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DROUGHT? TRY CAPTURING THE RAIN

By Anil Agarwal

It is possible to banish drought completely — and in ten years maximum if the government puts its mind to it.

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DROUGHT?

TRY CAPTURING THE RAIN

By Anil Agarwal

It is possible to banish drought completely — and in ten years maximum if the government puts its mind to it.

Dear Members of Parliament and State Legislatures,

Several parts of the country are witnessing a serious drought. The result is acute drinking water shortages in Gujarat, Rajasthan, western Madhya Pradesh, Orissa and Andhra Pradesh. According to newspaper reports, several towns in Saurashtra are getting an extremely irregular supply of water (see **table 1: Drinking water availability in Gujarat towns in April 2000**). Most of the dams and reservoirs in the region have dried up. The government is trying to deal with the problem by providing water through tankers and by deepening existing borewells. The Central government has promised to run water trains. ***But is all this inevitable? That we have to do this every time the rainfall is less than normal?***

We don't think so and we wish to brief you on what can be done to solve this problem almost permanently unless, of course, there is a series of consecutive droughts for several years. The change we are advocating will come, we are afraid to say, only if our political leaders are prepared to promote a new approach to water management in this country.

During one of the meetings of the World Water Commission, which submitted its report in the Hague

in April 2000 to a bevy of water ministers, a member had strongly emphasized the need for educating politicians about the importance of water. I, however, found that argument incorrect because I have rarely met a politician, especially in India, who does not emphasize the importance of water. But what I have indeed found is that hardly any of them know how to solve the water problem.

Not surprisingly, few government initiatives have been able to deliver the goods as the current unprecedented drought has shown in such starkness. The portents of this so-called once-in-a-century drought had become clear as far back as September 1999 when national elections were being held and Shri L K Advani had to face slogans like '*Pehle Paani Phir Advani*' in Saurashtra. As far back as December, many villagers in north Gujarat had begun to leave home because of water shortage. Once the monsoon season was over, the government could not have done anything to solve the water problem except to provide some succour in terms of drought relief works, emergency water supply through tankers, and digging deeper borewells for some residual water in the bowels of the earth.

But this is not enough. Many will term what is happening in Gujarat and Rajasthan a 'natural disaster'. This is really far from the truth. It is

Table 1: Drinking water availability in Gujarat towns in April 2000

Place	Availability of drinking water
Rajkot (1)	30 minutes every alternate day
Jamnagar, Jasdan and Amreli (1)	20 minutes once in three days
Jodiya town, Jamnagar district (2)	20 minutes in 12 days
Dhrol town, Jamnagar district (2)	Half the population gets water once in eight days

Sources: 1) Janyala Sreenivas 2000, Forget the Sensex for a second, look what else is going down, *Indian Express*, New Delhi, April 19, p.1
 2) Janyala Sreenivas 2000, Once a fortnight, they get a few drops and that too for 20 minutes, *Indian Express*, New Delhi, April 21, p.1

truly a 'human-made' or rather a 'government-made' disaster. Over the last one hundred years or so, the world and India, too, have seen two major shifts in water management. One is that individuals and communities have steadily given over their role almost completely to the state even though more than 150 years ago no government anywhere in the world provided water. The second is that the simple technology of using rainwater has declined and in its place exploitation of rivers and groundwater through dams and tubewells has become the key source of water. As water in rivers and aquifers is only a small portion of the total rainwater, there is an inevitable and growing and, in many cases, unbearable stress on water from rivers and groundwater.

Dependence on the state has also meant that costs of water supply are high; with cost recovery being poor the financial sustainability of water schemes has run aground; and, repairs and maintenance is abysmal. With people having no interest in using water carefully, the sustainability of water resources has itself become a question mark — problems we see across the board today. As a result, there are serious problems with government drinking water supply schemes. Despite all the government efforts, the number of 'problem villages' does not seem to go down. As N C Saxena, former rural development secretary puts it, "In our mathematics, 200,000 problem villages minus 200,000 problem villages is still 200,000 problem villages" (see **graph 1: UNENDING EXERCISE: Record of government rural drinking water supply schemes**).

Given the fact that India is one of the most well-endowed nations in the world in terms of average annual rainfall, there is no reason why it

should suffer from drought. This year or any other year. The most important lesson that our decision-makers should learn from the current crisis is how to drought-proof the nation in the years to come — a task that can easily be accomplished in less than a decade if the country puts its mind to it.

The government has indeed invested heavily on water resources development. But these programmes have focussed mainly on:

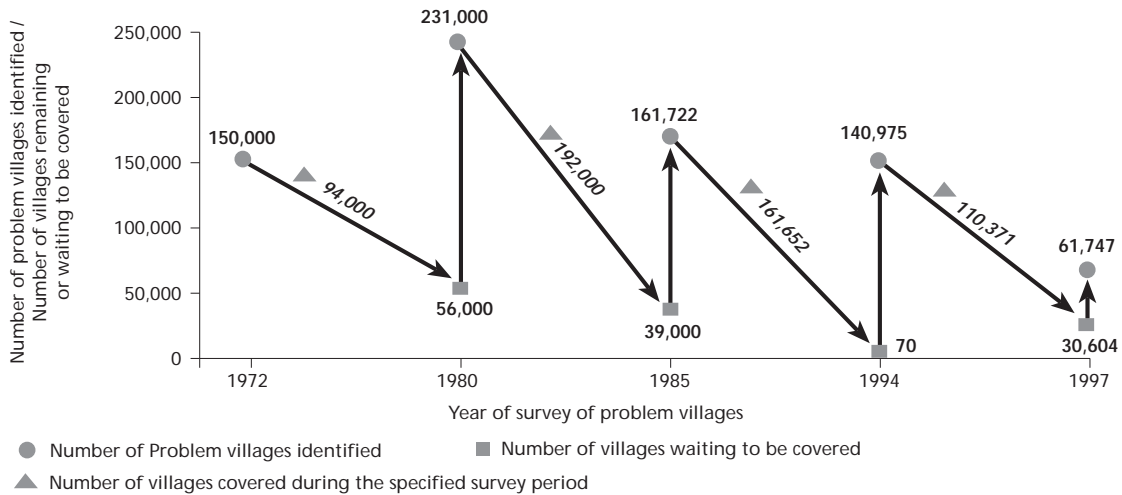
- (a) Large-scale irrigation development for increasing Green Revolution-style agricultural production; and,
- (b) Drinking water supply programmes.

Yet a large part of the country remains drought-prone. This is because no specific effort has been made to drought-proof rainfed areas which suffer from high rainfall variability from year to year and season to season. Moreover, the government has encouraged a massive intervention into the country's hydrological cycle but it has done precious little to sustain the integrity of the hydrological system. A fine example of the disintegration of the country's hydrological system is what we are doing to our groundwater. The country has been constantly encouraging exploitation of groundwater but has done little to recharge it. As a result, groundwater tables are falling all over the country. Considering the fact that over 90 per cent of rural Indians depend on groundwater to get their drinking water, the decline poses a serious problem which becomes an emergency in a year when the rains are low as in this year. The poor, of course, who depend on dug wells, which dry off first, as compared to tubewells or borewells, are the first to suffer.

Governments have paid little attention to efforts needed to drought-proof the country

Graph 1: UNENDING EXERCISE: Record of government rural drinking water supply schemes

The graph shows that even though a large number of villages are covered between two surveys the number of problem villages keeps growing. For instance, in 1980, there should not have been more than 56,000 problem villages, but there were 231,000. Obviously, the money pumped in and the methods used were unsustainable. As N C Saxena, former rural development secretary, puts it, "In our mathematics, 200,000 problem villages minus 200,000 problem villages is still 200,000 problem villages."



Year of Survey	Number of Problem Villages identified	Number of villages covered till the next survey	Number of villages not covered before the next survey
1972	150,000	94,000	56,000
1980	231,000	192,000	39,000
1985	161,722	161,652	70
1994	140,975	110,371	30,604
1997	61,747		

Source: N C Saxena, Ministry of Rural Development, Government of India

1. Communities and rain

Community-based rainwater harvesting — the paradigm of the past — has in it as much strength today as it ever did before. A survey conducted by the Centre for Science and Environment (CSE) of several villages facing drought in Gujarat and western Madhya Pradesh last December — Ghelhar Choti in Jhabua district, Thunthi-Kankasiya in Dahod district, Raj-Samadhiyala and Mandlikpur in Rajkot district, and Gandhigram in Kachchh district — found that all those villages which had undertaken rainwater harvesting and/or watershed development in earlier

years had no drinking water problem whatsoever and even had some water to irrigate their crops. On the other hand, neighbouring villages were desperate for water and planning to migrate when the real summer hit them. This survey revealed that rainwater harvesting can meet even the acid test of a bad drought.

In late March, we got further confirmation of our conviction. Going with president K R Narayanan in a helicopter to the Arvari watershed who was scheduled to give the *Down to Earth*-Joseph C John Award to village Bhaonta-Kolyala in late March, we could see nothing but barren fields all the way from Delhi to Alwar. This

Community-based rainwater harvesting has the potential to drought-proof the entire country

Traditionally, our ancestors have harvested water through *tankas*, *zings*, *ahars* and *johads*

area is suffering from a second consecutive drought-year. But suddenly we came across green and golden fields and realised that we had reached the oasis of the Arvari watershed where several villages have over the last 5-10 years built hundreds of rainwater harvesting structures. Nobody needed to emphasize the importance of rainwater harvesting any more. The president saw a more or less dead Arvari river, unable to withstand the burden of two years' drought, but wells were still full of water and, therefore, fields were rich and productive and villagers reasonably happy.

2. Getting priorities right: Potential of rainwater harvesting

What makes rainwater harvesting such a powerful technology? Just the simple richness of rainwater availability that few of us realise because of the speed with which water, the world's most fluid substance, disappears. Imagine you had a hectare of land in Barmer, one of India's driest places, and you received 100 mm of water in the year, common even for this area. That means that you received as much as one million litres of water — enough to meet drinking and cooking water needs of 182 people at a liberal 15 litres per day. Even if you are not able to capture all that water — this would depend on the nature of rainfall events and type of runoff surface, among other factors — you could still, even with rudimentary technology, capture at least half a million litres a year.

It is, in fact, only with this rudimentary technology that people came to inhabit the Thar desert and have made it the most densely populated desert in the world. And assuming you could capture the 2000 mm annual rainfall that is common in eastern India, you would need only 500 square metre of land (a 21 metre by 21 metre plot) to capture one million litres. It is also interesting to note that rural population density follows intensity of annual rainfall. Barmer, for instance, has less rainfall but few people and a lot of land available per person whereas 24-Parganas in West Bengal has much more rain but more people and less land available per person.

Even in the villages suffering from drought this year, it is not as if there was no rain. In many areas like Andhra Pradesh, Orissa and western Madhya Pradesh the rainfall levels, though lower than normal, were still more than 500 mm, which is an enormous amount of rainfall. The average annual rainfall in Saurashtra and Kachchh, the worst affected, is 578 mm. This year, according to newspaper reports, it was very depressed but still around a couple of hundred millimetres (mm). But the people of Saurashtra and Kachchh let the water go. ***It does not matter how much rain you get, if you don't capture it you can still be short of water. It is unbelievable but it is true that Cherrapunji which gets 11,000 mm annual rainfall, still suffers from serious drinking water shortages.***

In fact, we have consistently argued that there is no village in India that cannot meet its basic drinking and cooking needs through rainwater harvesting. Figures speak for themselves. India's average annual rainfall is 1170 mm. It varies from 100 mm in the deserts of Western India to 15,000 mm in the high rainfall hills of the Northeast. Nearly 12 per cent of the country receives an average rainfall of less than 610 mm per annum while 8 per cent receives more than 2500 mm. But more than 50 per cent of this rain falls in about 15 days and less than 100 hours out of a total of 8760 hours in a year. The total number of rainy days can range from a low of five days in a year in the desert regions of Gujarat and Rajasthan — though on some of these days there can be high-intensity rainstorms — to 150 days in the Northeast. Therefore, it is very important to capture this rainwater which just comes and goes in a few hours.¹

Recognising this fact that almost all the rain comes down in a few years, our ancestors had learnt to harvest water in a variety of ways:

- (a) They harvested the rain drop directly. From rooftops, they collected water and stored it in *tankas* built in their courtyards. From open community lands, they collected the rain and stored it in artificial wells called *kundis*.

Cherrapunji has water scarcity for nine months in a year despite having 11,000 mm of annual rainfall. This should be an eye opener. If you don't harvest the rain, there will never be enough water

India receives most of its rainfall in just 100 hours out of 8760 hours in a year. If this water is not captured or stored, there will be no water for the rest of the year

- (b) They harvested monsoon runoff by capturing water from swollen streams during the monsoon season and stored it in *zings* in Ladakh, *ahars* in Bihar, *johads* in Rajasthan and *eris* in Tamil Nadu, to name a few.
- (c) They harvested water from flooded rivers in places like north Bihar and West Bengal.

In 1991, India had 587,226 inhabited villages with a total population of 629 million giving us an average population of 1071 persons per village, up from 942 persons in 1981. Let us, therefore, assume that the average population of an Indian village today is about 1200. India's average annual rainfall is about 1170 mm. If even only half this water can be captured, though with technology inputs this can be greatly increased, an average Indian village needs 1.12 hectares of land to capture 6.57 million litres of water it will use in a year for cooking and drinking. If there is a drought and rainfall levels dip to half the normal, the land required would rise to a mere 2.24 hectares. The amount of land needed to meet the drinking water needs of an average village will vary from 0.10 hectares in Arunachal Pradesh (average population 236) where villages are small and rainfall high to 8.46 hectares in Delhi where villages are big (average population 4769) and rainfall is low. In Rajasthan, the land required will vary from 1.68-3.64 hectares in different meteorological regions and, in Gujarat, it will vary from 1.72-3.30 hectares (see **table 2: EVERY VILLAGE IN INDIA CAN MEET ITS OWN WATER NEEDS: Land area needed per village in different states of India to capture enough rainwater to meet drinking and cooking water needs**). And, of course, any more water the villagers catch can go for irrigation.

Does this sound like an impossible task? Is there any village that does not have this land availability? India's total land area is over 300 million hectares. Let us assume that India's 587,000 villages can harvest the runoff from 200 million hectares of land, excluding inaccessible forest areas, high mountains and other uninhabited terrains, that still gives every village on average access to 340 hectares or a rainfall

endowment of 3.75 billion litres of water. ***These calculations show the potential of rainwater harvesting is enormous and undeniable. There is just no reason whatsoever for thirst in India.***

Therefore, it is possible to drought proof the entire country. Not just drinking water, most of India's agricultural fields should also be able to get some irrigation water to grow less water-intensive crops every year through rainwater harvesting. ***The strategy for drought proofing would be to ensure that every village captures all the runoff resulting from the rain falling over its entire land and the associated government revenue and forest lands, especially during years when the rain was normal, and store it in tanks or ponds or use it to recharge the depleting groundwater. It would then have enough water in its tanks or in its wells to cultivate substantial lands with water-saving crops like millets and maize.***

Even with a national water grid or all the proposed dams like those on the Narmada being built, there just isn't going to be enough river water to provide irrigation to every single village of India. A substantial part of India's agricultural lands will remain rainfed. This is confirmed by official statistics. The National Commission for Integrated Water Resources Development Plan has estimated that the ultimate irrigation potential is as much as 140 million hectares. Some 75.9 million hectares will be irrigated by surface water schemes — of which 58.47 million hectares will be irrigated by major and medium projects and 17.38 million hectares will have to be irrigated by minor irrigation schemes like tanks² — while 64.1 million hectares will be irrigated by groundwater.³ But all this is still a dream. As of 1992-93, 119.3 million hectares were rainfed, of which 78.43 million hectares were under foodgrains.⁴

But there is enough rain which with a good combination of rainwater harvesting and groundwater recharge, can increase and stabilise the productivity of this rainfed land. These lands

Only 100 mm rainfall falling on a 1 hectare plot can yield upto 1 million litres of water

Table 2: EVERY VILLAGE IN INDIA CAN MEET ITS OWN WATER NEEDS: Land area needed per village in different states of India to capture enough rainwater to meet drinking and cooking water needs (in hectares)

State	Meteorological divisions	Average annual rainfall (millimetres)	Estimated no. of villagers per village, 2001	Land area needed per village to meet drinking and cooking water needs assuming half of normal rainfall is captured (hectares)	Land area needed per village to meet drinking and cooking water needs assuming severe drought conditions, that is, 50 per cent decline in normal rainfall (hectares)
INDIA	-	1,170	1220	1.14	2.28
Andaman and Nicobar Islands	Andaman and Nicobar Islands	2,967	408	0.16	0.32
Arunachal Pradesh	Arunachal Pradesh	2782	236	0.10	0.20
Assam	Assam and Meghalaya	2818	807*	0.32	0.64
Meghalaya	Assam and Meghalaya	2818	311	0.12	0.24
Nagaland	Nagaland, Manipur, Mizoram and Tripura	1881	1153	0.68	1.36
Manipur	Nagaland, Manipur, Mizoram and Tripura	1881	726	0.42	0.84
Mizoram	Nagaland, Manipur, Mizoram and Tripura	1881	549	0.32	0.64
Tripura	Nagaland, Manipur, Mizoram and Tripura	1881	3496	2.04	4.08
West Bengal	1. Sub-Himalayan West Bengal and Sikkim 2. Gangetic West Bengal	2739 1439	1602	1.1.0-1.22*	2.20-2.44*
Sikkim	1. Sub-Himalayan West Bengal and Sikkim	2739	1132	0.46	0.92
Orissa	Orissa	1489	683	1.10	2.20
Bihar	1. Bihar Plateau 2. Bihar Plains	1326 1186	1367	1.12-1.26*	2.24-2.52*
Uttar Pradesh	1. Uttar Pradesh 2. Plain of West Uttar Pradesh 3. Hills of West Uttar Pradesh	1025 896 1667	1026	0.68-1.26*	1.36-2.52*
Haryana	Haryana, Chandigarh and Delhi	617	2,258	4.00	8.00
Delhi	Haryana, Chandigarh and Delhi	617	4769*	8.46	16.92
Chandigarh	Haryana, Chandigarh and Delhi	617	2647*	4.70	9.40

Continued

Continue

State	Meteorological divisions	Average annual rainfall (millimetres)	Estimated no. of villagers per village, 2001	Land area needed per village to meet drinking and cooking water needs assuming half of normal rainfall is captured (hectares)	Land area needed per village to meet drinking and cooking water needs assuming severe drought conditions, that is, 50 per cent decline in normal rainfall (hectares)
Punjab	Punjab	649	1345	2.26	4.52
Himachal Pradesh	Himachal Pradesh	1251	328	0.28	0.56
Jammu and Kashmir	Jammu and Kashmir	1011	1140	1.24	2.48
Rajasthan	1. West Rajasthan 2. East Rajasthan	313 675	1039	1.68-3.64*	3.36-7.28*
Madhya Pradesh	1. Madhya Pradesh 2. East Madhya Pradesh	1017 1338	867	0.70-0.94*	1.40-1.88*
Gujarat	1. Gujarat region 2. Saurashtra and Kachchh	1107 578	1741	1.72-3.30*	3.44-6.60*
Goa	Konkan and Goa	3005	1816*	0.66	1.32
Maharashtra	1. Konkan and Goa 2. Madhya Maharashtra 3. Marathwada 4. Vidarbha	3005 901 882 1034	1389	0.50-1.72*	1.00-3.44*
Andhra Pradesh	1. Coastal Andhra Pradesh 2. Telengana 3. Rayalaseema	1094 961 680	2231	2.34-3.60*	4.68-7.20*
Tamil Nadu	Tamil Nadu and Pondicherry	998	2627	2.88	5.76
Pondicherry	Tamil Nadu and Pondicherry	998	1106*	1.32	2.64
Karnataka	1. Coastal Karnataka 2. North Interior Karnataka 3. South Interior Karnataka	3456 731 1126	1343	0.42-2.02*	0.84-4.04*
Kerala	Kerala	3055	14,083	5.04	10.08
Lakshadweep	Lakshadweep	1515	3,228	2.34	4.68

Notes: *Calculation based on the assumption that average village population in different meteorological sub-divisions is the same as that of the state.

Source: India Meteorological Department for normal rainfall data and projections of average population in 2000 based on Census of India data for 1981 and 1991.

Several village communities have shown their commitment, potential and perseverance in drought-proofing their own villages even during the present crisis

today support some of the poorest people in the country. And if we don't do this, people living in rainfed areas will not prosper.

3. Drought-proofing vs large-scale irrigation

But for this to happen, our planners and politicians will have to stop confusing irrigation for drought-proofing with large-scale irrigation for Green Revolution-style agricultural development. Otherwise, the country will get its priorities wrong and tens of millions of poor people will continue to suffer the horrors of drought. Depending on the availability of money and resolution of problems like rehabilitation, both can be attempted but the priority must go to drought-proofing measures which require little money in comparison and will bring results very quickly, within 5-10 years.

Drought-proofing and large scale irrigation development are not a substitute of each other. What one can do, the other cannot. Firstly, because even after all the proposed dams are built to promote large-scale irrigation development and interlinking of rivers takes place not every piece of the country's cultivated land will see the benefit of canal irrigation. These lands will have to depend either on groundwater or local water harvesting. These two will also have to go together because heavy use of groundwater can only be sustained if there are local efforts to keep recharging the groundwater. Therefore, large-scale irrigation development is no substitute for drought-proofing based on local water harvesting systems and sustainable use of groundwater.

The second argument against large-scale irrigation development follows from the first. Big dams can only help to create pockets of Green Revolutions-style agricultural production (with water-intensive crops) but they cannot drought proof the whole country. As a result they can at best create 'national' food security as they have done upto now — which means that few districts of country generate a huge agricultural surplus which is then used to feed the

ones which are doing agriculturally poorly, especially during drought years.

But they cannot create 'local' food security — which means that all areas of the country have water management strategies to ensure that local food production is as productive as possible and stable even during water-short years. Local food security is as important as national food security. Which Bhil or Oraon *adivasi*, for instance, wants to depend only on grains from Punjab? All of them would like to grow enough grain at least to feed themselves. Water harvesting and groundwater together can definitely drought-proof the country and create local food security which big dams cannot. Then India's poor people and poor lands will not have to suffer the ignominy of the kind they had to suffer this year. But the government has to realise that Indians cannot survive on a single-track water management policy.

In addition, it is important to realise that India's future food security even from its so-called Green Revolution areas will depend heavily on a nationwide groundwater recharge programme, which can only be taken by individual communities through rainwater harvesting. If this is not done, agriculture will suffer even in current irrigated areas because of the increasing overexploitation of groundwater and lowering of groundwater tables across the country. With more than 17 million tubewells and borewells energised by diesel and electricity, groundwater is now used to irrigate more than half of the country's irrigated area. And as areas irrigated by groundwater show higher productivity than those irrigated by canals, the contribution of groundwater to India's total agricultural output from irrigated areas is much more than that of canals. During drought years, when rivers dry up, groundwater becomes the main source of water both for drinking and irrigation.⁵ ***Indian agriculture and rural life is today heavily dependent on groundwater. Further lowering of groundwater tables can seriously threaten India's hard-earned food security at a time when India will need to produce more food to feed its growing population.***

The solution lies in harvesting rainwater through capturing, storing and recharging it and later using it during prolonged parched periods

4. Small means even more water

Let us look at the relevance of village-based rainwater harvesting from yet another point of view. The key component of water management is 'storage' especially in a country like India where the monsoon gives us on average about one hundred hours of rain and then nothing for the remaining 8,660 hours in a year.

This water can be captured in:

- large reservoirs with large catchments by building large dams,
- in small tanks and ponds with small catchments, or
- by storing it in a way that it percolates down into the ground and gets stored as groundwater.

In fact, there is strong scientific evidence to show that village-scale rainwater harvesting will yield much more water than big or medium dams, making the latter an extremely cost-ineffective and unscientific way of providing key water needs especially in dry areas. Some very instructive lessons can be learnt from the work of Israeli scientist Michael Evenari who has produced the best corpus of knowledge on this subject from the bone-dry Negev desert where the average annual rainfall is a mere 105 mm.

Evenari was intrigued by the fact that the ancient Israeli civilisation had built towns right in the middle of the Negev desert with their own agriculture and

water supply systems — much like the towns of Jodhpur and Jaisalmer that the enterprising *Marwaris* developed in the Thar desert. Both the Israelis and the Marwaris used the rain they received with great ingenuity to meet their food and water needs. In his effort to reconstruct the ancient farms of the Negev, Evenari came up with a very surprising finding: Water harvested from small watersheds per hectare of watershed area was much more in quantity than that collected over large watersheds. On hindsight this makes eminent sense because water collected over larger watersheds will have to run over a larger area before it is collected and a large part will get lost in small puddles and depressions, as soil moisture and through evaporation.

This loss of water can be stunningly high. While a 1 ha watershed in the Negev yielded as much as 95 cubic metres of water per hectare per year, a 345 ha watershed yielded only 24 cum/ha/year. In other words, as much as 75 per cent of the water that could be collected was lost. The loss was even higher during a drought year. After years of research, Evenari summed his findings as follows: "...**during drought years** with less than 50 mm of rainfall (normal rainfall in the Negev desert is about 105 mm) **watersheds larger than 50 ha will not produce any appreciable water yield** while small natural watersheds will yield 20-40 cubic metres per hectare and microcatchments (smaller than 0.1 hectare) as much as 80-100 cubic metres per hectare" (see **table 3: THE SURPRISING**

Table 3: THE SURPRISING EFFECT OF SIZE: The effect of the size of catchments on the quantity of water harvested as found in the Negev desert (in case of catchments with a 10 per cent slope and a 105 mm rainfall year)

A number of factors determine how much rain falling over a watershed will turn into runoff which can be collected by villagers for their drinking and irrigation needs. This table shows that all other factors like slope remaining the same, the larger the size of the catchment, the less runoff (water) can be collected from it. This is because in large catchments water has to run over larger distances before it gets collected and during that period, a lot of the water is lost in puddles and small depressions, in evaporation or through infiltration into the soil. Therefore, small catchments give the maximum water. And the difference can be quite high. As the table shows, 3000 microcatchments of 0.1 hectare each will give five times more water together than one catchment of 300 hectares even though the total land area from which the rain is harvested remains the same. In simpler words, in drought-prone areas, 10 dams with a one hectare catchment each will give substantially more water than one large dam with a 10 hectare catchment.

S.No.	Size of catchment (hectares)	Quantity of water harvested (cubic metres / hectare)	Percentage of annual rainfall collected
1	Microcatchment (a)	160 cubic metres/hectare	15.21%
2	20 hectares	100 cubic metres/hectare	9.52%
3	300 hectares	50 cubic metres/hectare	3.33%

Notes: (a) A microcatchment is a very small catchment of size upto 1000 square metres or 0.1 hectare.

Source: Michael Evenari *et al* 1971, *The Negev: The Challenge of a Desert*, Oxford University Press, UK.

An average Indian village requires just 1.14 hectares of land to meet its drinking water needs

Table 4: EVEN GREATER EFFECT DURING DROUGHT: The effect of the size of catchments on the quantity of water harvested as found in the Negev desert during drought years with less than 50 millimetres rainfall

The table below shows clearly that in a desert very little water can be collected from large catchments in a drought year.

S. No.	Size of catchment (hectares)	Quantity of water harvested (cubic metres/hectare)	Percentage of annual rainfall collected
1	Microcatchment (a)	80-100 cubic metres/hectare	16-20%
2	Small natural watersheds	20-40 cubic metres/hectare	4-8%
3	Larger than 50 hectares	No appreciable water yield	0%

Notes: (a) A microcatchment is a very small catchment of size upto 1000 square metres or 0.1 hectare.
Source: Michael Evenari et al 1971, *The Negev: The Challenge of a Desert*, Oxford University Press, UK.

EFFECT OF SIZE: The effect of the size of catchments on the quantity of water harvested as found in the Negev desert in case of catchments with a 10 per cent slope and a 105 mm rainfall year, and table 4: EVEN GREATER EFFECT DURING DROUGHT: The effect of the size of catchments on the quantity of water harvested found in the Negev desert during drought years with less than 50 millimetres of rainfall).

These were critical findings because the amount of rainwater one can collect depends on the amount of land from which the runoff can be harvested. But Evenari was finding that even if you have the same amount of land you will collect more water if you break up the land into many small catchments than if you collect water from it as one catchment. Several studies conducted in India by the Central Soil and Water Conservation Research and Training Institute in Dehradun also show a clear relationship between size of catchment and amount of runoff that can be captured. One study shows that just increasing the size of the catchment from 1 ha to about 2 ha reduces the water collected per hectare by as much as 20 per cent (see graph 2: EFFECTS OF SIZE ON QUANTITY OF WATER HARVESTED: Studies from India). Several other studies conducted by the Central Soil and Water Conservation Research Institute in Agra, Bellary and Kota and another study conducted in the high rainfall region of Shillong, have all found that

smaller watersheds give higher amounts of water per hectare of catchment area.⁶ *In simple words, all this means that in a drought-prone area where water is scarce, 10 tiny dams with a catchment of 1 ha each will collect much more water than one larger dam with a catchment of 10 ha (see diagram 1: SMALLER CATCHMENTS GIVE MUCH MORE WATER: One dam with a catchment of 10 hectares will collect much less water than 10 dams with one hectare catchment each).*

It should not be surprising that the large number of medium-size dams that have been constructed in Saurashtra stored very little water in this drought year and started going dry by December 1999. But then the answer to drought-proofing of the area lies not in mega-water harvesting projects with medium and large dams. It lies in small water harvesting structures which are constructed at the farm and village-level.

To demonstrate his findings, Evenari even developed an orchard in the middle of the bone-dry Negev desert by creating a separate microcatchment — a plot of land ranging from 15.6 sq m to 1000 sq m — for each tree to maximise the quantity of harvested water. *Therefore, look at it any way, community-based, small-scale rainwater harvesting is not just capable of providing more than drinking water needs even in the worst of drought situations but is also the most efficient way to collect water.*

Small is ecologically efficient as 10 dams with 1 hectare catchment will store more water than 1 dam of 10 hectare

5. Ministers are now talking of rainwater harvesting

In the last few weeks, since the media storm on drought hit our politicians, several of them, including the prime minister and the ministers for rural development, urban development and water resources, have made statements regarding the importance of a community-based rainwater harvesting strategy to drought-proof the country.

The first statement came from the rural development minister, Sunderlal Patwa, that the government hopes to gradually replace a government-oriented programme by a people-oriented, decentralised and demand-driven rural water supply programme, the budget for the programme is being increased by 8 per cent, from Rs. 1800 crore last year to Rs. 1960 crore in 2000-01, and a fifth of this budget will be given to state governments which undertake community-based programmes so that villagers have a decisive role. A part of the total capital cost and operation and maintenance cost will be borne by the users. Some 58 districts have been identified to try out this scheme.⁷ Meanwhile, a steering committee has also been set up to study the recharge of drinking water sources.⁸

The second statement came from the prime minister who told the parliament that only six per cent of the country's rain is being conserved and that

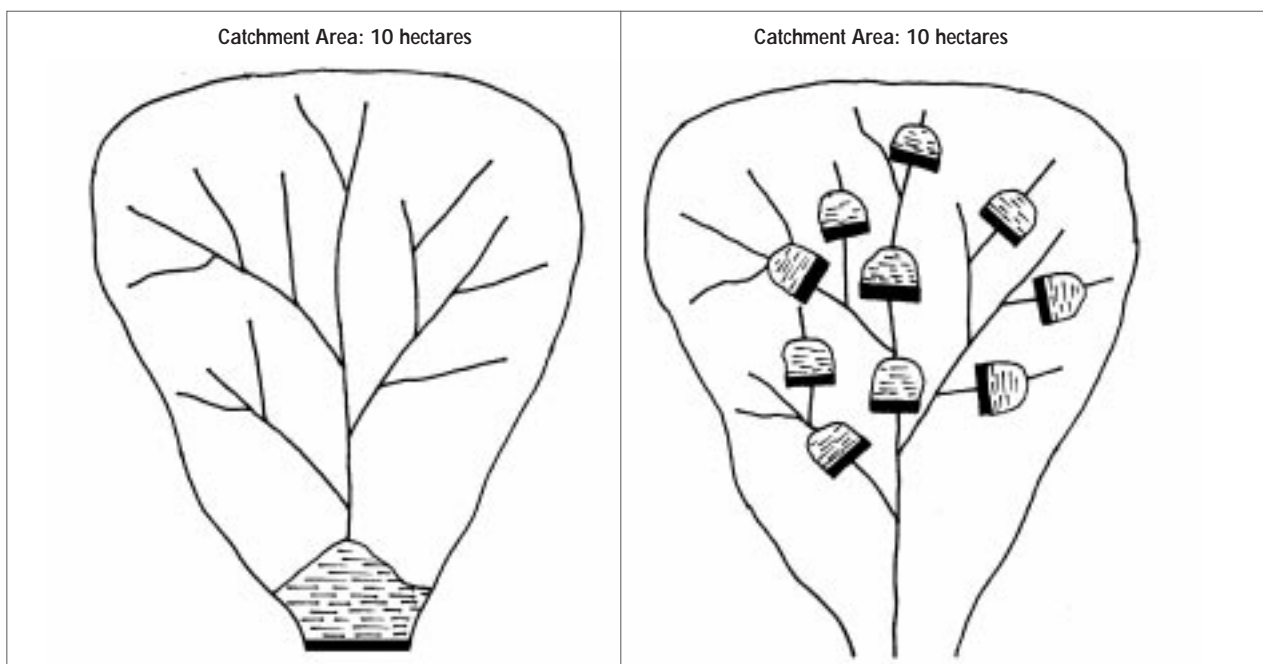
greater emphasis will henceforth be placed on water harvesting.⁹

The third statement has come from Jagmohan, minister for urban development, who has suggested that water harvesting should be made compulsory under the urban building bye-laws of the country.¹⁰

The fourth statement has come from the minister of water resources, C P Thakur, who in an interview in late April had merely talked about water harvesting in a few buildings in Delhi like the Shram Shakti Bhawan and the Indira Gandhi National Open University and some nine buildings in Jaipur as his key initiatives in this area, but by early April he was announcing a whopping Rs. 550 crore plan to recharge groundwater by constructing about 10,000 water harvesting structures in water-scarcity regions with these funds going directly to village beneficiary groups and water users associations.^{11,12}

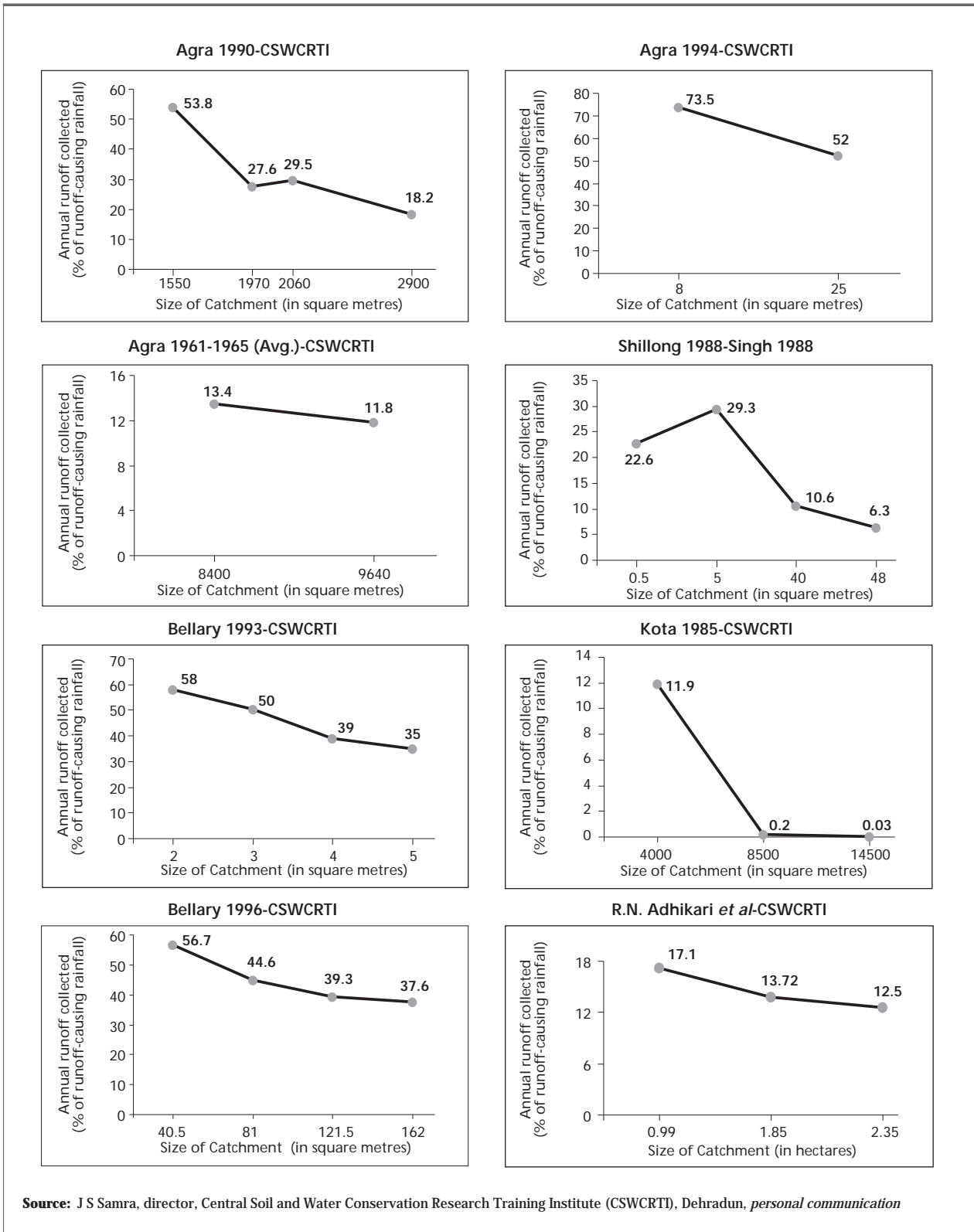
There have been developments in the states, too. Andhra Pradesh's chief minister, N Chandrababu Naidu, has announced and already held the first meeting of a Water Conservation Mission to revamp its existing watershed development programme.^{13,14} The chief minister told the *Indian Express* in an interview, "Till now, we have dumped crores of rupees into the watershed programme. But the results are very disappointing. Unless farmers are involved, the

Diagram 1: SMALLER CATCHMENTS GIVE MUCH MORE WATER: One dam with a catchment of 10 hectares will collect much less water than 10 dams with one hectare catchment each



Graph 2: EFFECT OF SIZE ON QUANTITY OF WATER HARVESTED: Studies from India

Several studies carried out in India show the same results that were found in the Negev desert: Larger catchments resulted in a smaller percentage of the annual rainfall falling on the catchment which resulted in runoff being captured.



situation cannot be reversed.¹⁵ The Andhra Pradesh government plans to spend Rs. 400 crore through the new mission and bring 10 million hectares of land under good watershed management. In the areas chosen, villagers will be given Rs. 20 lakh to develop a 500-hectare watershed.¹⁶

In the urban context, the Delhi government has expressed interest in water harvesting. Given the fact that groundwater levels have declined by 4-10 metres in several parts of the Capital over the last decade, the Delhi government is contemplating a law to make it mandatory for all new group housing societies to harvest that rain falling within their complexes.^{17,18} Meanwhile, the New Delhi Municipal Corporation has sanctioned a special water harvesting project which consists of water ponds being constructed in four major parks: Talkatora Garden, Nehru Park, Lodi Garden and Kushak Nullah.¹⁹

In Gujarat, irrigation minister Nitin Patel said in late April that the government is planning to construct 10,000 check dams across the state under its Sardar Patel Sahbhagi Jal Sanchay Yojana. Villagers will have to provide 40 per cent of the cost of the check dam. The government has received over 16,000 applications of which 8,563 have been approved and, to begin the exercise, the government has sanctioned Rs. 100 crore for the construction of 2,000 check dams.²⁰ This is a remarkable change as compared to the past. Between 1991 and 1999-2000, various departments of the Gujarat government only built a total of 1,341 check dams.²¹

In Madhya Pradesh, a workshop held in Neemuch district in late April emphasized the importance of water conservation through water harvesting and the district collector promised to promote rooftop water harvesting in the town and draw up a plan for restoring and developing ponds in each *gram panchayat*.²²

If all the commitments made by the Central Minister and the State government of Gujarat and Andhra Pradesh, come true, a sum of Rs. 1500-2000 crore has been committed for rainwater harvesting. This is indeed heartening. Equally heartening are reports of people promoting rainwater harvesting. Under the inspiration of the local Ananda Baba Ashram, a Lakhota Jal Sanchay Abhiyan Samiti has been set up to collect money from the residents

of Jamnagar town to desilt the the huge Lakhota Lake that had been constructed by the former royal family. The people of the town have given their full support to this exercise.²³ Under the leadership of the Swaminarayan gurukul in Rajkot, foundation stones were laid for check dams in more than 15 villages in just five days around the middle of April.²⁴ In Ahmedabad city itself, the Khadia Itihas Samiti headed by the state's health minister, has completed a survey of the underground water tanks (*tanka*) that were traditionally built in each house to harvest roof-top rainwater and is planning a campaign to revive them²⁵ Care Today, an organisation set up the magazine *India Today*, has announced that it has identified two projects, one each in Rajasthan and Gujarat, to help villagers desilt their traditional water harvesting structures.²⁶ The Supreme Court, hearing a case on water shortage in Delhi, has ordered the Delhi Development Authority (DDA) to harvest rain water starting off with the water-thirsty DDA colonies of Vasant Kunj in New Delhi.²⁷

These developments show that community-based rainwater harvesting may well become a widely adopted paradigm in the years to come both in the urban and rural areas. But the question is: Will this all lead to effective results, especially in the rural context?

6. Structures with a social process

Building water harvesting structures is a very easy task — any contractor endowed with a bit of money can do so. But building an effective structure which starts off a process of self-management in village communities is a much more difficult task. This is possible only if each structure is the result of a cooperative social process—the ability of a community to work in cooperation. Water is a strange natural resource: It can unite a community as easily as it can divide it. Therefore, it is essential that a strong social process precede each structure to build what economists call the 'social capital'. ***This is an area where the track-record of government agencies is literally non-existent and inflexible government rules militate against the very principle of social mobilisation.***

In other words, the above statements by state and Central officials are as much a cause of worry as of applause. Fixed annual targets will prove to be a total

Social mobilisation is a prerequisite for effective water harvesting activity

disaster: money literally going down the drain. At least the first two years of any water harvesting programme will have to be spent on social mobilisation. This will mean, firstly, creating awareness and confidence in the people that water harvesting works. Once this is achieved, it means sitting with the people to create village institutions which will decide where, when and how the water harvesting structures will be built, who will build the structures, how much the villagers will provide to share the cost of the structures, and once the structure is built, how will its benefit, that is, water, will be shared amongst the villagers, especially in the early years when water is scarce, and how will its use be regulated. Every part of the community will have to be involved by making each section — from the landed to the landless and women's groups — appreciate the benefits it will derive from the exercise. And by making efforts to ensure that benefits do indeed flow to each section of the community.

It is for this reason that water harvesting works best when combined with watershed development. It is in the nature of structures to benefit mainly those who have land leaving the landless without any benefits and therefore alienated from the exercise. But development of watersheds to conserve both water and soil not only increases soil and water conservation and leaf and grass production on what are usually common lands, which can greatly benefit landless households, but also increases the life and effectiveness of the structures that benefit the landed by reducing siltation. Contractors must be totally kept out and all wage benefits should go to the landless.

Nothing works better than when villagers see all this in actual practice. For this purpose, it is important to have funds to take interested villagers to see villages where such principles are being observed and how water harvesting has changed their lives. Under the Madhya Pradesh Rajiv Gandhi Watershed Development Mission (RGWDM), busloads of tribals from Jhabua were taken to see Ralegan Siddhi. Tarun Bharat Sangh (TBS) also regularly organises *Paani Yatras* in neighbouring areas so that villagers who have done it can talk face to face with those who have not.

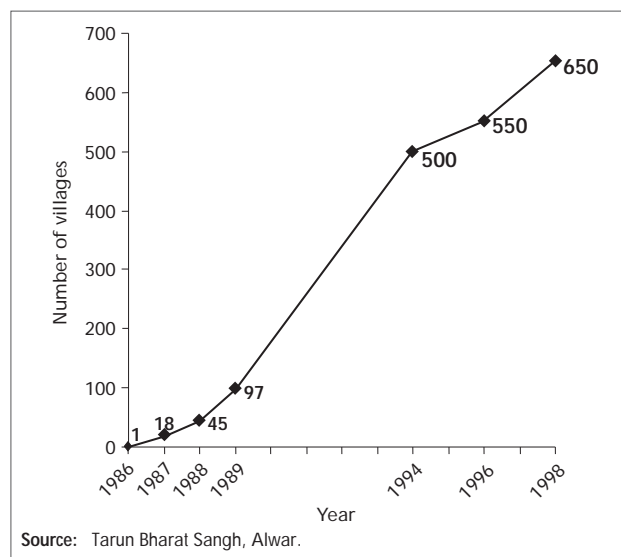
All this means that the progress in the first few years will be slow. This was the case both with RGWDM and TBS. But the experience of both also shows that replication comes very rapidly once 'the idea' catches on. As R Gopalakrishnan, who oversees RGWDM in Madhya Pradesh, puts it, "In the first two years of the programme, the results were so slow that we kept wondering whether we are getting it right." In other words, governments must be prepared to accept that

their first year's effort will bring nothing, second and third year maybe something, and fourth and fifth years hopefully a lot. It is a gradual exercise. The number of villages participating in the water harvesting programme of TBS also grew slowly at first and then very rapidly in the later years as the villagers became more and more confident of the value of what they were doing (see **graph 3: Promoting environmental self-reliance**).

Social mobilisation is essential for the success of water harvesting for several other reasons. Firstly, the community must be closely involved in the construction of the water harvesting structures to ensure that they are built with technical competence; that is, the site is chosen properly, the technical parameters are correct, etc. Badly built structures will not deliver water and can get easily washed away. Secondly, even in properly built structures which deliver water, once the water starts getting available either as increasing levels of groundwater or as surface water in a tank, the community will have to start managing the available water which in the earlier years may not be enough to irrigate lands of all the farmers. In those years, the farmers will have to share the water and use it on crops that don't use too much water. This will happen if there is already a community process associated with the water harvesting structure. Otherwise a few people will grab the water leading the rest of the community alienated.

Graph 3: Promoting environmental self-reliance

In the first three years, few villages got involved in the water harvesting programme of Tarun Bharat Sangh. With passage of time, the numbers, however, grew rapidly as villagers gained confidence in the programme and were able to see a positive outcome of their efforts.



In Indian context, rainwater harvesting is indispensable for fortifying food security, as rainfed land constitutes the bulk of the cultivated land

The government will also have to review and revise old British-time laws like the Indian Easement Act which prevent public participation in water management. Management experts point out, 'God is in the details'. ***Patwa, Thakur and Chandrababu Naidu and others like them will have to make sure the culture of rigid and inflexible government rules is changed to fit the task of social mobilisation.*** And as government officials are not social workers, all this will happen only if they hand over work to NGOs with a track record, howsoever few they might be, and wait patiently for results to come. But if they want a government programme, it can still be done, but then they themselves will have to oversee the implementation of the programme to keep their warring and errant officials in place. Inter-departmental coordination — between the departments of revenue, soil conservation, irrigation, forests and agriculture — is essential for water harvesting-watershed development programmes to succeed. The direct supervision of the Madhya Pradesh chief minister of the RGWDM was a key element of the programme's success. It is not surprising that despite the drought this year, newspaper reports from western Madhya Pradesh were few. Otherwise the result will be a lot of wasted mud, bricks and mortar and alienated people, with water harvesting getting a bad name. Already, newspaper reports are showing that there has been considerable corruption in the check dams sponsored by the government of Gujarat.²⁸ ***We must make sure that water harvesting does not become money harvesting.***

7. Reviving systems which have gone into disuse

It is not enough to build new water harvesting structures. Efforts must be made also to revive the vast treasure that already exists but has gone into disuse. According to official estimates, there were 15.13 lakh tanks in India in 1986-87 — 95 per cent of which were in eight states, Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal. But because of silting and poor maintenance, the gross area irrigated by them had come down from 4.78 mil-

lion hectares in 1962-63 to 3.07 million hectares in 1985-86 though many new tanks were constructed in this period. This represents a capital loss of Rs. 5,000 crore.²⁹ It is obvious that efforts must be made to restore these structures to their full potential.

8. Rainwater harvesting can eradicate rural poverty

If water harvesting-watershed development programmes are handled well, the experience of villages like Sukhomajri, Ralegan Siddhi and several villages in Alwar district has clearly shown that rainwater harvesting is not just the starting point for meeting drinking water needs but the starting point of an effort to eradicate rural poverty itself, generate massive rural employment and reduce distress migration from rural areas to urban areas. Increased and assured water availability means increased and stable agricultural production and improved animal husbandry — both of which together form the fulcrum of the rural economy. Rainwater harvesting has helped Ralegan Siddhi to transform itself from one of the most destitute villages of the country in the 1970s to one of the richest villages today. In all villages which have regenerated their local economy with the help of good management of their natural resources, distress rural-urban migration has been greatly reduced or has been totally eliminated.

Another interesting dimension of community-based rainwater harvesting is that it helps to generate a community spirit within the village — something that is getting lost across the country — and build up what economists call the 'social capital'. In fact, we can argue that if we want *Panchayati Raj* to work, then the first thing that *panchayats* should be asked to take up is water harvesting — *har gaon ka apna talaab* (a tank in every village).

If it all makes so much sense then why is this paradigm not accepted by the government and spread across the country? President K R Narayanan even called for a national movement for water harvesting in his last Republic Day address to the nation.

Proficient water harvesting along with political wisdom and community accountability can help solve rural poverty

The problem is really mind-sets. Rainwater harvesting demands a new approach to governance itself — a participatory form of governance rather than a top-down bureaucratic one. Unfortunately, our political leaders have created a culture of dependence on the government and love to make promises, howsoever hollow they may be, that they will provide everything to the people through government largesse. Given this political mind-set, the water bureaucracy, too, has developed a culture of providing services, howsoever poor and abysmal they may be, rather than one of empowering people to develop their own water supplies. And it is still locked into the big dam, pumps, pipes and borewell paradigm. Water resources minister, C P Thakur, today does not hesitate in accepting the importance of rainwater harvesting but when push comes to a shove, as it did, for example, at the recent World Water Forum in the Hague, he and the entire Indian delegation could do nothing but talk about big dams. We are not here going into the merits of the small versus large dam debate — in certain situations large dams could be needed — but there can be no doubt that the small has an extremely important role to play and this is

being totally neglected. A balance between the big and the small is essential.

But, nonetheless, there has been a remarkable change in the public discourse on the relevance of the country's rainwater harvesting traditions in the last few years, especially since Centre for Science and Environment (CSE) published *Dying Wisdom: The rise, fall and potential of India's traditional water harvesting systems* in 1997, a compelling account of how these traditions still work in many parts of the country even in the face of all odds. The recent statements by the Central and state ministers are encouraging but the government needs to go beyond them. It should heed the president's advice and prepare a concrete plan of action to develop a mass movement for water harvesting.

(The author was a member of the World Water Commission and is the director of the Centre for Science and Environment, New Delhi)

Note:

If any member of parliament or state legislature is interested in understanding this issue further, please do not hesitate to get in touch with the author or with Indira Khurana, CSE's coordinator for its Campaign to Make Water Everybody's Business.

REFERENCES

1. Anon 1999, Water an Overview — Issues and Concerns, *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, pp 6-7.
2. Anon 1999, Development and Management Issues Irrigation, Flood Control, Hydropower and Navigation, *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, pp 9-10.
3. Anon 1999, Water Availability and Requirements, *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, p 36.
4. Anon 1999, Water Availability and Requirements, *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, p 38.
5. World Bank/Central Groundwater Board 1999, *India: Water Resources Management — Groundwater Regulation and Management*, World Bank/Allied Publishers, Washington DC/New Delhi, p 15.
6. J S Samra 2000, Central Soil and Water Conservation Research and Training Institute, Dehradun, *personal correspondence*.
7. Anon 2000, Flood Of Promises To Deal With Lack of Water, *Times of India*, New Delhi, April 20, p.12.
8. *The Hindu*, New Delhi, April 22, p.7.
9. Anon 2000, PM Calls for Moratorium on Bickerings, *The Hindustan Times*, April 26.
10. Anon 2000, Water Harvesting may Become the Law, *The Hindustan Times*, New Delhi, May 6.
11. Sonu Jain 2000, Water in India is Like Draupadi, There Are Five Ministries That Deal With It, *The Indian Express*, New Delhi, April 30.
12. H S Bartwal 2000, Centre Readies Rs. 550 Crore Plan To Recharge Water Level, *The Hindustan Times*, New Delhi, May 5, p.12.
13. Anon 2000, Andhra Forms Conservation Panel, *The Indian Express*, New Delhi, April 28.
14. Anon 2000, Water Conservation Mission Launched, *The Hindu*, New Delhi, May 1.
15. S Ramakrishna 2000, AP Set to Revamp Watershed Project, *The Indian Express*, April 30.
16. Anon 2000, AP Government to Spend Rs 4,000 Crore to Conserve Rainwater, *The Pioneer*, New Delhi, April 30.
17. Anon 2000, Depleting Water Table is Now a Capital Woe, *The Hindustan Times*, New Delhi, April 29.
18. Anon 2000, Drafting of Bill on Harvesting Rainwater Begins, *The Indian Express*, May 8.
19. Arati Bhargava 2000, Harvesting of Water: NDMC Gives Approval, *The Hindustan Times*, May 5.
20. Anon 2000, Work on 10,000 Check Dams Begins, *Times of India*, Ahmedabad, April 28.
21. Darshan Desai 2000, Drought and Deja vu, *The Indian Express*, New Delhi, May 2.
22. Anon 2000, Minister's Call to Support Water Conservation Scheme, *Central Chronicle*, Bhopal, April 30.
23. Rathin Das 2000, Jamnagar Cleans up Lakhota Lake, *The Hindustan Times*, New Delhi, April 29.
24. Anon 2000, More Check Dam Projects take off in Amreli District, *Times of India*, Ahmedabad, April 18.
25. Tanvir Siddiqui 2000, Ahmedabad Falls Back on Old Way of Conserving Rainwater, *Indian Express*, New Delhi, May 2.
26. Anon 2000, Fight the Drought: New Innings, *India Today*, New Delhi, May 15.
27. Anon 2000, Harvest Rainwater, SC orders DJB, *The Hindustan Times*, New Delhi, May 11.
28. Anon 2000, Damning evidence against Junagadh check dams sites, *Times of India*, New Delhi, May 17.
29. Anon 1999, Local Water Resources Development and Management, *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, p 2.

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When the environment is degraded, the most vulnerable are the poor. Be it pollution by industry or drying up of water sources. It was while trying to understand the plight of the rural poor during the 1987 drought that CSE came across something that still escapes Indian policy-makers.

Several drought-affected villages of the mostly arid state of Rajasthan, where government relief was nowhere to be seen, were doing quite well for water.

These villages had traditional systems to harvest the little that rains during the monsoon and store it for times of scarcity. Time-tested systems. Traditions that understood that all water comes from rain, a simple fact that still eludes most water planners.

Further research revealed that India has had a plethora of such systems for millennia. Each one varied from the other, in accordance with local needs. Thinking on water was as decentralised as rainfall. All details worked out. No paperwork. No project proposals.

CSE came out with these findings in *Dying Wisdom*, the citizens' fourth report in the State of the Environment series. This marked a watershed in the Indian civil society's understanding of the water crisis. Or the creation of a water crisis that wasn't.

The immense success of *Dying Wisdom* led to a national conference on water harvesting with emphasis on technologies, policy and social mobilisation. The conference was inaugurated by K R Narayanan, the President of India. He was so impressed by the potential of rainwater harvesting that he instructed his officials to harvest rainwater for the 1.33-sq km President's Estate. CSE, along with a team of experts, has successfully installed the system in the Estate which captures 103 million litres of water per year, as well as recharges the groundwater. Recommendations of the conference led to the formation of the National Water Harvesters' Network with CSE as the central secretariat. The network provides a common platform to those interested in finding a lasting solution to water scarcity.

The primary aim is to make the management of water everybody's business. To ensure that this management is not a centralised issue that the State has to deal with.

The network aims to promote water harvesting in both rural and urban areas. *Catch Water*, the network's bimonthly newsletter encourages people in cities and villages to catch rain where it falls. To decentralise water thinking. The network has also established Technical Services for designing rainwater harvesting systems in the urban sector. Water harvesting manual for urban areas has been published by Centre for Science and Environment for the purpose of guiding individuals, households and institutions.

The rallying point of CSE's campaign on water management has always been decentralisation. That's why we created the slogan 'Make Water Everybody's Business'. We are happy to note that the World Water Commission found it meaningful and made it their slogan: *Make Water Everybody's Responsibility*.

Water is crucial. If we can manage it, the rest will follow. CSE has been very consistent in promoting good political efforts to manage water and pushing those who are yet to catch up. It is clear that good electoral future lies in sensible land and water management. At the same time, we highlight meaningful microexperiences sponsored by the communities and NGOs spreading the good word all the time.

CSE urges everyone to join its endeavour to make water everybody's business. All over the planet.



Dying Wisdom: Rise, fall and potential of India's traditional water harvesting systems



Water Links: Comprehensive directory of water harvesters in India



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