Ravi Chopra

Water and People: A National Perspective

Mitti Aur Pani Mein Sona Hai

People's Science Institute

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Introduction

रहिमन पानी राखिये, बिन पानी सब सून।
पानी गये न उबरे, मोती, मानस, चून।।

Save water, says Rahim, (for) without water there is nothing

If water goes, there will be no pearls, people or grain.

Rahim spoke simple truths. In our present-day information age even as we are swamped with information, simple truths elude us. But we ignore these simple truths at our own peril.

For almost a decade now, successive Indian governments have smugly expressed satisfaction at the nation being self-sufficient in foodgrain production. Though China has a much larger population, yet the Chinese per capita foodgrain consumption is forty per cent higher than the corresponding Indian figure; and the average Chinese meal is more varied and nutritious than the average Indian meal. The truth is that India's much vaunted foodgrains self-sufficiency is the result of a low normative figure, and our food exports are a result of the low purchasing power of the poor which leads to unsold stocks. In reality there is no real surplus production.

The media keeps harping about the "population pressure", but actually we are mismanaging the two most basic natural resources – land and water. We must bear in mind that India's water resources are large enough to sustain its expected climax population of 1,700 to 1,800 million people in the next century, provided we use these resources intelligently.[1]

India's Water Budget

India is one of the wettest countries in the world. On an average each year, about 120 cms. of rain (or snow) falls on every bit of India's landmass. The actual distribution of the rainfall, however, varies widely over space and time. These variations make regional and seasonal water shortages and floods an annual feature. When the prevailing political, social and economic disparities within the population are superimposed on the natural water distribution pattern, the result is an even more unjust and unfair access to water resources.

In addition to the 400 million hectare-metres (Mha-m) of rain and snow annually, we receive another 20 Mha-m from rivers flowing in from other countries. The distribution of this 420 Mha-m is shown in Fig 1. At present about 84 per cent of the water is used for irrigation purposes. Power generation, domestic and livestock consumption and industrial use compete for the remaining. Consequently, providing water for irrigation has been the main thrust of water resources management in independent India.

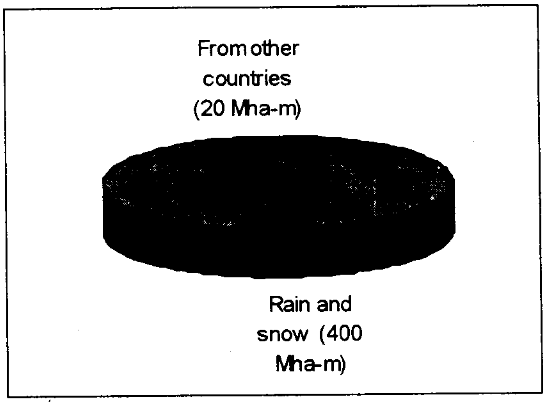
Water Use Planning In India

Official estimates of the maximum amount of water available for use, also called the ultimate utilizable potential, put the figure at about 105 Mha-m — just 25 per cent of the total.[2] But this figure is based only on the surface and groundwater resources. It totally ignores the largest component of India's water wealth — soil moisture. The neglect of soil moisture as a major productive resource betrays the myopia of our water technocracy.

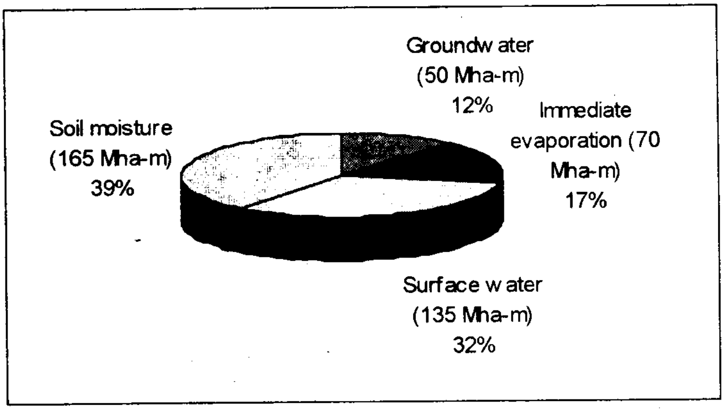
The technocracy's myopia is further revealed by its focus on the creation of large storage capacities, i.e., big dams and distribution through canals. A secondary focus has been the exploitation of groundwater with little thought to its recharge. In contrast, proper land and water management practices to maximize water use efficiency, land productivity, and to minimize social conflicts have been largely ignored. Thus, while over Rs. 50,000 crore were spent on major and medium irrigation projects between 1951 and 1995, only one-tenth of this amount was spent on forestry and soil and water conservation. The results of this blinkered approach have been disastrous: wasteful of water, environmentally destructive, socially disruptive and financially unremunerative.

Fig. 1: India's Water Budget

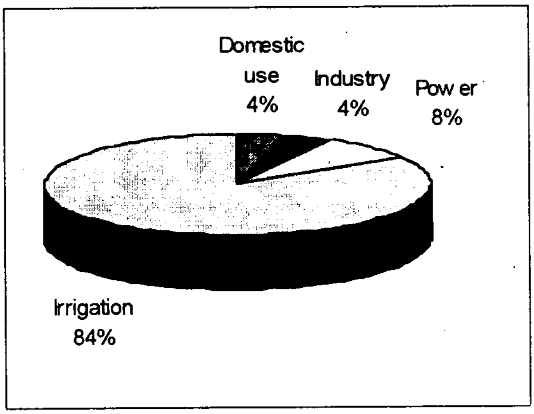
Where does the water come from?



Where does the water go?



Who consumes how much?



2

A Failed Strategy

The failures of water management in India have been extensively reviewed by several investigators.[3] The major shortcomings are outlined below:

◆ Children under the age of five years and women of reproductive ages form over 35 per cent of India's population. They are most vulnerable to communicable diseases, particularly water-borne illnesses, leading to a very high infant mortality rate (IMR) and low birth weights. Easily available safe drinking water is essential to reduce the high IMR and to increase birth weights. Yet, it was only in 1987 – 40 years after Independence – that the policy makers decided to adopt a mission approach towards the goal of providing safe and easily accessible drinking water to our entire population. The goal is still a distant dream.

◆ Despite the massive investments in dams and other irrigation works, both the drought-prone and flood-prone areas in India have both increased significantly between 1950 and 1990. Until 1960, 19 million hectares (Mha) were declared to be flood prone; by 1984, the figure had tripled to 59 Mha. The number of drought-prone districts also increased from 74 in the 1970s to 100 in the 1980s.[4] This happened even when there are no significant changes in the amount of annual rainfall.

◆ Though data for foodgrains productivity per unit of water are not available, India's output from irrigated lands is low compared to other nations (see Table 1). On an average, only 50 per cent of the water released at the canal headworks reaches the farmers' fields.[5] The rest is lost through evaporation and seepage. Where water is available, farmers tend to over irrigate their fields. One field study estimates that 60 per cent of rice cultivators apply

Table 1: Agricultural Productivities in Different Countries (t/ha)					
	Rice	All Cereals	Pulses	Groundnut	Sugarcane
World	**2.3**	**2.5**	**0.8**	**1.2**	**60.4**
Egypt	4.7	4.7	3.2	-	-
U.S.A.	2.3	3.7	1.7	2.8	80.6
Brazil	-	1.8	0.5	1.7	62.7
China	3.0	3.9	1.3	1.8	52.7
India	**2.0**	**1.7**	**0.5**	**1.1**	**60.7**

Source: Area & Production of Principal Crops in India 1988-89, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India, New Delhi, 1989.

excessive water.[6] Availability of water usually results in shifting the cropping patterns towards higher water consuming crops.

◆ Water logging and soil salinity are an inevitable result of canal irrigation in poor drainage areas. Between 1980 and 1989, the area thus affected increased from 13 Mha to 17.6 Mha.[7] The problem is especially grave in the black cotton soil areas. In stage I of the Rajasthan Canal, 34 per cent of the area has been affected by water logging and salinity while another 34 per cent of the gross command area in Stage II is vulnerable to water logging due to intensive irrigation.[8] The entire water-use plans of this scheme are now being reconsidered.

Thirty-two major projects under construction in the early 1980s showed cost overruns of 500 per cent or more. Inflationary costs accounted for only around 150 per cent. This is despite the fact that several social and environmental costs are never included.

◆ Though there is strong evidence that groundwater irrigation is more productive, it also correlates with over-exploitation of water, in the absence of water users' organizations or the necessary legal framework. In western U.P., for example, the 17 'dark' (highly-deficient) and 77 'grey' (nearly-deficient) blocks in 1990 increased to 77 and 184 respectively in 1996.[9] The over-exploitation is more critical in low rainfall areas where alternate sources of water are relatively limited.

◆ Big dams have become prohibitively expensive, forcing the country to go in for foreign loans, thus increasing its dependency on external assistance. The government's investment per hectare of canal irrigated land has been rising at an exponential rate. No project has been completed within the approved budget since Independence. Thirty-two major projects under construction in the early 1980s showed cost overruns of 500 per cent or more. Inflationary costs accounted for only around 150 per cent. This is despite the fact that several social and environmental costs are never included.[10]

◆ The burdens of big dams are borne largely by the rural poor. Estimates of the number of people displaced by these mega projects range from a few million to about 20 million and tribals make up a large fraction of the displaced population. According to a recent government report, out of nearly 1.7 million people displaced by 110 projects, over 0.8 million were tribals.[11] Other social conflicts generated by the emphasis on big dams and groundwater exploitation include urban rural conflicts, rich farmers versus poor farmers and regional imbalances.

A detailed analysis of India's population and water resources in the next century, done by the People's Science Institute (PSI) concludes that our present approach to irrigation will simply not be able to feed the country's climax population, of over 1,700 million people, in the next century.

◆ An increasingly large proportion of the available ground and surface waters are being withdrawn for non-irrigation purposes. Only a small fraction of it is consumed, the rest is returned back through drains, sewers and soakpits to the ground or streams and rivers. In the absence of a holistic approach to water management, the excessive non-irrigation withdrawals are heightening conflicts between rural and urban areas and between states. For example, while the conflict between Karnataka and Tamil Nadu over the Kaveri river is being argued in the Supreme Court, and fellow constituents of the United Front Government from Karnataka and Andhra Pradesh rail at each other over the Almatti dam, each summer Haryana issues dire threats to Delhi over the sharing of the Yamuna's water.

◆ The rapidly increasing effluent load on our rivers requires larger quantities of fresh water in them to dilute the pollution levels. But given the compartmentalised approach to water resources management in the country, keeping the rivers clean appears to be nobody's baby. The data given in Table 2 speaks for itself.

Fading Food Security

The most critical failure, however, is on the food front. The official rationale for large dams and canals derives from India's rapid population growth and the need to feed it adequately. But instabilities persist in Indian agriculture. The steep fall of over three per cent in the 1995-96 foodgrain production compared to that of 1994-95, despite normal monsoons, is a case in point.[12]

Table2: Water Quality Status of Some Major Rivers During 1992

RIVER	LOCATION	MAX. TOTAL COLIFORM (MPN/100ml)
Ganga	Narora	11,220,000
Ganga	Bithoor (u/s of Kanpur)	14,450,000,000,000
Beas	Gurdaspur	2,951
Satluj	Nangal, Punjab	363
Satluj	Ludhiana	316,200
Sabarmati	Dharoi dam	2,512,000,000
Sabarmati	Railway bridge	5,370,000,000,000
Mahi	Vasad	79,430,000
Tapi	Kathore	48,980,000
Narmada	Amarkantak	589
Narmada	Gurudeshwar	154,900,000
Godavari	Nasik	1,820
Kaveri	KRS dam	3,467,000
Kaveri	Pallippalayam	2,291,000,000
Subarnarekha	Jamshedpur (u/s)	489,800,000
Subarnarekha	Jamshedpur (d/s)	9,772,000,000

Note: The coliform count is a measure of biological water pollution. The acceptable standard for Indian river waters is 5,000 per 100 ml.

Source: Central Board for Prevention and Control of Water Pollution, Water Quality Statistics of India, 1992, New Delhi, March 1995.

Even more scary is a detailed analysis of India's population and water resources in the next century, done by the People's Science Institute (PSI). It concludes that our present approach to irrigation will simply not be able to feed the country's climax population, of over 1,700 million people, in the next century.(13)

What will be the foodgrains requirement of India's climax population? At our 1988-89 level of foodgrains availability, of about 204 kg per capita annually, we will require 347 million tons to feed 1,700 million persons. It is well known, however, that food consumption increases with economic development. The annual per capita foodgrains availability in China in 1989 was 279 kg. To match this level, we will have to produce 474 million tons of foodgrains for our ultimate population.

Official estimates, by the Central Water Commission, set India's ultimate irrigable area at about 113 Mha. It is then assumed that in the future, farm productivities will be much higher — four to five tons per hectare — because many other countries have already achieved such levels. The future foodgrains production potential is then said to be more than adequate. An additional component in such strategies is the interlinking of river basins. This will add an estimated 15 per cent to the net water resources available for irrigation.

The official strategy thus seems to be: more of the same. More water (through interbasin transfers), more high yielding variety seeds, more fertilizers and more pesticides. But how realistic are these estimates? These calculations have a fundamental flaw. They ignore the fact that increasing land productivity requires increasing application of water. Hence, it is water and not land that is the limiting factor for foodgrain production in India.

The analysis of foodgrain production potential carried out by PSI follows similar steps as the official one, except that it is based on more realistic numbers. All production data are taken from field performance studies and then linked with estimates of water requirements. It begins with an estimate based on current production patterns of area, productivities, water-use efficiencies, etc. It then considers two enhanced land productivity scenarios — moderately and highly enhanced land productivities. The water requirements for each of these land productivity scenarios are then calculated using present (low) as well as moderately and highly enhanced water use efficiencies.

Official calculations have a fundamental flaw. They ignore the fact that increasing land productivity requires increasing application of water. Hence, it is water and not land that is the limiting factor for foodgrain production in India.

The results of PSI's calculations show that the high land productivity scenario is unrealistic due to the inadequacy of water available for irrigation, even at high water-use efficiencies. The moderate land productivity scenario is feasible only if the irrigation water losses are lower than today, i.e., the net amount of water available for irrigation is greater than that available today.

The actual foodgrain production that can be achieved, within the constraints of available water, from non-interlinked and interlinked river basins are shown in Figs 2a and 2b. Fig 2b makes clear the attraction of the interlinked basins strategy for our irrigation planners. The major conclusions from PSI's analysis are highlighted below:

1) At current farm yield levels, we cannot expect to provide even the presently available amounts of food to India's climax population in the next century.
2) We need to attain at least moderate land productivity goals (equal to the best statewide productivities today) to provide the present levels of foodgrains to India's

Fig. 2: Food Production Potentials

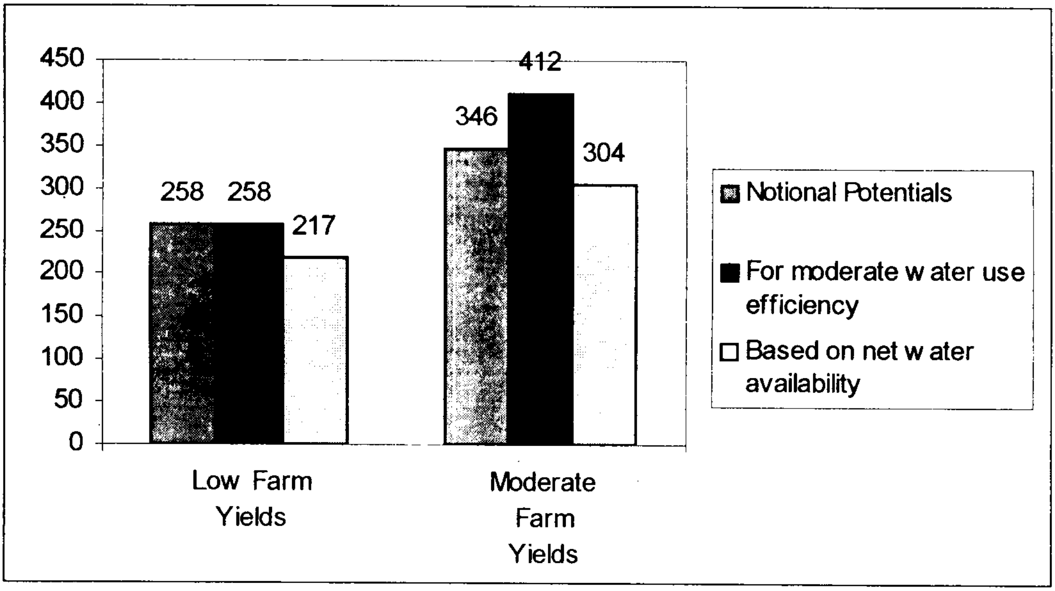


Fig 2a: From non-interlinked basins

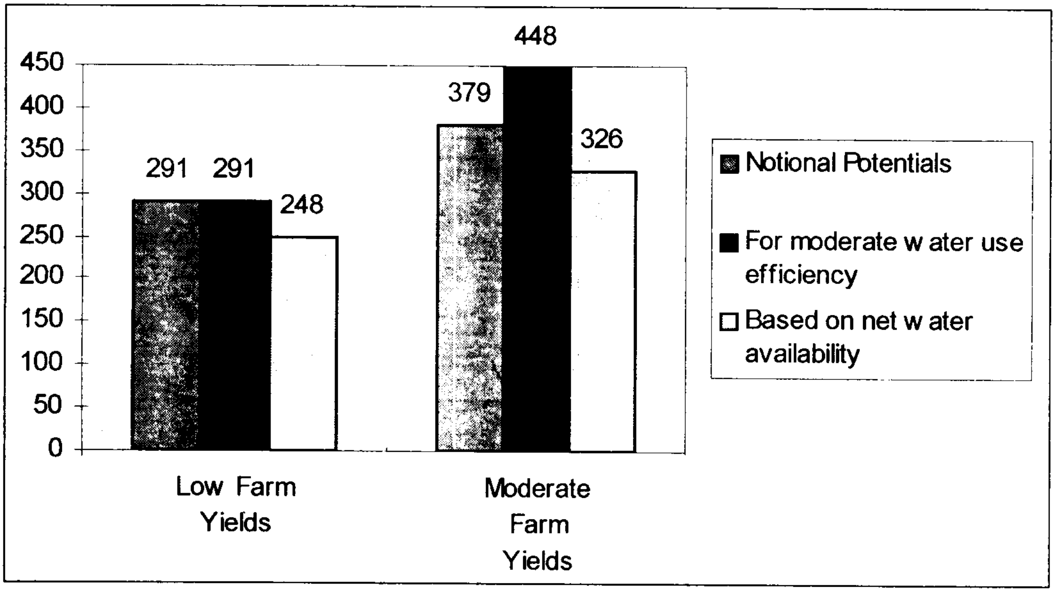


Fig 2b: From interlinked basins

climax population. This must be combined with moderate enhancements in water use efficiencies and lower conveyance losses in irrigation, or there will not be adequate carry-over stocks to tide over poor rainfall years.

3) None of the above scenarios enable us to reach the nutritional levels available to the Chinese population today.

4) Ultimately, the maximum output we obtain from our land is limited by the amount of water available for irrigation.

5) We have to pay more attention to rainfed areas. Significantly higher yields have to be obtained from rainfed areas to achieve the levels in Figs 2a and 2b.

6) The additional gains from river basin transfers are unlikely to be worth the cost.

7) Even the above levels of production may be difficult to reach due to the non-sustainable aspects of present irrigation practices. Thus, for example, (i) A quarter to half of all the irrigated areas may become permanently uncultivable due to soil salinity and water-logging, (ii) Several Mha-m of groundwater may be lost due to overexploitation of aquifers and (iii) Loss of soil fertility will result due to a shift away from fertility-building crops like moong beans and chickpeas.

If a quarter of our irrigated lands are permanently lost for cultivation, providing even today's per capita food availability to India's climax population will become impossible. Hence a radically different approach to water resources management becomes imperative.

3

Causes of Failure

There are several reasons for the failure of the official water management policies. The first lies in the nature of the development planning model that India has adopted after Independence. It emphasizes the maximization of certain benefits, usually for the well-to-do classes, at the expense of the environment — and hence the rural poor. Also environmental and social costs are usually ignored or undervalued in the cost-benefit estimates of big dam projects.

Another fundamental flaw is the engineering approach that is typically adopted towards water management, with its focus on big dams. Very little attention is paid to the use of soil moisture, where most of the rainwater is naturally trapped. To develop this resource the focus of planning has to shift to rainfed lands and to crop management as part of a rational water policy. Enhancing the productivities of these lands is essential for meeting India's food needs in the next century.

By concentrating on big dams, traditional irrigation systems have been badly neglected. The area irrigated by them has been reducing steadily. In several parts of the country where canal irrigation has not developed significantly, the overall irrigated area has fallen in the last few decades. These include some of the poorest regions in the country, like south Bihar (see Fig. 3) and the mountain districts of U.P.

Though big dams have received the lion's share of resources, it is their poor performance that is largely responsible for the lower than anticipated benefits from the irrigation sector. Some reasons for their poor performance are:

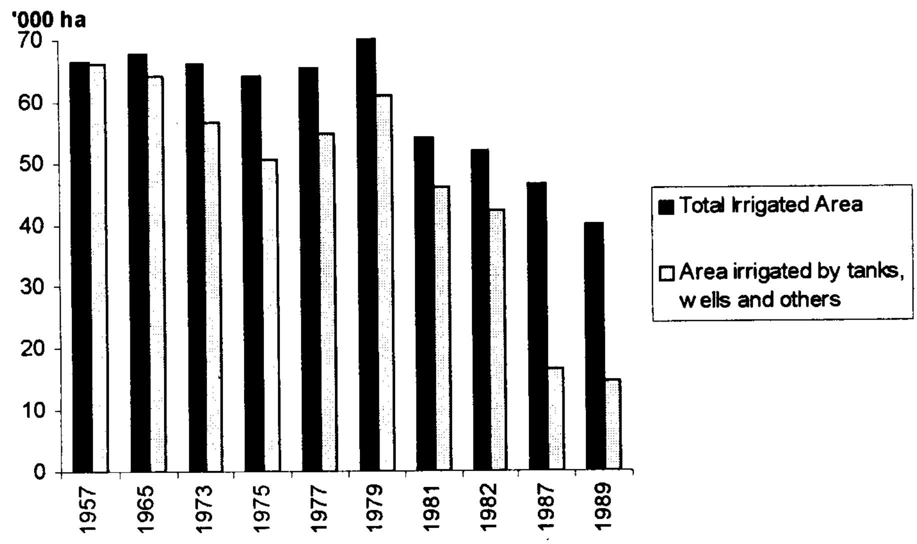


Fig 3: Comparison between total irrigated area and area irrigated by traditional irrigation systems in Palamau, Bihar

By concentrating on big dams, traditional irrigation systems have been badly neglected. The area irrigated by them has been reducing steadily. In several parts of the country where canal irrigation has not developed significantly, the overall irrigated area has fallen in the last few decades.

◆ The planning and design of dams is based on poor data. Basic design parameters, e.g., siltation rates, water flows, submergence areas, etc. are incorrectly determined. For example, the life span of a dam (and hence the cost-benefit ratio) depends on the siltation rate of the reservoir. Official studies have shown that the actual siltation rates of most of the large dams are significantly greater than the anticipated rates (see Table 3)

◆ The project design and execution emphasis are usually lopsided as they concentrate mainly on the construction of the dam and less on the water delivery systems. Even the main canals are poorly designed and aligned, especially in medium irrigation projects. Very little attention is given to seepage losses from the main canals, construction of distributaries and field channels and drainage. Water-logging afflicts several million hectares of irrigated lands. Incorrect location of big dams is an associated factor. Sometimes dams are located in seismic regions, posing the threat of reservoir-induced earthquakes —as it happened at Koyna and is now perceived in Tehri.

◆ The planning process which finally sanctions these dams is itself flawed. Alternatives to a proposed project are never considered to see if it is the best or the optimal choice. Projects are sometimes begun before clearance is given by the Ministry of Environment or the Planning Commission.

◆ The management of canal irrigation systems is highly centralized. The timing and allocation of irrigation water is under the control of Irrigation Department officials. To insure against delays in release of adequate amounts of water, farmers tend to flood their fields, leading to inefficient water use. This is particularly true in areas outside the north-

Table 3: Anticipated and Actual Rate of Siltation of Some Major Reservoirs

Name of Reservoir	Annual rate of siltation (ha-m/1,000 sq km)	
	Assumed	Observed
Bhakra	4.29	5.95
Tungabhadra	4.29	5.98
Matatila	1.33	4.33
Panchet	6.67	10.48
Maithon	9.05	12.39
Mayuraksh	3.75	16.48
Shivaji Sagar	6.67	15.24
Hirakud	2.52	6.6
Gandhi Sagar	3.61	9.64

Source: From PAC 1982-83: p. 103 as reported in reference no.11

western region (Punjab, Haryana and U.P.) where water users' organizations are relatively scarce.[14]

◆ The concentration of power in the hands of the Irrigation Department officials promotes corrupt practices. A powerful lobby of engineers, construction companies, politicians, bureaucrats and farmers in the command areas have often pushed for mega projects in their own self interest at the cost of powerless people and the environment.

4

People's Protests

Protests against ill-conceived water-related projects have taken place from time to time in the past. [15] For example, plans to embank the Kosi river in Bihar were periodically debated, objected to and rejected from the end of the nineteenth century till the 1950s. In a series of insightful essays, *Glimpses of Floods and Famines,* Sister Nivedita analysed the ill-effects of water misuse by the indigo planters. Her writings were the forerunners of the present-day critiques of the Green Revolution. Some of the early large water projects in independent India, like the Rihand dam and the dams on the Damodar river were also opposed. These protests, however, are not recorded in official project reports.

In the 1970s, a nationwide campaign was launched against the proposed Silent Valley dam in Kerala, focussing on its potentially negative environmental impact. The protest succeeded in 1983 when the dam was denied clearance. Since then, protests against major dams have intensified. As environmental awareness in the country has increased in the last decade, these protests have received wide publicity.

During the last decade, the agitations against the Narmada Valley projects and the Tehri dam have attracted international attention. The anti-Narmada campaign has protested the displacement of lakhs of tribals, the destruction of their ecosystems and raised doubts about the adequacy of the impounded waters to fulfill the promises made by the project authorities. Protestors against the Tehri dam have warned against its location in a seismic zone and the threat of reservoir-induced seismicity.

In the same period, there have been several other lesser known protests that have highlighted a variety of issues. Some illustrative examples are:

◆ Shri Chandi Prasad Bhatt and his co-workers in the Chipko Movement have successfully opposed the proposed Vishnuprayag hydel project in the Garhwal Himalayas. With the help of geological and other data, they questioned the official estimates of the Alakananda river's discharge rates, the stability of the hill slopes at Joshimath and the environmental impact of a proposed barrage in the famed Valley of Flowers.(16)

◆ In the Thar desert, the Bikaner-based URMUL Trust organized a Nahar Yatra in September 1991 to draw attention to the problems of water logging and soil salinity created by the Rajasthan Canal.(17) Peoples' demands for drinking water have forced the planners to reconsider the water-use plans in the lower stages of the canal.

◆ Independent investigations since 1984 into the annual floods and water logging in the Kosi basin area of North Bihar have shown that the natural drainage of the area has been ruined by the ill-conceived Kosi embankments scheme to control annual floods. In September 1992, the Kosi Yojana Mukti Manch organized a *padyatra* to mobilize public opinion in the region against plans to embank more rivers.(18)

◆ At the request of the Auranga Bandh Virodhi Sangharsh Samiti, in Palamau district of Bihar, PSI conducted field studies which showed that the siltation load in the Auranga river was almost ten times the value assumed in the official Detailed Project Report for the proposed Auranga dam.(19) Work on the project remains suspended as a result of local opposition.

People, assisted by social action groups, in various parts of India have thus begun to successfully challenge big water projects that are seen as symbols of an unsustainable development process. Technical data and analyses provided by public spirited scientists have enhanced the credibility of protesters at times and thereby helped sustain some of these struggles.

5

Alternative Approaches

A primary aim of natural resources management must be to use land and water for fulfilling the basic needs of the people, i.e., foodgrains, fuelwood, fodder, water and livelihoods in a sustainable and socially just manner. In addition, water resources must also be conserved to ensure the ecological health of our rivers, streams and other water bodies.

The major operational thrusts of various alternative approaches for rational land and water management are discussed below.

Developing rainfed lands on a watershed basis appears to be the most useful approach to enhancing their yields. A review shows that rainwater harvesting and good farm management practices can push the yields of rainfed lands to nearly those of irrigated ones.

1) **Priority For Drinking Water:** The volume of water utilized for domestic and livestock consumption is miniscule. Our continuing inability to fulfill this basic need in tens of thousands of villages is unpardonable. The problem is acute in the arid and semi-arid districts and in crestline villages in the Himalayas and the Western Ghats. Pollution of available resources is further reducing access to potable water. Hence pollution control must be an essential component of water management policies.

2) **Reducing Non-Irrigation Demands:** Significant savings can be effected in the industrial and power generation sectors by conservation, more efficient water utilization and recycling. These savings can augment the water available for irrigation by about 15 per cent. These measures will also reduce the pollution loads on our rivers and lakes.

3) **Promoting Rainfed Agriculture:** We have totally neglected to use the productive capacity of our most well distributed water resource, i.e., soil moisture. Nearly 165 Mha-m out of the annual rainfall of 400 Mha-m is locked up as soil moisture. Maximizing water use where it falls saves enormous amounts of energy and money. Future production increases must come from rainfed areas, where an estimated 80 per cent of the population below the poverty line live.

   Since many of the rainfed areas are in hilly tracts where canal irrigation and groundwater boring have limited possibilities, these areas have been neglected by our water-use planners. With the collapse of community-based resource management systems after Independence, these regions have suffered doubly.

   Developing rainfed lands on a watershed basis appears to be the most useful approach to enhancing their yields. A review of the results obtained by the Central Soil & Water Conservation Research & Training Institute's stations in different parts of the country shows that rainwater harvesting and good farm management practices can push the yields of rainfed lands to nearly those of irrigated ones.[20]

4) **Enhancing Irrigation Efficiencies:** Water use efficiencies on Indian farms range from 2,000 to 3,000 tons of water per ton of foodgrains produced. As mentioned earlier, it is estimated that 60 per cent of the farmers irrigating paddy fields apply excessive water. The pattern in wheat fields is also similar. Water saved by better irrigation efficiencies can be used to irrigate larger land areas or for ecological protection functions, e.g., flushing polluted rivers, flooding wetlands and conserving groundwater particularly in drought-prone areas.

Changing cropping patterns is thus the most effective way of extending water use and meeting the nation's future food and nutritional needs.

5) **Extending Water Use:** Water use can also be extended by growing low water consuming crops over larger areas. In the case of foodgrains, this would mean cultivating more coarse cereals in place of wheat and rice. Such a shift is also desirable from a nutritional point of view.[21]

PSI has calculated the ultimate foodgrain production capability, using an alternate cropping pattern with a higher component of coarse grains for better nutrition. The results show that:

1) The nutritional needs can be met at moderate farm yields and water efficiencies.
2) With higher farm yields and water-use efficiencies than at present we can provide

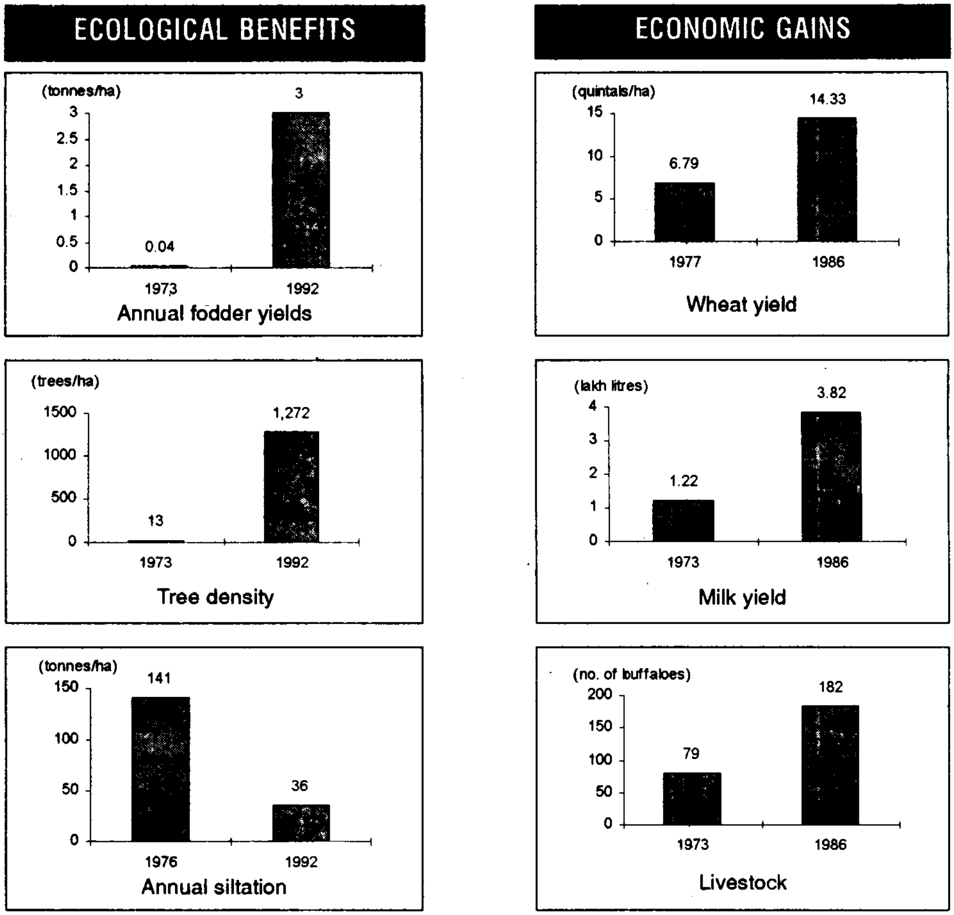


Fig 4: Benefits of Sukhomajri

Green Revolution Unsustainable: Fresh Evidence

Rice and wheat crops form the base of India's green revolution. But recent studies on the rice-wheat and rice-rice crop rotation systems in two major green revolution regions of India indicate that these systems are becoming unsustainable. "They have started showing signs of stagnation and deceleration," argues Prof S.K. Sinha, former Director of the Water Technology Centre at the Indian Agriculture Research Institute, New Delhi.

Referring to Punjab, Haryana and western Uttar Pradesh, Prof Sinha says that the sustainability of the rice-wheat systems "is a matter of concern for this region." He has also cited a recent report of the Andhra Pradesh Agricultural University which concludes that the rice productivity in that state is stagnating.

Excerpted from *The Economic Times*, New Delhi, Dec 30, 1996 more food and better nutrition.

3) The land and water required are within the net area and volume available respectively.

Changing cropping patterns is thus the most effective way of extending water use and meeting the nation's future food and nutritional needs.

Living Alternatives

Several innovative efforts, undertaken in different parts of the country, have shown that the above ideas are practical and desired by the people. Some of the well-known examples are:

◆ Anna Hazare has mobilized his fellow villagers in Ralegan Siddhi to collectively plan and demonstrate a highly productive and sustainable micro-watershed in a semi-arid area. The emphasis here is on (1) peoples' participation, (2) voluntary contribution by the prospective beneficiares, (3) equity, (4) sustainability through the cultivation of low water consuming crops only — in an area that is otherwise fixated on growing sugarcane. Ralegan Siddhi is a living example of Gandhiji's dream of self-reliant villages. It has become a *tirthsthan* for other villagers, administrators, policy makers and activists.

Table 4: Impact of Afforestation Activities by DGSM

Years	Forest Loss (ha)	Forest Gain (ha)
1972	3235	-
1973-82	824	666
1983-92	179	2258
TOTAL	**4238**	**2924**

◆ Vilasrao Salunkhe has experimented with the implementation of participatory management and equity in lift irrigation schemes in Pune district. A conceptual breakthrough by Salunkhe has been to delink the right (access) to water from land-ownership. In these Pani Panchayat villages, lift irrigation schemes entitle all the villagers to the same quantum of water, irrespective of their land-holdings.

◆ As a government research scientist, P.R. Mishra developed a model micro-watershed at Sukhomajri based on the principles of people's participation, equity and sustainability. The physical gains at Sukhomajri are shown in Fig 4.

◆ K.R. Datye and his colleagues at CASAD have developed analytical models to optimize the use of land and water resources, particularly soil moisture, in low rainfall areas for meeting the basic needs of the local populations. Implementation of these ideas is being attempted at Tandulwadi (Sangli district) and Khudawadi (Osmanabad district), with a primary focus on the involvement of women, landless and artisanal families. Lessons learnt about equity and community mobilization from the Pani Panchayat villages and Ralegan Siddhi are also sought to be replicated here.

◆ SEWA in Gujarat, is organizing women in the semi-arid Banaskantha district to develop and manage their scarce local water resources.

◆ Mahila Mandals mobilized by Dasholi Gram Sawarajya Mandal have undertaken afforestation works in the Alakananda river valley in Chamoli district for the past 20 years now. Satellite imagery data analyzed by scientists at the Physical Research Laboratory (Ahmedabad) show a major regenerative impact in the micro-watersheds studied (see Table 4).[23]

◆ PSI has operationalized a three-way partnership between the local administration, the people and voluntary organizations for successfully harvesting rainwater, as part of an effort to drought-proof Palamau district in Bihar. Again, based on peoples' participation in a micro-watershed development approach, this work demonstrates that water needs can be met in a cost-effective way quickly.[24]

◆ Tarun Bharat Sangh in Alwar district has assisted villagers to build hundreds of low-cost rainwater harvesting structures using their indigenous knowledge for siting and designing them.

A commonality of approach appears to be emerging from the above efforts. They are community-based with a strong reliance on peoples' knowledge and management. Productivity, sustainability and equity are also sought to be enhanced through systemic approaches.

◆ The Central Soil and Water Conservation Training and Research Institute, an ICAR-funded organization, has also demonstrated several successful technology packages for land and water management through its Operational Research Projects.[25]

A commonality of approach appears to be emerging from the above efforts. They are community-based with a strong reliance on peoples' knowledge and management. Productivity, sustainability and equity are also sought to be enhanced through systemic approaches.

After a comprehensive review of such efforts, in 1995 the Ministry of Rural Development, GOI, launched a new programme of integrated micro-watershed development based on the active participation of the local people. [26]

6

New Policy Framework Needed

From time to time, official documents, reports by administrators, scientists and NGOs have called for a thorough review of India's water resources management policies and the need to evolve an alternate approach. Proposals for alternatives have argued for incorporating the principles of participation, equity and sustainability in the development of water resources. Since these values do not fit in easily with the present model of development planning, there have also been demands for an overhaul of the country's planning process.

The logic of the current water management strategy derives from the present economic development model. This model proposes that the goal of economic development should be to maximize the wealth of a nation and that this can be done by maximizing the ratio of the monetary value of the national output to that of the inputs. It also assumes that somehow this wealth will trickle down to the last person; hence the common name "trickle down" model. Unfortunately, this strategy cannot feed India's future population.

The current approach to water resources management is biased in favour of centralized management. This explains the low priority accorded to utilization of a highly dispersed resource like soil moisture, in favour of large projects. Again, the logic flows from a highly centralized model of development planning and governance. But water is a dispersed natural resource and is meant to be used so. (It is not hard to see that our cultural diversities are a reflection of natural diversities many of which spring from the variations in water availability.)

The alternative approach of promoting the cultivation of low-water consuming crops, suggested above, is in conflict with the present economic development model. Coarse cereals fetch low prices. In economic terms, they are "inferior goods". Raising their market value becomes difficult because of possible consumer resistance. Hence there is a need for public education highlighting the values of a nutritious diet.

By extending irrigation facilities to more farmers, while reducing its intensity, and by emphasizing rainfed agriculture, the alternative cropping pattern promotes the concepts of sustainability and equity which do not fit in easily with our current economic development model. Hence an alternative economic development framework is needed. The principles of an alternative economic development model are outlined and contrasted with the present model in Table 5.

We stand today, in the 51st year of our Independence and at the edge of a new century. This is an opportune time to review the past and forge a new, more just and sustainable future.

Table 5: Conventional Development versus Alternate Development

Characteristic	**Conventional Development Strategy**	**Alternate Development Strategy**
Engine of Development	Industrialization	Meeting the Basic Needs of the Common People and Conflict Resolution
Central Thesis	Maximizing the monetary wealth of the nation	Development on a sustain able basis with social jus tice
Assumptions	Wealth of the nation will trickle down to the poorest	--
Decision-Making	Centralized, non-participatory	Decentralised, participatory
Resource Distribution	Transfer of resources from . poor to the rich, rural to urban areas	Resource sharing through .employment and distribu tion of means of production
Knowledge Systems	Downgrades traditional knowledge in favour of 'modernism'	Builds on traditional knowl edge
Relationship with nature	Antithetical, emphasizes mono-cultures	Harmonious, recognizes strength in diversity

7

Conclusion

India has ample water resources to meet the needs of its climax population in the next century. But the current approach to water resources management is unsustainable. It will not be able to produce the required amounts of foodgrains to feed India's population in the next century.

The value of the analyses presented here lies not so much in the exactness of the numerical results, but in the issues that they highlight.

A radically new approach to water resources management, based on a conservationist ethos, is urgently needed. We must recognize that water is a dispersed resource in nature. Hence the new approach must emphasize use of rainwater where it falls, and move away from the current obsession with large irrigation projects.

India is a water-harvesting civilization. We have more then 5,000 years' experience of storing and harnessing rainwater. The simple truths distilled from this enormous experience need to be relearnt and used. Nature has endowed us with ample rainfall, sunshine and fertile lands. We must manage this bounty wisely.

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A primary aim of natural resources management must be to use land and water for fulfilling the basic needs of the people, i.e., foodgrains, fuelwood, fodder, water and livelihood in a sustainable and socially just manner. In addition, water resources must also be conserved to ensure the ecological health of our rivers, streams and other water bodies. But our official water management policies have consistently done just the opposite. They have mined our water resources in an unsustainable manner for the benefit of the few and to the determent of the many.

This monograph by PSI analyzes where our official water management policies have failed and offers alternative solutions. It argues for a radically new approach not only for water management but also for the path of development that we are following.

People's Science Institute (PSI) is a non-profit public interest research and development organisation. Its aim is to provide technical support services to social action groups.

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