 million acre feet each of water. There was also a directive that a canal be dug in Punjab territory to carry Haryana's share of water.

(iii) Haryana paid Rs one crore to Punjab on November 10, 1976 and another Rs one crore on March 31, 1979 towards construction of the SYL Canal. Mr Prakash Singh Badal was then the Chief Minister of Akali Dal government in Punjab.

(iv) Having first accepted money for constructing the SYL Canal, in terms of the centre's order/notification of March 24, 1976, Punjab backtracked. Haryana then filed Suit No.1 of 1979 in Supreme Court of India on April 30, 1979 for implementation of the March 1976 order/notification for constructing the SYL Canal in the territory of Punjab within two years. Punjab filed a counter Suit No. 2 of 1979 on July 11, 1979 challenging not only the validity of the centre's March 1976 order/notification allotting Haryana a share of water but the very foundation of the Punjab Reorganisation Act,1966.

(v) This vexed issue was again settled on Indira Gandhi's intervention and it resulted in the signing of a tripartite agreement between states of Punjab, Haryana and Rajasthan on December 31, 1981. Under this agreement:

- Haryana was allocated 3.5 million acre feet of water.
- Punjab and Rajasthan were allocated 4.22 million acre feet and 8.60 million acre feet of water respectively out of the total surplus water of Ravi-Beas rivers.
- SYL Canal was to be completed within two years.
- Based on this agreement, both the aforementioned suits were withdrawn by Punjab and Haryana from Supreme Court of India on February 12,1982.

(vi) On April 8, 1982, Indira Gandhi took another initiative to have digging of a canal in Punjab territory at Kapoori started.

(vii) Ninety-five per cent of the work was completed till June 1987 while the Congress was in power.

(viii) Meanwhile, Punjab went through a period of extreme turmoil of terrorism and various leaders of different political shades continued to question Haryana's claim on the waters in Punjab rivers based on riparian principles.

(ix) Matters were again taken up at the central level by Rajiv Gandhi, when he became Prime Minister. He took the initiative to settle not just the inter-state water dispute but other inter-state issues as well.

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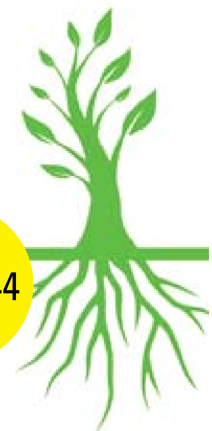
(x) On July 24, 1985, an agreement historically known as 'Rajiv-Longowal Accord', was signed between Rajiv Gandhi and the then President of Shiromani Akali Dal, Sant Harchand Singh Longowal. Mr Surjit Singh Barnala, who rose to become Punjab Chief Minister after the Rajiv-Longowal Accord, was also party to this agreement on behalf of the Akali Dal. The Government of India agreed to appoint a tribunal for adjudication of the share of water as also claims of the states of Punjab and Haryana.

(xi) A judicial tribunal was, accordingly, constituted under the chairmanship of Mr Justice V. B. Eradi. This tribunal toured the states of Punjab and Haryana, called for all the documents and heard extensive arguments. On January 30, 1987, the Eradi Tribunal delivered its landmark verdict and allocated 3.83 million acre feet of water to Haryana based on 'riparian principles' and 5.00 million acre feet of water to Punjab. Rajasthan and Delhi were allocated water too.

(xii) In 1991, the Congress government of Haryana instituted a suit for issuing directions to the state of Punjab for completion of the canal. On September 6, 1996, the Bansi Lal government instituted an amended suit for the same relief after withdrawing the earlier suit. On January 15, 2002, the Supreme Court of India allowed the suit of Haryana government, directing the Punjab government to complete the SYL Canal within one year.

(xiii) Upon the Punjab government failing to do so, an executory application was filed for issuing directions to Punjab for completion of the canal. On June 4, 2004, the Supreme Court again directed Punjab to complete the construction of SYL Canal within a year, failing which it should be constructed by a central agency. Punjab filed review petition against the June 4 judgment/order, which was dismissed by Supreme Court on July 2, 2004.

(xiv) On July 12, 2004, in a blatant affront to federalism and parliamentary democracy, Punjab passed the Punjab Termination of Agreements Act, 2004. Considering the gravity of the matter, the government of India intervened by exercising extraordinary powers of reference under Article 143 of Constitution of India and referred the validity of the 2004 Act to a Constitution bench of Supreme Court of India.



On January 30, 1987, the Eradi Tribunal delivered its landmark verdict and allocated 3.83 million acre feet of water to Haryana based on 'riparian principles'

Undisputed facts

- Haryana has a right to the waters of the Punjab rivers being a part and parcel of the erstwhile state of Punjab.
- Haryana's right to a share of the waters was affirmed by the Food Committee on Land and Water Use in Punjab (1965) and the Haryana Development Committee (1965) when the Haryana area was part of joint Punjab.
- Haryana's right has been recognized by the 1976 Government of India award issued in terms of Section 78 of the Punjab Reorganisation Act, 1966. Even the Punjab government had acquiesced to this award by accepting money from Haryana twice (1976 and 1979) for constructing the SYL Canal.
- Haryana's right to share of water has also been recognized by a tripartite agreement between Haryana, Punjab and Rajasthan (1981), based on which 95 per cent of the SYL Canal was constructed and completed till June, 1987.
- Haryana's right to the waters, including its claim as a 'riparian basin state, was further recognized by the Eradi Tribunal (1987) that was constituted on the basis of the historical 'Rajiv-Longowal Accord (1985).
- Haryana's right to share of water in terms of verdict of Eradi Tribunal was fructified by the 2002 Supreme Court judgment in Suit No. 1 of 1995 directing the state of Punjab and the Union of India to construct the SYL Canal.
- Haryana's right was further affirmed by the second (2004) Supreme Court verdict, directing the construction of SYL Canal within a year.

There can be no better case for sharing of water either on facts or in law or based upon the spirit of brotherhood. The construction of the SYL Canal is not only an article of faith for the people of Haryana but also a test of democratic resilience and equitable distribution of resources in this country. It is time politicians rose above the parochial and myopic vested interests and vote bank politics to ensure equitable distribution of ancestral family legacy between the two brothers – in this case share the water through construction of the SYL Canal. ●

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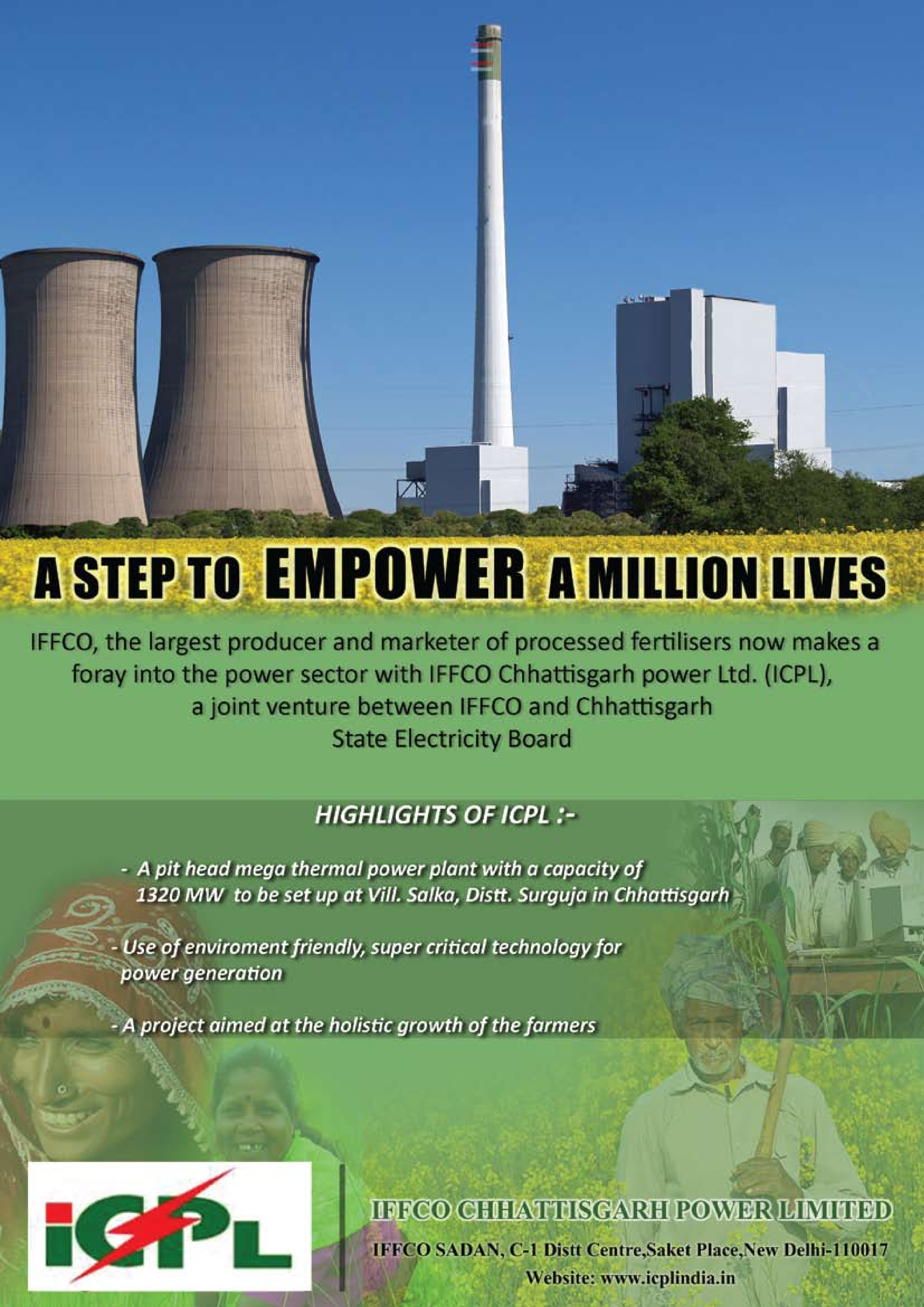
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COVER STORY

WATER WOES

Whither land of the five rivers?

Manpreet Singh Badal

Dil tut de hawavaan de,
Boond, boond layee taras gaye,
Asseen putt dariawan de,
Sanoo Eedan war ayeean,
Ravi tere pattana te
Ainwe akhian bhar ayeean

(Shattered are the hearts of the winds;
Alas! We, the offspring of the rivers
Pine for a mere drop of water.
For us, even the joys of the festivals of Eid have become a rarity.
Sitting on the banks of the river Ravi,
My eyes swell up with tears for no rhyme or reason)

This heart-rending song of poet Kulwant Grewal reflects the brutal injustice done to Punjab over the waters of its celebrated five rivers. Punjab draws its name from these rivers: Punj (five) Ab (waters). Only three have stayed with Punjab post partition but worse was to follow. Defying national and international laws, conventions, precedents and practices, even those waters were denied to the state. The bigger irony is that those who have made a travesty of national laws to deprive Punjab of its waters have the effrontery to paint Punjab as the 'bully', unwilling to share its 'bounty' with the rest of the country.

No one outside the state has paused to check if Punjab has any bounty to share. The biggest myth floated is that Punjab is a very well-irrigated state. The truth is that only 27 per cent of the state is irrigated by surface water and that 120 of the 140 blocks are termed as dark blocks where ground water has reached alarmingly low levels. If urgent remedial measures are not taken, Punjab may well be turned into a man-made desert and an ecological catastrophe in the next 15 years.

Punjab the bully or being bullied?

It is often the unfortunate duty of the policy makers and academics to play up popular misperceptions to confuse the truth. Truth demands patience and not many have the time to take the tedious walk through the winding paths of logic because it is so temptingly easy to jump to conclusions. Punjab is the victim of such hasty conclusions. Yet, the sharing of waters is not just an emotive issue but a matter of survival for the people of this brave and patriotic state. Punjab has always been generous while dealing with the rest of the country; its palm always turned down; rarely up. Punjab has been the giver.

Historical perspective

The story, as it should be read, begins with the International Indus Drainage Basin, spread across Tibet, India, Afghanistan and Pakistan. The main river Indus rises in Tibet, cuts through the mountains in Jammu and Kashmir in India, enters the plains of West Punjab in Pakistan and, finally, splits into channels forming a delta in the Sindh province in Pakistan, before entering the Arabian Sea. The important tributaries, which join the Indus, are Kabul, Jhelum, Chenab, Sutluj, Ravi and Beas.

Historically, like any other river system, such as Ganges, Brahmaputra, Nile, Rio-Grand, Colorado, Cauvery, Krishna or the Godavari, the waters of the Indus basin were utilized by a natural system of channels in the delta region, which lies in Pakistan's Sindh province. The freely available water led to the birth of the Indus Valley Civilisation in the delta region of Sindh about 6,000 years ago. However, the growth of high dam technology, agricultural sciences and the experiences with reclaiming arid lands in the western states of United States of America in the 18^{th} and 19^{th} centuries inspired the people living in the upstream areas to utilize water to irrigate their lands. The colonial British government in India started irrigation schemes by constructing diversion weirs across the rivers and the canals to irrigate low-lying lands in the upstream areas. Important among them in the Indus basin are the Madhopur Headworks, (Upper) Bari-Doab canal, Sirhind canal, Lower Chenab canal, the lower Jhelum canal and the lower Bari Doab canal. Further, responding to the needs and aspirations of the people and recognizing the skills of the farmers in Punjab, in the early 1920s, the British planned a high dam, the Bhakra, to store the waters of the Sutluj.

The passage of the Indian Independence Act, 1947 in the British Parliament and led to the division of British India into the Dominion of India and Dominion of Pakistan from August 15, 1947. Partition brought about immediate problems in the regulation and use of Indus waters but such problems were solved by official arrangements. However, larger questions arose with regard to the further development and allocation of water between India and Pakistan. Being free from colonial bondage, India pursued the Bhakra project more vigorously to store waters of the Sutluj for use it own areas. The negotiations were conducted under the mediation of the World Bank.


Source: www.oecd.org

Applying the rules of equitable apportionment, India and Pakistan finally resolved their differences and entered into an understanding, known as the Indus Water Treaty, 1960. Broadly, it permitted India to hold waters of Ravi, Beas and Sutluj (the eastern rivers) and Pakistan was given all the waters of Jhelum, Chenab and Indus (the western rivers). Quantitatively, the treaty gave India and Pakistan 32 MAF and 136 MAF of waters respectively, based on mean of the flow series 1921-45.

While the Indus water talks were going on between India and Pakistan, an ad hoc interim arrangement, for sharing the waters of the rivers Ravi and Beas (exclusive of the pre-partition uses), was arrived at in the inter-state ministerial meeting of the Punjab, Kashmir, Rajasthan and Pepsu, as follows:

a)	Punjab	5.90 MAF
b)	Kashmir	0.65 MAF
c)	Rajasthan	8.00 MAF
d)	PEPSU	1.30 MAF

This apportionment was purely ad hoc, interim and political. The hydrological and ecological impact of such large scale trans-basin diversions

were neither considered nor investigated, as India was keen to project its case by showing dry areas of Rajasthan. However, such arrangement was not intended to convey that Rajasthan should get water without meeting the requirements of Punjab, which is a riparian state. The riparian states alone have "legal rights" to the waters and only surplus water can be considered for transfer to the non-riparian areas.

On November 1, 1966, Punjab was further reorganised and the new state of Haryana was created out of it under the provisions of Punjab Reorganisation Act, 1966 (hereinafter referred to as "Act of 1966"). Section 78 (1) of the Act of 1966 provided for division of waters of the Beas Project although the Haryana was not riparian in relation to the Ravi and Beas rivers. This was a departure from the general principle that, even upon a reorganization of states, if the new state was not riparian in relation to a river, no part of the waters would be allocated to that state.

Thus, when Andhra was carved out of the Madras province under the provisions of Andhra Act, 1953, the waters of Cauvery were not given to Andhra. Similarly, the benefit of Koyan Project was not given to the dry areas of Bijapur district, when the district was transferred from the Bombay province to Mysore under the provisions of the State Reorganisation Act, 1956. Even the Krishna Water Disputes Tribunal could not accommodate the claims of Bijapur district in the Koyna Project.

Distribution of the assets of the undivided states between the existing state and the new state do not extend to artificially creating a riparian status in this manner. The root cause of the festering disputes in relation to the allocation of and sharing Ravi and Beas waters initially emanated from the interpretation of the provisions of Section 78(1) of the Punjab Reorganisation Act, 1966. On March 24,1976, the Government of India issued a notification, purportedly under Section 78 of Punjab Reorganisation Act, to allocate waters of rivers Ravi and Beas as under:

a)	Punjab	3.50 MAF
b)	Haryana	3.50 MAF
c)	Rajasthan	8.00 MAF
d)	Jammu & Kashmir	0.65 MAF
e)	Delhi	0.20 MAF
	Total	15.85 MAF

The central government went beyond the mandate of the provision, arbitrarily included the water that was not a part of Beas project and allocated a substantial 3.5 MAF of water to Haryana from the rivers Ravi and Beas. More importantly, the allocation in favour of Haryana proceeded on the basis of an assumption that "limited resources" were available to Haryana to develop its irrigation, which lie in the Yamuna basin area. However, the following events, inter alia, show that Haryana's resources were not limited:

a) The Yamuna basin state, excluding Punjab, entered into an agreement on May 12, 1994 and Haryana has been allocated 4.65 MAF of water from the Yamuna.

b) Further, pursuant to the directions of the Supreme Court in the "Networking of Rivers" case, has proposed the Sharda Yamuna Link to further augment the flows of Yamuna. Haryana is likely to get an allocation of additional large quantity of water from this link.

c) The National Water Development Agency, after investigation, published a pamphlet in 2002, holding that the Yamuna basin is a marginally surplus basin.

Haryana unilaterally planned the Sutluj Yamuna Link Canal

Having secured a large quantity of Ravi and Beas waters under the March 24,1976 notification issued under Section 78(1) of the Act of 1966, Haryana unilaterally planned the Sutluj Yamuna Link Canal to draw the waters allocated to it, as aforesaid. It dug the portion of this canal within its territory. The canal was expected to transfer water outside the Indus basin and into the Yamuna basin. The length of the proposed SYL Canal was 214 kms, of which 122 kms were in Punjab and 92 kms in Haryana. Punjab continued to contend that the March 24,1976 notification was wrongful and that apportionment of river waters had to be on the basis of legal rights.

By 1979, the Prime Minister also appeared to be of the view that the March 24,1976 notification needed to be reviewed. In fact, a meeting with the Chief Minister suggested that the quantum of available surplus waters of Ravi and Beas may again be examined by the chairman of the Central Water Commission. Punjab was agreeable to this. The Prime Minister held that the issue of allocation of waters had to be on the basis of legal rights and that this aspect should also be referred to the Attorney General for his opinion. It seems the issue was referred to the Attorney General. On February 27, 1979 the central government also wrote to the Haryana that the order of March 1976 could not be implemented and both states should agree to the entire matter being reviewed. The central government also informed Haryana, vide its letter of April 20,1979, that the SYL Canal in the territory of Punjab could not be constructed without the concurrence of Punjab.

Of disputes and agreements

In this backdrop two suits came to be filed in the Supreme Court: (i) Suit No.1 of 1979 filed by Haryana seeking a declaration that the March 24,1976 notification was final and binding and seeking mandatory and consequential orders for the construction of the SYL Canal; (ii) Suit No.2 of 1976 filed by the State of Punjab impugning Section 78 of the Punjab Reorganisation to make a determination with regard to river waters and for a declaration that the March 24,1976 notification was invalid and void. These suits were withdrawn subsequent to an agreement of December 31, 1981.

In view of the events and circumstances and under the guidance and in the presence of the Prime Minister, the Chief Minister of Punjab signed an agreement on December 31, 1981 with the Chief Minister of Haryana and Rajasthan. Apart from reallocating waters of Ravi and Beas on the assumption of surplus water availability of 17.17 MAF based on the series of 1921-60, the agreement also provided for the digging of the Sutluj Yamuna Link Canal under Clause (iv).

The re-allocations were as under:

a)	Punjab	4.22 MAF
b)	Haryana	3.50 MAF
c)	Rajasthan	8.60 MAF
d)	Delhi	0.20 MAF
e)	J & K	0.65 MAF
	Total	17.17 MAF

Haryana was already receiving 1.62 MAF of Beas diverted water through the Bhakra Main Line Canal.

In India an ad hoc interim arrangement, for sharing the waters of the rivers Ravi and Beas (exclusive of the pre-partition uses) was arrived at in the inter-state ministerial meeting of the Punjab, Kashmir, Rajasthan and Pepsu. This apportionment was purely ad hoc, interim and political with the hydrological and ecological impact of such large scale trans-basin diversions neither considered nor investigated. India was keen to project its case by showing dry areas of Rajasthan. However, such arrangement was not intended to convey that Rajasthan should get water without meeting the requirements of Punjab, which is a riparian state. The riparian states alone have “legal rights” to the waters and only surplus water can be considered for transfer to the non-riparian areas.

Thus, even without the SYL canal, Haryana gets 1.62 MAF of Beas diverted waters, apart from 4.33 MAF of Sutluj water. Also, the agreement was not in conformity with the procedure prescribed under Article 299 of the Constitution as it was neither made in the name of the Governor Punjab nor executed on his behalf.

Rajiv-Longowal Accord

Pursuant to the December 31, 1981 agreement, Punjab commenced the digging of the SYL Canal. The allocation of waters under the 1981 agreement and the issues of the SYL canal were, however, amongst the major causes leading to political turmoil in the state. Punjab suffered the advent of militancy and terrorism in the once peaceful and safe land. This period saw “Operation Blue Star” and the imposition of Governor’s Rule in Punjab as also the assassination of Indira Gandhi, the Prime Minister of India. Subsequently, on June 24,1985 the then Prime Minister of India, Rajiv Gandhi and the President of the Shiromani Akali Dal, Sant Harchand Singh Longowal, signed a document known as the “Punjab Settlement” that dealt with various issues including sharing of river waters. The circumstances that led to the execution of the Rajiv-Longowal Accord are a matter of public record. The states of Punjab and Haryana were not parties to the Punjab Settlement that dealt with various issues, including the digging of the Sutluj Yamuna Link Canal in the territory of Punjab (under para 9.3) and settlement of water allocations (under paras 9.1 and 9.2) by constituting a Special Tribunal.

The other issues in the Punjab settlement, inter alia, included the transfer of Chandigarh to Punjab. The Punjab Settlement was a Composite Settlement.

It may be noted though that even the statement of objects and reasons to the Inter State Water Disputes (Amendment) Bill stated "as the intention was to give effect to all the terms of the Punjab Settlement from January 26, 1986, the Ravi and Beas Waters Tribunal Ordinance, 1986 (2 of 1986) was promulgated to enable the constitution of the Ravi and Beas Waters Tribunal to give effect to the provisions of paragraph 9 of the Punjab Settlement…" However, ultimately, except for clause 9.1 and 9.2, no other clause of the Punjab Settlement was ever sought to be given effect to. In fact, for all intents and purposes, the Punjab Settlement was abandoned by all parties and became *non-est*.

Suits and countersuits

In 1996, Haryana filed a suit in the Supreme Court (Suit No. 6 of 1996) seeking directions against Punjab and the centre for completion of the SYL Canal in the territory of Punjab. Punjab, inter-alia, contended that the suit raised a water dispute and, therefore, the jurisdiction of the Supreme Court was barred under Article 262 of the Constitution of India read with Section 11 of the Inter State Water Disputes Act, 1956. The contentions of Punjab were rejected and the suit was decreed on January 15, 2002. The review was also rejected on March 5, 2002.

Punjab then filed a complaint under Section 3 of the Act of 1956 seeking re-allocation of the Ravi-Beas waters. It is submitted that water allocations, whether effected by agreement, legislation or adjudication are always subject to periodic reviews. The Krishna Water Disputes Tribunal, 1973 and 1976 has prescribed a review of its decision after 25 years. Similarly, the Narmada Water Disputes Tribunal, 1979 has prescribed a review of its decision after 30 years. The U.S. Supreme Court, which has apportioned inter-state river waters in many cases, has always retained jurisdiction at the foot of the decree to review and modify the allocations. The practice with regard to the agreements is also the same. For instance, the Yamuna Basin Agreement of May 12, 1994, where Haryana is a party, contemplates revision after 2025. The allocation of water in Ravi-Beas, originally made on January 29,1955 and subsequently reaffirmed after the Punjab's reorganization is liable for review on the grounds of a fundamental change of circumstances.

Briefly, these circumstances are as follows:

a) Reduction in the available water from 17.17 MAF to 14.34 MAF or about 16 per cent on account of climate change;
b) Availability of additional waters or 4.65 MAF to Haryana after the conclusion of Yamuna Agreement of May 12, 1994;
c) Further availability of large quantity of waters to Haryana under the Sharda Yamuna Link proposed by the Government of India pursuant to the court judgement in the "Networking of Rivers" case;
d) Depletion of ground water table and further depletion if waters are diverted to Haryana;
e) Punjab areas gaining a preferential right to use the Ravi-Beas water, which is a deficit basin;
f) Any equitable or other claim by Haryana in respect of the Ravi-Beas waters having to be reconsidered and evaluated in the light of the Haryana receiving water under the Yamuna Agreement of May 12, 1994 and the proposed Sarda-Yamuna Link.
g) The present uses of Punjab, particularly in the


Photo: Mira Pavlakovic

It is well settled that diversion of water even by interlinking of rivers can be resorted to only from a surplus to a deficit basin. Since the requirements of the basin areas within Punjab are not fully met, the question of any trans-basin diversion from Ravi or Beas would be contrary to such well-settled norms.

districts of Ferozpur, Faridkot, Muktsar, Moga and part of Sangrur, Mansa and Bathinda, which were allocated water legally before the reorganization of the states and where the people have continued to use water have led to the creation of legitimate expectations over the last several decades.

Despite the one-year time limitation prescribed by the statute within which the central government was required to refer the said water dispute to a tribunal under the provisions of the Act of 1956, the Government of India failed to do so. These circumstances prompted Punjab to file a suit being OS 1 of 2003. It sought the dissolution of the injunction under changed circumstances, inter-alia, arising from a decline in the quantity of available surplus water and the complaint made by Punjab on January 11, 2003 in this, under Section 3 of the Act of 1956, seeking reallocation of Ravi and Beas waters. Punjab also questioned the vires of Section 78(1) of the Act of 1966 and Section 14 of the Act of 1956. However, the suit was dismissed on June 4, 2004.

Punjab Termination of Agreements Act of 2004

On July 12, 2004 the Legislative Assembly of Punjab passed "The Punjab Termination of Agreements Act, 2001" terminating all the agreements, including that of December 31,1981 and paragraphs 9.1 and 9.2 of the Punjab Settlement relating to Ravi-Beas and discharged Punjab from the obligations contained therein (hereinafter referred to as "Act of 2004"). The agreement dated December 31, 1981 was the basis on which the judgements of January 15, 2002 was passed in OS No.6 of 1996 and of June 4, 2004 was passed in IA No.4 in OS 6 of 1996.

Notably, on May 12, 1994, a Memorandum of Understanding for allocation of Yamuna waters was signed by and between the states of Uttar Pradesh, Haryana, Delhi, Rajasthan and Himachal Pradesh. Interestingly, while Haryana and Rajasthan were permitted to use Ravi-Beas waters outside the basin – though admittedly they are not the riparian states – a request by Punjab was turned down administratively by the central government (D.O. No. 10 (66)/74-WD/I.T.-8264 of August 14, 1992) at the instance of and on the objections of Haryana with regard to use of the waters of the river Yamuna on the ground that the Punjab is not a basin state. This was despite the report of the Irrigation Commission, 1972 (volume III part 1) that categorically noted that areas in the Sangrur district in Punjab fall within the Yamuna basin. Thus, different standards were applied only in respect of Punjab to its prejudice and detriment.

> Haryana and Rajasthan are not riparian to the rivers Ravi and Beas; they are not even basin states. As a result of the ad hoc arrangements, more than 70 per cent of the waters of the rivers Ravi and Beas was diverted to areas outside the basin in Rajasthan and Haryana, without even considering the hydrological impact of such trans-basin diversion.

Trans-basin water diversion

Haryana and Rajasthan are not riparian to the rivers Ravi and Beas; they are not even basin states. As a result of the ad hoc arrangement of 1955 and the 1976 notification, more than 70 per cent of the waters of the rivers Ravi and Beas was diverted to areas outside the basin in Rajasthan and Haryana, without even considering the hydrological impact of such trans-basin diversion. It is well settled that diversion of water even by interlinking of rivers can be resorted to only from a surplus basin to deficit basin. Since the requirements of the basin areas within Punjab are not fully met with, the question of any trans-basin diversion from Ravi or Beas would be contrary to such well-settled norms and the rights of the basin areas. It is estimated that if the trans-basin diversion, as sought by Haryana, is permitted, about 19 lakh acres within the basin areas of Punjab would go out of irrigation and would become dry.

It is Punjab's stand that Haryana has been favoured by the centre in the allocation of Ravi and Beas waters. The reasons are:

a) Parliament, by enacting Section 78(1) of the Act of 1996 in respect of the waters of the Beas Project, enabled allocations to Haryana to which it was not entitled and in violation of the requirements of List I Entry 56 of the Seventh Schedule of the Constitution.

b) The entitlement of Haryana in the waters of Beas Project was made subject to the administrative decision of the Government of India, which is always political in inter-state waters and the provisions of the Inter State Water Disputes Act, 1956, read with Article 262 of the Constitution, were conveniently by-passed, depriving Punjab of an opportunity to present its case before an impartial authority.

c) The observations of the Report of the Irrigation Commission, that a small part of Haryana lies in the Indus basin, which is disputed, are relied upon to support the claim of Haryana to Ravi and Beas waters but when it came to the claim of Punjab for Yamuna waters, the Report of the Irrigation Commission that parts of Punjab lie in the Yamuna basin was ignored.

d) The Yamuna basin area of Haryana has received triple benefits in the allocations of inter-state waters because:

- Haryana has got an allocation of 4.65 MAF in the Yamuna waters vide the agreement of May 12,1994 to cater to the Yamuna basin areas in Haryana.
- Haryana also got allocation of 3.5 MAF in Ravi and Beas waters to cater to the Yamuna basin areas in Haryana.
- Haryana also uses about .5 MAF of Sutluj water to cater to the Yamuna basin areas.
- In addition, as per the National Water Development Agency Report submitted pursuant to the court directions in the 'Networking of Rivers case', Haryana is to receive another 3.5 MAF of water from the proposed Sarda-Yamuna link, which, in fact is, admittedly, going to service the very same areas meant to be served by the SYL canal.

In the Punjab context, the centre very clearly disregarded what Gandhiji had said on March 16, 1931 when he had visited Gurdwara Sis Ganj Sahib in New Delhi. Asked what guarantee there was that the Indian National Congress would fully implement the assurances given to the Sikhs in 1929 at Lahore Congress Session, Gandhiji gave his answer in Young India, 1931: "…Sardar Madhusudan Singh has asked for an assurance that the Congress would do nothing that might alienate sympathies of the Sikhs from the Congress. Well the Congress in its Lahore Session passed a Resolution that it would not enter into or be a party to any settlement with regard to the minorities' question that failed to satisfy any of the minorities concern. What further assurances the Congress can give to the Sikhs. I fail to understand?

"I ask you to accept my words and the Resolution of the Congress that it will not betray a single individual, much less a community. If it ever thinks of doing so, it will only hasten its own doom. I pray you, therefore, to unbosom yourselves of all your doubts. What more shall I say? What more can I say than this 'Let God be the witness of the bond that binds me and the Congress with you'".


Source: www.research4development.info

Sardar Madhusudan Singh has asked for an assurance that the Congress would do nothing that might alienate sympathies of the Sikhs from the Congress. Well the Congress in its Lahore Session passed a Resolution that it would not enter into or be a party to any settlement with regard to the minorities' question that failed to satisfy any of the minorities' concerns. What further assurances the Congress can give to the Sikhs. I fail to understand? – Mahatma Gandhi

Sadly, the central leadership of India perspicaciously forgot the promise of the Father of the Nation and Punjab and Punjabis were left to suffer injustice in inter-state disputes, especially the allocation of waters. The silence, kindness and big heartedness of Punjabi people emboldened the central government further and it showed hype and gesture of bravado many a times and contemptuous rejection of Punjab's requests generally.

I am reminded a quote from the Mahabharata:

Adi Parvan (Sub Chapter 74 and Verse 25)

Yo anayatha santamatmanam
Anayatha pratipadyete
Kinten na karitam papam
Caurainatmapaharina

(He who has one thing in mind but represents another thing to others, what sin he is not capable of committing? For he is a thief and a robber of his own self.)

The author is Minister for Finance, Planning & Programme Implementation, Government of Punjab

CHANGE MAKER


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WATER MANAGEMENT

Restoring India's indigenous knowledge systems

Rajendra Singh

The annual floods of Bihar bring unimaginable misery to the victims with cynical inexorability as a helpless people and slothful administration watch on. Yet things were not always so. Thanks to its ancient indigenous knowledge, Bihar had developed the wherewithal to put to use the excess water: a system called 'Ahar-Pyne'. In other words, Bihar had a flood water harvesting system! Very simply, the excess water from the Ganges was driven by channels, called 'pyne', up to 30 to 40 kilometres into the land to fill tanks called 'ahar'. This ensured a long-lasting retention of water throughout the year and a better distribution of silt.

Bihar was no exception. India's indigenous knowledge system has been a highly evolved one; demonstrably providing ways for sustainable living. Nature was respected; so was the diversity of agro-ecological climatic zones, even those that appeared to be the most difficult and inhospitable. More importantly, society had devised a mechanism for the traditional knowledge to be transmitted down the generation through practice; under the tutelage of elders and gurus.

Those who actually executed the projects were the pupils of the indigenous knowledge system. They could be poor or rich pupils; it did not matter. The state would work with them for conservation of water (among others) and the overall preservation of knowledge. The richer pupils helped the poorest engaged in this function with financial wherewithal where necessary, while the state provided the land. It was a pupil-driven, decentralized water management; in other words: indigenous water management.

This functional management of water had the wisdom of every drop of rain and the raindrops were the life of the Indian pupil and society. The system kept in mind the various agro-ecological zonal diversities and developed specific sciences, relevant engineering and technologies appropriate for every part of the country.

India's lowest rainfall is in the arid districts of Jaisalmer and Badmer, where people have a '*tanka*' in every house for drinking and domestic use and a pond (*talab*) for other use to serve the animals. They also use the *kuinya* (well) for harvesting drinking water present in the form of sand moisture in the sub-surface, where the aquifer is brackish and separated from the layers above it by a layer of gypsum.

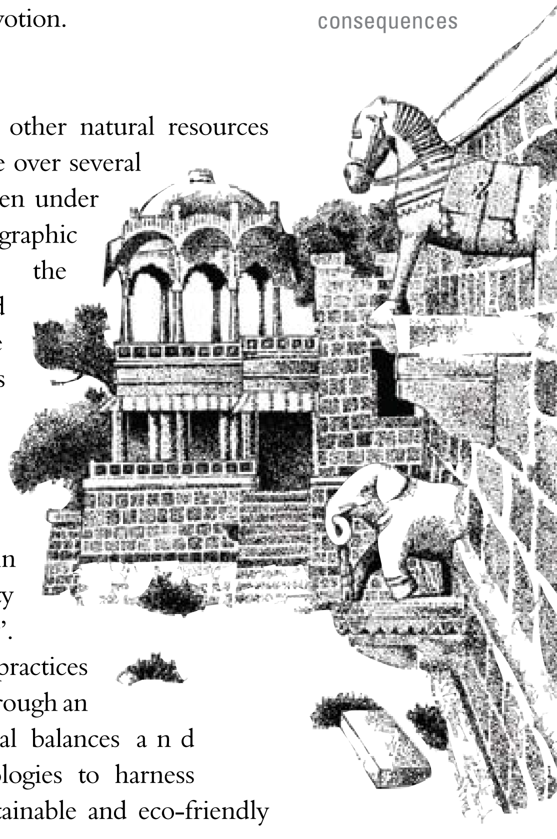
Kautilya's record

The indigenous engineering was not well documented because the technical aspects were transmitted through practice and word of mouth and gradually perfected by tradition. In some cases though, the legal and administration aspects were written. Kautilya's Arthashastra (Treatise of Administration by Kautilya, advisor and minister of the first Indian emperor Chandragupta Maurya, 321-297 BC) has a very comprehensive chapter with detailed administrative rules, covering the gamut of legal and economic implications of a decentralized community-driven water management system, which was facilitated by the state.

The ruler had to provide land, roads, trees and equipment to participants in the community construction of the water works. Those who did not participate were made to contribute financially but were not entitled to benefit directly from the structure. The methods of ownership and maintenance of new, ancient and repaired structures were described in detail. All users of irrigation facilities had to pay a tax, even if they had their own waterworks though there was a multi-year tax exemption for those who built new structures. These administrative rules were simply safeguards against any adverse economic consequences arising out of the implementation of the waterworks. The real motivation to engage in the community projects came from elsewhere: participating in such community construction of ponds, tanks and waterworks was a matter of pride and done with religious devotion.

Loss of tradition

Forests, water bodies and other natural resources were in a very healthy state over several thousand years in India even under difficult climate and geographic conditions and despite the growing population and demand. This was possible because of society's extremely eco-friendly culture and traditions (*dharma/parampara*) that were woven around the philosophy of 'live within what nature sustainability releases; do not be greedy'. Traditional knowledge and practices in every area – imbibed a through an understanding of ecological balances and preserved through technologies to harness natural resources in a sustainable and eco-friendly



Gadhsisar Tank, Jaisalmer. The level of water is measured with the sculptures of the different animals, for an easy recognition of water level and its consequences manner – were not professionally 'documented' in the modern sense of the term as we have seen. For centuries, the concept that soil, water, forest, wildlife and the whole environment were common assets of the local people – bestowed by the almighty, to be managed as a 'trust' – was the commonly-accepted worldview.

This age-old balance has been disturbed at an accelerating pace in the last 200 years; every revolution and counter-revolution has increased the intensity of the impact on the environment: the industrial revolution, the education revolution, the agricultural 'green' revolution, the 'development' revolution and now the 'privatization' and 'information technology' revolutions.

It was the European colonizer with his idea that nature was to be 'exploited' who undermined the traditional sense of feeling responsible for nature. The modern state (colonial or independent) dispossessed the rural communities of their rights and responsibilities around the rivers and forests, either legally (tree felling licenses, water rights) or illegally (corruption). Their so-called 'education revolution' convinced the people that traditions and oral knowledge were the cause of poverty. The post-independence 'development' and socialistic 'welfare' state promoted the illusion that everything had to be taken care of by the all-powerful government. It is only now that the sheer incompetence of state power is getting exposed. Also exposed is the incompetence of the capitalistic empires. Multinational corporations and high-tech solutions (IT, GMO and such others) are being called to the rescue. They are very likely to result in further and deeper degradation.

Making matters worse is the corruption of language. The official jargon for the undisciplined water extraction technology is 'ground-water development'. When educated engineers 're-discover' the ancient tradition of responsible management of common resources, they create abstractions and awkward technologies, like 'artificial groundwater recharge', ignoring the proven local traditions like 'johads'. Even when they begin to understand a traditional technology like the 'tanka', they feel compelled to 'improve' it, using cement instead of lime or reinforced or cement concrete (RCC) slabs instead of brick domes. This results in degrading tradition and its relevance to the level of their limited understanding. The natural methods are forgotten and their vestiges are buried deep into the earth.

Impact of the paradigm shift

What difficulties does such a paradigm change inflict on society?

- Sheer exploitation and disintegration has replaced the sense of bonding and integration.
- Communities have been dispossessed of their traditional rights and responsibilities.
- The state has encouraged a dependence syndrome because wherever it has succeeded (even partially or for a short period) in implementing modern amenities like water supply, sewage or power, the communities have lost their initiative.
- Traditional systems have been neglected because modern facilities have replaced them, even though expectations of them have often been belied.
- Community institutions have got disintegrated and have succumbed to modern education and other hollow dreams of modernity.
- There is inability to cope with increasing human and livestock population given the general degradation of natural and social conditions. The rural communities have lost their food and livelihood security, their living conditions have become more difficult, resulting in forced migration to big cities in search of survival in indecent and exploitative conditions.

This bring us to the need to reawaken the indigenous knowledge base and to figure out how to do so. Water harvesting provides an excellent way to revive much of our lost knowledge. There are various water harvesting methods in India, founded on some common features around the use of local resources and technology; community-based operations; community-driven de-centralized water management, sustainable conservation and use of natural resources. The revival of systems using indigenous knowledge would include:

> The post-independence 'development' and socialistic 'welfare' state promoted the illusion that everything had to be taken care of by the all-powerful government. Only now is the sheer incompetence of state power getting exposed.

- Understanding traditional systems and use of indigenous knowledge
- Mobilization of community around land, water and forest
- Participation in rejuvenating old structures and construction of new structures
- Creation of new, village-level and river basin institutions.

The Tarun Bharat Sangh (TBS) revolution

On the night of October 2, 1985, when I got off at the last stop of the bus to Bheekampura with four friends, we had a single agenda: 'fight injustice against the people'. We knew only one way to do it, by spreading literacy in the villages. So we started a literacy drive only to discover that people suffered most from the severe scarcity of water. The region that once sustained the Aravalli eco-system had become barren.

It was difficult to find young people in the villages. They had gone off in search of employment; women trudged long distances for a pot of water; crops failed regularly; lack of vegetation led to soil degradation; the monsoon runoff washed away the topsoil. There was not a single blade of grass in the region and we often stumbled on the carcass of cattle. Barely three per cent of cultivable area was irrigated. Life was an endless hardship. One day, Mangu Patel, the wise old man of this village, told me, 'we do not want your literacy, we want water'. Where was the water though? I knew nothing about it.

Mangu explained to me about the rich tradition of building 'johads' in this region; a prime example of the ingenuity of the inexpensive and simple traditional technology. Yet it was quite remarkable in terms of recharging groundwater of the entire region. The '*johads*' are simple mud barriers, concave shaped, built across the slope to arrest the rainwater runoff. They have high embankments on three sides while the fourth side is left open for the water to enter. The height of the embankment gives the '*johads*' a capacity in excess of the volume of runoff coming from the catchment, based on a rough estimation of maximum possible runoff that could come into it. Therefore, the height varies from one '*johad*' to another, depending on the site, water flow, pressure and such other parameters. An '*afra*', a masonry structure, is made in some cases to provide an outlet for the excess water. The water storage area varies from two hectares to a maximum of 100 hectares.

Water collected in a '*johad*' during monsoon penetrates into the sub-soil. This recharges the groundwater and improves the soil moisture in

vast areas, mostly downstream. The groundwater can be drawn from traditional open wells, built and maintained by the villagers themselves without any input from outside. As the percolation process takes some time, depending on the soil and the depth of water, amongst others, during this temporary period (sometimes several months), the water in the '*johad*' is directly used for irrigation, as drinking water for and other domestic purposes. The advantages of this structure is that apart from arresting and storing rainwater, it checks the soil erosion, mitigates the floods and ensures that there is water in wells even through several successive years of drought, like the five-year drought in recent times.

Also, during the dry season, when the water gradually recedes in the '*johad*', the land inside it becomes available for cultivation. This land periodically receives good silt and moisture that enables cultivation of crops without any irrigation. So the '*johad*' does not take away arable land from cultivation. The distinctiveness of this structure is that it is based on simple and cheap technology with locally-available resources, mostly labour and soil. When necessary, locally-available stones, sand and lime are used. All the estimations are based on the villagers' experience and intuition, without any physical measurements.

When I went to Bheekampura in 1985, this unique traditional water management system was alive in the collective memory of the people who had still not been alienated by the global environment. On Mangu Patel's advice, we became a catalyst for building '*johad*' but ran afoul of the local authorities because we had by-passed all bureaucratic channels and dealt with the people directly to fulfill their requirements in any manner that they thought fit. The first '*johad*' took three years to build. In the fourth year, we built 50 '*johads*'; in the fifth we built almost 100. In 2001, we built around 1,000 water structures and in all we have built nearly 9,000 water-harvesting structures in more than 1,000 villages. When we started working, our area was classified by the government as the 'dark zone'; an area with severe water shortage where the water level had receded to difficult depths. After 10 years, the same area, was classified as 'white zone', which indicates satisfactory underground water level; an area that does not need government attention.

No engineer was called for consultation; we were guided entirely by the traditional wisdom of the people who have maintained the ecological balance for generations. These water structures were constructed with the active participation of the community from the stage of site identification, to the designing of the structure and with contributions towards the cost of its construction and, later, in its maintenance. This ensured that all the structures were need-based and water became abundant. More water meant better crops, better soil conditions, spare time for the girls to go to schools and a richer community life. It also helped forestation in the area and development of wildlife. Prosperity returned to the region, agriculture became productive and, with the availability of fodder, cattle-rearing could be started. This resulted in increased production of milk. Higher water levels also meant less money on the diesel for pump set.

Small inputs, great returns

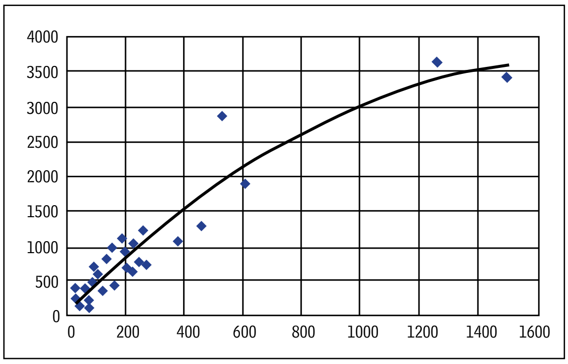
In 1985, only 20 per cent of the agricultural land was cultivated. Currently it is 100 per cent and villages have started selling surplus grains in market for the first time. Studies have shown that an investment of Rs 100 per capita on a 'johad' raises the economic production in the village by as much as Rs 400 per capita per annum.

As villages mobilized themselves to improve their quality of life by contributing to the 'johad' building, it meant enhanced participation of community for common facilities that promoted self-reliance, optimized social cohesion and emotive bonding in the community. Since people realized that members were responsible not only for individual but also collective action, they became more aware of their rights taking on an activist stance to stop employment of children in the carpet industry and fought a legal battle up to the Supreme Court of India to stop indiscriminate mining on forest land.

An enlightened and active community also enforced self-discipline for the common good of the village. It strictly enforced its own rules to stop deforestation, hunting and consumption of liquor. The evolution of community participation through the *Gram Sabha* or village assembly, gave everyone an opportunity to freely discuss, decide and implement a common decision taken for general benefit. This process also enabled them to reflect on the problems of others in the community and helped each other in solving them. An active community meant improved social and economic conditions in the entire region and the crime rate dropped in the villages. All this was attributed to the 'johads' that generated a momentum of change and encouraged the villagers to look for more innovative methods to bring about social change. The greatest challenge they face is sustaining those traditional values that started this movement in the face of the transformation of the community due to progress and prosperity.

Rebirth of River Aravari

The 'johads' that we helped build from 1985 are simple traditional earthen dams; small-scale, low-cost structures that hardly seem to such powerful change-makers but, taken together in hundreds and thousands, they have changed the face of that part of Rajasthan. TBS has helped people to build more than 9,000 'johads', check dams and anicuts for harvesting rain water. In 1996, we were amazed to find Aravari river flowing even during peak summer.



Rise in Annual Gross Village Product in Rs Per Capita against Investment in Water Conservation Per Capita, Source G. D. Agrawal

Groundwater level in wells of the village Buja before and after Johad

No.	Total depth of well (in feet) 1988	Water level before Johad	Water level of well after Johad, 1994 (in feet)
1.	81	Dry completely	44.5
2.	73	Dry completely	37
3.	67	3 feet	40.5
4.	55½	4 feet (dry most of the time)	27
5.	81	10 feet	66
6.	69	20 feet	50
7.	43	15 feet	35
8.	83	20 feet	58
9.	80½	19 feet	55
10.	66½	Dry completely	25

Since then four more rivers, Sarsa, Ruparel, Bhagani and Jahajwali have become perennial.

When there was plenty of water in the Aravari, there was natural growth of fish, which kept multiplying. The government then wanted to stake a claim to the fish and brought in a contractor to handle the fishing, prompting a people's resistance that forced the government to cancel the contract. Not that the local people wanted control over the fish. Far from it; they are vegetarians and did not eat fish but they realized that today the government wanted the fish; the next day it would want the water.

Since the 1940s, the river Aravari had been degraded to a mere monsoon drain, with only brief and strong flows of muddy water. We had been building these structures over the years without realizing that we were in fact recharging the river through percolation underground. Now the water is clear and flows gently throughout the year.

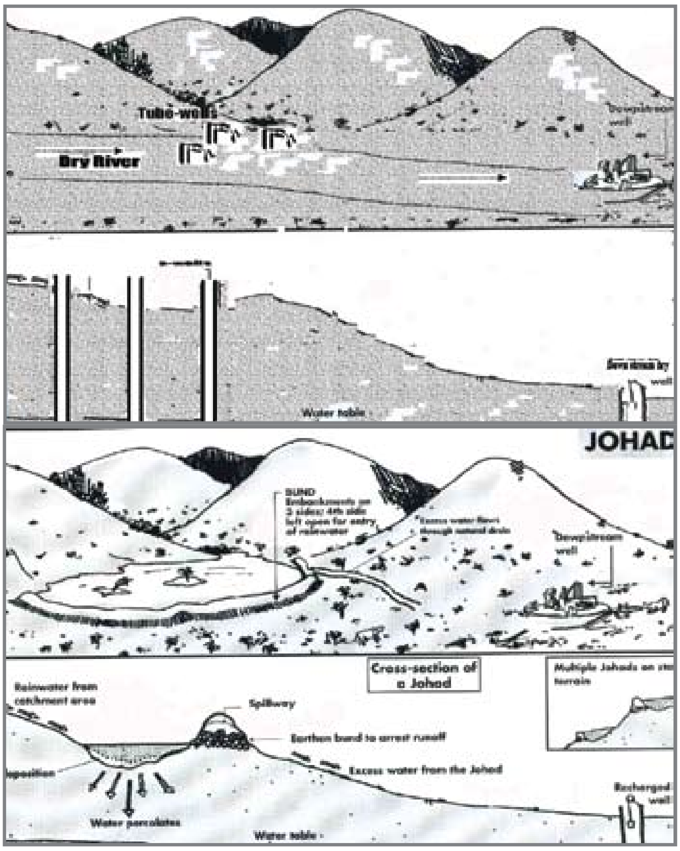
Even though the community had developed the water as a common resource, the government wanted to intrude into the community's domain through the contractor. Had the community allowed that intrusion to succeed, the leadership would have failed the community; to protect its right over the water. It resisted and won and the shift in the centre of power as far as control over use of the Aravari waters is concerned is now clear.

The sequence of events is interesting:

- People work on what they need the most: water. They develop this resource through rainwater harvesting
- When a resource is fully developed, there is an intrusion to demolish the concept of people's right over water.
- The community puts up a strong resistance and removes the intrusion.
- The community consolidates and takes responsibility. It gets a mandate from 72 villages
- The lesson learnt: Community initiated work unites people and builds bonds of co-operation between different constituent groups.

There is, however, fear that intrusion would happen again because of differences over sharing of the Aravari waters within the community. This led to the formation of the Aravari Sansad (Parliament) representing 72 villages which it has framed 11 rules for use of the Aravari waters. This Parliament meets twice a year.

The restoration of the river Aravari to life is also the story of various watersheds linked to each other. Contrary to the impractical engineer's dream (or nightmare?) of interlinking rivers (current project of



massive inter-basin water transfer), it represents the logical conclusion of decades of water conservation work by the people and a practical and efficient step towards retrieving the link between the people and their river in a meaningful manner. The Aravari river is the lifeline for the prosperity for 72 villages along its bank and the Aravari River Parliament acknowledges this fact while drawing the logical conclusion: this river has to be taken care of in a civilized, concerted and responsible manner.

Need for Aravari Parliament

Why should people come together to form a parliament around natural resources is a logical question? It would have been impossible to think of a river parliament without the TBS' intervention in formation of new institutions, such as the Village Water Council and Women Self Help Groups and construction of different kinds of water-harnessing structures directly benefiting the population.

The rise in groundwater level and increase in area under cultivation and irrigation tempted people to listen to the TBS idea of forming of the River Parliament[1]. The awareness built by various discussions, group meetings, training programmes, exposure trips and the like also contributed in mobilizing and sensitizing the community to form a group to address inter and intra village land, water

[1]The concept of river basin approach was applied to the Aravari River Basin in Alwar district of Rajasthan, using community centre water management approach. On December 28, 1998 a River Parliament of 70 villages with the membership of 205 was formed in the catchment area of the Aravari river. The Parliament meets twice a year at intervals of six months. The Arvari Parliament has met 14 times since its formation.

[2] Water-harnessing structures called Jabbar Sagar dam in Hamirpur village were constructed by Tarun Bharat Sangh. The state government tried to claim ownership and control over water by floating a tender for fishery activities in 1996. One morning, a contractor came to collect fish from the dam. The village community was taken by surprise as it was under the impression that water belonged to it. The community fought with the state and won its claim over water and fish resources.

and vegetation related issues and to resolve conflicts if any. Also, events, such as conflict between state and community in reaping benefits of water stored and conflicting claims over ownership and control over surface water harnessed through various structures triggered the idea of the coming together and protecting the interest of the community[2].

The river basin approach

The Aravari river basin has 46 micro watersheds. Broadly, there are two streams starting from the top of the basin and joining at the Sainthal Sagar dam. Tarun Bharat Sangh constructed water harvesting structures in the catchment area along with other watershed management activities. This led to a rise in the groundwater table in the basin and an increase in the longevity of flow in the Aravari river. The TBS' objective was to take a holistic view in management of natural resources by undertaking land, water and vegetation related activities. The existing formal state structure – that comprised the different departments of government, namely forest, irrigation, groundwater and revenue department – had almost failed to check the deteriorating condition of natural resources. TBS tried to educate people on the NRM issues by forming a Village Water Council in each village. The objective of this village institution was mainly to protect, conserve and manage the natural resources in a sustainable way by community participation.

After years of hard work, these councils made a dent in natural resource management by forming certain informal rules, acceptable to all the village members. However, water and vegetation are common pool resource and do not belong to only a single village as was contemplated while planning the Aravari River Parliament. More than one village had access to and use of forest and water resources. It was decided to form a River Basin Parliament comprising several micro watersheds. It was planned that each Village Water Council would be represented by two or three nominated members in the Parliament. A working group of 20 members, including few co-opted members from outside basin, to guide the proceedings and activities of the Aravari Parliament, was also proposed. It was planned to have at least two meetings of the full house, while the management committee or working group was required to meet more than twice. The main goal of this Parliament was to create a larger vision or perspective; thinking beyond a village, while managing the common pool of resources (see box for specific activities).

Certain guidelines were drawn to regulate the behaviour of people in the first meeting of the Parliament. It sought to foresee future problems in management of NRM, resolve conflicts if any vis-a-vis access to and use of resources, provide guidelines for conservation, protection and management of resources and treat water and forest as a community resource rather than private property. The specific informal rules formulated are:

1. Ban on sale of fish produced in water stored by anicuts or *johads* to contractors.
2. Ban on use of pumps to lift water from anicuts
3. Not to sell land for mining or quarrying or industrial activity.
4. Encouraging people to grow water-saving crops
5. Restricting use of chemical fertilizers
6. Limiting production of cotton and sugarcane crops only for self-consumption
7. Construction of anicut, *johad*, *mairbandi* to check free flow of rainwater
8. Construction of mairbandi to check degradation of farmlands
9. The issues related to land, water and vegetation would be dealt by a combined effort of village community by ensuring maximum participation of households in a village.

These informal rules are discussed in each Parliament meeting and practical problems encountered in their implementation are highlighted.

New guidelines are suggested when needed and debated and discussed at the village level for a general consensus. Members report on their efforts in implementing the objectives of the parliament at the meetings and seek guidance for resolving conflicts, if any. Most of the conflicts pertaining to access control and management of resources are resolved in the meetings of Village Water Council.

Organization of parliament

The basin level institution created by TBS is expected to perform several roles:

1. To conserve water resources and emphasize demand side management
2. To ensure community control and management over water resources
3. To ensure equitable distribution of resources
4. To provide equal access to all sections of the society
5. To ensure sustainable use of water resource to protect interest of future generation
6. To resolve conflict if any around water resources and
7. To organize and empower people through natural resources management.

Ensuring equal participation of women on all its activities has been an integral part of the objectives. It also sought to ensure that they too are empowered in the process.

TBS: an evolving institution

Being a very young organization and first of its kind, it will take TBS some time to understand and act. Different stakeholders take a lot of time to understand the concept of a river parliament and practice it well. Change – moving from an individual, private, and narrow profit-maximization approach to a broad, village and basin-level community approach to water resource management – is a painstaking process. People gradually understand the benefits of coming together and managing natural resources. All this while they had all the freedom to use land, water and forest resources to meet not only domestic requirements but to derive livelihood as well. The cost in terms of complete degradation or deterioration of the natural resource occurred to them later.

Today, the social sanctions approved by the parliament are adhered to by most of the villagers. It has made a dent in their behaviour pattern towards natural resource management. The Aravari Parliament has also provided people a platform to address their needs, prioritize them and design use patterns that would enhance the health of the resources. It has provided an opportunity for young local leaders to come up and safeguard the interest of the community. The discussions at the Aravari Parliament meetings are open, providing opportunity both for men and women to express their views. Despite these achievements, certain objectives are only being partially attended to. It is not that people do not want to address those issues but the process of evolution in any institution is both time and energy consuming. This is especially so when it is a matter of arriving at major issues of equity in use of natural resources and access to them. However, some traditional norms for sharing of water from a well in case of joint ownership are still in practice.

The major problem in attaining the objectives of equity and access is the multiple and undefined nature of property regimes. The ownership and control rights are loosely defined; they are rarely understood or practiced in a correct perspective. In case of water, surface and groundwater it is governed by different laws related to private property, state property and community property. Groundwater is completely privately controlled and managed. On the other hand, surface water, harnessed by construction of structures both by state and community, is legally-owned by the state. Also, the water laws directly favour the state government and people are mostly unaware of these laws. Groundwater is treated as private property and, therefore, used to maximize individual profits at the cost of over-exploitation of the resource to the extent that it has a negative environmental impact. In the case of forest resources ownership, however, the rights are clear and, therefore, better managed by the community, compared to water resources.

The community efforts in water resources are mostly in the form of harnessing of rainwater by

TBS objectives:

1. Sustainable management of natural resources through the Aravari Parliament
2. Control usage of water by treating it a scarce resource
3. Managing the soil fertility and checking land erosion by constructing anicuts, '*mairbandi*' and '*johads*'
4. Stopping illegal mining activity that was negatively affecting the land, water and vegetation
5. Generating self-employment and alternative livelihood options through better management of land, water and forest resources
6. Sensitizing and building awareness among women groups on water-related issues and seeking their active participation
7. Increasing agricultural productivity by growing water-saving crops with local seeds and manure.

Source: www.gravis.org.in

creation of different types of surface structures. Since community participation has been ensured right from the time of initial construction of the structures, people show interest in the Aravari Parliament.

Impact of the Aravari Parliament

There are direct and indirect effects of the Aravari Parliament that may broadly be categorized as physical, economic and social. The physical impact is mainly in terms of protection of water resources, increase in area under cultivation, improvement in the quality of land and forest resources and, most important of all, the physical community control over land, water and forest resources.

The economic impact is largely manifested in the change in livelihood pattern because of improved access to water resources in general and groundwater specifically. Increased water availability has led to several commercial activities such as production of tomato and other vegetables and increase in employment and trade activities. Because of increase in agricultural produce of both commercial and other nature, marketing activities have been stepped up and the river basin produce is exported to metropolitan cities. Besides, commercial activity has increased. This has also led to diversification in livelihood activities and the newer alternatives have employed a large number of people who need not migrate to urban centres for jobs.

The social impact is quite significant as the Aravari Parliament empowered people to fight for their claims over resources, question the state bureaucracy on its programmes and plans and argue for better implementation of programmes at the ground level. Further, it also helps in planning for the future use of natural resources.

Women have been particularly advantaged; they had no chance to express their views and opinion on any policy matters or activities in a village. Now they have a platform to represent their case and participate in all activities organized at the village or basin level. Significantly, the self-help groups formed by women are all active and doing well, compared to the many failed initiatives formed by men. Women SHGs have changed the status of women in the household activities and decision-making.

The author won the Ramon Magsaysay Award for community leadership in 2001 for his pioneering work in water management.

Challenges for the Parliament

There is, however, a continued lack of clarity regarding the ownership and responsibility for water harvesting structures and resulting water resources. The Aravari Parliament attempts to retrieve the ancient tradition of community responsibility towards common resources. It is, however, faced with a difficult legal and administrative environment, with its impractical and counterproductive provisions, which lets the so-called "owner" of a plot of land to do virtually anything with the soil and water. This includes, for example, emptying the entire aquifer or polluting the soil forever. Such actions are obstructionist in terms of any community-based management initiative of the common resources. One of these obstructions is the Irrigation and Drainage Act, 1954, which does not recognize the indigenous water management system.

In all these discussions the workers of TBS function as facilitators with the *gram sabhas*.

Tarun Jal Vidyapeeth

After having run a nine-month training for its volunteers for many years, Tarun Bharat Sangh has started a Professional School of Water, Tarun Jal Vidyapeeth, in 2005. The Vidyapeeth offers different courses specifically designed to fulfill the needs of young village boys and girls. The course design process itself involves the active participation of the students, to ensure a "need-based" course that would enable them to be fully committed to the indigenous knowledge system and empower them to take responsibility for the revival of the indigenous knowledge system of water management.

Hopefully, India's vast wealth of informal knowledge system will finally get recognition and the best professional knowledge that one can get. ●

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GREEN FINGERS

MARRYING SCIENCE AND TRADITION

Viswasrao Patil's 'Living' Land

Ajay Vir Jakhar

I had heard of a red-carpet welcome. I had never heard of a green-carpet reception. Yet, as I stepped into the Jalgaon farm of Viswasrao Anandrao Patil, my feet sank into a verdant, velvety surface. I am a farmer too; and a good one at that but nothing prepared me for the soft feel of sponge under my feet. I knew instantly that I was stepping on to 'quality' soil. Welcome to the world of Viswasrao ji's organic farming at Village: Lohara; Taluka: Pachora; District: Jalgaon. (Maharashtra).

Viswasrao Anandrao Patil has been a very distinguished member of the Bharat Krishak Samaj (BKS) and he was one of the first people I met as I went about rejuvenating our heritage farmers' organisation; farming knowledge as it were. Mr Patil was the epitome of wisdom and innovation; the rains in the region had been poor for a few years in a row but his 100 acres looked lush.

Water is a scarce commodity in this region and Mr Patil's farm is a dry one. He has 23 wells but being rain dependant many of them run dry. The master innovator that he is, Mr Patil has devised a system of connecting 10 wells with an underground pipe system, which helps him provide an ample supply of water to his farm.

His brother and he realized way back in 1973 that the land was fast losing productivity and the two had the scientific acumen to understand the essence of organic farming. They studied literature, talked to experts and learnt on the job. Over time they became experts and they have their prosperous farm as a testament to their commitment to conserving nature, earth, water and greenery.

Today the farm grows sesame over five acres; cotton over 10 acres; corn over 10 acres; javari over five acres; moong over five acres; bajra over six acres; sugar cane over 10 acres; custard apple over three acres, mango over three acres, sago over three acres and there are two acres left unused. Life has not been smooth sailing all the time. Mr Patil's mind goes back to the days when he had to uproot his orange trees because he could not control the disease with organic practices and there was just not enough water. Later he learnt to grow sugarcane with dryland practices even as he learnt to recharge his wells with stored water and how to use every bit of waste productively; as fertilizer.

So what does his brand of organic farming imply? "Well, instead of burning the residue of the previous crops, we started to bury it in the farm itself or cover our crop land with it. We stopped using chemical fertilizer and replaced it with bio fertilizers. We started rainwater harvesting and cross harvesting on the slopes of the farms. That enables us to save more water. To do so we built five check dams and started storing more water. Each drop of water is now stored in the land; to store more we planted trees such as bamboo, bhenda or neem on all four sides of the farm to prevent evaporation of the water stored in the land. The added boon was that birds starting sitting on our trees and started eating insects visiting our crops. This is the essence of our organic farming".

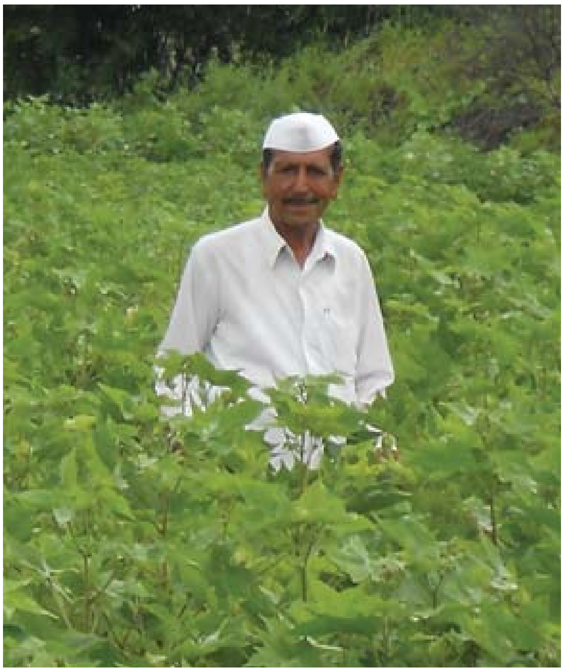
Cotton is Mr Patil's forte. He has sown 6301, super Maruti, Ajit 155 and Ankur 3028 this year because they are fully dry crops and consume minimal water. "Last year, the rains were good so I used Mallika and Brahma. This year there is no water and I was unable to use Brahma". It is experience that tells him what to choose and experience that tells him how to grow it. "My farm is dry; therefore I started using water-management by increasing the distance between the two lines. I used state-of-the-art seeds; a new breed, twin testing, cross sowing on the slopes and short spanned crops. Normally I do the dry sowing as well".

How does he manage for fertilizers for the cotton crop? "It depends on how you manage your crop. When it rains, I use wet cow dung (20 kgs), rotten besan (500 gms), rotten jaggery (250 gms), cow urine (as much as is available) and a kilogram of compound. After mixing it well, I spread it on an acre of land. Besan has urea, jaggery has phosphorus and cow urine is rich in nitrogen". The fertilizer must be applied when the land is wet. It need not be used more than twice of thrice, or even once or twice but it should be used on wet land.

There are lessons to be learnt on the pest management front too. "We have to deal with two types of pests; one is a friendly kind and the other is the harmful kind. The friendly one comprises 98 per cent of the pest population. It is to deal with the two per cent harmful pests that we use mixed farming. I use raai, corn, chowli, bhagar, javari, bajra, sesame and cotton. After every 25 to 30 feet, we sow cotton by the 4x2 system. This is because if the pests get

Viswasrao Patil uses ancient techniques even while using the most modern technology; he even grows BT cotton on his farm. Asked if there was any contradiction in being an organic farmer and also growing BT cotton, he said: "It is a matter of economics. BT cotton is giving better yields and works with organic practices. This combination helps me to increase profits and conserve the environment".

The knowledgeable are open to knowledge; the unwise have closed minds... The idea, says this super farmer, is to combine science with tradition. "That will give you more life; make your land alive and bountiful."



whatever they want on outskirts they will not enter in the main crop. Ultimately the main crop is saved. This is called as 10-floored crop system".

Why this 10-floored name? I ask. Mr Patil explains: "This is also called the multi-storeyed cropping system because with cotton as the main crop, the farmer can alternate with different crops every three years. Thus we can have 10 different crops sown in alternating rows to avoid pest attacks and to save the main crop".

Nothing goes to waste in his farm. Weeds are removed and stored and used as fertilizer when they get fermented. This is to be used between the two rows to prevent the rainwater from flowing away from the crop.

There is more innovation in sight. Mr Patil has used bamboo and neem trees on the borders. "Bamboo gives some extra income but also helps in saving water from flowing away from the farm. It helps retain water in the farms. Also, silica is derived from bamboo leaves. Neem leaves serve as very useful fertilizer too and also help the earth retain water; it saves more water in the earth. The returns are satisfying. "Dry land gives eight quintals and fertile land gives me 13 to 14 quintals per acre".

The knowledgeable are open to knowledge; the unwise have closed minds. Clearly, despite his achievements and experience, Viswasraoji and his brother are always soaking up information; putting it to test. I have always believed that farmers would have to combine age-tested practices of farming with new technology and Viswasraoji is the living embodiment.

He uses ancient techniques even while using the most modern technology; he even grows BT cotton on his farm. When I asked him if there was any contradiction in being an organic farmer and also growing BT cotton, he answered simply: "It is a matter of economics. BT cotton is giving better yields and works with organic practices. This combination helps me to increase profits and conserve the environment".

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Is any one listening? •


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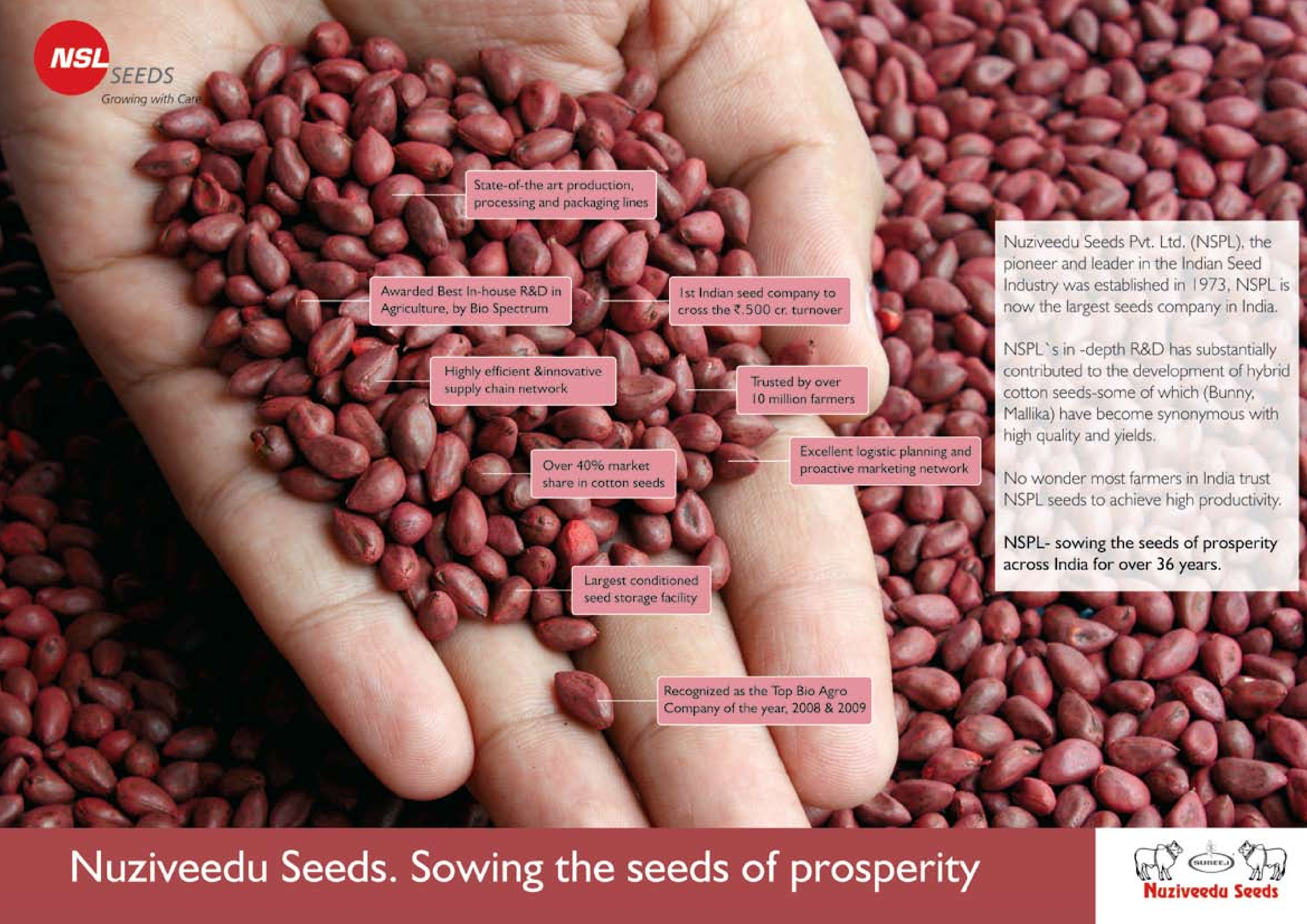
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