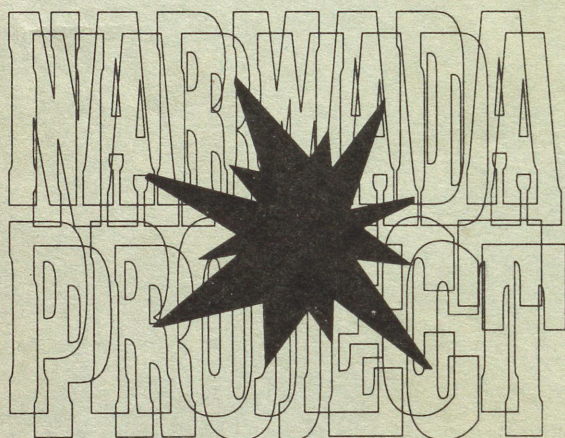


The Myths Exploded

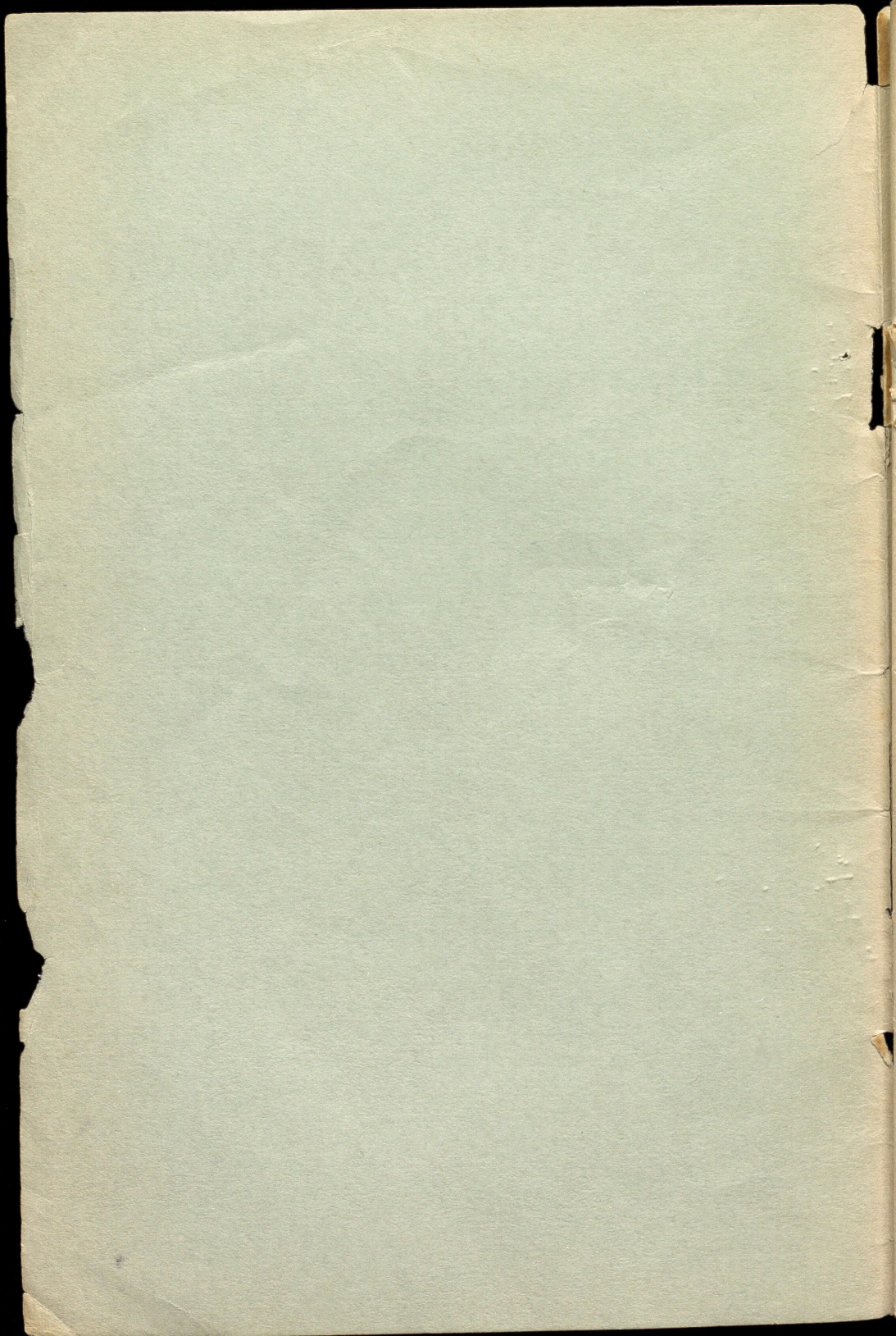
The Unscientific Ways of Big Dams and Narmada Project

Jashbhai Patel



EDSA:PPA

Evictions and Displacements in South Asia:
Towards Preemptive Action



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**Evictions and Displacements in South Asia:
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Published by:

EDSA:PPA

Evictions and Displacements

in South Asia: Towards Preemptive Action

c/o YUVA

8, Ground Floor,

33-L, Mughhat Lane,

Bombay 400 004

Printed by:

Mudra,

383 Narayan Peth,

Pune 411 030

We acknowledge with special thanks the permission given by the Economic and Political Weekly to reprint the article "*Is National Interest Being Served by Narmada Project?*" (E. & P. W. Volume XXIX, No. 30, July 23, 1994)

Price: Rs.10/-

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Introduction - Miss Phipps
Part I. Gijzen and his SSP Dam
Part II. Review of the book:
The Social and Environmental Effects of Large Dams
By Edward Goldsmith & Nicholas Hildyard

Introduction

The people's struggle in the Narmada Valley for the last ten years has brought out the need to review emphasis on the large irrigation projects and the land and water utilization policy, development concept behind it. The Narmada struggle has brought about some change in the attitude, approach and some aspects of policy regarding Sardar Sarovar Project (SSP) particularly and the large irrigation projects generally. Yet the superstitious and old habits die hard. Superstitious myths, obsolescence rule in the name of science, modernization while no effort is made to look into the indigenous alternative, sustainable ways.

Jashbhai Patel's two articles are an attempt to demolish the myth about the SSP and the large dams. He forcefully challenges with all data, analysis the myth of SSP being most planned project and the claims and planning scientifically, cost benefits and such projects in his first article about SSP Dam. On a larger canvas through the review of the celebrated magnum opus- "Social and Environmental Effects of Large Dams" by Edward Goldsmith and Nicholas Hildyard, Mr. Patel shows the world-wide challenges to the established engineering superstition. Here the purpose of the article is to introduce the book which can rightly be termed as a landmark in the analysis of prevalent concept of development. Both these articles would prove useful for understanding the present debate in India and abroad and would encourage students, policy makers, activists, opinion makers to bring our effective change in the present destructive mode of development.

Jashbhai Patel is a scientist who has been teaching physics, mathematics and chemistry. He took his Ph.D from the Carnegie -Mellon University, Pittsburgh and was a post doctoral Fellow and a Research Associate at the Northwestern University, Evanston; Rice University; Houston; and Ohio University, Athens. He was also a visiting lecturer at IIT Bombay, Kanpur. He took voluntary retirement and devotes his time to assist the efforts of alternative development through experiments, research, writing. Now he lives in Baroda. He has drawn his conclusion about the SSP dam way back in 1960's. We are greatly indebted to him to allow both these articles for publication. We are also indebted to the staff of Nubhav Shiksha Kendra Pune and Sanjay Sangvai of Narmada Bachao Andolan for editing and proofreading the text.

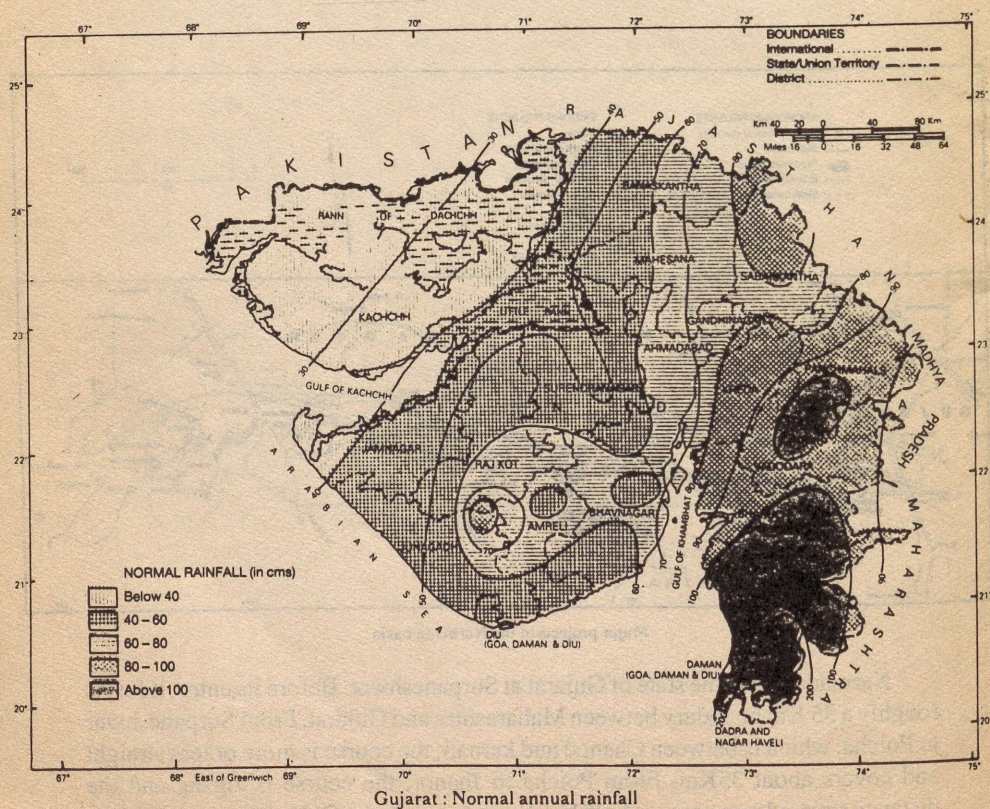
Minar Pimple
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becomes a saline estuary which is about 60Km in length. Thus, the overall length of Narmada in Gujarat is: $3 \times 35 + 60 = 165$ k.m. Deducting the boundary and saline parts of the river, Narmada in effect is 70km from Surpaneshwar to Jhanor. The catchment area of Narmada in Gujarat is about 10,000 sq km. This area lies in the annexed tribal regions which morally do not belong to Gujarat.

Of 1,312 km of Narmada, Gujarat can claim at the most 130 km of the river as for its exclusive right. Of this 60 km belong to the sea. With just 70 km of the river, Gujarat has master-minded the entire Narmada River Project. Although essentially a MP river, Narmada has been converted into a Gujarati river. Gujarat has claimed Narmada as its lifeline but in essence made it a deathline for Madhya Pradesh and Maharashtra.

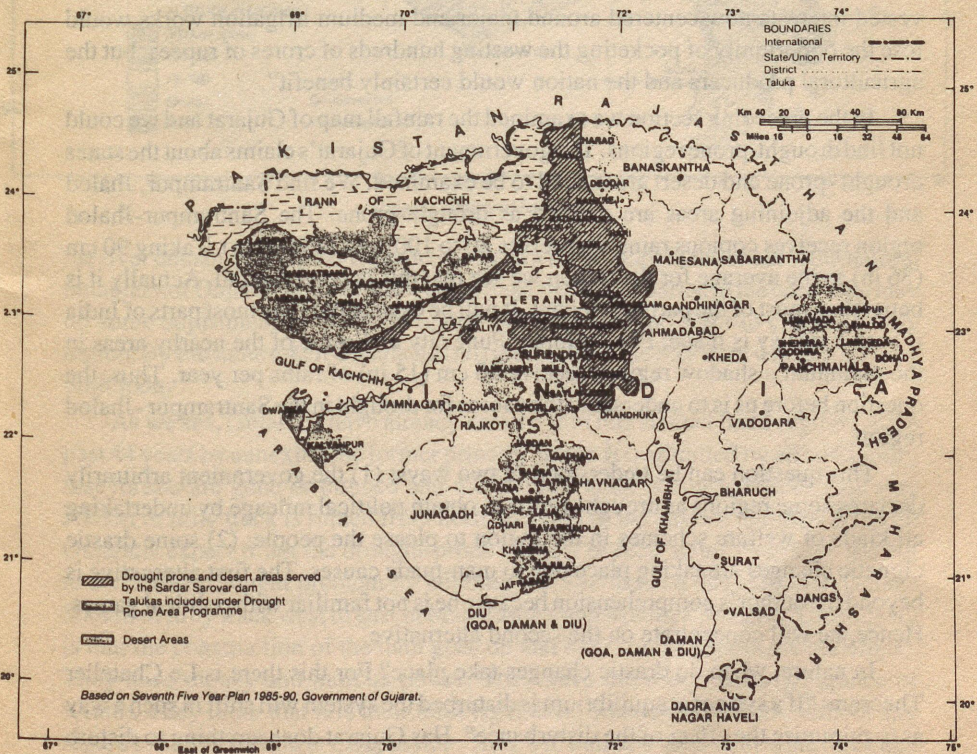
Myth of Drought prone Areas of Gujarat

The state of Gujarat is a coastal part of India and the slightest common sense would tell anyone that it cannot be a drought prone region. However, there can be drought prone pockets which are manmade due to wanton destruction of nature's ecological



balance. The average annual rainfall in Gujarat is either 50cm (20 in) or more. There is only a single marginal strip of region where the rainfall in Gujarat is between 40 cm (16in) and 50 cm (20 in). Otherwise, east of 70 cm line, the rainfall is between 75 cm (30 in) and 100 cm (40 in), which is good and west of the same line, the rainfall is between 70 (28 in) and 50 cm (20 in), which is fairly good. So the drought-prone Gujarat is myth because 50 cm (20 in), rainfall is considered fairly good by the standard of meteorological science. Also, the average rainfall over the entire length and breadth of India cannot exceed 50 to 75 cm (20 to 30 in). The same is true for the whole world. So Gujarat should stop crying wolf and exploiting adjoining states to get rich.

The only part of Gujarat where the rainfall is less than 40 cm (16 in) is Kachchh. But Kachchh is not Gujarat. It was the greatest folly to lump Kachchh with Gujarat. That only shows the lack of scientific temper among the people in power. The rightful place for Kachchh was in Sindh. The latter is not in India, hence, Kachchh could be in Rajasthan. The tragedy of Kachchh is that the rich Kachchhi's want to be with rich Gujarati's because of their business interest. They have ignored their



Based on Seventh Five Year Plan 1985-90, Government of Gujarat.

Gujarat : Drought prone and desert areas

historical, geographical, ecological, linguistic and cultural interests completely. This has proved their undoing. They have failed to help their poor brethren.

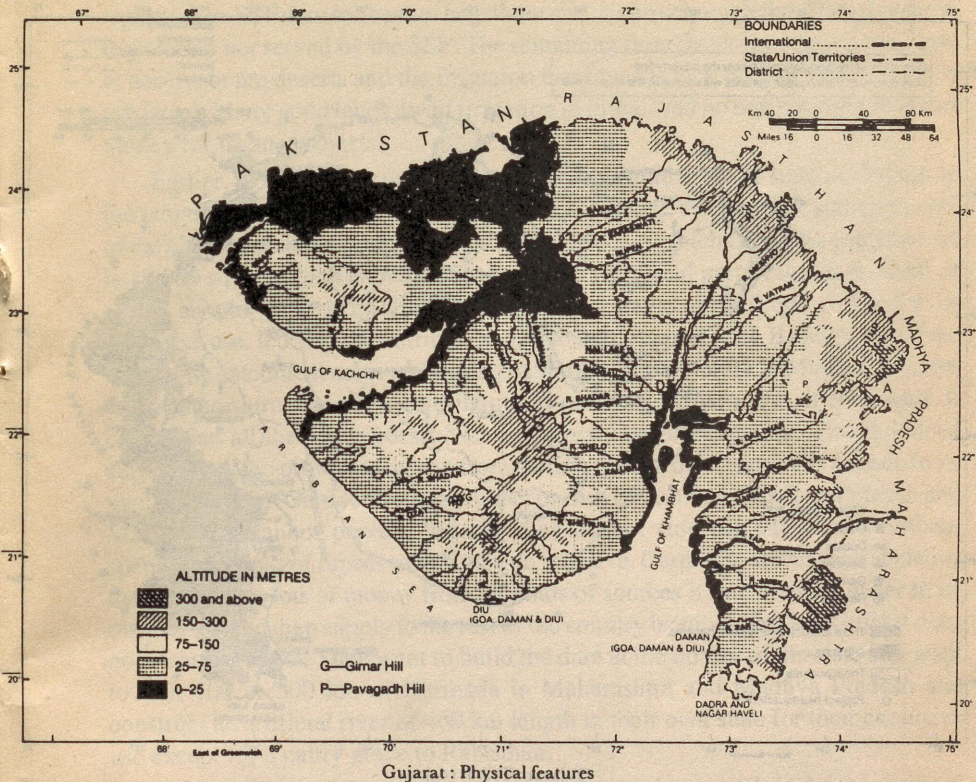
If technologists and engineers of Gujarat had cared to study their past history, their table-land and flow of water from the adjoining states, they would have come to one basic conclusion: 'dig deep and not dam'. Damming is suitable to Rajasthan, Madhya Pradesh and Maharashtra because they cannot stop the quick running waters without dams. Also they possess natural lakes. MP built its early dam between 10 and 55 AD on the Bhojpur lake, Rajasthan built its earliest dams, namely Uday Sagar dam on the river Arat-Banas near Udaipur in 1700 and Jai Samand dam on the river Gomati-Mani near Udaipur in 1730. Gujarat is not faced with quick running waters but with soggy land. It should not copy others blindly. To quote an eminent meteorologist:

"Professor Pisharoty a reputed scientist in Gujarat has argued that the best solution for our water and soil conservation problem is what the Dravidians did several centuries ago-the construction of about 30, water tanks, each about 100m X 100m x 10 m, in each of the 300 and odd district which have an annual rainfall of 50cm or more. Such water ponds could improve our ecology, trees would grow around them and ground water will be recharged. By means of this alternative the vested interests now centered around major and medium irrigation works would lose the opportunity of pocketing the wasting hundreds of crores of rupees, but the agricultural producers and the nation would certainly benefit".

In the preceding section we examined the rainfall map of Gujarat and we could not find drought-prone regions. The government of Gujarat's claims about the states drought-prone and desert areas need to be examined. We find Santrampur, Jhalod and the adjoining areas are defined as drought-prone. The Santrampur-Jhalod region receives copious rains: it receives 80 to 100 cm (32 to 40 in). Taking 90 cm (36 in) as the average for the region we see that this is good rainfall. Actually it is better than most of the parts of Gujarat. It will be even better than most parts of India if such a survey is made. For example: Pune city and some of the nearby areas in the mountain's shadow regions receive 40 cm (15 in) of rains per year. Thus, the question before us is to understand the causes for drought in the Santrampur-Jhalod region.

This question can be understood in two ways: (1) the government arbitrarily declares some regions as drought-prone to obtain political mileage by undertaking all kinds of welfare schemes in the region to please the people; (2) some drastic climatic changes are taking place due to man-made causes. The first alternative is beyond the author's comprehension because he is not familiar with political games. Hence, he will concentrate on the second alternative.

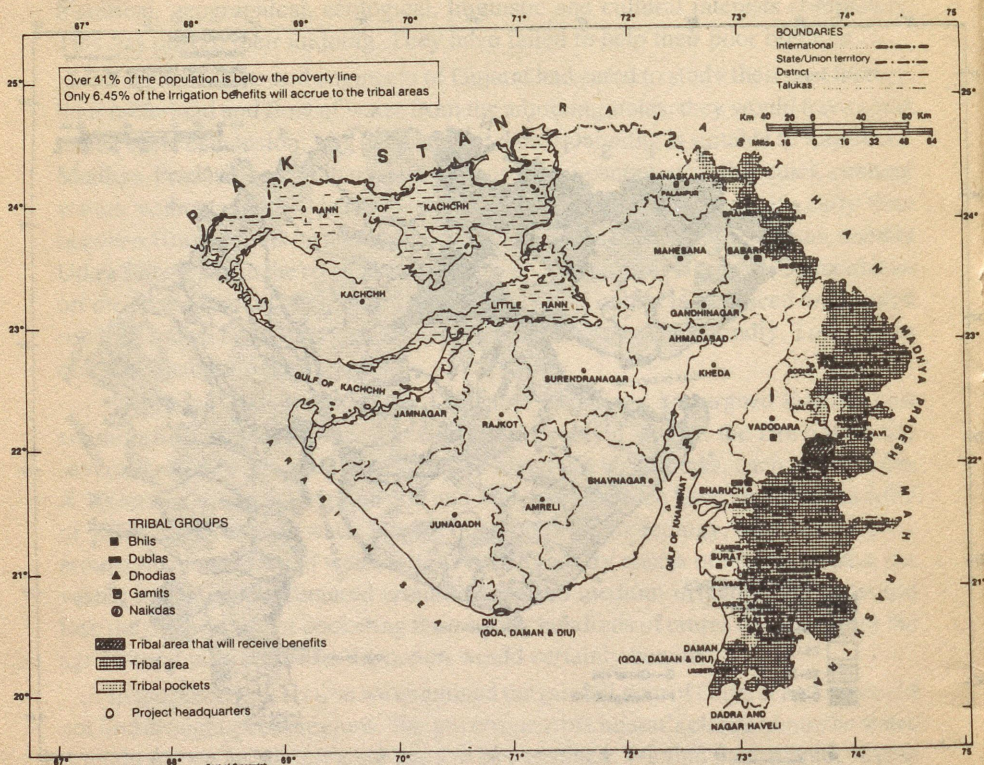
In nature, when do drastic changes take place? For this there is Le Chatelier Theorem: "If a system at equilibrium is disturbed the system will shift in such a way as to minimise the effect of the disturbance". Has Gujarat done anything to disturb the natural rainfall system? Ideally, the region from the river Banas in the north to



the river daman-ganga near Daman (not shown in the map) in the south is the natural boundary of Gujarat. If Gujaratis want to push their boundaries to the east, they may do some adjustment in the plain region but they have no right to enter the hilly region. By the same token Gujarat has no right to build the SSP dam where it is being built today.

As we see, Gujaratis have already entered into this slanted lined region for the past 44 years by annexing the former princely states. It is admitted by all and sundry that forests are gone or thinned and the damage done is considerable. This way 500km of hilly track is ruined from north to south in the eastern Gujarat. What do Gujaratis expect if not the drought-prone pockets in their state? Now they are out to solve their drought problem by building the SSP dam so that they can damage 500km of hilly track west to east in Maharashtra and Madhya Pradesh. The tragedy is that the construction of the dam goes on and their tomfoolery is unchallenged. They have money and morcha power. They have the most vulgar arrogance of wealth. They think that it is their birth right to do what pleases them without any regard to fellow feeling or compassion. They will build the dam with brute force and naturalists have to oppose this force.

Is the eastern region really Gujarat? The tribal region exactly coincides or overlaps with the eastern regions of Gujarat. This means that the eastern region in



Gujarat : Tribal regions

reality is not Gujarat and the tribals living there are not Gujaratis by any stretch of imagination. This fact can also be verified by consulting the tribal map of India. These tribal regions were annexed by Gujarat to exploit their natural wealth and to use tribals as bonded laborers. Besides these tribals are useful to project rich Gujarat's poverty and to extort grants from the central government. Even then, the fact remains that the appropriate sections of the slanted line region be given back to Rajasthan, Madhya Pradesh and Maharashtra, so that, these tribals join their own tribes and do not remain divided. This way the tribals can fulfill their expectation for full autonomy provided the tribal regions are made autonomous within the states.

So is there a way to help drought-prone pockets of Gujarat? To answer this question, we once again, refer to the maps. We find that hilly regions of Saurashtra and Gujarat get copious rains but these very regions are declared drought-prone. Why? The reason is: These regions do not have optimal forest cover. Hence water runs off the rocks; running streams and small lakes dry up soon without the protection of woods. The end result is man-made drought for which there is no remedy except one: to restore the hills to their original condition. Otherwise to pump up water from river or reservoirs will prove very costly and will be beyond the financial means of tribals. Thus, no dam, however, big, can help hilly drought-prone

regions. The SSP dam too cannot help them and it is an acknowledged fact that these regions are not served by the SSP. The remaining drought-prone regions are close to deserts or are deserts and the irrigation there means lack of total sanity. India is not Israel. Many good lands await irrigation in India. And no one has right to divert money for insane projects.

Earlier, we have seen that the effective contribution of the state of Gujarat to the length of Narmada river is just 70 km in 1,312 km. The overall catchment area of the Narmada basin is roughly 1,00,000 sq km out of which Gujarat's contribution is 10,000 sq km which is in the annexed immorally held part of the state -most of which should go to MP. Gujarat practically reserves this 10,000 sq.km for its exclusive use. It does not contribute a drop to the common pool. Besides, out of the remaining catchment areas amounting to 90,000 sq km mainly in Madhya Pradesh and Maharashtra, Gujarat's contribution is paltry 423 sq.km. Yet, it cries wolf. It claims that all the water goes to sea as a great loss to the nation. This is indeed surprising. Who prevents Gujarat from storing the run off waters of Narmada in its own region from Garudeshwar to Aliabet in Gulf of Cambay? Madhya Pradesh and Maharashtra cannot prevent because they cannot stop run off waters without spending billions of rupees which they do not have. Certainly, since Gujarat claims that it can raise lots of money from all kinds of sources it can store the water in its own region and then supply to the rest of the country by pipelines. But Gujarat does not want to do that. They want to build the dam at the border of the state and want to ruin 400 or 500 km of Narmada in Maharashtra and Madhya Pradesh and construct an artificial river of 460 km length in their own state for their exclusive use except for a paltry grace to Rajasthan.

What is injustice? Do money and political clout play any role in doing injustice? Did the Narmada Tribunal Award come during the prime ministership of Moraji Deasi? The answer to these questions readers have to discover for themselves. Then, will it be a wonder if the award is in favor of Gujarat? The very fact that riparian state like Gujarat with 423 sq km of contribution in 90,000 sq km gets equal representation with other states on the Narmada Control Authority does not prove the injustice? Only the weakling states can accept such injustice. Otherwise, the concerned states would have told Gujarat that this 423 sq km of contribution is ours and Gujarat has no right of any representation on the Narmada control Authority.

Award of Narmada Water Disputes Tribunal

The Gujarat Government and the vice chairman and managing director of Sardar Sarovar Narmada Nigam Limited harp again and again on the remarkable decision of the tribunal.

The Narmada Water River Disputes Tribunal gave its final decision in 1979. The main parameters of the decisions were as under:

(a) Allocation: (at 75 per cent dependable yield)

State	MAF
MP	18.25
Gujarat	9.00
Maharashtra	0.25
Rajasthan	28.00

b) Height of the Dam: FRL at 455.0'

(c) FSL of the Main Canal -3000 ft: To be extended up to Rajasthan border to cater irrigation to the drought-prone areas of 75,000 ha in Barmer and Jalore districts of Rajasthan.

(d) Power allocation: (in percentage)

MP.	57
Maharashtra	27
Gujarat	16

There would be regulated release from Narmada Sagar Project in MP 280 km upstream.

Did the Gujarat government and its spokesperson P A Raj ask themselves a simple question: Is this a fair victory? A riparian state with 0.5 percent contribution to the catchment area taking away 33 per cent of water and 16 per cent of electricity. Above this state keeps 10 per cent of its own catchment area for its own exclusive use. The state also gains equal rights to sit on the Narmada Control Authority and dictate terms on the basis of the given award. This is patent injustice.

One would like to pose this simple question: Suppose Bangladesh insists on building dams on Ganga and Brahmaputra rivers exactly near the borders of India and submerge India's vast territory, would India agree? Obviously the answer is simple 'No'. What Bangladesh talks of international laws as the one given here? "It is well-established in law that the waters of a natural stream or other natural body of water are not susceptible of (sic) absolute ownership as specific intangible property. On the contrary, flowing water is public juries or res communis and not subject to individual ownership" would India agree? The answer is again 'No'. Because a law cannot be used to destroy people. There were protests registered with Tribunal:

(i) ... on November 28, 1963 D.P.Mishra, the chief minister of Madhya Pradesh, in a letter to K.L.Rao, the union minister for irrigation and power, clearly stated that the state of Madhya Pradesh was not in agreement with the statement that the Navagam dam should be built up to FRL 425 and the entire benefits should be enjoyed by the state of Gujarat.

(ii) The government of Madhya Pradesh argued that Navagam dam should be restricted to FRL 162 since that was the bed-level at the Madhya Pradesh border.

(iii) The Khosla Committee rejected the proposal of the Maharashtra government that the FRL of the canal should be at RL 185/190.

(iv) Madhya Pradesh claimed that a better utilization of Narmada waters would be possible if part of it were diverted to the Tons Valley in the Ganges Basin.

The protests numbered (i) to (iii) are absolutely reasonable but the committee and /or tribunal pushed them aside and imposed their will. This was indeed an unreasonable and unpardonable folly which proves that Madhya Pradesh and Maharashtra have not accepted the award but their governments have compromised the interests of their people for the so-called national interest.

The most remarkable claim by MP is found in number (iv). It shows how desperate the government of MP was to save its sacred waters. It was prepared to transfer them into sacred Jamuna instead of allowing them to flow into the mighty man-built base gutter of Gujarat.

Tribunal's Reasonings

Now, we will see how the tribunal tried to resolve the Narmada water disputes and how the government of Madhya Pradesh tried to contest for many years to save its sacred river. We will list here the main arguments of the tribunal:

(i) Since water resources are not divisible into pieces like land lots, the equality to which parties are entitled does not mean equal division. It means equality of consideration, it means equality of opportunity which very often may not result in the same quantity of water.

(ii) The tribunal refers to various international treaties to establish the convention that the contribution to runoff is not an important criterion for apportionment.

(iii) (The Tribunal) felt that the Helsinki Rules clearly show that in determining a state's reasonable and equitable share in the beneficial use of waters of a river basin, the needs of the state as a whole should be taken into account and not merely the basin portion thereof. Under Section 3 of the Inter-State Water Disputes Act of 1956 also, the state is considered to be an integral unit and its interests include the well-being of its inhabitants within its entire territory including areas outside the river basin.

These are the basic principles used to resolve the Narmada water disputes. Are these principles absolutely valid in the present context? Let us see them one by one.

The item (i) is a beautiful rhetoric which can be used to justify any water dispute and any judgment.

Item (ii) shows the slavish mentality of the Indian authorities, because they cannot think up anything original without consulting the foreign laws- in this case international laws. All Indian states do not have international borders, but only state borders. The principles ought to have been formulated taking into consideration the topography of basins and not the verbosity of foreign laws.

The height of absurdity is reached in applying item (iii) to the Narmada basin. This basin is essentially intra basin and Madhya Pradesh cannot use its water for the entire state without resorting to some artefact such as tunneling water through mountains. Thus, there was no question of considering "the well-being of its inhabitant within its entire territory including areas outside the river basin". This principle was specially used to favour Gujarat. With a 70 km river, it can use the Narmada waters across trans-basins and cover a large portion of its entire territory. This is patent injustice and even a blind man can see it.

Did Madhya Pradesh feel this injustice? Here is the evidence: (a) "Madhya Pradesh had contended before the tribunal that along with the factors listed by the Helsinki Rules (1956) equal weightage should be given to the contribution of Gujarat and Madhya Pradesh to the dependable flow. That is 9.2 per cent for Gujarat and 90.8 per cent for MP at 75 per cent dependability." This plea was ruled out using item (i) and the quote given with reference to Bangladesh (p16).

(b) "Both Madhya Pradesh and Maharashtra also stressed that the question of equitable apportionment must be related exclusively to the area and people within the basin. Extension of irrigation to adjoining extra-basin areas could not be justified on the grounds of their dependence on the waters of the basin in question or the easy commendability of such areas. MP and Maharashtra argued that the basin was a legal entity and hence should be treated as such; the water apportionment had to be intra-basine and could not be trans-basin". This was the most valid argument, because Narmada flows between Vidhya and Satpura ranges for more than a thousand km, in its course of 1,312km. But this was ruled out by item (iii). This was stupidly extraordinary.

If anyone examines the tribunal's report, one finds that Madhya Pradesh's high points are ignored and Gujarat's high points are artificially inflated. For example, Madhya Pradesh gains high points as to cultivable area, net sown area and population dependent on agriculture, whereas Gujarat is way down in these categories. To prop up Gujarat the myth of drought area and population affected by drought area and population affected by drought is brought in. These categories are not easily verifiable and figures can be easily manufactured. Rather, figures can be grossly manipulated. What we find in the report is this: drought areas in Gujarat are 1,74,630 acres and weightage given is 73 per cent; drought areas in MP are 1,01,020 acres and weightage given is 27 per cent, people affected by drought in Gujarat are 54,80,000 and weightage given is 72 per cent; people affected by drought in MP are 30,70,000 and weightage given is 22 per cent. Gujarat is propped up and brought to parity with Madhya Pradesh by such means. This casts shadows on the tribunal award. This is not the end of the story. The way the Khosla Committee recommended the height of Navagam dam is the blackest chapter among the papers on the SSP dam. Madhya Pradesh and Maharashtra wanted to build Jalsindhi dam between Harinphal and Navagam. How the Khosla Committee scuttled this proposal, we read as under:

The committee was totally in favour of the higher Navagam dam. It observed that instead of a high Navagam dam, if Harinphal or Jalsindhi dams were raised to the dam FRL, the submergence would remain almost the same because the cultivated and inhabited areas lie mainly above Harinphal while in the intervening 113 km gorge between Harinphal and Navagam there is very little habitation or cultivated areas.

RELEVANT FACTORS ABOUT GUJARAT AND MADHYA PRADESH

	Gujarat	Value %	Madhya Pradesh	Value %
Culturable Area (in lakh acres)	297.31	31.1	629.21	68.9
Net Sown Area (in lakh acres)	232.59	29.48	453.21	70.52
Population dependent on Agriculture (in thousnads)	5509	31.75	121.47	68.25
Drought Area (in thousand acres)	174.63	72.72	101.02	27.23
Population affected by drought (in thousand)	5480	72.16	3070	21.84

Source: Narmada Water Disputes Tribunal Award

The Khosla Committee observed:

... that they had kept in mind national interest rather than state boundaries when considering the possibilities of harnessing the waters of the river Narmada. They further observed that irrigation should receive priority over power and the water going waste to the sea without doing irrigation or generating power should be kept to the unavoidable minimum.

Now we will see the fallacy in these reasonings. The Navagam dam submerges 214 km of the valley and 37,000 ha of the surface area. The Harinphal dam does almost the same, but it cannot do anything between Harinphal and Navagam, a distance of 113km, because the dam is at Harinphal. If you want 113 km to come into the picture, then the Harinphal dam just submerges $214 - 113 = 101$ km. By this token the surface area too will be less than 37,000 ha. Any way, the important point

to note is this: "in the intervening 113 km gorge... there is very little habitation or cultivated areas". Thus, intervening 113 km submergence is of no account even though it involves at least 19 villages of Gujarat and 36 villages of Maharashtra. This is the logic the men in high places use. Hence, bad arithmetic gives us: 214 km = 101 km. Besides, we have: bad arithmetic + Bad logic = national interest.

Obviously, the members of Madhya Pradesh were dumbfound with this type of reasoning. This, we may see from the following narration.

Gujarat had asked for a height of 530ft on the shrewd calculation that even after the tribunal reduced the height substantially (say 80 ft or so), a very high dam could still be built. It has been pointed out (Mathur 1978) that Madhya Pradesh was placed in a Catch 22 situation regarding the height of the Navagam dam. In the master plan prepared by Madhya Pradesh in 1965 it had proposed that a dam at Harinphal of the height 465 ft to convince the tribunal that the state wanted to make optimum utilization of the waters of the river Narmada. At the same time, Madhya Pradesh also tried to argue that the height of the Navagam dam should be restricted to 162 ft so that the dam would submerge no areas from Madhya Pradesh (162 ft is bed level of the Narmada at the border between Madhya Pradesh and Gujarat). Whether a 465 ft high dam is built at Navagam or at Harinphal, the submergence unto 465 ft with a high Harinphal for the sake of hydel power, then it could not as well argue against a 465ft SSP, provided that it was being compensated for the loss of potential hydel power generation. Hence, the tribunal settled for a 460 ft high Navagam dam.

This long discourse clearly shows that Gujarat is building the SSP dam at Navagam after gaining a totally unfair victory which was full of legal quibblings and political chicanery. To cover up these dirty possible games, it had to invoke official Secrets Act and needs an advertising agency to do its false propaganda. Readers should ask themselves: are dams built in this fashion anywhere in the world?

The myth of drought has been invented to serve the industrial belt between Baroda and Ahmedabad. Irrigation too is meant for rich farmers who are mostly found in this region. It was explained earlier that drought areas cannot be helped by building any dam howsoever big. Gujarat has shown drought areas under three categories; (a) mountainous or hilly regions, (b) deserts, and (c) regions adjoining to deserts. Earlier it was pointed out that the hilly regions of Santrampur, Jhalod cannot be served by the SSP dam because to pump up water is very costly. The only way out is to restore these regions too cannot be served by canals because the sand dunes offer adverse or uneven gradient, the sand accounts for adverse absorption of water and high temperature and zero humidity explain the adverse evaporation. The only way out is via pie-lines and not canals. Ambika Singh, the agronomist appointed by the tribunal said to the panel:

I have arrived at the conclusion that Ranns area is characterized by high salinity, a very low horizontal permeability, a vertical permeability of nearly nil, a high ground water table and an impervious layer near the ground water, and low rainfall. From this description it could be easily understood that reclamation of the area, even

if possible will be a very difficult task. It has not been established till now whether or not desalination of soil is possible. (He) concluded that (considering the proposed pattern of irrigation and transit losses) the amount of water required to irrigate one acre in Banni would suffice to irrigate 3.9 acres of better quality land near the canal head.

Did tribunal agree with its agronomist? Here is its view point.

Gujarat's claim on Narmada waters to irrigate areas in the little and the great Rann of Kutch and the Banni area also was unreasonable. The assessor Dr Ambika Singh had expressed the opinion and the tribunal had concurred with his view that the desalinization of these areas would prove costly and impracticable.

Readers should note again that India is not Israel. Good land awaits irrigation in the country. Also Israel had not diverted a mighty river like Narmada in its desert. Their methodology is original.

Now remain the remaining drought areas which are adjacent to the desert areas. Those areas very close to deserts cannot differ much, hence a little portion remains which may benefit. Actually, an agronomist's opinion is very necessary even for this little portion.

The tragedy of the whole situation is: the tribunal props up Gujarat by giving high weightage to drought areas and the people affected by drought and then do not serve them by the dam, nor does it lower this weightage and rule out such a high dam. For sometime the Gujarat government even imposed the official Secrets Act which was lifted under public pressure. Are dams built under secrecy like atom bombs or destructive weapons?

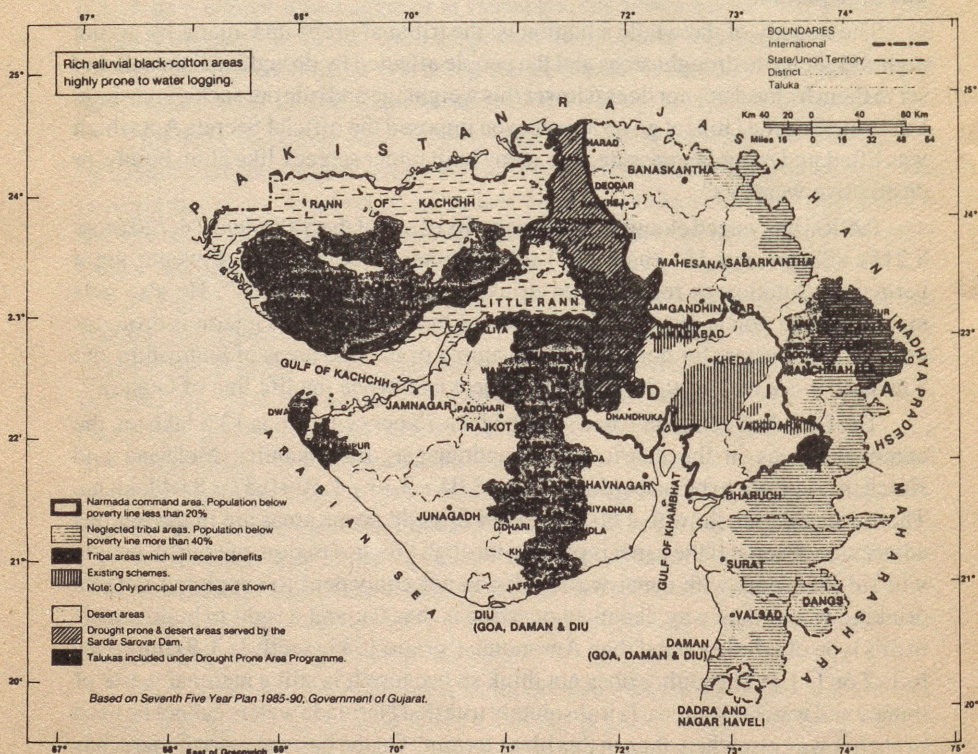
PA Raj has waxed eloquent on the benefits of use of the SSP canal: "4,720 (now 8,215) villages and 131 (now 132) urban centers in Gujarat state would get a permanent solution as regards their drinking water supply needs". He also gets emotional and points out that "75 per cent of the command in Gujarat is drought-prone... and it caters for domestic water supply of the arid areas of Saurashtra and Kutch; it is a real drought-proofing project and hence the life line of Gujarat".

The SSP dam command area is 18 lakh ha 75 per cent of it is 13.5 lakh ha. the command areas in the district of Surendranagar, Bansakantha, Mehsana and Kutch come out to be (according to Raj) $3.04 + 3.13 + 1.50 + 0.37 = 8.04$ lakh ha. These calculations show that 60 per cent of drought prone areas are in the regions adjacent to deserts. If the canal is passing through this arid region, of course, people will fill their pots with canal water. This is not equivalent to supplying potable drinking water. Any way, the main question is: has Gujarat a right to build canals in this type of terrain even if then Agronomist's ratio 1: 4 (exactly 1: 3: 9) improves to 1: 2 or 1: 1.5. The author does not think so because it is still a national waste of money and water resources. Is it absolutely true that Narmada waters cannot be used in a better way elsewhere than in this bleak terrain? On the basis of merit Gujarat has no right to build such a high dam at Navagaon, irrespective of Tribunal's favour.

Plunder of Annexed Adivasi Areas

We have already seen that Gujarat gets sufficient rains every year. There may be some lean years, but then this is true of whole India which includes Madhya Pradesh and Maharashtra. Did the tribunal worry about drought affected persons of these two states? M.P gets very poor weightage. We leave aside this injustice and come to see how Gujarat generated drought areas in the states?

In the last 44 years Gujarat has plundered the forest wealth of annexed adivasi areas right from the Danta state in the north to Dangs in the south. What can be the outcome? Drought! According to the report of the principal of the Forest Rangers College at Rajpipla, "Rajendra Sharma stated that between 1970 and 1990, the forests which extended west of Rajpipla had been decimated systematically not only with the full knowledge but with the active participation of the member of the legislative assembly from Rajpipla and the series of ministers in charge of the forest department of the government of Gujarat. He added that this systematic and organised forest felling had led to a recession of the forest area by about 60km to the east of Rajpipla | The people of Rajpipla openly stated that Chandubhai



Gujarat : Sardar Sarovar command area showing drought prone and desert areas, and tribal areas not covered by irrigation.

Deshmukh, Amarsigh Choudhari, shri Patel... and Virji Munia who had all been minister of forests of the government of Gujarat had all been responsible for the politicisation of tribals in the Rajpipla area which had eventually led to the commercialisation of forest resources and the large scale illicit removal of timber. Further, Mr. Sharma added that in the Rajpipla division the efforts made by the social forestry department and not made any dent in the rate of forest depletion. He stated that Karaya white gum extracted from *Sterculia urens* was being systematically pilfered. In such circumstances, he said, it was no surprise that in the forest areas there was a physical battle between the forest department on the one hand and the local leaders enjoying political patronage, on the other."

This is a true story not only the Rajpipla region but also for the whole eastern region. The length of this region is 5000 km from north to south and is the eastern most part of Gujarat habituated by adivasis. In reality (or morally) this region could be classified as a trust territory. Gujarat had no right over this region before annexation and now they have doubly lost it by devastation and default. The Rajpipla area is highlighted here because Rajpipla is 23 km by road from Garudeshwar on Narmada and the region lies on the southern bank of the river and extends up to Manibeli in Maharashtra where the present anti-dam satyagraha is on. In retrospect, "Near the Gujarat border, the Rajpipla forests have contractors, with the implicit and explicit support of the local members of the legislative assembly of Gujarat, during the last two decades. Gujarat politicians have systematically encouraged the decimation of the forest areas right up to the district Jhabua in Madhya Pradesh on the excuse that these will in any case be submerged under Garudeshwar and Sardar Sarovar reservoirs. But the forest destruction has proceeded far beyond the likely submergence areas. The local Bhils, who are substantially dependent on forests, have either been pushed further into or near the Dangs or towards the Alirajpur areas across the Madhya Pradesh border." The Rajpipla area had tigers, panthers, civets and jungle cats, the mongoose, hyena, wolf, wild dog, foxes and jackals, others and sloth bears. The black buck, once a common sight, is now seen occasionally". This is the fate of wildlife. How can anyone a common sight, is now seen occasionally". This is the fate of wildlife. How can anyone assess this loss in terms of money or compensation. Yet the Gujarat government speaks of compensatory afforestation. This is height of callousness, but let us assess even this callousness.

The SSP Dam will submerge 37,000ha of land of which 11,000 ha are forests. The government of India has released on September 8, 1987, 4,165,91 ha of forests for Gujarat, 2,731.00 ha for MP and 6,4888.54 ha for Maharashtra. The total area of forests comes out to be 13,385.45 ha. Of this area, 11,000 ha will get submerged due to the dam. Gujarat's share is 4,523 ha out of these 11,000 ha. Thus Gujarat will compensate only for 4,523 ha. The rest is not his concern because the remaining areas are not in Gujarat.

As against this 4,523 ha Gujarat will grow 4650 ha of compensatory forests in the villages of Kachchh. And wide publicity is given to this feat. BUt let us look at the opinion of principal Rajendra Sharma. "IN his opinion, the area selected for

afforestation is absolutely unsuited for raising trees, because the level of pH (acidity) in these areas is greater than 9.5. *Prosopis juliflora* which had been selected for plantation will not survive in such soils." He ended by stating that trying to raise compensatory forests in the Rann of Kutch will be an exercise in futility if not in sheer stupidity.

Of course, the Gujarat government can bring in some other forestry expert to prove that Sharma is wrong. The author does not deny this possibility. Nay, he is aware that the Gujarat government may invite journalists and show them as a matter of fact the compensatory forests in the desert areas of Kutch and there by prove this opinion to be unacceptable.

Can artificial forest be equated a virgin or a true forest? The answer is an absolute commercial forestry. It is beneficial to the government officials and contractors in two ways: they make money while growing these forests as well as at the time of felling. This way money always remains in the pipelines. To grow a natural forest requires devotion, love for nature and a rare expertise.

In the present case, in a 113 km stretch or gorge between Harinphal and Navagam, there may be 6,488 ha of natural forest of Maharashtra and 2,731 ha of MP and most of these will be submerged by the Sardar Sarovar. Who will compensate for this submergence is not clear. However, we may assume that the governments of Maharashtra and Madhya Pradesh will grow roses, sag, sal and deodar trees in the deserts of Thar because ample useless land is available there and in the present scientific impossibility can be converted into reality. Even then, the question reïns: Why will Rajasthan accept these graceful faked forests and why will Maharashtra part with their genuine forests? When consumer societies are supported by the state governments to guard against the ills of faked goods, are there no societies to guard against governments faked forests?

About 33 per cent of India's land used to be covered by forests. Obviously 20 percent is natural forests inaccessible for commercial use. 8 per cent has to be for the homeland of adivasis who number 6 to 8 percent of India population, 5 per cent of forests then will be available for commercial use. It is said that forest cover has come down to 20 per cent (forest's estimate) or 10 per cent (ecologist's satellite based estimate). This is near bankruptcy. Besides, all Indian states can not have 33 per cent forest cover, for example, Rajasthan. This means that some states should have 66 per cent of forests, where some states may not have natural forests at all. Also hilly regions in any one state need to have 89 per cent of forest because the flat populated areas will have none. The Narmada flows between Vindhya and Satpura ranges, hence this region ought to have 80 per cent of forests. More so, because MP is adjacent to Rajasthan which in turn is adjacent to Sindh in Pakistan and MP has to compensate for Rajasthan and Sindh. Similarly, Maharashtra has to compensate for Gujarat. So, Gujarat has no right whatsoever to destroy Maharashtra or MP forests.

Comparison of SSP and NASP Dams

In this section we give some data for the Narmada Sagar project dam and the SSP dam. This is necessary because the NSP dam is nothing but an appendage to the SSP dam. This point will be clear once the readers examine these data.

The points to be noted are: (a) the true dam height and length, (b) the catchment area, (c) the live storage capacity of the reservoir and the irrigation facility, and (d) the electric power.

Gujarat builds a 460 ft high dam whose length is 3, 970 ft. The owner state of the river, MP, is just given a 250 ft high dam whose length is 1,894 ft. Gujarat uses 88,000 sq km of the catchment area for the SSP dam in which its own contribution is just 423 sq km. It reserves its own 10,000 sq km of catchment area for its own exclusive use. MP uses its own 61,642 sq km for its NSP dam, which is only true on paper, in actuality it is used by Gujarat but the said area gets included in the above 88,000 sq km Gujarat's SSP dam submerges 37,000 ha of lands, of which 11,000 ha are forests. But Gujarat's own submergence is a paltry 4,523 ha, the remaining 32,477 ha is of Maharashtra and MP. MP's NSP dam submergence 90,000 or more hectares, of which 44,363 ha are cultivable lands and 40,332 ha are forests. But this submergence through accredited to the NSP dam is in actuality due to Gujarat's SSP dam. Thus, according to Baba Amte, the SSP dam and NSP dams are together going to submergence about 1,30,482 ha of land of which 55,681 ha is mostly prime quality cultivable land and 56,066 ha is forest land. Except 4,523 ha, all the land belongs to MP and Maharashtra, predominantly the former. In short, Gujarat actually submerges 1,30,482 ha of land which 1,25,959 ha will lie outside its own territory, that is, in Maharashtra and MP.

Gujarat's ministers, its newspapers editors, its religious leaders, its Gandhian sarvodaya workers, its spokespersons, keep saying that the 4,523 ha submergence will be compensated in Rann of Kachchh, but they never speak about 1,25,959 ha submergence in others territory. Gujarat contributes 0.5 per cent to the catchment area and obtains 33 per cent of waters. But then it does not know where to store them in its own territory. so it submerges others' territory and then claims that it is in the national interest. It builds a 460ft dam, but the live storage capacity of its reservoir is only 4.73 MAF, that too, after damaging 214 km of Narmada mostly in Maharashtra and MP. Thus the storage of water is mostly in Maharashtra and MP. Gujarat has taken 33 per cent of Narmada waters which turns out to be 9MAF. So far 4.73 MAF has been stored in the adjoining states. The question is: Where to store the remaining 4.27 MAF of water? Of course, it has to be in Narmada. Where? They have already used 214 km of river up stream from the SSP dam site. thus, they need another dam which is 300 km away from the SSP dam site. Thus, they need another dam which is 300km away from the SSP dam site. This is the NSP dam, 259 ft high which is in real terms a storage tank of the SSP dam. The reservoir here isn't lengthwise but is irregular. Hence, the damage is drastic 90,000 ha or more. the live storage capacity of this smaller dam is greater than that of the SSP. It is 7.9 MAF. Of this 4.23 MAF is utilized by Gujarat via regulated releases, the remaining

3,67 MAF is for MP. In spite of this fact, Gujarat harps that the SSP submergence is the lowest (37,000) instead of 1,30 482). Does MP need 3,67 MAF of water for irrigation? the answer is no is astonishing: the NSP is allotted only a little (1,23, 758 ha) for irrigation as against 18 lakhs ha for the SSP, that too, for some desert like areas (8 lakh to 13 lakh). Thus, M.P destroys 1 1/4 lakh ha of excellent cultivable land and virgin forest to irrigate as much or less of its land. Does MP need the NSP dam to irrigate a paltry 1 1/4 lakh ha of its agricultural land? The answer is again absolute no -9MAF of gujarat suffices for its 18lakh ha command area, which amounts to 0.5 MAF per 1 lakh ha of land with submerged soil. Thus, MP will not need more than 0.5 MAF of water for its 1 1/4 lakh ha command area. Assuming that MP will utilize 0.67 MAF of water, even then, 3 MAF is surplus. This surplus is a cushion for the SSP dam which can be used in item of distress. Thus Gujarat takes away 12 MAF of waters of Narmada as against its allotment of 9 MAF. This is indeed clever. NOT only that it makes MP pay 82 per cent of the cost on the NSP dam and it pays only the remaining 18 per cent which too it did not want to pay in the first place. Thus with little money Gujarat takes away all the benefits. Gujaratis may say that MP's downstream Omkareshwar and Maheshwar is not an irrigation project is not bigger than that of the NSP and hence it cannot utilize more than 0.5 MAF, which it can collect from its own catchment area, irrespective of the NSP. Hence, it is useless to argue on these points, Gujaratis may point out that MP is utilizing these waters for generating electricity. This point we will deal separately below.

Readers may wonder that author's calculations may be wrong somewhere. IF this is the doubt we proceed by an alternative path. Rajasthan is given 0.5 MAF to serve its 75,000 ha of command area. We know the agronomist ratio for Banni in Kachchh. It is 1: 4. Assuming that Rajasthani's soils is better than Banni's this ratio may improve to 1;2 or 1: 1: 5, but it cannot be 1: 1. This means that 0.5 MAF in MP will serve the command area of 1,50,000 ha or 1,12,5000 ha. This proves that the NSP and Omkareshwar can use at the most 1 MAF for irrigation purpose. To be on the safer side we assume 1.63 MAF instead of 1 MAF. Even then, Gujarat takes away 11 MAF out of the combined live storage capacity (12.63 MAF) of SSP and NSP. It may be that Gujarat uses 9 MAF, but then keeps 2 MAF as cushion for the SSP. WHichever way we may look, the NSP dam is nothing but an appendage or a storage tank for the SSP dam. Gujarat gets away with a huge dam at the expense of MP. It pays very little.

Now we see clearly NSP as an appendage or a storage tank of SSP. This can be further proved by the following evidence: "It is on record that covering of the height of the dam (i.e.NSP dam) from 860 ft to 814 ft (ie from 250 ft to 200 ft) would mean that the land submerged would come down by 80 percent (I.e from 90,000 ha to 18,000 ha) t There is little substance in the criticism form Gujarat's industrial interests that this would affect the viability of the project. apparently the Madhya Pradesh government that prosed just such a step at the Narmada water disputes tribunal as well. Why the proposal was not considered in the first place is a disturbing comment on the lack of concern for the ecological viability of the

project" This evidence proves beyond doubt that the tribunal has shown partiality to Gujarat.

Now we come to the next question: Does Gujarat really need a 455 ft dam? Gujarat misusing its dam's water only from 455ft to 363ft. The canal outlet is at 300ft. It needs 363 ft of water above the bed level to keep the generations operative. Thus, Gujarat has an effective 100ft dam. The outlet is kept at 3000ft because it want canal waters to reach the borders of Rajasthan. Also it wants to use 363 ft of dam as a dump or a pit for silt, so that it can use the dam for the next 50 or 1000years without much worry. This is pure extravagancies. Gujarat deserves a dam between Garudeshwar and Aliabet and this should be not more than 100ft. The waters should be used intra basin. (ie. between Tapi and Mahi) and not trans-basin (ie. upto to state' borders).

The SSP dam and its canal power houses will produce $1,200 + 250 + 1,450$ MW Madhya Pardesh's NSP, Omkareshwar and Maheshwar power houses may produce $1,000 + 390 + 240 = 1,630$ MW. These are then the bare facts. We do not know for the present how 1,450 MW electricity will get distributed among MP, Maharashtra and Gujarat although on paper it is 57 percent + 27 per cent + 16 per cent = 100 per cent. We have to wait to see in how many phases they produce the targeted electricity. The production of electricity comes much after the dam. So, we cannot deal with facts, but arguments. also it should be noted that in the present case electricity is just the by product because MP can produce electricity in a better way.

Gujarat makes MP spend 82 per cent of the NSP dam's cost because it uses say 0.9 MAF of water for irrigation and the rest (7 MAF) for electricity. In the first place, let us see why MP produces electricity while releasing regulated supply of water for SSP. Between NSP and SSP dams, there is a fall of 860ft (FRL) to 460 ft (FRL), i.e. 400 ft. Now, if this water runs down without being utilized for electricity then the energy stored in the water at the higher level will go waste and that is national waste. Thus, MP has no alternative but to produce electricity at the NSP site (whether it is the best site or not) for the first fall of 250 ft, then again at Omkareshwar for the second fall of say 90 ft and then at Maheshwar for the third fall of say 60 ft. Actually, MP has no alternative but to produce electricity at the NSP site even if the dictating state's choice is bad. Not only that, the Omkareshwar and Maheshwar dams too act as regulators for the SSP dam. If Gujarat does not pay service charges or does not contribute to the cost of these dams then it is a further exploitation of MP. Thus, Gujarat in no way being charitable to MP when the latter is producing electricity at an exorbitant cost to its environment and at a higher price. The grave injustice done to MP is that it is not given any choice or voice. A riparian state which has all the rights over the river, at least above the dam site, is given maximum say.

Had MP been given a free choice, it could have utilized its waters and produced electricity in a much better way. Hence, it is MP, which is storing and regulating the supply for the SSP dam, is doing charity to Gujarat and not vice versa. It is indeed a sad kind of development scheme in which a poorer state is made to serve a richer state.

The SSP and NSP dams are thus one and the same dam located at different places, i.e., at Navagam in Gujarat and near Punasa in MP and the storage of water is primary and generation of electricity is secondary, that too, the later is merely a by-product.

For the SSP dam, Gujarat gets Rs. 2,063 crore from MP, Maharashtra and Rajasthan, whereas pays Rs 828 (B) on the main dam and Rs 809 crore (B) on the power house, that is RS 1,637 crore. This way too it seems Gujarat gets away with the dam free of costs.

The tribunal has started with wrong premises: it wants to use Narmada intra-basin for the first 1,182 (1,312- (70+60)) km and trans-basin for the last 130 (70+60) km -actually 70km. This is done with this premise, Navagam in Gujarat becomes the best artificial site for a dam because Narmada just enters Gujarat above it. This premise destroys valuable dam sites like Jalsindhi, Harinphal and makes redundant sites like Maheshwar, Omkareshwar. Gujarat also knows that if MP fails to build its own dams then too nothing will happen to it except that it will not get regulated flow. On the other hand unregulated flow will be copious and Gujarat can take as much advantage as possible of this extra flow of water.

Conclusion

a) The number of people who will get ousted by the Narmada project ranges from 1,00,000 to 3,00,000 and the author does not know which figure he should take as reliable. Assuming the lowest possible figure 1,00,000 as true for the SSP-NSP combine, even then, human suffering involved is heart rending. Assuming four persons to a family, this means 25,000 families and 250 villages. To honestly document the aspirations and hopes of 25,000 families and 250 villages. To honestly document the aspirations and hopes of 25000families is not an easy task. To complete the task in a year or two would need at least 250 well qualified social workers.

b) The origin, living, and artistic traditions, especially paintings of Narmada Man (5500 BC) and of Navdatolian Man(1600 to n1440 BC) are linked to many of the sites which will be destroyed by the project. Ancient and medieval historical sites, such as Maheshwar or Mahishmati and Bhojpur, and Dhar which had Bhoj-Sata University. There is a ruined dam (10-55 AD) on the Bhojpur lake. Flora and fauna of the Narmada basin, specifically, magnificent sal forests. Historical monuments and archaeological sites. And, temples will all be submerged . To out before the readers what is already on record: " The archaeological survey of India has recently completed studies of the historic monuments and archaeological sites. The main conclusion which may be derived is that more than a hundred monuments will be submerged and lost forever. Neither the project authorities not the World Bank have made an assessment of this loss. In addition, more than 132 prehistoric sites, which are literally a goldmine for archaeologists, will be lost. It may be possible to transplant some of the temples and monuments physically, but in the case of prehistoric sites the loss will be permanent."

c) Narmada has preserved very useful older alluvia deposits (1,00,000 years old) which will help in studying past climatic changes and the river flooding. Those areas come under paleoflood and paleomonsoon studies. This is a task for specialists in the aforesaid fields.

d) The Gujarat government has assured all that the SSP dam is safe against any earthquakes. Accepting this claim as honest what does it mean? It means that the government has used the latest technology in constructing the dam. What is great about it? The dam is being built in 1991 and obviously the dam will be built using the 1991 technology. There are cities in Japan and in Californian coasts of the USA where buildings are seismically shock-proof. The SSP dam too may be shock-proof in this sense. It only means that the 4,000 ft (i.e. length of the dam) of the dam is shock-proof and will not collapse and the towns of Bharuch district are safe. But this does not rule out the reservoir induced seismicity all around 212 km of submergence. If this seismicity manifests after the completion of the dam then people of Maharashtra and MP living on the Narmada banks will never be secure unless they learn to live with earth tremors as Japanese do.

The SSP-NSP combined dams destroy 1,30,482 ha of virgin forests and cultivable land of high quality mainly in MP and Maharashtra to irrigate 18 lakh ha in Gujarat, of which 75 per cent (i.e. 13.5 lakh ha according to PA RAJ) is drought prone. That is, 9 lakh ha is arid and remaining 4.5 lakh ha is of poorer quality of land than in MP. This means that a small high quality part of India is destroyed to serve a large arid and semi arid part of the country. This is called national interest. In Russia, Siberian waters were diverted to some fertile regions. In the US arid region waters are taken to fertile regions and not vice versa. And, that is national interest. In Russia, Siberian waters were diverted to some fertile regions. In the US arid regions waters are taken to fertile land.

It is a normal practice, that people from arid and semi arid regions (i.e. drought prone regions) should migrate to more favorable regions and not vice versa. In the present case, people residing in favorable regions and who have no complaint whatsoever against nature are first made destitute and then shown charity. This is a crime against science and humanity. High technology is there to serve science and humanity; it is not there to destroy well-settled people. If the Gujarat government is so rich as to build a huge dam, relocate people who do not need in the first place relocation, why does it not relocate its own people in favorable regions within the state? This will be in the national interest.

Gujarat has done injustice to Maharashtra by building the Ukai dam and making Maharashtrian adivasis destitute. It got away with that crime easily. Later, it did injustice to Rajasthan by building a dam at Kadana on the border of Gujarat. It made Rajasthani-tribals destitutes. Now, it is the turn of MP. And, this is all in the name of national interest. In building Kadana, or Ukai or SSP, Gujarat sees that it suffers the least damage and causes vast damage to adjoining states. In the present case, 19 villages are submerged in Gujarat, whereas 36 and 193 villages are affected

in Maharashtra and MP respectively. This is also true for families affected and the land submerged.

The SSP-NSP combined dams are planned to store 9 MAF of water for Gujarat. Thus, irrigation is primary and electricity is secondary, i.e. it is a by-product. MP could have produced electricity at more favorable states, if it would have been given a free hand. Also, natural dam sites like Jalsindhi and Harinphal are lost due to submergence to MP whereas Navagam is not a natural dam site. This is a national loss.

The Narmada river is an intra-basin river for most of its length. It flows between Vindhya and Satpura ranges. Hence, Narmada should be used between Mahi and Tapi. It cannot be used for irrigation purposes in the Bharuch and Baroda districts. Perhaps, it may irrigate at the most 4 lakh ha land. Thus Gujarat needs a dam to store at the most 2 MAF of water. For this, it can build a dam between Garudeshwar and Poicha. The dam height may be 100 to 150 feet.

Gujarat has no right to complain about MP or Maharashtra as long as the Narmada waters flow through Gujarat. During monsoon, Gujarat will easily be able to store 2 MAF of waters, because MP or Maharashtra cannot stop the flow of Narmada without spending a fantastic amount of money. River waters going to sea is not a national loss. It is a natural eco-cycle and no one has right to stop it.

Indians have lived in arid regions for hundred of years and they know how to survive there. There is no point in teaching them wrong methods of living. This is not to say that right type of modern technologies should not be used to remove their distress.

The government of Gujarat and the people of Gujarat are happy to see that the SSP dam is coming up fast and now it is a fait accompli. They are convinced that the dam can be built by brute force, repression and cruelty. It is a challenge now for ecologists, environmentalists, botanists, zoologists, all scientists and all sane and scientific tempered people of India to see that this dam becomes a grand monument to truth, compassion and justice. And, this can only become so by not allowing the mighty gates of this most sinister dam to be closed and impound waters to form a vast destructive reservoir. This is not an easy task.

The first point to be raised by the state and the central governments will be rhetoric. They will say: we have now spent Rs 20,000 to Rs 50, crore to build this dam. It cannot be a waste. That will not be in the national interest. The Supreme Court of India will endorse this stand by saying that this is the most valid argument. So the anti-dam activists will have no alternative but to accept the dam as a fait accompli. Are the anti-dam activists prepared to remind the central government it was already warned by hundreds of eminent persons of this country to reconsider this SSP dam? Yet, the State government rushed to complete the dam in haste and hence should take the resulting consequences of the fait accompli philosophy. The natural beauty of this country and the lives of simple, innocent folks living in such surroundings cannot be saved by all kinds of compromises in the name of national

interest. The fight is never against any dam but against the philosophy behind it, i.e. brute force and cruelty. This is then the challenge.

All present day environmentalists and anti dam activists should note that they are not the first to take up this challenge. Vishnois or Bishnois who live somewhere near Jodhpur in India took up this challenge long back and won against the might of Jodhpur Maharaja by quietly sacrificing 360 of them just to save their few trees. Even today, they have a beautiful habitat in the desert where deer and peacocks move freely around them without fear. There is a modest temple raised on the ashes of these 360 and it will do a great good to the spirit of modern ecologists to put two small flowers on the shrine.

This is an adapted version of Mr. Patel's original detailed article.

Courtesy:- The Economic & Political Weekly.

Part II:

"The Social and Environmental Effects of Large Dams"

By Edward Goldsmith & Nicholas Hildyard

Reviewed by Jashbhai Patel

Today, in India, the building of big dams is a rage. The politicians, bureaucrats and technocrats cohort in unison that big dams are the panacea for a poor country like Bharat. They project their own civil engineers, electricians and hydrologists as the world's renowned experts. And, the experts are considered the final authorities in this matter in this country. They think that those who do not agree with them are ignorant goons.

Most people seldom distinguish between science and technology. Science allows human beings to know things; technology allows people to do things. Science never becomes obsolete; it progresses slowly and steadily; this progress cannot be ordered and scientists have to struggle hard to make a little advance. On the other hand technologies become obsolete.

The western multinational companies mostly sell obsolete technologies because they can make profit from discarded, useless techniques. No doubt the poor countries resent this treatment, but then they run after them. The columnists of the Indian newspapers too can do no more than coin a word like "G-7" for rich countries which own multinational companies. Then they use this word "G-7" to tell their people that these countries are there to keep Indians backward and poor and thereby defend their obsolete mind. They never tell their countrymen that by hard work and originality they too can defeat G-7. And, hard work and originality do not need G-7's money.

To survive, India needs energy as any other country. The readily usable energy is electricity. One simply puts on the switch and the energy is used up. Electricity is generated by many techniques. Among them, atomic energy reactors and hydroelectricity via big dams are glamorous because power stations can be used as huge show pieces or places. And these show places become colorful feathers in politicians caps. And, all politicians are after them.

"Small is Beautiful" is a title of a famous book. Its author has justly recommended the use of small projects. And, it will do good to many countries if they heed to his advice. But it seems that in this country, people in power have not taken note of him. Perhaps they believe in the dictum: Big is beautiful. This is, in a way true in Nature and in Arts. For instance, the Himalayas- the mountains are big and magnificently beautiful. Also, among human beings, it is the grown up persons who, if perfect, are beautiful. However, these grown up persons should not forget that 'children are cute'. Their pretty, innocent, charmingly spontaneous natural behavior attracts ready attention. So, if the learned men of India want to change the title of the above book, they may do so by writing; 'Small is cute'. But they cannot write Big is beautiful or magnificent unless they admit: 'Big is beautiful only if, it is

perfect'. And, perfection is almost an impossibility in technology as in other fields. This is much more so in India with borrowed or bought technologies. So Indians have to be content with "Small is cute".

Some Gandhians and Sarvodaya workers have taken to heart the book 'Small is beautiful'. However, when it comes to Sardar Sarovar Project, which is the biggest of all the Indian dam projects, some of them endorse this mighty project wholeheartedly. They believe that this project is perfect-forgetting the fact that it is built by using the borrowed and bought technologies and partly by G-7's money. This is highly shameful as it is the height of human hypocrisy. Surprisingly, Rajasthan's Dhebar lake, which is not very far from the SSP site, has the most beautiful indigenous dam technology. Yet this is totally ignored in the country.

The myth of the mega-dams has been exploded by many researchers. Many campaigns and most important of all the people's struggles all over the world against the various aspects of the dams. These struggles have raised important issues regarding the projects and the concept of development. These struggles have sharpened the debate, encouraged more research and search for alternatives and new approaches. The magnum opus "The Social and Environmental impacts of Large Dams" is one such exploration regarding the problem and the way out.

This highly acclaimed book was published by the Sierra Book Club in 1984. The book was written around 1980. It is a study of *Large Dams*. It lists in all 278 dams of the world. This shows that the author have studied most of these dams, if not all. They have examined many points and counter-points made by most of the world's authorities in the field. They have answered these points squarely.

A Compelling Case

This is the first critical study to systematically analyze the consequences of building large-scale dams. From primary sources and first hand observations, Edward Goldsmith and Nicholas Hildyard bring together all the evidence from water development projects around the world, including Egypt's Aswan Dam, Ghana's Volta dam, Bratsk in the USSR, Kurkawa in Japan, and the "model" Tennessee Valley Authority, to produce this comprehensive and profoundly disturbing landmark study.

Popular thinking holds that big dams are of great economic and social benefit because they produce clean power, halt unpredictable flooding and help combat world hunger by providing water for irrigation. In fact, the authors demonstrate, big dams and water projects have not only failed to achieve these basic objectives but they are actually leaving a legacy of unsurpassed cultural destruction, disease and environmental damage.

The authors consider the difficulties of resettling the inhabitants of area flooded by reservoirs, the loss of wet lands, forests, and agricultural land, water losses from reservoirs caused by seepage from irrigation canals, and the increasing incidents of water born diseases such as malaria associated with perennial irrigation schemes.

They also show how these projects have actually triggered earthquakes, been ineffective in controlling floods, destroyed fisheries in the rivers, reservoirs, estuaries and seas beyond and created serious problems of water logging and soil salinisation. They present evidence of dangerous operational errors and engineering mistakes, underscored by dam collapses in Turin, Italy and Orville, California.

The authors study ancient and traditional irrigation systems which offer alternatives that are appropriate in scale, demonstrably effective, and architecturally stable. They sound a worldwide alarm that the pace of international dam construction is accelerating, with plans massive projects on the Amazon in Brazil and on the Yangtse in China. In the United States, major schemes on the drawing board include the Texas Water system and the North American Water and Power Alliance.

Ultimately, Goldsmith and Hildyard build a compelling case against large scale water projects, leading to the inescapable, emphatic conclusion that superdams should never be built.

The significance of the book is admirably brought out by Brent Blackwelder, Director of Water Resources, Environmental Policy Institute, Washington D.C. He wrote in the Forward of the Book: "Popular thinking holds big dams to be of great economic and social benefit because they produce clean power, stop damaging floods, and help combat world hunger by providing water for irrigation. Edward Goldsmith and Nicholas Hildyard have pulled together an unparalleled assemblage of data demonstrating that big dams and water projects have not only failed to achieve those basic objectives but are also leaving a legacy of unsurpassed cultural destruction, disease, and environmental damage. This remarkable study of large water development schemes from around the world shows the dramatic difference between the rhetoric of project promoters and the grim reality of the superdams.

Goldsmith and Hildyard present telling evidence of the extensive range of problems that large dams have caused throughout the world - from engineering mistakes and operational errors to severe social disruption and the spreading of disease; to the destruction of estuaries and endangered species; to the ruination of the very land designed to be made productive. Because the pace of large scale dam building is increasing exponentially it is imperative that industrialized nation take the warning in this book to the heart. The case against irreversible manipulation of river systems on a global scale is so overwhelming that we proceed with funding of these superdams at our own peril.

A significant percentage of water development programs in the United States has been sadly in error, and developing countries seem intent on replicating our mistakes. America's Tennessee Valley Authority is often held up as a model of how to make the economy of a valley flourish. People from all over the world come to see what TVA has done. Unfortunately TVA story is reply a myth (See William V Chandler, "Water Stewardship and Development". in Volume Two, case studies, available from The Ecologist, Worthyvale Manor, Camelford, Cornwall, U.K."

The Environmental Policy Institute's analysis of the costs and benefits experienced by TVA's water products during its first fifty years showed that the flood control and navigation objectives have yet to pay for themselves by any reasonable standard of accounting. Furthermore, areas in the Southeastern United States that did not receive financial aid from TVA do as well as or better than the TVA region, even though they were as poor or poorer, begin with.

One outstanding feature of Goldsmith and Hildyard's work is the discussion of ancient or traditional irrigation societies sustained over centuries. This is in stark contrast with the short lived, poorly designed irrigation projects that industrialized countries have funded throughout the Third World.

The staggering array of problems created by large scale water development is so alarming and widespread that an international network has been established to halt the destruction and to propose sensible alternatives. Goldsmith and Hildyard's book stands as a land mark in providing the most comprehensive information and analysis to date on the tragic impact of the superdams..."

This book has received favorable comments from some of the outstanding newspapers/journals of the world. *The Times* (London) stated:

"The impact of Goldsmith and Hildyard's blockbuster could be dramatic... especially if enough scientists, politicians, civil servants and international bureaucrats are convinced by the enormous mass of evidence"

This comment is noteworthy that it puts scientists in the forefront of the battle against the destruction of our planet.

The Economist Wrote:

"The Social and Environmental Effects of Large dams assembles a wealth of examples to support its proposal that all funding agencies cease paying for large dam projects forthwith-even for work in progress. The book is strong on the ecological damage caused by dams-the loss of wildlife, forests and fish, the erosion of deltas, salinisation of once fertile soils and the horrifying connection between dam schemes and water borne diseases...(and) their evidence for a connection between reservoirs and earthquakes is chilling."

The spirit of the book is very well expressed by a poet in his

"A Ballad of Ecological Awareness"

*"The cost of building dams is always underestimated
There's erosion of the delta that the river has created,
There's fertile soil below the dam that's likely to be looted,
And the tangled mat of forest that has got to be uprooted.
There's the breaking up of cultures with old haunts' and habits' loss,
There's the education programme just doesn't come across,
And the wasted fruits of progress that are seldom much enjoyed
By expelled subsistence farmers who are urban unemployed.*

*There's disappointing yield of fish, beyond the first explosion,
There's silting up, and drawing down, and watershed erosion. Above the
dam the waters lost by sheer evaporation;
Below the river scours, and suffers dangerous alteration.*

*For engineers, however good, are likely to be guilty
Of quietly forgetting that a river can be silty,
While the irrigation people too are frequently forgetting
That water poured upon the land is likely to be welting.*

*Then the water in the lake, and what the lake releases,
Is crawling with infected snails and water-borne diseases.
There's a hideous locust breeding ground when water level's low
And a million ecologic facts we really do not know.*

*Therefore benefits, of course, which may be countable, but which
Have a tendency to fall into the pockets of the rich,
While the costs are apt to fall upon the shoulders of the poor.
So cost-benefit analysis is nearly always sure
To justify the building of a solid concrete fact,
While the ecologic Truth is left behind in the Abstract."*

The overall impact or feel of the book is expressed on its last page:

THE DAMS ARE ALL WE TALK ABOUT THESE DAYS IT'S LIKE TALKING
CONTINUALLY OF DEATH, OF CERTAIN DEATH. THE PRESIDENT WILL
HAVE TO PUT US ALL IN PRISON IF HE WANTS TO CONTINUE WITH THE
CONSTRUCTION OF THE DAMS ON THE CHICO—BETTER STILL HE
SHOULD BOMB US OUT OF EXISTENCE. THIS WOULD BE MUCH EASIER
FOR HIM AND FOR US BECAUSE WE ARE NOT GOING TO ALLOW THE
DESTRUCTION OF OUR HOMES AND FIELDS AS LONG AS THE BREATH
OF LIFE IS IN US

The Scheme of Study

The volume is divided into six parts and contains 26 chapters, The parts are so made that the authors can deal with each and every aspect that concerns the Big Dams.

Initially, in part I, the authors deal with the Reasons Given for Building Dams.

In part II, the other important aspect dealt are: A) *Before the Flood*; i.e, before the public and private properties are drowned. This section contains the following

points: Dams and Society: The problems of Resettlement and Social and cultural Destruction.

The part III is titled: *After the Flood*; i.e., after the public and private properties are drowned. This is the largest section of the book and contains in all 14 chapters, forms the bulk of the book. This part include various issues such as: Closing the Dam: Loss of Land and Wildlife Upstream, Loss of Silt and Fertility Downstream Water Loses: Do they Exceed Gains?, The Effect of Perennial Irrigation on Pest Populations, Dams and Diseases, The Effects of Large scale water Projects on Fisheries, Dams, Failures and Earthquakes, The Myth of Flood Control, Salting the Earth: The Problems of Salinities, Management and Maintenance-Perennial Problem, Loss of Land and Food to Plantations, The Loss of Land and water to Industry and Urbanization, Dams, Pollution, and the Reduction of Food Supplies, Sedimentation, The way of All Dams, Are these problems Inevitable?

The part IV is titled: *The Politics of Damming*. This section sets context with: Social and Environmental Impact Studies, The politics of Damming, Fudging the Books - a favorable method with bureaucrats.

The part V is titled: *Traditional Irrigation: Learning from the Past*. This section explores into various other aspects of irrigation such as: The Qanats of Iran, Two Traditional Irrigation systems in Tanzania, Traditional Irrigation in the Dry Zone of Sri Lanka, Traditional Irrigation in Mesopotamia, The Lessons of Traditional Irrigation Agriculture: Learning to Live with Nature.

The last part (VI) obviously is *What Should be Done*? This long list of chapters is not given here to bore readers but to show how the authors have faced each and every problem squarely. They have prepared themselves to meet the arguments of any proponents of *Big Dams*. The reviewer of this books thinks that the proponents of *Big Dams* in this country should read this book honestly and face the evidence put forward by the researchers.

The first chapter traces the history of dam building from the ancient times to the present. It notes the engineering skill of Sumeria, Babylonia, Egypt, Sri Lanka and Cambodia. Then, it points to Aswan High dam, Volta dam and many other dams which are under construction and which are going to come up in the near future. The authors ask: why big dams? And, they give reasons for building big dams. They say: "There is little doubt that at least some of those involved in building the massive...projects...believe that they are improving the lot of mankind".

"The ability of large dams to compensate for the unpredictability of nature is what makes them so attractive; dams can store peak flow during the rainy season for use as irrigation water during the dry season. Moreover, large dams can irrigate land in those very areas that are likely to be the most fertile, namely the "rich alluvia soils of the world's major river basins and river valleys. Such basins and river valleys include those of the Nile, the lower Mekong, the Indus, the Ganges, and the Brahmaputra, the Tigris and the Euphrates, the Grijalva and Papaloapan in

Mexico, the Sao Francisco valley in Brazil, and the Lower Colorado in the United States. Once dammed, those rivers will yield their rich alluvia soils for irrigation throughout the year, with their annual flood waters impounded in a reservoir and released when required. No longer will their waters be wasted on the journey to the sea.....”

Playing with Water: Playing with Fire ?

Such then are the two major benefits claimed for large-scale water development projects. Given that food and energy are the two commodities in shortest supply throughout the Third World, is it any wonder that so many developing countries now see large-scale dams as the touchstone of future prosperity? In a world where millions go to bed hungry and where few have access to even the cheapest material goods that we take for granted in the West, a demand that the further building of large-scale dams should cease forthwith must sound churlish. Would not doing so effectively condemn still more people to death by starvation? And if the experts insist that dams provide the route to material property for impoverished millions, who are we to gainsay them?

But there is another aspect to the dam-building issue, one that the industry is less than keen to display. It includes massive ecological destruction social misery, and increasing ill health and impoverishment for those very people who are expected to benefit most. That underside of the issue is the subject of this book. In our examination, we shall see:

1) How little of the extra food grown through irrigation schemes ever reaches those who need it most; how, in the long run those irrigation schemes are turning vast areas of fertile land into salt-encrusted deserts, and how, too, the industry powered by dams is further undermining food supplies through pollution and the destruction of agricultural land;

2) How millions of people have been uprooted from their homes to make way for the reservoirs of large dams, how their social lives have been shattered and their cultures destroyed; and how, also, their health has been jeopardized by the water-borne diseases introduced by those reservoirs and their associated irrigation works;

3) How dams are now suspected of triggering earthquakes; how they have failed to control floods and have actually served to increase the severity of flood damage; and how in many instances, they have reduced the quality of drinking water for hundreds of millions of people;

4) And finally, how the real beneficiaries of large-scale dams and water developments schemes have invariably been large multinational companies, the urban elites of the Third World, and the politicians who commissioned the projects in the first place.

Truly, by playing with water, we are playing with fire. This chapter deals with *Dams and Society: The problem of resettlement*. It gives the number of people affected by such dams like Volta, Aswan, Kariba, Keban, Ubolratana and Pa Mo.

The number ranges per project from 30,000 to 4,50,000. It is estimated that in China, the vast Three Gorges dam scheme will displace 1,400,000. Indigenous tribes, are threatened all over the world.

Displacement

The authors think that the resettlement schemes bring nothing but untold misery. They add that "it is hard to find examples elsewhere in the world of successful settlement of ... a large number people in...a short time. It is observed that 'people were often relocated or resettled without regard to their individual, community-or societal needs'

"Settlement schemes have a high failure rate around the world". And, "even where planning is effective, some (especially the aged) will never come to terms with their new homes. For them, the transition period ends only with death. The politicians and the government officials" insensitivity is illustrated as under: "if we have to drive our people to paradise with sticks, we will do so for their good and the good of those come after us". Many times the project is presented to the people as a fait accompli and are told that the scheme would go ahead regardless of their opposition'.

In short "Treatment of people arbitrarily forced out of their home ... varies tremendously. At one end of the scale, the people receive scarcely a warning that the waters will rise, others may be noticed but neither compensated nor assisted to move... Lengthy police intervention, military coercion, and the bulldozer sanction, which is used in places, is acclaimed as successful if bloodshed can be avoided". Unfortunately, even the 'bloodshed is not always avoided."

The theme is further elaborated in the chapter 3, which is concerned with Social and Cultural Destruction. It begins noting that those earmarked for resettlement are frequently unwilling to move. Love of birthplace, no matter how inhospitable it may appear to strangers, is quite possibly a universal human characteristic. "When the society.. is a tribal one..." "Love of land" takes on a significance for greater than... in societies where land is ...just another commodity to be bought and sold". This way, they dwell in the problems of ignored ethnic differences; of inappropriate housing; of the integrity of traditional culture and housing; and ask finally, *Is Better Planning Possible ?* The answer is: "Such procedures are hardly equipped to ensure better planning of resettlement schemes". To them, they lead to *The Road of the Slum* . "cultural change is actively sought by the governments of the Third world nations. For them, resettlement and development projects are a vital means of bringing "progress to the people . Indeed, the aim is quite explicit: to transform traditional life-styles. Nomads must be settled, pastoralists turned into farmers, subsistence farmers into modern agriculturalists"...

"To ask a traditional society to change is in effect to ask its people to abandon their whole way of life. It is not comparable to, let us say, asking a western pig-farmer to go into sheep or cattle, nor is it like asking a man to change his job. It is

saying that traditional societies should embrace 'modern' values and 'modern' lifestyles regardless of what that will do to their own culture. As Stanley Johnson comments of the Volta scheme: "Anyone who has endured the horrors of Accra and witnessed the ultimate consequences of 'modern' sets of values and a 'modern' approach to life may justifiably wonder whether the game is really worth the candle"

Indeed they might be deprived of their traditional culture and stripped of the support of their communities, many of those who are resettled drift towards the cities. There, a now familiar tragedy repeats itself. The men frequently turn to alcohol, and the women are often forced to prostitute themselves simply to earn the wherewithal to feed themselves and their families. Malnutrition and disease are rife, jobs almost impossible to find. It is a world far removed from the "paradise" offered to them by the authorities. Unfortunately it is a world in which most of them will spend the rest of their lives.

Chapter 4 points out the Loss of land and wildlife upstream and the loss of Silt and Fertility Downstream. When a dam is closed, the waters of its reservoir begin to rise, submerging vast areas of land. Beneath the waters of Lake Nasser, for example, 400,000 hectares disappeared; 848,200 hectares were lost to the Volta River project; 510,000 hectares were flooded by the Kariba Dam; 380,000 hectares by the Cabora Bassa Dam in Mozambique; and 328,000 by the Guri Project in Venezuela.

Often the area flooded contains thousands of acres of good agricultural land. In Sri Lanka, for example, the Victoria Dam (part of the giant Mahaweli Project) will, according to L. Alexis, "destroy 3000 acres of land cultivated with paddy, tobacco, vegetables, and other food crops; 2000 acres cultivated with mixed fruit, cocoa, coffee, coconut, spices, tubers, and soft wood in village gardens and homesteads; and 2000 acres in big and small estates of cocoa, coffee, pepper, rubber, coconut, sugar cane, and softwood".

Figures are not available for the total worldwide loss of farmland to dam projects, but the number of people who have had to be resettled as a result suggests the productivity of the lands they previously occupied, which have now been flooded. In India for example, the Srisaïlam Hydroelectric Scheme near Hyderabad flooded some 107,000 acres of farmland, land which, until the dam was closed, had provided a livelihood for some 100,000 people. Discussing that loss of agriculture land, the Fact-Finding Committee on Srisaïlam Project Evaluations notes:

"The agriculture economy of the region was considered to be highly prosperous. The lands, both dry and wet, situated along the Tungabhadra and Krishna rivers were highly fertile and the cropping patterns adopted by the farmers were both remunerative and profitable. Not only food crops such as paddy, wheat, and redgram, but also commercial crops such as groundnut, tobacco, chilies, and cotton were grown extensively in the areas which have been submerged. The level of food production in these areas was quite high as the soil and the climate were very favorable to agriculture. Thus, the submersion of 107,000 acres caused an enormous amount of loss and hardship to the local villagers."

Loss of Forests and Wildlife

"Dams have also caused the drowning of thousands of acres of forest. It is estimated, for example, that between 1950 and 1975, India lost 1479,000 hectares of forest land to various river valley projects. For the promoters of large-scale dams, that loss of forests is generally seen only in economic terms—that is, in terms of the actual market value of the timber submerged.

Forests provide benefits that cannot be given an economic value. "Even if the intangible ecological benefits are quantifiable, the social value of forests is not. Yet, for the indigenous tribal groups the forest is of great cultural and psychological importance, and its destruction represents a serious disruptive event. Moreover, there is no way of calculating the losses of the economic and genetic potential of a forest, for there may be dozens or hundreds of species which have not been even identified."

"The inevitable loss of wildlife due to the flooding of forests, agricultural land and bush is rarely cited as a reason for preventing the building of a dam. Indeed at times the indifference shown by officials to the fate of those natural species that will be drowned by a dam's reservoir is astounding. We quote again from the report cited above on India's Narmada Valley Project.

Characteristically, there is no plan to relocate the wildlife [in the threatened area]. When we asked officials about this, they stated that there would be "natural relocation"—that is to say, the animals would move out of the area to be flooded by themselves. Such an assumption, however, seems to us to more of a sick joke and a convenient excuse than a serious proposition. Other than birds, and possibly a few alert mammals, how many animals really stand a chance of relocating themselves when the water come their way? How much adjoining forest is there anyway for them to move into? Will not such a movement increase competition between animals (especially the strongly territorial ones) in the new habitat? And, if one includes wild flora in the category "wildlife" how on earth are all the plants going to naturally relocate themselves? or, for that matter, the microorganisms.

Incredibly enough, for some government departments "Wild life" seems to mean only tigers and deer and other big mammals. In answer to a query from the Department of the Environment, the Government of Gujarat says, "at present there is no wildlife in the reservoir area of the proposed Sardar Sarovar Dam and its vicinity". The sick joke continues. To the very next question, the reply is "After construction of the dam and the creation of the reservoir, it will be possible to develop a wildlife sanctuary or Safari Park in the vicinity, Where pray, is all the wildlife suddenly going to come from? When it comes to costs, there seems to be none; when it come to benefits there are suddenly a lot. And when asked to specify rare and endangered species, as well as fish and crocodile breeding grounds in the submergence zone, the Gujarat Government has kept silent. Why?

At a time when experts warn that 20% of the world's animals and plants could be extinct by the end of the century as a result of poaching and illegal trading alone,

the indifference of Third World and industrialized governments alike to the fate of their wildlife is alarming. Underlying that indifference is the widely held view that "conservation" is somehow the concern only of the rich and the indulgent.

To those committed to the idea that industrial development offers the panacea for such ills as poverty and malnutrition, the very thought that the interests of the wildlife should take precedence over the requirements of development is inconceivable. The authors note that the idea that future of the man is linked with that of such species as the lion or the elephant- let alone the termite or the snail- is still alien to the most ... of today's ... planners. In the study about the reduction Of fertility downstream due to impoundment, they have shown in a table, citing the exact figures for the content of potassium oxide, phosphoric oxide, nitrogen and organic matter in sediment. About Loss Of Silt And Coastal Erosion, they cite the example of Egypt. The Aswan Dam has helped in advancing the coastal erosion and the authors fear that the consequences for Egyptian agriculture could be severe.

Water Losses, Diseases

About the water losses in chapter 5 The authors deal in three sections: (a) Losses to; Evaporation; (b) Losses to transpiration and The Problem of Aquatic Weeds; and (c) Losses due to Seepage and Overuse of Water. Obviously, these wipe out the gains. In hot dry climate the loss of water from reservoirs due to evaporation is staggering: it is as high as 300 cm a year in some parts of India whereas their 160 million hectors of cultivated land receive a paltry 75 cm of rains annually. Can man defeat the Nature?

Regarding the Perennial Irrigation on Pest Population they attempt to introduce perennial Irrigation into an arid area is to change the microclimate... the moisture level of the atmosphere increases as a result of evaporation from the... reservoir... what was previously a hot dry ecosystem... is transformed into one that is permanently moist." "The new moist ecosystem will attract all sorts of micro-organisms, insects (etc.) that are particularly adapted to the new conditions. Inevitably, their populations build up at the expense of the species that previously lived there and cannot adapt to the new moisture levels." "Some of the new species may, of course, be beneficial to agriculture. Earthworms... are useful,..." "But many of the forms of life encouraged by the new moist conditions are highly undesirable".

In chapter seven "Dams and Disease" makes a very important point. "When a lake is created, life adapted to the previous riversides ecosystem are likely to disappear . In their place, other species will emerge that are adapted to the new environment ... Unfortunately, such change is generally for the worse. Indeed, ... it has led to ...waterborne and other diseases." Among the diseases, it lists: Malaria, Schistosomiasis, Filariasis And Onchocerciasis.

Also, the authors point to 'diseases introduced as an indirect result of water projects'. In such cases, people contract diseases because they are dumped in inhospitable places.

Under the section "*Efforts to Combat Disease*", it is pointed out that ... if only the local people would refrain from using river... in the way that they do,... they would not be vulnerable to so many waterborne diseases'. But is such talk realistic?.. in India, the Ganges, a holy river, plays an even more central role in social life; millions make the pilgrimage to Benares in order to submerge themselves in its (spiritually at least) cleansing waters. Can we really ask those people to abandon their ancient customs and transform their whole way of life simply to serve short-term political interests.

In the chapter about "The Effects of Large-Scale Water Projects on Fisheries" it is found that, as a short term success, fisheries flourish for the first five years, then sets in the long-term failure. The examples cited are those of lakes Karit and Valta. The findings are supported by the Ukrainian Academy and other researchers.

The herbicides used to control aquatic weeds and pesticide to kill the germs of waterborne diseases too harm the fisheries. "In India, for example, pesticide use has led to the complete loss of fish life in some rivers, reservoirs and estuaries".

Earthquakes, Failure

About the "Dam Failures and Earthquakes" "it is only recently that we have started building large dams, so our experience so far has been largely with small ones. Those, however, have not proved particularly reliable; ..." "The incidence of dam failures is, for a number of reasons, likely to increase in the years to come." The reasons given are

1) The lack of experience in design, construction and operation of dams may lead to errors and serious mistakes.

2) "As appropriate sites for dams dwindle -and such sites are strictly limited - less and less suitable locations will be chosen". Example is: Malpasset dam, Frejus, South France. The dam failed: December 2, 1959; 471 people died. The threatened dam is (1983): Tablachaca dam, Peru. A billion dollars are needed to sort out the threat.

3) The most common cause of dam failure is 'overtopping' during floods. Examples is; Machau II dam, India; Failed in 1979; 1500 people died downstream. The near-failure case due to malfunctioning of spillway is; Tarbela dam, Pakistan 1975-76. Faulty foundation failed the St. Francis dam, California USA; the death toll 300. Teton dam USA, collapsed due to design errors.

4) Administrative failure is one more cause. This is due to lack of cooperation among the various departments involved in putting up a dam. There exists a constant struggle to get managerial control over the scheme.

5) Political interference: Governments insist that the dams be constructed in the shortest possible times because ministers do not want their successors to run away with the undue credit. Example: Mahaweli scheme- 6 dams -Sri Lanka; 30 year period reduced to 6 years. (Also, note the case of SSP- dam, Gujarat, India.)

6) Enemy- attempt for sabotage: Dams make good targets for enemy action. Examples; attempt on Cabora Bassa dam, Mozambique by rebels. USA destroyed North Korean's dams in 1953.

7) "Pilot project" syndrome: "The new technology of large dams is only imperfectly understood and largely relies on the extrapolation from the design of smaller dams." This "scaling up" is also used in the nuclear industry. Hence the technology of large dams is compared with that of the nuclear industry: "Both require massive capital expenditures; both are new technologies with limited operating experience; and, for both, the consequences of catastrophic failure are large scale devastation."

Although the hazards associated with nuclear power are now generally accepted, though such hazards are rarely allowed to interfere with governmental nuclear policies, the perils associated with the building of large dams are usually ignored, despite our knowledge that the failure of a dam could cause the loss of hundreds of thousands of lives and billions of dollars worth of damage. As a result, the safety of large dams is nowhere near as intensively examined as is that of nuclear power plants, for which, as Williams notes, "comprehensive risk analyses identifying all possible failure modes are routinely undertaken." "For large dams, on the other hand," if a safety analysis is carried out at all it usually focuses solely on the dam embankment."

In the section: about the Earthquakes And Dams, we find the important work of the French seismologist Rothe. Earlier, it had been recognized that the pressure applied to often fragile geological structures by the vast mass of water stored by big dams could cause earthquakes. The first recognized case of reservoir-induced seismicity was recorded in 1939 at the time of the Lake Mead Earthquake [Boulder dam -renamed Hoover dam]. Since then many earthquakes have taken place due to reservoir induced seismicity and these are tabulated by the authors.

Death toll in some of these earthquake are as under: Koyna: killed 177; injured 2300, Vaiont: killed more than 2000, Kremasta killed 1 injured 60, destroyed 480 houses. The authors conclude: "It now seems clear beyond any reasonable doubt that reservoirs can trigger earthquakes,- sometimes serious ones - even in areas where there has been no previous seismic activity".

That knowledge, however, does not seem to have had any influence on current dam-building plans. The Indian government, for instance, is at present constructing a large dam near Tehri on the Bhagirati river in the mid-Himalayas, an area that has been marked by considerable seismic activity. Indeed, such activity appears to be on the increase: between 1971 and 1973 the yearly average was one or two earthquakes; in 1974, five earthquakes occurred, and in 1975, there was seven. There also appears to be heavy cracking in the rocks of the river Gorge where the Tehri dam is to be built. Those rocks, according to V.D. Saklani, president of the committee Against the Tehri Dam, are "most unlikely to be able to bear the weight of [the] 2.62 million acre-feet of water to be impounded in the lake". In 1992

devastating earthquake occurred in Uttarakhand Himalaya region. But, the note on Tehri in this region is not abandoned.

Floods Uncontrolled

The chapter ten explodes "The Myth Of Flood Control". In reality, floods have become an increasing menace throughout the world particularly in the monsoon and typhoon areas of south east Asia.

In 1978, India saw the worst floods in its history, inundating thousands of villages, damaging millions of areas of farmland, drowning hundreds of people, making millions homeless and the damage ran into billions of dollars. Between 1951 and 1981, i.e. in 30 years, the area ravaged by flood has almost doubled. In USA, in 1983 the flood damage was costing \$ 4 billion annually. By the turn of this century it is likely to cost \$9 billion. The authors ask: "What, then, has gone wrong? Why despite massive expenditure world wide on flood control measures does the damage done by floods continue to rise"? They answer: it is "The Failure of A Strategy." The strategy consists of using the technique of "structural" control, i.e. embankments dams etc. For example, by 1979, India spent 9.75 billion rupees (nearly a billion U.S dollars) on structural controls, yet flood damage is increasing year by year. B.B.Vohra, president of the Environmental Planning Commission, Govt. of India warns: "... embankments -which ...have to be ... raised every year - is no answer at all to the problems of floods. Structural control merely creates the illusion of doing so. The situation in USA is no better. There, since 1937, government spent \$ 12,000 million on structural controls and flood relief and gained the average annual cost of flood damage from \$ 350 million to \$ 4 billion in 1976.

In fact it is experienced that the flood situation worsens in case of dams. Ukai dam (Gujarat) has not saved floods ravishing Surat and adjoining areas. And in the monsoon of 1994 the combined effect of the Bargi, Tawa and Sardar Sarovar dams have caused unprecedented submergence in Narmada Valley villages extending waters upto Nimad regions. Thus all the estimates of officials collapsed.

It seems paradoxical that embankments increase the severity of floods. But this is easily understood . They do not reduce the total volume of flood waters but increase the river's rate of flow. And, faster water do more damage.

Under the section, *Deforestation, Erosion, and Floods*, the authors explain how deforestation increases soil erosion and floods; how faster run off threatens the embankments.

In the section, *Building on the Flood Plains*, the authors note that in the olden days people avoided low lying areas for permanent settlements. India's recent problems are due to intensified use of flood plains.

The section "*Why Structural Controls Cannot Workd*" they point out that they are too expensive for poor countries like India. In the next few years India will spent \$900 million on flood control whereas she needs \$1,300 million for the Ganges basin alone.

"*The Trade off Between Flood Control, Hydropower, and Irrigation*" shows how management is encumbered by the politicians desire to use reservoirs water maximally. The telling sentence is: "The high short term value of water for irrigation on hydropower would be too strong an argument not to sacrifice some flood mitigation benefits in favor of increased supply benefits." A.L.Mukherjee described such an incident in West Bengal and that trade off proved highly disastrous . The 1978 floods in West Bengal are too well known.

B.B. Vohra's quotation is very important to understand the issues. It is mentioned in the last section of this chapter, namely, *Dealing With Floods: the Ecological Approach* : "The only way to tackle the growing menace of floods is to control deforestation, denudation, and soil erosion in the watershed of rivers. [Such a task] must be undertaken on the most urgent basis, particularly in the case of the Himalayan rivers, if certain disaster is to be avoided. If this problem is not tackled in time, it is not difficult to imagine a situation in which, thanks to increasingly frequent and intense floods, and the consequent rise in the level of river beds, large portions of rich flat lands of the Ganga basin may be turned into undrainable swamps. Perhaps it is already too late to save the situation because, while the denudation and erosion of the Himalayas is already far advanced and is growing rapidly, it will be years- even with the best will in the world - before we will be able to control it effectively."

The authors end the chapter with these words: "If floods could be brought once more under the joint control of the forests and the flood plains, we, too, might learn to live with floods and derive from them still more sophisticated benefits."

Salinization, Maintenance

Chapter eleven describes the disadvantages of irrigation, the Problem of Salinisation. The basic point is that all soil contains salt. Similarly all natural water contains salt. A mountain stream has in its water 50 ppm (parts per million) of salt; sea water has 35,000 ppm. Soil, whose salt content ranges from 0.5 to 1.0 percent, is toxic to plant life. This means that "water salt balance" is absolutely necessary to keep the soil healthy. This is a very delicate proposition which any irrigation department cannot handle with ease. This is the root cause of salinization. Normally, the water table should be at least 10 feet below the ground. But, irrigation usually raises the table to the ground surface or keeps it 2 feet below. This shift in water table pushes all the salt of the soil to the surface. And, this shows the intimate connection between irrigation and Salinization. As a general rule, soil of arid and semi-arid regions of any country has high salt content. Irrigation pushes the water table to the surface. In summer water evaporates, and the salt is deposited on the surface. Hence, the lands become alkaline. Such alkalization has already taken place in some parts of northern India and these regions in effect are dead for ever.

Indian climate in general being hot, the soil greater tendency for alkalization. The extent of the problem is worldwide, yet, in India the problem has become acute and the question is: Can salinization and waterlogging be avoided? Of course, the

methods are there but these are too costly. The cost is \$200 to #1,000 per hector, hence, we pose to say: Why No Drainage?

The chapter on "Management and Maintenance-Perennial Problems", begins with the sentence "It is generally agreed that the performance of most large scale irrigation schemes in the Third World has been very poor.""the pattern of its distribution is often inequitable with farmers in the head reaches receiving far more than those at the tail, whose supplies (if they get any at all) tend to be sparse and unreliable." *Management and Maintenance* receive a low-priority concern and this explains the poor performance. *The Bureaucratic Ignorance* further compounds the smooth running of irrigation schemes. This, with lack of accountability completes the circle of favoritism and corruption. Maintenance requires competence, but nepotism prevents it.

More Food?

The chapter on "Loss of Land and Food to Plantations" should serve as an eye opener to those who harp again and again that irrigation help the hungry poor people. The claim that more food is grown due to irrigation schemes is a myth, and the impartial readers can verify facts or surprise themselves by reading the evidence given here. The irrigation projects need millions of dollars. These are borrowed from foreign banks. The interest rates are high. To repay the loans cash crops are exported. There is no other way. Also, the bill for industrialization of the country is also paid through these cash crops. Then how poor people can get their food; will proponents of dams enlighten us? These and other facts are fully documented here. Even without the documented evidence, are not Indians aware that their best food such as sugar, cashew, cardamom, tea, coffee, basmati rice and mangoes, to list a few, exported abroad. Their prices in the country of their birth are so high that they can't afford them. Thus, the cash crop agriculture should be called plantation agriculture and not the poor man's agriculture. The plantation agriculture needs heavy dose of chemical fertilizers and pesticides. This degrades the agricultural land. The destruction cycle sets in and there is no end expect the total ruin.

In short, poor people do not benefit by big dams. They do not get more food. Only they find increase in food prices due to inflation. We conclude: "...land that is brought under perennial irrigation in hot dry areas will almost become water-logged and salinized, and the reservoirs will rapidly silt up. We have now shown that little of the land that is irrigated will in any case produce food for local inhabitants. On the contrary, most of what is grown will be exported to the peoples of the Industrial World or else made available to local peasants at a price they cannot...afford. Once the land has served that purpose, it is likely to be so degraded that it will be of little use for further food production. On that score alone, further large scale water development schemes are little more than recipe for starvation and hunger."

The chapter fourteen on "The Loss of Land and Water to Industry and Urbanization," has shown how industrialization in USA and Egypt led to urbaniza-

tion. This, in turn led to the loss of land and water to rural population. This picture, although not discussed in the book for India, is self-evident. The dams provide hydroelectricity to various giant industrial complexes like IPCL and GSFC near Baroda. In such cases agricultural land is lost to housing developments, shopping centers, office buildings, roads, highways and many other infrastructures. The net result is reduction in farmland for food. It is food and not goods the rural people need most. So big dams are not for rural people but for the benefit of urban elites.

Unfortunately, current government plans are addressed to a massive increase in water use for wasteful large scale irrigation projects and, also, for urban and industrial use. Those plans are, of course, totally unrealistic; the water required will simply not be available. Indeed, according to Falkenmark, requirements will exceed dependable flow very quickly in some states (Gujarat, Uttar Pradesh, West Bengal, Tamil Nadu and Maharashtra) and later in others (Arunachal and Andhra Pradesh) but it will do so in all states by the year 2000.

Pollution, Siltation

The chapter "Dams, Pollution, and the Reduction of Food Supplies" does not discuss the disasters of Bhopal, Minamata, Love Canal and Seveso nor does it consider hazards to human health or to wild life. It concentrates only on the effects of pollution on food supplies.

The rich countries lucrative business is the *Export of Hazardous Industries*. This is possible because the Third World countries offer the multinational all kinds of concessions, namely, license to pollute, tax-exemptions, repatriation of profits, duty-free imports of raw materials, access to low cost land, and finally and tellingly, the hydroelectricity from dams at a price lower than the generating costs. Hear the thunder of the President of Sri Lanka: "I want to say quite frankly that the Free Trade Zone will be like the 'Robber Baron' areas set up in America, Japan and Britain before the industrial revolution. Let them fight each other, complete with each other, destroy each other, and let the fittest survive - all for the benefit of Sri Lanka."

The Effect of Pollution on Crop Growth is documented for countries like USA, U.K. and India. In USA, pollutant ozone, reduced the yield of corn, wheat, soya beans and peanuts. If loss reaches as high as 4.5 billion dollars worth of such crops a year. In UK the pollutant, sulphur di oxide has reduced the yields of perennial rye grass. The combination of two pollutant ozone and sulphur dioxide, do more damage on crops like snap beans and tomatoes. In India, Prof. Rao of Banares Hindu University has estimated that "pollution has reduced agricultural yields...by between 17 and 30 percent." The Mirzapur district of UP has suffered the most.

The connection between *Pollution and the Reduction of Fish Yields* is too well-known. The authors cite examples from many countries but India receives the maximum attention. Indian rivers which are named as worse suffers are: Hoogly, Damodar, Periyar, Chaliyar, Yamuna, Chambal, Gomati, Son, and others. Dal lake and Thana creek too are not exempted. Finally they note: "The occurrence of

massive fish kills and the destruction of low aquatic life forms, due to industrial pollutants have become a common feature in various parts of the country. Dead fish means the loss of a major source of protein and worse still, a livelihood for millions of Indians." The authors sum up that building dams to increase the Third World's hydroelectricity capacity provides power is a process of further urbanization and industrialization.

The chapter on Sedimentation lists reasons for not building dams: (1) the ecological havoc due to salinization; (2) the human suffering due to waterborne diseases; (3) the destruction of fisheries due to river pollution; (4) the social upheavals due to resettlement programmes; (5) the decrease of food supplies due to hydro industrialization; (6) the overall deprivation of benefits to the poor due to irrigation programs; and finally they add their last reason, (7) the decommissioning of the dam due to siltation of its reservoir. The end result is a dam as a monument of a useless slab of concrete.

Forest keeps the soil together, saves it from wind and rain erosion. Deforestation helps in increasing the soil erosion by the gushing waters and the sedimentation is the only way to the death of a dam.

In India, the expected siltation rate of the Nizamsagar Dam in Andhra Pradesh was 530 acre feet a year; the actual rate was closer to 8,700 acre feet a year. Indeed, the dam's reservoir is already estimated to have lost 60 percent of its storage capacity. Other reservoirs in India have suffered similarly high siltation rates. In fact, few of the dams now operating in India (in 1978, there were 835, of which 26 provided more than two thirds of the country's storage capacity) have escaped siltation problems: more important still, many have experienced siltation rates above those predicted by their planners.

Clearly, the premature sedimentation of reservoirs seriously affects their economics. Already, as we have seen, the final cost of constructing a large dam is for various reasons -nearly always far higher than estimated. If, therefore, the dam's reservoir silts up far more rapidly than predicted -or worse still, as at Laying, before the dam even has a chance to function- the time over which the costs of the dam must be amortized is inevitably decreased, thus making nonsense of the calculations used to justify the dam's construction.

As today's dams silt up, so they will leave behind a vast muddy wasteland. Compacted by the weight of a reservoir's waters, the fine particles of silt that have been deposited in the reservoir form a brick hard pan as they build up. Even when the last waters of the reservoir have drained away, therefore, the land beneath will not be suitable for basin irrigation or rainfed agriculture. Only a narrow strip close to the dam, where the coarser and thus less compacted particles of silt are likely to have accumulated, will be suitable for cultivation.

Moreover, as reservoir after reservoir is abandoned, it will become increasingly difficult to find sites for new dams. The number of sites where dams can be built is strictly limited- and, in many parts of the world, those sites have already been

exploited. For that reason alone, it seems inevitable that large dams will prove to be a passing phenomenon in the history of human affairs. The devastation they will have caused, however, will be of a very much more permanent nature.

Preconditions

In chapter seventeen the authors have answered fully questions raised by authorities in the field for or against the dams. In India nonsensical debate on the subject is going on for years. It will do go to debaters if they read this chapter. The obsolescence of dams is proved beyond any doubts. This does not mean that Science and Technology have ended. It is time to discover new safe techniques. Necessity is the mother of invention. Also, it is high time that SSP comes to an end before it plays havoc in Madhya Pradesh, and Maharashtra now and in Gujarat later.

Can there be Satisfactory Large Scale Water Development Schemes? The historical experience has unquestionably been disastrous. We have seen the terrible consequences of canal building in India during the British raj and building vast dams in hot dry areas in recent years. On the basis of the empirical evidence, therefore, the answer to that question is a resounding no. Yet even the most active and outspoken critics of large dams assume, implicitly at least, that if the site is geological and ecologically appropriate and if sufficient precautions are taken, it is possible to put up a large water development scheme with relative impunity.

Brent Blackwelder, of the Washington based Environmental Policy Institute; Philip Williams, a hydrologist and a principal of Philip Williams and Associates, San Francisco; Barbara Bramble, of the National Wildlife Federation, Washington, D.C.; and Bruce M. Rich, of the Natural Resources Defense Council, also in Washington, D.C. state certain useful recommendations as to the conditions that should be satisfied before a dam is authorized.

The first recommendation made by Bramble, Blackwelder and Rich is that no dam should be built until an adequate assessment of its probable environmental effects has been completed and made available to the public. Clearly, such an assessment would be of use only if it could be made by an objective body. But can an objective body really be found? And would such a body have the courage to advise the government, if need be, not to build a particular dam?

Countless environmental assessments have been made of water development schemes but usually not before the governments concerned have become committed politically and economically to building them. Not surprisingly, very few, if any, such assessments have actually concluded that a scheme should not be built at all. Indeed, it appears that the main motivation for commissioning environmental assessments has been to rationalize decisions already made. These decisions are based not on a scheme's capacity to achieve its overt goals but rather on political and economic considerations of an often dubious nature.

The second recommendation, this one by Williams, is that water development projects should only be undertaken if they can be shown "to benefit large sectors of

the population instead of the urban elite". That condition is extremely unlikely to be satisfied particularly in the Third World. Such projects cannot benefit the people whose homes and land are flooded to create a dam's reservoir; nor those in the immediate vicinity of a dam, most of whom will see their land taken over by plantations and eventually degraded into little more than a salt desert; nor those who will fall victim to the inevitable outbreak of water borne diseases. Nor will it be that rural peasants of the Third World who benefit from the manufactured goods produced by the industries that a dam powers. Not only are peasants unable to afford such goods but, once in the cash economy, they are often unable to buy the food they so desperately need to survive.

The people who benefit from major water development projects are who have the proper connections and can afford to obtain water for domestic use, those industrialists who obtain water and electricity at cost for their factories, those plantation owners who get much of the irrigation water, the donor Governments abroad whose industries put up the dams and ancillary installations and provide most of the equipment used, and, finally, those local politicians who reap the short term political capital to be gained from the project-not to mention whatever may come their way under the table.

The third recommendation, made by Williams, is that the scheme should favor labor - intensive rather than capital - intensive economic activities. If this recommendation were followed, then all large - scale water development projects would have to be abandoned. Labor - intensive agriculture does not require water from large - scale irrigation works, nor does labor - intensive manufacturing require hydroelectricity from large dams. Moreover, large - scale water development projects are economical only if they are farmed by capital - intensive agricultural enterprises that are fully competitive on the world market. Large - scale dams are thus quite incompatible with labor - intensive development projects.

The fourth recommendation, also proposed by Williams, is that future water development scheme should permit the production of food crops for feeding the local population rather than for growing export crops. This is not possible for very much the same reasons that giving a preference to labor - intensive farming is not possible. First, peasants producing food for local consumption can not afford to farm land irrigated by massive water development schemes; it is simply too expensive. Second, the foreign exchange needed to pay the interest on the loans contracted to finance a dam (and, more important still, to finance further development projects) can be earned only by exporting crops, not by consuming them. To observe this fourth recommendation would thus mean forgoing nearly all future large - scale water development schemes, as well as any other form of capital-intensive agriculture. For this reason alone, the Green Revolution, which involves substituting modern technological agriculture for traditional labor - intensive agriculture, cannot conceivably provide a means of feeding the poor of the Third World.

The fifth recommendation, made by Rich, is to avoid schemes that would compromise public health and safety in ways that would be viewed as unacceptable by the people affected." Similarly, Blackwelder recommends that dams should not be built if they "significantly increase the spread of disease such as schistosomiasis, malaria or onchocerciasis." Indeed, the title of a talk by Letitia Obeng of UNEP, "Starvation or Bilharzia," is indicative of the view held by many authorities that bilharzia (or schistosomiasis) schemes. As Gilbert White tells us, the "noninvolvement of schistosomiasis in a region where the disease exists is exceptional." Efforts to control such diseases by the use of molluscicides, nematocides, insecticides, and other biocides, have as we have noted, been singularly unsuccessful. Moreover, since many of those biocides are either known or suspected carcinogens and mutagens, their routine use over a long period will almost certainly give rise to other equally serious health problems.

The sixth recommendation made by Bramble, Rich, and Blackwelder is to avoid building dams and other water development schemes that adversely affect national parks, heritage sites, areas of scientific and educational importance, tropical rainforests, or areas inhabited by wild animals threatened with extinction. As we have seen, however, the destruction of such assets is almost inevitable where dams are concerned. Moreover, since the number of suitable sites for building dams is limited and can only become more so as the most obvious sites are used up dams will be built in areas that are less and less suitable. Sooner or later, one of the areas blacklisted by Bramble and her colleagues will be selected as a dam site.

The seventh recommendation, Blackwelder's is that dams should be built only where they will not silt up within a hundred years. It is possible to observe this recommendation in temperate areas but not in the tropics, where rivers carry high quantities of silt. Indeed given the experience of the last thirty years, it would seem almost impossible in the tropics to build dams whose reservoirs did not silt up prematurely. It would mean, at the very least, the reforestation of the whole catchment area of those rivers to be dammed—and not with shallow-rooting pines, but with trees that reconstitute, as closely as possible, the original native forests. As we have seen, the World Bank is beginning to insist on the reforestation of watershed. To date, however, the bank has recommended only the planting of pine and eucalyptus: never, to our knowledge, native trees. We see little reason to suppose, therefore, that this condition will never be met.

The eighth recommendation, by Blackwelder and Rich, is that dams should not be built if their associated irrigation schemes are likely to lead to the salinization of agriculture land. Unfortunately, the building of large dams in hot dry areas almost invariably leads to "waterlogging and salinization. Or both problems, will inevitably arise in all but the truly exceptional surface water irrigation system".

Victor Kovda feels the same way. "During many centuries, and even millennia", he writes, "only areas having a free outflow of groundwater, as in Tashkent and Samarkand, have not undergone salinization or waterlogging". In other words, "increasing salinity in irrigated soils on arid lands is practically universal". As

salinization inevitably builds up, almost all the land put under irrigated agriculture since the war will have to be abandoned, possibly in the next decades. Effective methods for inhibiting the process, such as the lining of irrigation canals and building horizontal drains, are too expensive and are rarely adopted, even on a small scale. Others, such as reducing the amount of land under irrigation to make water available for flushing out salts, or observing long periods of fallow, would so reduce economic output as to be impractical in the context of capital-intensive, market-oriented agriculture.

This brings us to the ninth recommendation, proposed by Williams, that the emphasis of funding should be "towards sustainable long-term resource enhancement rather than short-term resource exploitation." Simply on the basis of the predictable premature siltation of reservoirs and the salinization of the land that dams serve to irrigate, large water development schemes cannot by any stretch of the imagination be regarded as sustainable. In fact, it would be difficult to imagine any development schemes that more clearly involve "short-term resource exploitation".

The tenth recommendation by Blackwelder and Rich is that dams should not be built "if they displace indigenous peoples from their homes and destroy their cultures" or at least, as Rich puts it, where they "would displace or strongly disadvantage indigenous people or other vulnerable social minorities unless compensation is provided to ensure that the affected people are made no worse off, and preferably better off, than before the projects". We have seen how the cultural pattern of indigenous people, is highly adapted to survival in their natural environment to flood that environment and force them to live elsewhere generally, as we have seen, in degraded (and degrading) conditions is to subject them to an environment in which they are not equipped for survival. Inevitably, their society disintegrates; invariably, too, they become part of an aimless and rootless proletariat. To observe this eleventh recommendation would thus mean to desist from building dams in areas inhabited by indigenous peoples.

A further recommendation by Blackwelder warns against building dams that "have significant engineering or safety problems." This, of course, would rule out building dams in areas with any sort of seismic activity or in areas subject to landslides. Even then, however, as we have seen, the safety of dam could not be guaranteed. Both Rothe and Simpson agree that it is impossible to identify the exact conditions under which large dams can trigger off earthquakes; indeed, it appears that dams can cause earthquakes even in areas where no seismic activity has ever been recorded.

The twelfth recommendation, also by Blackwelder, is that dams should not be built where they are likely to inflict significant damage on estuaries or ocean fisheries. All dams, however, affect estuarine nurseries and fisheries by depriving them of the nutrients contained in the silt that the dams prevent from flowing downstream. Moreover, the upstream abstraction of water for irrigation and urban and industrial uses also increases the salinity of the water flowing into estuaries.

That water is also invariably contaminated by the toxic wastes—in the form of fertilizer and pesticide run off and industrial effluent—that inevitably accompany both modern intensive agriculture and modern industry. It follows that this twelfth recommendation is also unlikely to be observed.

Finally, it is recommended by Rich that dams should not be built if they are likely to harm “significantly” the environment of a neighboring country, without its full consent. Unfortunately, no fewer than 214 rivers or lake basins in the world are shared by more than one country; 57 in Africa, 40 in Asia, 48 in Europe, 33 in North and central America, and 36 in South America. Moreover, much of the total area of many countries falls within such international basins: 80 percent of more than ten African countries and 100 percent of another ten, for instance, and over 80 percent of at least five Asian countries and 100 percent of another two. Whenever several countries are situated along the same river basin, the water that reaches the population living downstream becomes scarce, salty, and contaminated. To observe Rich’s recommendation would thus mean desisting from building dams on any of the world’s large international rivers.

The chapter eighteen is devoted to “Social and Environmental Impact Studies.” The authors say that both the governments and their financiers do not care for ecology or social problems when they build big dams. They prove their point by presenting the detailed studies of the following projects. We simply list these projects: (1) James Bay, Canada; (2) Tana river, Kenya; (3) Anchicaya, Colombia; (4) Skagit valley, Canada; (5) Helmand, Afghanistan; (6) Teton Dam, USA; (7) Jonglei canal, Sudan; (8) Selingue, Mali/Guinea; (9) Kariba, Zambia; (10) Volta, Ghana; (11) Chico, Philippines; (12) Mesopotamia; and (13) The Texas Water Plan, USA. And they add: “Indeed, environmental problems were perceived largely” as political obstacles to the plans adoption,” rather than as geographic realities in which the development is to be carried out.”

Politics of Damming

The chapter on The Politics Of Damming, the authors give certain explanation. “Oneview is that we cannot reasonably expect....detailed studies for every dam at least....we can never know enough about...ecological and social effects to resolve every uncertainty.” As Worthington put it in 1970: “In developing countries at least, there never be enough funds or enough scientists to cover all aspects of information needed for thorough prediction.” “...Worthington...has a case. But lack of funds hardly explains the James Bay example.”

The second view is: governments and industry minimize the problems they are likely to face because of misplaced optimism and wishful thinking. The authors say: “the facts suggest otherwise.”The industry is unwilling to learn from the past and would ignore its own experts if it is not in tune with what it wants to hear. Thus, Michael remarks: “The saddest thing about Helmand experience is that it will probably be repeated, if not in Afghanistan then in Iran or Iraq....”

John Waterbury goes so far as to suggest that in developing countries information is wailfully fragmented because planners wish to avoid future responsibility for any disasters. The authors add: "no dam is built in a political vaccum. On the other hand, there are those who must design, plan, and construct the dam; and, on the other, there are the politicians who must approve its construction." Both are afraid of their jobs want to impress colleagues and win promotion and recognition. The authors endorse Waterbury by citing the example of Aswan Dam and then add: "political motives are symptom of most dam building projects." Then they call those who run after politicians (i.e. senators or M.P.'s) to promote their projects as "power brokers" and politicians who acquire a dam for their home state or district as wheelers of pork barrels."

The chapter twenty explains the anatomy of corruption. Under, *Cost Benefit Studies: the Pattern of Falsification*, they begin with a striking passage: "The old adage that he who plays the piper calls the tune is as apt today as when it was first coined. The record of industry is littered with examples of cover-ups to justify the marketing of products that are unsafe or suspected of causing harm. Invariably an "independent" expert is on hand to tell the public what industry would like heard. That should not surprise us. Scientists and consultants in industry are ruled by everyday concerns the mortgage, the need to provide for a family, the fear of failure and criticism. They know they were not hired to rock the boat and that trouble-makers do not get promotions. Is it any wonder, then that many are tempted to cut corners and see things in the best light for the sake of their companies and their careers?"

That fudging of the books is mainly done by *Over Estimating Benefits, Underestimating Costs*. It is done under the following heads:

1. Using unrealistically low discount rates.
2. Overestimating job creation potential.
3. Failing to account for the energy costs of building the dam.
4. Overestimating the benefits of flood control.
5. Underestimating the costs of decommissioning.
6. Overestimating the life of dams.
7. Underestimating construction costs.
8. Failing to count land flooded as a cost.
9. Overestimating the benefits of recreation.
10. Overestimating the benefits of irrigation.
11. Overestimating the economic benefits.
12. Underestimating the costs to the environment of irrigation.

Alternativiers

It thus seems that those who stand to gain politically and financially from the building of a large dam are willing to go to inordinate lengths to ensure that it will

be built. Among other things they are willing purposefully to mislead those who must be persuaded of the dam's desirability and viability before the go-ahead to build it will actually be given. This they do by grossly exaggerating the dam's likely benefits and seriously underestimating its probable costs—in particular its social and ecological costs, which, as we have seen, are often totally ignored.

The power, prestige, and financial resources of the politicians, bureaucrats, and industrialists involved in dam projects greatly facilitate that deceit. So do the credulity and apathy of the public. Moreover, unlike the authorities, those who oppose dams—mostly local tribal or peasant leaders, obscure academics, or youthful environmentalists have meager financial resources and little credibility. Furthermore, they must confront the entrenched belief that large-scale water development schemes are an essential part of the process of economic development—and we have been taught to see that process of economic as the only means of combating poverty and malnutrition and assuring health, longevity, and prosperity for all. To challenge dams is thus considered to be to challenging a fundamental tenet of our civilization.

But enough of criticism. As we have already mentioned, the problems that dog modern irrigation schemes have not, historically, affected the irrigation systems of traditional societies of both the past and the present. In the next section we shall see how, in five such societies, all the problems associated with modern irrigation agriculture have been avoided—and why.

In the chapter *The Qanata of Iran*, the authors explain a traditional irrigation system which is the most sophisticated one in the world and is in use for the past thousands of years. A qanat is a conduit that collects the water from an aquifer on the slope of a hill and exploits the natural gradient of the land to transport the water underground to the agricultural areas in arid and rainless regions. A conduit may be 80cm wide, 150 cm high and 70 km long. Its rate of discharge of water may reach 500 liters per second. There are some 22,000 qanats in Iran which amount to 170,000 miles of underground channels. Their merit was recognized in around India (now Pakistan) and Afghanistan where it is called *Karez*. It is known as *Foggars* in North Africa and as *Falaj* in UAE.

While discussing "Two Traditional Irrigation Systems in Tanzania", the author describes the lifestyle of a Tanzanian tribe known as *Sonjo*. There are some 4500 *Sonjos* in the North Tanzania. From time immemorial they use irrigation as a sacred ritual. Their mythical home in heaven is *Belwa*. Their formal prayer for rain is: "Open the sluices of *Belwa*." The rainfall is: "the overflow from a celestial irrigation system." In short, irrigation and agriculture are their religions and they have developed a highly beneficial system which is made of "a fine network of small channels reinforced by a superimposed coarser network of larger channels." The details are given in this chapter. The other Tanzanian tribe, the *Chagga* of *Kilimanjaro*, too has developed a remarkable irrigation system which works from time immemorial.

It is said that a dry zone village in Sri Lanka could not be imagined without a tank any more than its temple or a rice field. In ancient times irrigation was a part of religion; it was not commerce. That explains its success. Details of tank irrigation in Sri Lanka are very interesting.

Traditional Irrigation in Mesopotamia, takes us far into early history of irrigation and agriculture. The great success of a community called the El Shabana was that they minimized the effects of salinization in their irrigation system. This they did by a scheme called alternate year following. This method became possible because of their social way of life. The authors trace the history from 3500 B.C. to the present and regret the modern development there.

It is time we ask ourselves what we have learnt from this book, hence, "The Lessons of Traditional Irrigation Agriculture: Learning to Live with Nature." The chapter opens with a rebuke from an hydrologist: "Three sins beset water planners and their advise on faith in ...technology, worship of bigness, and arrogance towards the landscape...The belief that technology can solve any water problem...is wrong..."

Strong words indeed. The authors ask: why the El Shabana, the Sonjo, or the Chagga could practice sustainable irrigation agriculture over thousands of years whereas modern ones rarely last a few decades?

One reason could be the size of the scheme which was small and appropriate. The authors say: "Small is certainly preferable to big andwe should be quite emphatic but small is not necessarily safe when it comes to ecological damage." In Nepal, a small hydro dam silted up so quickly that the turbines stopped producing electricity and the power house became "a millstone of modernity around the Nepalese neck". The author adds that perennial irrigation is unacceptable and seasonal agriculture is the best.

Traditional irrigation agriculture survived because it kept forest cover intact. But the modern irrigation destroys that cover and the end result can best be put in 80 years old words of Hopkins about Indian Narmada Valley. All that great bare belt of country which now stretches south of Ganges- that vast waste where drought seems to be perennial and famine as much at home as in Civic in a graveyard- was once an almost impenetrable wood.

Luxuriant growth filled it: self irrigated. It kept the fruit of the summers rain till winter, while the light winter rains were treasured there till June monsoon came again. Now the forest is gone, the hills are bare, the valley is unprotected.

The forests provide water in perpetuity, harbour a wealth wildlife, give all sorts of wild fruit and berries, maintain humus in soil and make timber for homes. Besides, they generate oxygen for life, absorb carbon dioxide to produce food and stabilize climate. All these benefits are free for all and not for the urban elite alone.

The traditional irrigation endured because they drew water which was due to them. They knew of balancing water consumption with water availability. The system ran smoothly because it was designed and managed by village elders and not by distant bureaucrats. The elders knew local geological, biotic and climatic conditions and had the well-being of their families and that of villagers at heart.

“What is perhaps most distinctive about traditional irrigation agriculture is that it is geared to producing food for local consumption. Indeed, it is only by ignoring the export market that irrigation schemes can fulfill their intended purpose, which is to serve the interests of the local population.

To produce enough food to feed itself, a society need not ravage its own environment. Once, however, it becomes geared to producing food for export to a highly competitive and, at times, seemingly insatiable —world market, such devastation is unavoidable. Indeed, to achieve success in exporting, agricultural activities must be undertaken by vast, capital-intensive enterprises, and society must be willing to subordinate long-term social and ecological considerations to the demands of short-term economic competitiveness.

Under such circumstances, the dams that store the water for irrigation schemes cannot be small. Everything conspires to make them bigger and bigger. Nor can irrigation systems possibly be seasonal. Perennial irrigation is essential if vast stretches of water-intensive monocultures are to be multicropped year after year.

Nor can forests be preserved. Put bluntly, there is no room for them. Moreover, exporting their timber provides an essential source of the foreign exchange needed to finance capital-intensive development systems.

Nor can the overuse of water be avoided. All the water that can be made available must be abstracted in the interests of economic competitiveness and of maximizing economic activity.

Nor, finally, can export-oriented irrigation schemes be managed by local communities. Widstrand, for example, notes the failure of water-users' associations in the Third World and the high death rate of government-introduced cooperatives in East. Why should farmers willingly participate in projects designed to raise food for export on the only land available to them for meeting the needs of their own families, in exchange for money that will be spent by an urban elite on expensive imported goods?

Inevitably, the conflict between the “ecological” and “industrial” views of water supplies in the western United States raises questions more generally about our attitudes towards both nature and economics. Can we really take the view that it is justifiable to jeopardize future water supplies in the interests of economic growth? Is it really “economical” to expose vast number of people to malaria or schistosomiasis in exchange for the hydroelectricity or irrigation water that a dam provides? What is “economical” about transforming good agricultural land into a salt desert for short term increases in agricultural yields?

Clearly, the concept that what is “economical” need serious reconsideration. The point is well made by Robert Goodland: “Economics excludes considerations of ...adverse consequences frequently referred to as “externalities”—from customary evaluations. The time frame of economic thinking is so shortsighted, and the perspective of economic vision is so narrow, that such criteria frequently act to the detriment of the environment.” He concludes that “In the final analysis, anything environmentally unsound can never be economically healthy.

Sooner or later, all social and ecological costs must be translated into economic costs—be it in terms of higher medical bills or diminishing agricultural returns. By incurring such costs, we are in effect signing postdated cheques against future generations. When those cheques are presented for payments, we will probably not have enough money set aside, or we will have forgotten even incurring the debts in the first place. The only outcome of such shortsighted behaviour is ecological and social bankruptcy and such must eventually be the fate of all countries.

To emphasize this message, we need look no farther than to the Dustbowl years in the United States. The fragile soils of the southern plains should never have been put under the plough. This was recognized by the Mexican government, which had decreed as far back as 1823 that its plains should be used only for ranching. John Wesley Powell (who in 1881 became head of the U.S. Geological Survey) also thought ranching was the only suitable use of the southern plains. To the American governments, however, ranching suggested an “Undemocratic” policy that would create “great landowning barons” whose interests could only conflict with those of the small homesteader. Even religion was used to justify the popular view that the plains should be cultivated: God, it was claimed, intended “not cattle, but wheat” to be raised on the plains.

The plains were thus cultivated—and the great dustbowls of the 1890s and 1930s were the inevitable consequence. When, in 1936, the Great Plains Committee (under the chairmanship of Maurice Cooke) reported on the tragedy, it vindicated the warnings of Powell. “Nature,” the committee wrote, “has established a balance by what, in human terms, would be called the method of trial and error. The white man has disturbed this balance—he must restore it or devise a new one of his own.” The Great Dustbowl, the committee insisted, was a wholly man-made disaster, the result of a series of misguided efforts “to impose upon the region a system of agriculture to which the plains are not adapted”.

Cooke and his colleagues went on to criticize the prevailing attitude “that nature is something of which to take advantage and to exploit—that Nature can be shaped at will to Man’s convenience”. They observed:

In a superficial sense, this is true—feeling of trees will clear land for cultivation, planting of seeds will yield crops, and applications of water where natural precipitation is low will increase yields. However, in a deeper sense, modern science had disclosed that fundamentally nature is inflexible and demands conformity...

We know now, for instance, that it is essential to adjust agricultural economy on the plains to periods of deficient rather than of abundant rainfall, and to the destructive influence of wind blowing over dry loose soil rather than primarily to a temporary high price for wheat or beef—that it is our way, not Nature’s which can be changed.

This is the heart of the matter. Living things are not arranged in a random manner. Nature is not totally malleable, as those who wish to transform it would have us believe. It is, on the contrary, highly organized—and that rigid order must

be maintained. Once degraded by over exploitation and pollution, nature cannot hold its own. Cut down forests and overtax the land, and soils will become eroded. Pollute rivers, and fish will die. Upset the natural balance between pest and predator, and pestilence will be epidemic. Destroy the habitat of wildlife, and species will become extinct. Indeed, the whole gamut of ills that now beset the earth are merely the symptoms of a degraded ecosystem which, under pressure from *Homo sapiens*, can no longer continue to function properly. Historically, it has been mainly traditional societies that demonstrated an awareness that "it is our way, not Nature's which can be changed".

What Should be Done?

"There is Clear Evidence, unpalatable as it must be to some, that building large dams is not an appropriate means of feeding the world's hungry, of providing energy, or of reducing flood damage. To conclude otherwise would be to accept as largely expendable the flora, the fauna, the population, and the land itself—the whole area effected by the dam—simply to further the political and financial interest of a very small minority.

In the light of today's knowledge, it is clear that the building of large-scale water development schemes can be justified to an electorate and to the world at large only by systematically covering up—as governments and their advisers have shown themselves adept at doing—their true implications.

To persuade Third World governments to abandon plans to build water development schemes to which they are often totally committed is very difficult. Nevertheless, every effort must be made by local environmental groups to do so. If necessary, they should resort to nonviolent direct action at the dam site. We in the West can best prevent the construction of further dams by systematically lobbying donor governments, development banks, and international agencies, without whose financial help such schemes could not be built.

If they build all this destruction occurs, we will eventually be left with a silted-up reservoir and the vast concrete hulk of an abandoned dam. Those ruins can serve but one salutary purpose: as a permanent monument to folly, or the cynicism, of those who now direct the organizations that have financed so much destruction and so much misery throughout the world, a monument set in vast muddy wasteland where once the fertile soil nourished happy and sustainable communities."

Jashbhai Patel's two articles are an attempt to demolish the myth about the SSP and the large dams. He forcefully challenges with all data, analysis the myth of SSP being most planned project and the claims and planning scientifically, cost benefits and such projects in his first article about SSP Dam. On a larger canvas through the review of the celebrated magnum opus- "Social and Environmental Effects of Large Dams" by Edward Goldsmith and Nicholas Hildyard, Mr. Patel shows the worldwide challenges to the established engineering superstition.