

Protecting the quality of life and eradicating rural poverty

presentation to the State Governors
of the Republic of India

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by

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Government spends money but no drought-proofing done

- In the past 50 years, government has spent vast sums on water resource development. Programmes have focussed on:
 - a. Irrigation development for increasing Green-Revolution-style agricultural production; and,
 - b. Drinking water supply programmes.
- But no specific effort has been made to **drought-proof** rainfed areas which suffer from high rainfall variability from year to year and from season to season

So what has the government done?

- The government has intervened in the country's hydrological system in a very big way but it has done precious little to sustain the integrity of the hydrological system

Community based rainwater is the key

- We believe that **community based rainwater harvesting** is the answer to drought-proofing the country
- But in order to undertake rainwater harvesting we must understand that **water is the most fluid substance** on Earth.

Only 100 hours of rain

- Out of 8760 hours in a year, most of the rain in India falls in just 100 hours.
- In low rainfall areas, most of the rain can come in a few cloudbursts.
- The only solution lies in capturing, storing, recharging and then using the rainwater over the long dry periods

Learning from traditions

- Our ancestors harvested water in a variety of ways; for instance,
- — they harvested the rain drop directly, from rooftops and stored it in *tankas* in the courtyards;
- — they harvested monsoon run off and water in swollen streams during the monsoons and stored it in structures like *zings, ahars, johads* and *eris*;
- — they harvested water from flooded rivers in places like Bihar and West Bengal.

Rainwater harvesting has enormous potential

- **100 mm rain falling on 1 ha of land means 1 million litres of water.**
- Not all of this can be collected because of evaporation etc. But even if 50 per cent is collected we get 0.5 million litres of water which can provide 91 persons 15 litres per day for drinking and cooking for a whole year.
- **There is no village in India which cannot meet its drinking water needs through its own rainwater endowment.** Any additional water harvested would mean water which can be used for irrigation.

There is never enough water

- **If we don't catch, store and manage our rain endowment there is never enough water. Even with 11,000 mm of rain in Cherrapunji it has drought 9 months of the year**

Strategy for Drought-Proofing

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.

Communities take the lead

- In drought-stricken regions of Rajasthan, Gujarat, Western Madhya Pradesh there are outstanding examples:
- **Hamirpura and Bhaonta-Kolyala** in Alwar district;
- **Gelhar Choti** in Jhabua district;
- **Thunthi Kankasiya** in Dahod district;
- **Raj-Samadhiyala and Mandlikpur** in Rajkot district;
- **Gandhigram** in Kachch district

Confirmation of our conviction

In late March 2000, 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 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. 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.

Small is also ecologically efficient

- Smaller watersheds give more water than large watersheds.
- **10 dams with 1 ha catchment each will store much more water than 1 dam of 10 ha catchment.** In areas with erratic rainfall, drought proofing demands as small structures as possible.
- Not surprising medium size reservoirs in Saurashtra have gone dry this year.
- Michael Evenari created an orchard in the Negev by making a micro-catchment for each tree.

Rainwater harvesting needed for food security also

- **Rainfed lands constitute the bulk of our cultivated lands.** In 1992-93, some 119 mha was rainfed of which 78 mha under foodgrain.
- It is also needed to sustain Green Revolution. **Over 50% of agricultural output today is dependent on groundwater** — levels are falling dramatically.
- Rainwater harvesting can increase and stabilise agricultural production in rainfed areas and recharge groundwater in irrigated areas.

Everyone is talking about rainwater harvesting....

- Prime Minister
- Rural Development Minister
- Urban Development Minister
- Water Resources Minister
- Planning Minister
- Gujarat Government
- Rajasthan Government
- Andhra Pradesh Government
- Delhi Government
- **But will government sponsored water harvesting — built on programmes, money and bureaucracies work?**

Not without social mobilisation

- **Water harvesting needs a social process.**
 1. Create awareness and confidence in people that rainwater harvesting works;
 2. Sit with people to create institutions which will discuss how and when these structures will be built etc etc
 3. Change laws to empower people to manage their resources
- **Only then go ahead with the work with catalytic technical and financial support from government**

Annual targets and budgets...

-**Could destroy the entire exercise.**
- This is a process of social mobilisation. First and second years there may be nothing. Third and fourth year there may be something. Fifth year onwards the work expands as people see results.
- **GOD IS IN THE DETAILS**
- **Water harvesting should not become money harvesting**

Reviving disused systems

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 million 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.

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.

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.

Community-based rainwater harvesting can help to generate a community spirit within Indian villages — something that is getting lost across the country. 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).

Scientific Challenges before India

- Science for Food Security
- Science for National Security
- Science for Industrial Development
- Science for Ecological Security
- Science for Social Security

Findings of the Citizens' Fifth Report on the State of India's Environment

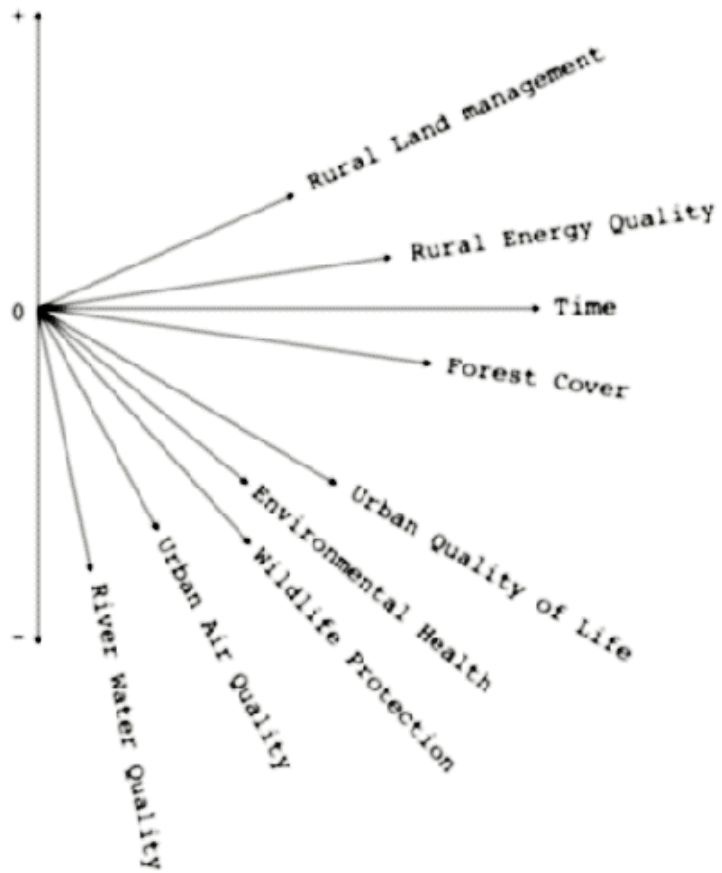
1. Rural Environmental Problems

- Growing but several high points in land / water / forest management - if only they can be replicated on a big scale
- Public participation / decentralisation work

2. Urban Environmental Problems

- Real crisis / serious pollution problems emerging
- All polluting activities arising out of urbanisation, industrialisation and agricultural modernisation growing
- Hardly any best practices in India to learn from

Finding of the Citizens' Fifth Report on the State of India's Environment



Major environmental costs estimated for India, 1992

Problem	Impact on health and/or production	Low estimate (Rs. crore)	High estimate (Rs. crore)	Average (Rs. crore)
Water pollution (health impacts)	Urban and rural health impacts, esp diarrhoeal diseases	10,766	29,204	19,985
Urban air pollution	Urban health impacts	1,810	7,357	5,895
Soil degradation	Loss of agricultural output	5,306	8,288	5,747
Rangeland degradation	Loss of livestock-carrying capacity	833	1,460	1,148
Deforestation	Loss of sustainable timber supply	641	854	749
Tourism	Decline in tourism revenues	497	991	746
Total costs of environmental degradation		19,852	48,153	34,003
Percentage of gross domestic product, 1992		2.64%	6.41%	4.53%

Source: World Bank

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

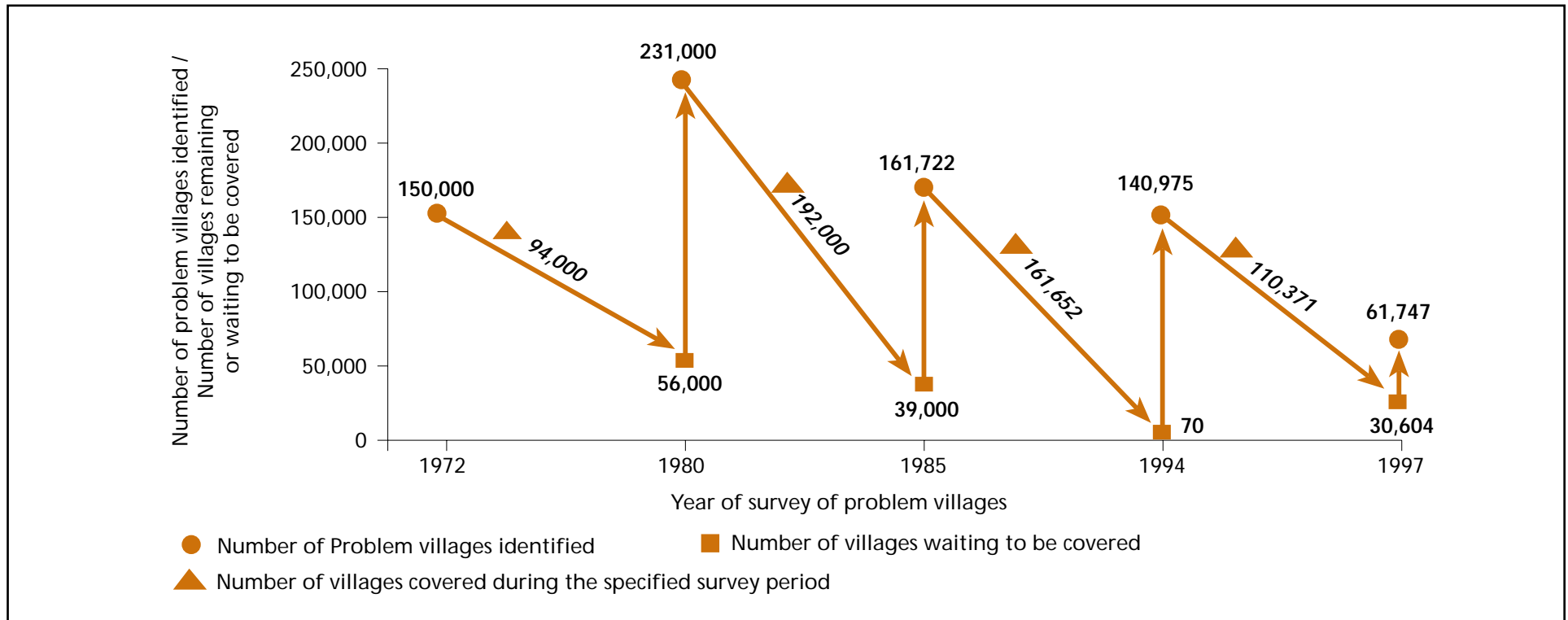
Sources: 1) Janyala Sreenivas 2000, Forget the Sensex for a second, look what else is going down, *Indian Express*, New Delhi, April 19, p.1

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

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."



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.

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%

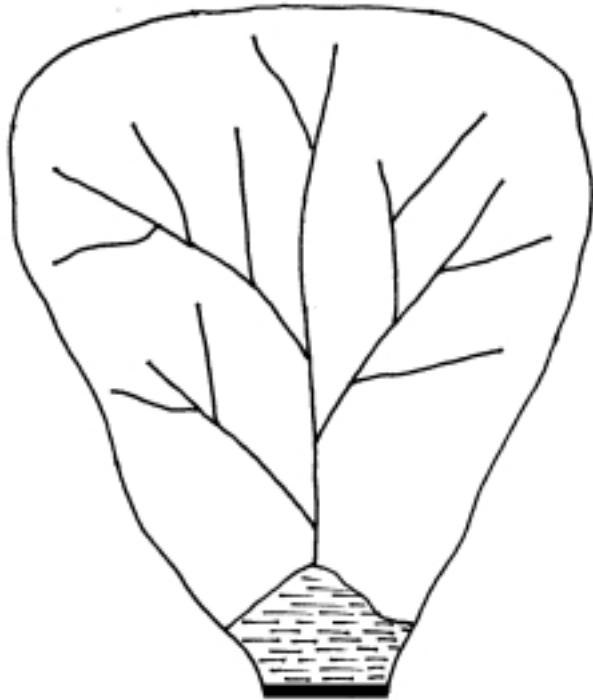
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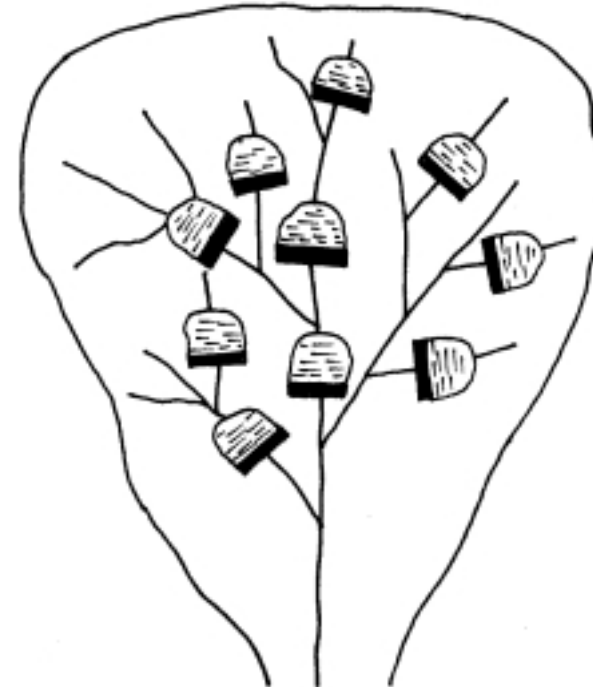
Smaller catchments give much more water

One dam with a catchment of 10 hectares will collect much less water than 10 dams with one hectare catchment each

Catchment Area: 10 hectares



Catchment Area: 10 hectares



Days with a pollution emergency in Delhi – based on Mexico City model (Based on ITO Crossing RSPM data)

Month	Year	Measured days	Level 1 emergency (1.75 times the standard)		Level 2 emergency (3 times the standard)		Total % of measured days with a pollution emergency in the month
			No. of days	% of measured days	No. of days	% of measured days	
March	1998	19	6	31.57	0	0	31.57
April	1998	18	7	38.87	0	0	38.89
May	1998	99	10	52.63	0	0	52.63
June	1998	22	4	18.18	0	0	18.18
July	1998	22	0	0	0	0	0
August	1998	21	0	0	1	4.76	4.76
September	1998	21	0	0	0	0	0
October	1998	18	9	50.00	5	72.22	72.22
November	1998	22	11	50.00	10	45.45	95.95
December	1998	21	1	4.76	20	95.74	100
January	1999	19	6	31.57	10	52.63	84.2
February	1999	20	13	65.00	3	15.00	80.00
March	1999	20	13	65.00	1	5.00	70.00
Total		262	80	30.53	49	18.7	49.2

Source: Calculated on the basis of data provided by CPCB.