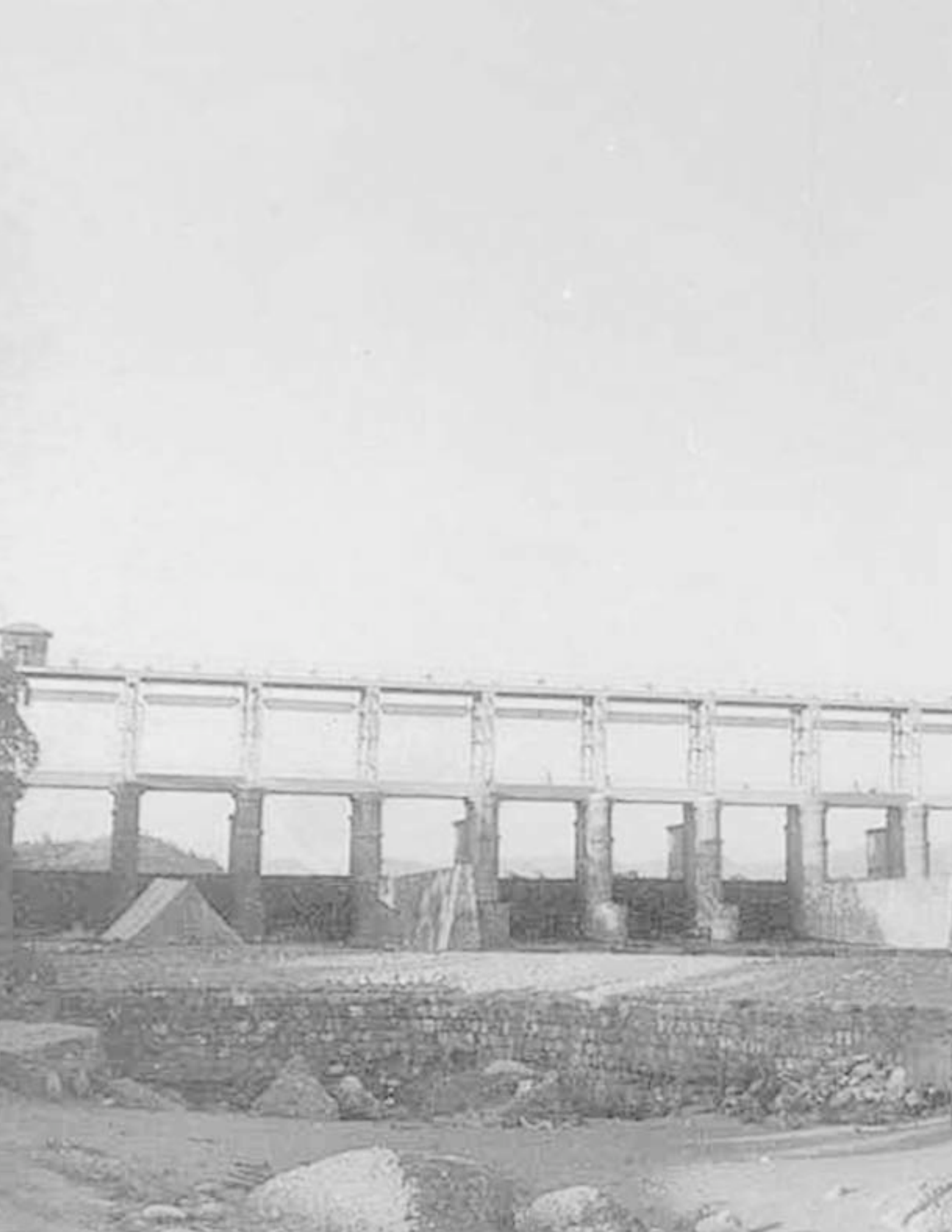


**7**

Role of Bhakra In Food  
Production



## Role of Bhakra In Food Production

WE SAW THAT THE SPREAD OF GREEN REVOLUTION AS INDICATED BY THE areas covered with HYV was high in Punjab and Haryana as compared to the rest of the country. We saw several factors that were partly responsible for the performance of the Green Revolution in the two states. We now analyse the role of one of the crucial factor – one which is the chief mandate of our enquiry – the role of water and irrigation in general and Bhakra in particular.

We start by noting that the contribution of Punjab and Haryana to foodgrains production in the country is not equal. In this matter, Haryana has been the “junior partner” to Punjab, even though they are comparable in terms of geographical areas (Punjab is about 5.038 m ha and Haryana is 4.4 m ha) and cultivable areas (Punjab 4.3 m ha and Haryana 3.79 m ha). Some figures given below illustrate the point.

**Table 7.1: Wheat Production in Punjab and Haryana (m Tons)**

Year	Haryana	Punjab	Prod. of Wheat in Haryana as % of All India	Prod. of Wheat in Punjab as % of All India
1960-61	0.814	1.742	7.4%	15.8%
1970-71	2.342	5.145	9.8%	21.6%
1980-81	3.490	7.677	9.6%	21.1%
1990-91	6.436	12.159	11.7%	22.1%
1999-00	9.650	15.910	12.6%	20.8%

**Table 7.2: Rice Production in Punjab and Haryana (m Tons)**

Year	Haryana	Punjab	Prod. of Rice in Haryana as % of All India	Prod. of Rice in Punjab as % of All India
1960-61	0.175	0.229	0.51%	0.7%
1970-71	0.460	0.688	1.09%	1.6%
1980-81	1.259	3.233	2.35%	6.0%
1990-91	1.834	6.510	2.47%	8.8%
1999-00	2.583	8.716	2.88%	9.7%

**Table 7.3: Total Foodgrains Production in Punjab and Haryana**

Year	Haryana	Punjab	Prod. Of Total Foodgrains in Haryana as % of All India	Prod. of Total Foodgrains in Punjab as % of All India
1960-61	2.755	3.162	3.4%	3.9%
1970-71	4.771	7.305	4.4%	6.7%
1980-81	6.036	11.921	4.7%	9.2%
1990-91	9.559	19.222	5.4%	10.9%
1999-00	13.065	25.197	6.3%	12.0%

It is seen clearly from this that for rice, wheat and for all foodgrains taken together, whether it is the absolute amounts or the percentage of all India production, Punjab's contribution has been about twice that of Haryana. When we analyse this in terms of the role of the Bhakra project, we need to remember that the major irrigation of the Bharka project has been in Haryana.<sup>1</sup>

We have noted earlier that there are three broad strategies for expanding the food production.

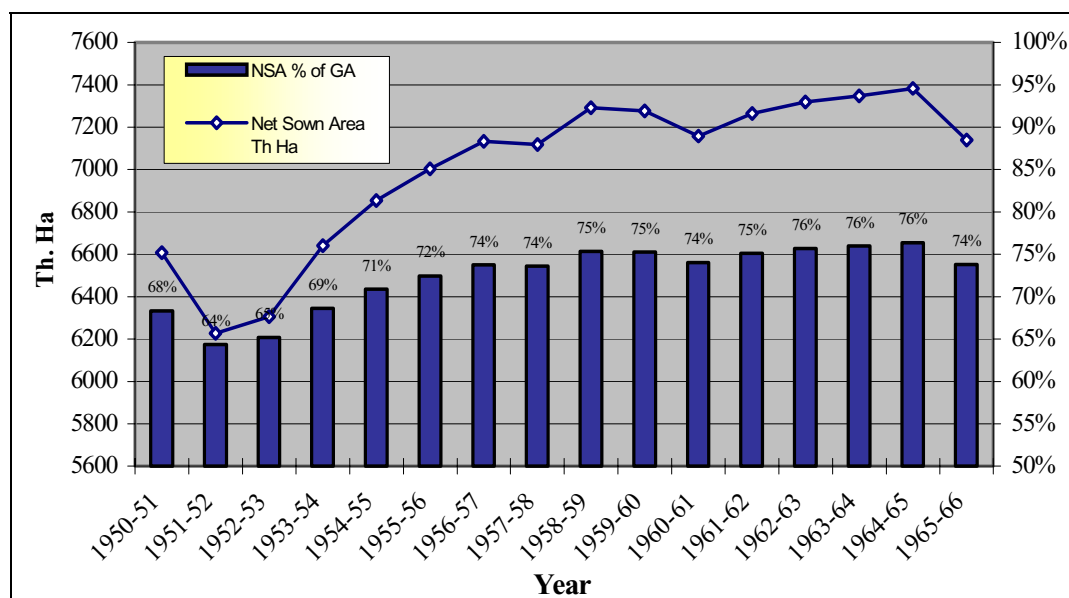
1. Bringing in new areas under cultivation – i.e. increasing the net sown area
2. Multiple cropping – increasing the gross sown area
3. Increasing the per hectare yield.

Water is one of the several – but a crucial - input for all these three. For the new HYV seeds, assured supply of water was even more crucial. It is said that Bharka played the crucial role in all these three factors. In particular, two important claims are made for the project. *One, that it brought in vast amounts of new areas under cultivation and made possible multiple cropping in much of the cultivated area. Secondly, it enabled the Green Revolution, which was essentially about increasing the yields.*

### INCREASE IN SOWN AREA

The following graph shows the Net Sown Area (NSA) and Net Sown Area as a percentage of the geographical area in unified Punjab<sup>2</sup> from 1950-51 to the date of reorganisation.

**Figure 7.1: Net Area Sown in Unified Punjab from 1950-51 to 1965-66**



Source: Various Statistical Abstracts of Punjab  
 Note: NSA= Net Sown Area, GA= Geographical Area

It is seen from the graph that there was an increase in the net area sown of about 531.5 thousand hectares from 1950-51 to 1965-66. This increase was quite sharp from 1951-52 to

<sup>1</sup> Another interesting thing to note from the above tables is that while in 1960, wheat and rice together formed about 36% of total foodgrains in Haryana and 62% in Punjab, by 1990-91, most other crops had gone – and wheat and rice together formed 86% of all foodgrains production in Haryana and 97% in Punjab.

<sup>2</sup> The figures have been adjusted for the districts of Kangra and Simla which were at that time part of Punjab.

about 1958-59 and then was quite uneven. After 1958-59, the Net Sown area remained more or less the same – around 75% of the total area.

Was the irrigation that had commenced from Bhakra responsible for this? We need to look into the districts for this.

An analysis of the district-wise growth gives some very interesting results. If we look at the figures of net area sown and net area irrigated for the period 1953-54 and 1958-59 (where the increase was sharpest), we find that the maximum increase has been in the (then) district Hissar where the NSA went up by 187000 ha and the net irrigated area by 275000 ha. Next was Patiala with 144000 ha increase in NSA, but irrigation increasing only marginally by 15,000 ha. Hissar includes areas which received irrigation from the Bhakra project. We also have districts like Ferozpur where the net sown area went up by 77000 ha but the net area irrigated *decreased* by 116000 ha! Bhatinda too had similar figures.

Part of the reason seems to be that districts like Ferozpur and Bhatinda were already irrigated to a good extent, and Bhakra did not bring new areas under irrigation in these districts. Hissar and Patiala were districts in which new areas were irrigated with the irrigation from Bhakra<sup>3</sup>.

Even in the (then) Hissar district, while it was clear that some of the new areas being brought under cultivation were due to the irrigation from the Bhakra project, it should be noted that parts of the district received irrigation from the Western Jamuna Canal.<sup>4</sup>

Thus, while there is little doubt that irrigation from Bhakra contributed to bringing in new areas under cultivation, this was limited to few parts of the two states.

Overall, in these years (53-54 to 58-59), for the whole unified Punjab, the Net Sown Area went up by 645000 ha while the Net Area Irrigated decreased by 47000 ha. !

**Table 7.4: Net and Gross Sown Area in Haryana 1950-51 to 1998-99**

(Area in m Ha)

Haryana Geographical Area - 4.389

Haryana Cultivable Area - 3.800

Year	Net Sown Area (NSA)	Gross Sown Area (GSA)	NSA as % of Cultivable Area	GSA As % to Net Sown (Cropping Intensity)
1950-51	2.983	3.47	78.5%	1.16
1955-56	3.300	4.504	86.8%	1.37
1962-63	3.471	4.614	91.3%	1.33
1966-67	3.423	4.599	90.1%	1.34
1974-75	3.519	4.842	92.6%	1.38
1985-86	3.613	5.601	95.1%	1.55
1998-99	3.692	6.214	97.2 %	1.68

What is trend for the years after the bifurcation? The following table gives the NSA and Gross Sown areas for the two states for selected years. The ratio of Gross Sown Area to Net Sown area, also know as the Cropping Intensity, is a measure of the amount of areas under double or multiple cropping.

<sup>3</sup> It also appears that Patiala was an area where large tracts of land were cleared to reclaim land to resettle the Partition refugees. This could be one reason for the large increase in the net area sown in this region, though whether this reason operated even during 1953-54 to 1958-59 is not clear.

<sup>4</sup> In Hissar, the net irrigated area increased by 43000 ha from 1950-51 to 1952-53 i.e. before the irrigation from Bhakra had started.

From the figures given above, it is seen that over 90% cultivable areas had been brought under the plough in Haryana by 1962-63. After that, there has been only a small increase of about 221000 ha in the next 36 years.

**Table 7.5: Net and Gross Sown Area in Punjab 1950-51 to 1996-97**

(Area in m Ha)

Punjab Geographical Area 5.038

Punjab Cultivable Area 4.300

Year	Net Area Sown (NSA)	Gross Area Sown (GSA)	NSA as % of Cultivable Area	GSA As % to Net Sown (Cropping Intensity)
1950-51	3.544	4.170	82.4%	1.18
1955-56	3.615	4.567	84.1%	1.26
1962-63	3.833	4.981	89.1%	1.30
1966-67	3.87	5.171	90.0%	1.34
1974-75	4.092	5.904	95.2%	1.44
1984-85	4.189	7.013	97.4%	1.67
1996-97	4.223	7.808	98.2%	1.85

In Punjab, the expansion of area under cultivation took place at a high rate till 1966-67 (326000 ha in 16 years) and after that, in the next 30 years at a slower rate – about 353000 ha added in the period.

While area under cultivation can be increased by bringing in new land under cultivation, this has an obvious physical limit. Multiple cropping – two or more crops on the same land in a year - allows this limit to be broken. *Double or multiple cropping has added millions of hectares to the total cropped area in the two states.*

The Gross Sown Area (same as total cropped area) – which consists of the net sown area and the areas double or multiple cropped - showed a major growth in both the states and this appears to have been more or less a steady growth over the years.

In Haryana, the Gross Sown Area (GSA) went up by 1.13 million ha from 1950-51 to 1966-67 and in the next 32 years by about 1.615 m ha. In Punjab, the increase was 1.001 m ha till 1966-67 and then 2.637 m ha in the next 30 years.

The cropping intensity in both these states is much higher than the All-India cropping intensity – and has been so right from the early years. The cropping intensity in Punjab and Haryana in 1955-56 was 1.26 and 1.37 respectively when the All India figure was 1.14. By 1985-86, the same figures were 1.67 for Punjab and 1.55 for Haryana and 1.27 for All India.<sup>5</sup>

This spectacular rise in the *total cropped area* is one important reason behind the rise in agricultural production in these two states. What made this possible?

There are several factors that can help bring in new areas under cultivation or multiple cropping. For example, we saw in the earlier chapter that the new varieties of seeds, through a shorter maturing period, made possible double cropping where the longer growing period earlier was not allowing it. Water is one crucial input, and we will focus here only on the role of water and irrigation. Bhakra is said to be major force behind this spectacular growth in the total cropped area in Punjab and Haryana.

<sup>5</sup> The figure for Punjab is for 1984-85; Source for All India Cropping Intensity is Planning Commission Data, from <http://planningcommission.nic.in/data/stat/statistics3.pdf>  
Accessed on Nov.10, 2004

But Punjab and Haryana are much more than Bhakra as we have noted from the earlier chapters. The areas commanded and irrigated by Bhakra form a limited part of these two states. Let us recollect these figures.

*The cultivable area commanded by Bhakra is 20% of the total cultivable area of Punjab. For Haryana, the same figure is 31% . The other major systems in the two states include Western Jamuna Canal, the various lift commands in Haryana, the UBDC, the Sirhind (in Punjab).*

*However, there is another component and that is the groundwater based irrigation. In Punjab, many districts while having areas being shown as part of the Bhakra command receive little irrigation from the canal. For example, Patiala district, while being in the Bhakra command had, in year 2001-02 only 9.5 thousand ha irrigated by canals while tubewell based irrigation is 281.2 thousand ha.*

What is not often understood is that vast areas of Punjab and Haryana are irrigated not by canal (whether Bhakra or others), but by groundwater. If we look at the figures for the areas actually irrigated and not just commanded – we have the following figures for Punjab for the year 2001-2002.

Net Area Irrigated By Canals –	987,000	ha
Net Area Irrigated by Tubewells –	3,068,000	ha

*Thus, only 24% of Punjab's irrigated area is served by canals – and this includes not only the Bhakra canals but also other canal systems.*

The figures for Haryana for the year 1998-99 are as follows:

Net Area Irrigated By Canals –	1,433,000	ha
Net Area Irrigated by Tubewells –	1,395,000	ha

*Thus, in Haryana, about 50% of the irrigated area was served by canals. Note that the canal irrigated area includes significant areas irrigated by the Western Jamuna Canal and other canals.*

It is clear that vast areas were brought under cropping in the two states, first, by bringing as much land as possible under cultivation, and then increasing the multiple cropping hugely. This has been one of the key factors in the increase in the food grain production in the two states.

There is little doubt that irrigation has played a very important role in this. However, in Punjab and Haryana, and especially in Punjab, this role has been played essentially by groundwater based irrigation and canal irrigation has contributed to only a limited extent. Within the canal irrigation, Bhakra is only a part.<sup>6</sup>

One fact illustrates this sharply. In Punjab, from 1990 to 2001-02 the Total Cropped Area (same as gross sown area) increased from 7.501 m ha to 7.941 m ha – an increase of 440,000 ha. Yet, the Net Area Irrigated by canals decreased in this period from 1.576 m ha to just 0.987 m ha – a decrease of 589,000 ha! And Net area irrigated by tubewells increased from 2.233 m Ha to 3.068 m Ha – an increase of 837,000 ha.<sup>7</sup>

<sup>6</sup> There are some important issues related to the ground water use. One is that the estimate of the areas irrigated by tubewells is generally an underestimate since areas with conjunctive use are reported as canal irrigated areas.

There is another aspect often argued that the groundwater irrigation has been made possible only because of the canals, through seepage, provided the groundwater. Hence, much of groundwater irrigation should be counted as benefit of canal. We will estimate this contribution in the next chapter and see that it is a small one.

<sup>7</sup> If we look at the coefficient of correlation for the Gross Cropped Area and Area Irrigated by Canals and Tubewells respectively, we see the same reflected in the values.

Coeff. Of Correlation for: (Cont. next page)

To credit the “success” of Punjab and Haryana to Bhakra and Bhakra alone is absurd – but that is the general perception. The figures above show how unfounded this assumption is.

If we assume that the contribution to the (increase in area and hence) food production is roughly in proportion to the extent of irrigation from each source, then we see the following.

In Punjab, the increase in area has come essentially and overwhelmingly from the groundwater based irrigation. Canal irrigation is about 24% of total irrigation, and within this, Bhakra would be a small proportion (if we recollect the discussions in the chapter on Command Area). We would say that contribution of Bhakra to Punjab’s food production is limited.

In Haryana, the groundwater and canal irrigation have played an equal role. If we assume that the Bhakra system provides about 50% of the canal irrigation, then its net contribution to foodgrains production would be about 25% of the state total. (Since total canals itself constitute 50% of the irrigation source). Even in the Bhakra commanded areas, there has been a huge explosion in the ground water use. It is mainly the areas with saline or bad quality groundwater that are still mainly depended on the canal irrigation as the major source. These include primarily the districts of Hissar, Sirsa, Fatehbad, Jind and to some extent Kaithal. It is in these districts the Bhakra canal irrigation has had a major impact in terms of bringing in new areas under cultivation and in increasing multiple cropping. We have seen that Bhakra irrigation is primarily concentrated on the three districts of Hissar, Sirsa and Fatehbad which account for about 75% of Bhakra’s irrigation in the state. The food production in these three districts is about 25% of the state total.

Considering that the Punjab produces twice as much food as Haryana, we can see that Bhakra has played a very limited role in the food production from these two states considered together.<sup>8</sup>

### INCREASING THE YIELDS

Let us now come to the third component of increasing the agricultural production – increase in the per hectare yield. We have seen that the Green Revolution was sparked off by the HYV seeds which had a much higher yield than the best seeds available till then.

The graph in Figure 7.2 illustrates this. The yield for wheat which was increasing slowly till 1966 shot up sharply and then continued rising. The *average* yield of wheat doubled in just 6 years after 1965-66 from 1236 kg/ha to 2400 kg/ha.

It is this spectacular increase in the yields of wheat, followed later by rice that led to the green revolution. Unfortunately, this has remained more or less confined to these two crops. This growth in the yield has been a major contributor to the dramatic foodgrains output of Punjab and Haryana. We have already seen that there were large number of inputs that were necessary to achieve these yields – including fertilisers, machinery, and so on. Water was a crucial input. In fact, the new seeds required an “assured” supply of water.

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#### Haryana

GSA and Net Area Irrigated by Canal	0.8184
GSA and Net Area Irrigated by TW	0.8410

(For Years 1960-61 to 1998-99)

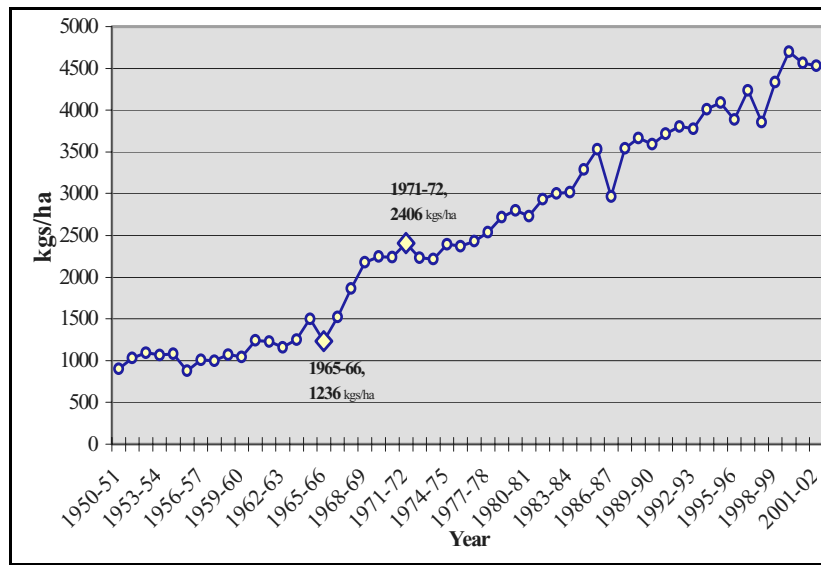
#### Punjab

GSA and Net Area Irrigated by Canal	0.391
GSA and Net Area Irrigated by TW	0.969

(For Years 1955-56, 1960-61 to 2001-02)

<sup>8</sup> We have not attempted to put any numbers to this contribution at this stage but have limited ourselves to indicative estimates. We will bring in some more data in the next chapter and estimate the contribution quantitatively.



**Figure 7.2: Yield of Wheat in Punjab from 1950-51 to 2001-02**

This is a key to understanding the green revolution in the two states. While canal irrigation certainly was helpful with the new seeds, it could hardly provide the kind of assured supply required by them. Increasingly, the farmers in Punjab, and then in Haryana turned to groundwater irrigation.

The Fourth Plan document – which came out in 1969 – after just a few years of experience of the HYV seeds has noted this phenomenon.

“11.8. Minor Schemes.—Minor irrigation scheme include all ground water development projects as well as surface water projects. Most deep tubewell schemes are community-based; open wells and shallow tube-wells, however, are usually constructed and owned by individuals. *In either case, ground water provides the farmer with just the type of ‘instant’ and controlled irrigation which the new high-yielding varieties of seed demand.* This fact, coupled with the increasing extension of electricity to rural areas, explains the expansion which has taken place in recent years in the development of ground water resources. The expansion has taken place not only in areas which are without any other source of irrigation but also in alluvial tracts already commanded by existing canal systems; ... The remarkable development of ground water resources during recent years was stimulated by the droughts of 1965-66 and 1966-67 which also happened to coincide with the development of high-yielding varieties *which perform best under conditions of controlled and timely irrigation.*”<sup>9</sup> (Emphasis added)

Tubewell based groundwater irrigation has grown exponentially since then. This has been the turning point in the agricultural development of the two states. There is little doubt that it has been groundwater that has been, and remains, the driving force behind the spectacular agricultural growth in the two states.

It is not only that HYVs perform their best with controlled and timely irrigation that has led to the boom in tubewell irrigation. There are several other factors too. We examine this phenomenon, its various dimensions and its implications separately in the next chapter. ✍

<sup>9</sup> Chapter 11 *Irrigation and Flood Control*; Fourth Five Year Plan; Planning Commission  
 URL: <http://planningcommission.nic.in/plans/planrel/fiveyr/4th/4planch11.html>  
 Accessed: Dec. 17, 2003

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# 8

## Groundwater- The Real Driving Force

*“Particularly in northern India (especially the northwest), the development of tubewell irrigation, .....has been the main driving force behind irrigation expansion and productivity improvements over the past several decades.”*

**India: Irrigation Sector Review (Vol II),**  
The World Bank 20 Dec 1991

*“.... majority of districts of Punjab and Haryana rely heavily on groundwater, but have limited stocks of the resource”.*

**The Socio-Ecology of Groundwater in India**  
Aditi Deb Roy and Tushaar Shah, IWMI-Tata  
Program

*“Even though the villages here get waters from the canal, we still have to rely on the tubewells; without it we cannot grow the crops we are growing.”*

**Santokh Singh, Farmer,**  
Village Kotli Khakhyan Dist. Nawanshahar  
(Part of Bhakra Command)

*“Even though the ground water is saline here, people have still sunk in tubewells because the wheat-rice cycle is just not possible on canal waters.”*

**Agricultural Development Officer,**  
Hansi, Dist. Hissar, Haryana  
(Bhakra Command Area)



## Groundwater The Real Driving Force

FROM THE FARMER TO THE WORLD BANK, FROM RESEARCHER TO POLITICAL activist, all agree that the real driving force behind the growth in irrigation, production and productivity in Punjab and Haryana has been the explosive growth in tubewell based groundwater extraction. Even in many of the areas served by canals, tubewell irrigation is not just a supplementary source, but has assumed the primary role.

Indeed, farmers we met told us that the mainstay of the farming in Punjab and Haryana – the wheat/rice cycle – is impossible with only canal waters. Paddy in particular is just not possible without heavy extraction of groundwater. Indeed, such is the imperative to use groundwater that even in areas that are underlain with saline waters, people still sink in tubewells for irrigation. For example, farmers in Hansi in Haryana told us that they have no choice but to draw upon groundwater.

Yet, it is not only Paddy that is not possible with just canal waters. Almost every factor that has led to the growth in agriculture in Punjab and Haryana is largely dependent on the groundwater based irrigation.

The intensive cultivation, with massive inputs of chemicals and fertilisers, combined with HYV seeds plus a variety of other factors like support price, input subsidies, mechanisation and so on - in short the Green Revolution - was what led to the growth of agriculture in Punjab and Haryana. Much of this would not have been possible - or least - the results would have been far less spectacular with only canal irrigation.

### EXPANSION OF THE TUBEWELL IRRIGATION

There has been a dramatic growth in the areas irrigated by tubewells in both the states; this growth has been especially high after 1965-66.

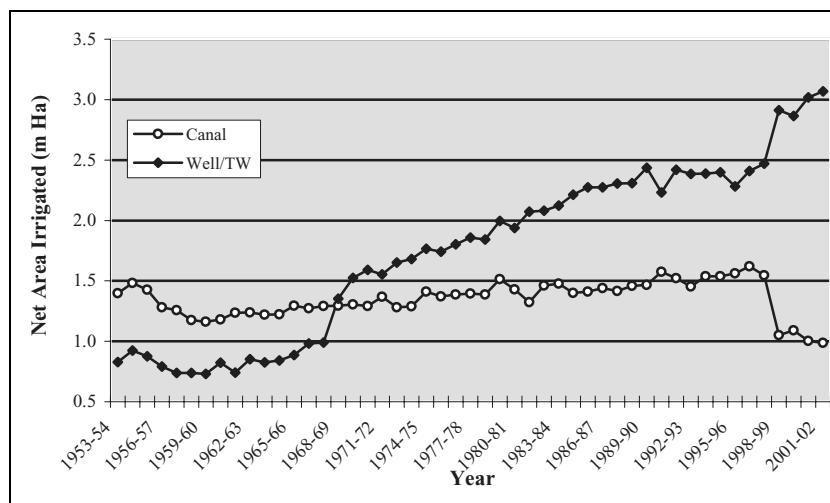
By the late 60s, tubewell<sup>1</sup> irrigated areas had equalled and soon outstripped canal irrigated areas in Punjab. (See Figure 8.1). In Haryana too, the tubewell irrigation grew rapidly till it now equals the canal irrigation (Figure 8.2).<sup>2</sup>



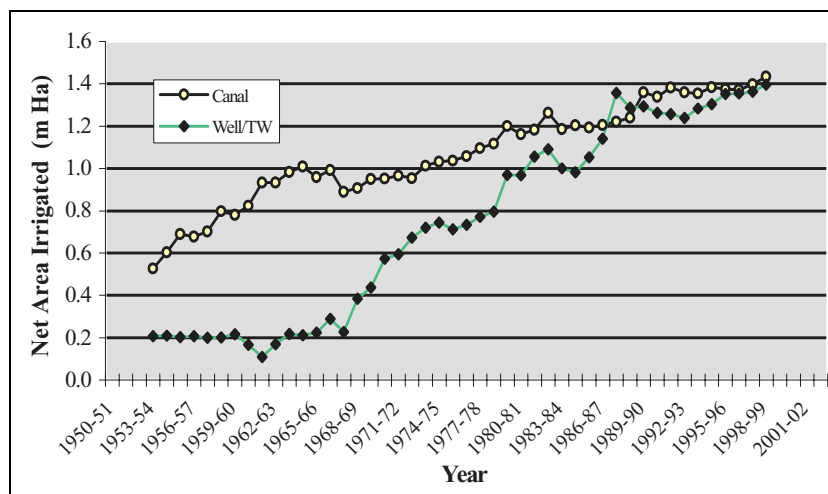
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<sup>1</sup> This includes the small area irrigated by wells. The Statistical Abstracts give only the combined areas for tubewells and wells.

<sup>2</sup> The data for this figure is taken from the various statistical abstracts for Punjab and Haryana. The figures refer to the Net Areas Irrigated. Statistical Abstracts of both Punjab and Haryana do not give the break up by source of the gross areas irrigated.

**Figure 8.1: Net Area Irrigated by Source<sup>3</sup> in Punjab**

Source: Various Statistical Abstracts of Punjab

**Figure 8.2: Net Area Irrigated by Source<sup>4</sup> in Haryana**

Source: Various Statistical Abstracts of Haryana

The same figures in tabular form are given in Tables 8.1 and 8.2.

**Table 8.1: Net Area Irrigated by Source: Punjab**  
(<sup>000</sup> ha)

	1965-66	1975-76	1997-98	2001-02
Canals	1289	1366	1356	987
Tubewells	887	1742	2356	3068

<sup>3</sup> We give only canals and tubewells here. The "Other" sources are negligible

<sup>4</sup> We give only canals and tubewells here. The "Other" sources are negligible

The number of tubewells in Punjab jumped from 20,066 to over 450,000 from 1965-66 to 1975-76. In 1997-98, this figure was 910,000. In Haryana, the number of tubewells jumped from 25,311 in 1965-66 to 204,736 in 1975-76, and in 2000 stood at 583,705.

**Table 8.2: Net Area Irrigated by Source: Haryana**  
(’000 ha)

	1965-66	1975-76	1993-94	1998-99
Canals	960	1036	1353	1433
Tubewells	224	682	1283	1395

It should be added that the figures for areas irrigated by tubewells are conservative estimates while the canal irrigated areas are estimates on the higher side. This is due to the particular way of collecting these statistics in both the states.<sup>5</sup> Lands that are irrigated by both canal and tubewells are classified as canal irrigated – even if they receive only one watering from canal and rest from tubewell. In fact, even if the farmer makes the use of the watercourse to take tubewell water from the well to his field, it is still counted as canal waters!

We have already seen that the HYV seeds performed much better with a controlled water supply and this was a key factor behind spread of tubewell irrigation. There were some other important factors also. Let us quickly look at these.

### CANAL WATERS ARE LIMITED

Farmers at many places told us that the quantity of water that they get from the canals is very limited. The timing too is such that crops would go for long periods without water. For example, in village Mahas, Dist. Patiala, Punjab, served by the Kotla Branch, the canal runs for 7 days and then is closed for 15 days. Due to this, only about 10% of the irrigation in the village is from canals and 90% by tubewells. In village Simla, District Kaithal Haryana, the canal runs for only 7 days in 42 days. The villagers told us here that due to this, they have to use tubewells, even though the groundwater is saline.

This situation is not surprising since the Bhakra canals were *meant* to be used for protective irrigation, and not for intensive cultivation.

As per the original plans, Bhakra project was to have a maximum irrigation intensity of 62%. The irrigation intensity – which means the percentage of the culturable command area that is irrigated in a year – was fixed by the project for all the three zones. This was 45% in Zone I, 35% in Zone II and 62 % in Zone III. This means that the highest an area would be irrigated in any given year was to be 62%.

In their detailed study of the Sirsa Circle of Bhakra command area, Bastiaanssen et al. state that<sup>6</sup>:

“Because the reference evaporation is 1,721 mm/yr, or 4.7 mm/day, average canal water deliveries (1.5 mm/day) are sufficient for only about of third of each farmers cultivable command area.”

More generally about the whole Bhakra system, they point out that<sup>7</sup>:

<sup>5</sup> Related to us by revenue officials, irrigation department staff and *jiledars*

<sup>6</sup> Bastiaanssen, W. G. M., D. J. Molden, S. Thiruvengadachari, A. A. M. F. R. Smit, L. Mutuwatte, and G. Jayasinghe (1999): ‘*Remote sensing and hydrologic models for performance assessment in Sirsa Irrigation Circle*’, India, Research Report 27: International Water Management Institute, Colombo, Sri Lanka : Page 11  
Accessed from: [www.iwmi.cgiar.org/pubs/PUB027/REPORT27.PDF](http://www.iwmi.cgiar.org/pubs/PUB027/REPORT27.PDF)

On 2 Feb 2003

<sup>7</sup> *ibid* Page 2

“The canal systems in Haryana were designed to serve the greatest number of farmers possible by distributing a limited supply of water over a large area. The major objective of irrigation development at that time was to prevent crop failure and avoid famine.”

“The Bhakra canal system was designed for an irrigation intensity of 62% of the cultivable command area” (Reidinger 1971<sup>8</sup>)

Intensive farming with such allowances was not possible.

This limitation of canal irrigation was recognised early on. For example, this issue was important enough to merit a discussion in the Conference of Chief Ministers in 1967. The "Proceedings of Conference of Chief Ministers, Ministers of Agriculture and Irrigation, New Delhi 7 July 1967" notes<sup>9</sup>:

“On many irrigation projects, particularly in the North, the intensity of irrigation, i.e. the ratio of area irrigated by the project to the total culturable command area is considerably less than 100%. ....Supply pattern of this type is not conducive (sic) to scientific irrigated agriculture for maximum production in a given area. *The deficiency also stands in the way of double or more intensive cropping on the same area during the same year....*The possibility of providing supplemental irrigation in the command of low-intensity irrigation canals like the ones ...in Punjab ...therefore needs to be explored.” (Emphasis added)

Similarly, about 10 years later, the "Irrigation, Floods and Waterlogging Statistics" brought out by Government of Punjab for 1978-79 noted<sup>10</sup>:

"While canal water supply may be inadequate and uncertain, tubewells and pumping sets provide assured supply of water.....

“Main factor behind the increase in irrigation facilities is the installation of more and more tubewells and pumping sets in the State”.

What this means is that the intensive cultivation in Punjab and Haryana would not have been possible with the Bhakra irrigation canals. *They were not designed to do so.*

### AMOUNT OF CANAL DELIVERIES DECLINING

Another complaint that farmers made to us everywhere we went is that the waters coming in the canals have gone down over the years<sup>11</sup>. Two reasons seem possible, from our study and observations:

- A. General deterioration in the canal system leading to heavier losses. The lack of maintenance of the canals has been noted by several writers and commentators. On the other hand, there have been, according to the Government of Punjab and Haryana continuous attempts to renovate, line and in general maintain the canals. In particular, loans from the World Bank have come in for this purpose. Clearly these do not seem to have been enough.

We were told by the irrigation officials in Haryana that intensities of irrigation in the Bhakra command had gone down by at least 10%, but again no details were forthcoming.

<sup>8</sup> Reidinger, R.B. 1971: ‘*Canal Irrigation And Institutions In North India*’, PhD Thesis, Department of Economics, Duke University, Quoted in *Bastiaanssen et al.* 1999

<sup>9</sup> Government of India 1967: ‘*Proceedings of Conference of Chief Ministers, Ministers of Agriculture and Irrigation, New Delhi 7 July 1967*’, Ministry of Food and Agriculture, Government of India, New Delhi.: Page 77

<sup>10</sup> Government of Punjab 1981a: ‘*Irrigation, Floods and Waterlogging Statistics of Punjab 1978-79*’, Economic Advisor to the Government of Punjab, Government of Punjab, Chandigarh., Page 7 & 9

<sup>11</sup> We have also seen the sharp fall in canal irrigated areas in Punjab since 1990-91



According to a study carried out Dr. Prem Vashishtha (Vashishtha 2003) in the Bhakra (and Yamuna) command in Haryana:

“Most farmers complain that keeping the present cropping pattern in view, the overall release of water in canal is much less than their requirement. Some unscrupulous elements do not hesitate to lift water from canal through unlawful means. This phenomenon is rampant.”

The study also found other technical and managerial problems leading to less water availability, like growth of weeds in water channels, defective slope of channels etc.

- B. Another important reason for the decrease in the canal waters could be the siltation in the Bhakra reservoir. By 1975, the Bhakra reservoir had lost 2.5% of its live capacity and 16.42% of its dead storage to siltation.<sup>12</sup> In year 2000, about 10% of the live storage and 31% of the dead storage was silted up<sup>13</sup>.

In view of the inadequate, unreliable and limited supplies of canal waters, the farmers were forced to go in for tubewells - as a supplementary source of irrigation, at least initially.

### **CROPPING PATTERN DEMANDS EXCESSIVE WATER**

However, there is another, far more important factor that overrides this reason for the use of tubewells. That is, there is no way in which the canal waters can support the intensive cropping patterns of Punjab and Haryana - especially crops like paddy.

It should be noted that Paddy was not a traditional crop of Punjab or Haryana.<sup>14</sup> That paddy cannot be grown on the canal waters alone (in these states) is noted by a number of academic studies, and repeated to us by farmers everywhere. Hence, farmers had to go in extensively for tubewells based irrigation. In the process, a supplementary source of irrigation emerged as the dominant one. It is ironic that the reason rice was introduced in some parts was to control the waterlogging due to canal irrigation. As the Committee set up by the Punjab Government notes:<sup>15</sup>

“Initially, the rice cultivation was taken up in the 50s to reclaim waterlogged soils because rice is the only crop that can be grown under waterlogged conditions.....Cultivation of rice was however extended to other areas due to higher profitability and availability of water at shallow depths, which was exploited by installation of ..pumps...”

But due to the profitability and the policies, this did not remain confined to areas with good groundwater availability. How the policies compelled the farmers to go in for tubewells is clear from what an agricultural officer told us in Hansi:

"Support price was available only for wheat/rice and these were the only remunerative crops. But the canal waters were inadequate for these. So the farmers went in for tubewells, knowing fully well that the groundwater was saline. This has resulted in the land becoming salinised."

<sup>12</sup> Central Board of Irrigation and Power, as quoted by Singh 1997: Page 140-1, quoted in Thakkar 1999 Irrigation Options paper done for the World Commission on Dams

<sup>13</sup> Duggal *et al*, 2002

<sup>14</sup> Area under rice in Punjab in 1955-56 was 0.149 m ha as against 2.489 m ha in 2001-02. In Haryana, it was 0.078 m ha in 1955-56 and 1.028 m ha in 2001-02

<sup>15</sup> Punjab, Government of 2002: ‘*Agricultural Production Pattern Adjustment Programme in Punjab for Productivity and Growth (Report of the Johl Committee)*’, A Report by Chief Minister’s Advisory Committee on Agriculture Policy and Restructuring, Submitted to the Government of Punjab, October 2002: Page 12

In other words, what this means is that a principal "glory" of agriculture in Punjab and Haryana – namely, rice<sup>16</sup> – is based on extensive and massive groundwater based irrigation.

### INCREASE IN YIELDS DUE TO GROUNDWATER IRRIGATION

The high levels of productivity in Punjab and Haryana are due to the Green Revolution package including HYV seeds, high inputs of fertilisers and pesticides etc. However, the performance of these seeds is very sensitive to the timing of watering, and the high productivity of agriculture in Punjab and Haryana would not have been possible without groundwater.

"Now it is groundwater which is playing a critical role in our agriculture transformation, ever since the advent of high yielding variety (HYV) seeds. In fact, innumerable research investigations have highlighted a close relationship between the success of HYV programme in an area and the use of groundwater irrigation -- especially individual-owned wells and well fitted with power pumps....

"The HYV seeds, unlike the earlier or *desi* seeds perform well only when pampered with requisite inputs and care. In view of their exacting demands for water, ensuring timely irrigation for them is impossible unless a farmer has control on the source of irrigation....a condition easily fulfilled by groundwater as compared to surface water..."

B.D. Dhawan<sup>17</sup>

This is also reflected in the fact that yields from wells/ tubewell based irrigation are generally much higher than canal based irrigation. This is the experience of farmers all over the country. The World Bank Irrigation Sector Review for India states:

"An important conclusion is that land irrigated from private wells has notably higher productivity than from canals, which can also be readily observed in field visits. The principal reason for this that farmers with wells have much better control over water than is possible through canal irrigation." (World Bank 1991:7)

The table given in the same document gives the figures as follows:

**Table 8.3: Land Productivity Per Net Irrigated Hectare  
By Source of Irrigation**  
(Tons/Ha in foodgrain Energy Equivalent)

	<b>Wells (Private)</b>	<b>Canal Irrigation</b>	<b>Ratio of Productivity of Wells:Canal *</b>
<b>Punjab</b>	5.5	3.2	1.72
<b>Haryana</b>	5.7	2.4	2.375

\* The last column is calculated by this author from the second and third column figures

### CONTRIBUTION OF GROUNDWATER

Considering that the yield from tubewell irrigated areas is much more than canal irrigated areas, we can see that the impact of the increased tubewell irrigation would be huge. We now try and quantify this impact.

<sup>16</sup> Rice forms about 30% of the total foodgrains in the two states (in 2001-02). In 1975-76, it was only 15%.

<sup>17</sup> Dhawan 1977: 'India's Groundwater Resources'; in Economic and Political Weekly, March 1977 Page A-18

It is a complex task to try and segregate the contribution of groundwater and canal irrigation in terms of crop production. First of all, much of the command area has conjunctive water use - i.e. it receives water from both canal and tubewells. However, we can get around this because the tubewell areas reported in the Statistical Abstracts are purely tubewell irrigated areas. The canal areas reported include purely canal irrigated areas *and* areas with conjunctive use. Using these figures will give us a conservative estimate of the contribution of groundwater.<sup>18</sup>

Secondly, various crops respond in different manner to irrigation. Calculating at the aggregate levels, we lose these finer distinctions.

Then of course, there is the difference in climate, soil condition, land holdings and so on. Again, calculating at the aggregate level will not be able to consider this.

There is also the difference between individual farmers - in their skills, effort, land holdings - all of which influence the yields and the response of crops at the micro level.

In spite of all these differences, it is still possible to get a broad picture.

We have calculated the contribution to crop production in Punjab and Haryana from the following:

- Unirrigated Areas
- Areas Irrigated from Canal and Other sources
- Areas Irrigated by groundwater

In doing this, we have taken that the productivity of tubewell irrigated areas is 1.7 times the canal irrigated areas, and the productivity of irrigated areas overall (i.e. both canal and tubewell areas) is 2.5 times the productivity of unirrigated areas<sup>19</sup>.

Based on these ratios of productivity, and knowing the figures of the acreage under each of the above, we can calculate how much of the total state production comes from each of these areas.<sup>20</sup>

The methodology of the calculations is given in Annexure I to this chapter.

From these calculations, we find the following.

*For Punjab, a full 71.8% of production is from groundwater irrigated areas (which means tubewell based irrigation), about 25.7 % attributable to canal areas and other sources, and about 2.5% to unirrigated areas.*

For Haryana, we get similar figures.

### **SOME IMPORTANT CONSIDERATIONS**

There are two important arguments put forward in this context.. The first argument is that much of the groundwater comes from the seepage from canal waters, and hence the benefits should be counted as indirect benefits of the canals.

The second argument is that the tubewells are run by the electricity from large dams like Bhakra and hence this should be counted as a contribution of large dams.

<sup>18</sup> See Also ADDITIONAL NOTE 8.1 with this chapter.

<sup>19</sup> The ratio of productivity of tubewell and canal irrigated areas are from sources already quoted above. The ratio of productivity of irrigated vs unirrigated areas is from Rangachari, R., Sengupta, N., Iyer, R.R., Banerji, P., and Singh, S. (2000): Page 24 .

<sup>20</sup> Note that we have refrained from saying that this is the production *due to canals or groundwater*, but instead say that this is the production *from canal or groundwater areas*. The reason is that the rainfall does not figure in these calculations. What our calculations give us is the production from each of these *areas*. The figure we get, say for production from canal irrigated area will be the production due to the canal and rainfall water. Thus, in all the three categories rainfall will be a common factor.

### Groundwater As Indirect Benefit Of Canals

Let us look at the first argument; namely, that it is the canals that have made the tubewell irrigation possible.

There is certainly some truth in the contention that canal seepage recharges groundwater; and this means

- a) more wells can be run in the area
- b) each well can run for more time.

The issue however is the *extent* of this contribution. There is limited study of the extent of groundwater recharge from canals.

Prof. B.D. Dhawan estimates that for Punjab, about 50-70% of all groundwater recharge comes from the recharge from canals<sup>21</sup>. His calculations are aggregated estimates for the whole state. He says that the total recharge in Punjab is of the order of 1.81 ha-m. (14.66 MAF). If average rainfall is taken as 600 mm, at 25% infiltration rate over 5 m ha of geographical area, the total rainfall infiltration is 0.75 ha-m (6.08 MAF). This is 41% of the total recharge. The rest must come from canals - about 60%.

Surendar Singh (1991)<sup>22</sup> too gives a figure of 60%, based on estimates prepared by Directorate of Water Resources, and Groundwater Cell of Department Of Agriculture of the Punjab Government.

However, there are several problems with these calculations and their interpretation. For one, these do not consider the direct seepage from the rivers - Beas, Sutlej and Ravi. This also does not consider the fact that a large part of canal seepage that occurs in areas underlain with saline waters is lost - since the seepage itself is rendered saline. Today, Punjab and Haryana can be divided into roughly two zones - one in which the water tables are declining, and the other in which the water tables are rising. The water tables are rising in the latter areas *precisely because the infiltration here is not being pumped out* - the quality is not good enough. What this means is that even if there is groundwater recharge due to canals in these areas, large portions of it will not be useful.

Dhawan himself qualifies the beneficial effect of canal seepage thus:

"Innumerable scholars have drawn pointed attention to the marked superiority of private tubewells over other means of irrigation, namely canals, traditional dugwells ....How prior development of canal irrigation in north-western India has facilitated the rise of private tubewells needs due recognition. Here, two aspects are noteworthy. On the one hand, there occurs improvement in the availability of groundwater through the seeped-in canal waters. *In low rainfall regions not underlain with brackish waters*, the improvement in groundwater regime has two beneficial consequences...reduction in water lifting cost (and) ...added scope for sustaining many more tubewells....."(Dhawan 1989: 96) (Emphasis added)

Another issue with these calculations is that some of the seepage attributed to canals may not be from canals. To clarify, in the Punjab Government figures groundwater recharge has three major components - rainfall recharge, seepage from canals and recharge from surface water infiltration (SWI)<sup>23</sup> (meaning - the irrigation waters applied to the field that seep into the groundwater). According to Surendar Singh, the canal seepage for Punjab state as a whole is 25% of the total recharge, and SWI is 34%. But at least half the surface water application

<sup>21</sup> Dhawan 1989: Page 93

<sup>22</sup> Surendar Singh 1991: 'Some Aspects of Groundwater Balance in Punjab', Economic and Political Weekly; 28 Dec. 1991

<sup>23</sup> Singh 1991

comes from tubewells - hence, not all of this infiltration can be attributed to canals. (Dhawan's figure of 60% will include SWI)

Then, Dhawan also points out, the large amount of seepage from canals in Punjab is because the canals in Punjab carry about 10 MAF of waters of the share of Rajasthan and Haryana. Thus, the amounts of infiltration in other states will not be to this extent.

### Implication of Canal Waters Recharging Groundwater

For the moment, let us take the figure of 60% as given by Prof. Dhawan - that is - 60% of the groundwater recharge is due to the canals. What are the implications of this? Does this mean that 60% of the production attributed to groundwater should actually be considered the indirect benefit of canals?

This would be a highly inaccurate. Why?

For, total ground water used for irrigation does not consist only of two components - naturally recharged groundwater and recharge by canals. There is a third component - the unsustainable mining of groundwater- extraction of groundwater that is not being recharged, groundwater that has accumulated since generations. In other words, the contribution to the groundwater *irrigation* (as against groundwater recharge) comes from three components:

1. The recharge from rainfall, rivers, streams and other sources
2. The recharge from canals (Including SWI)
3. The mining of groundwater reserves accumulated over generations

We were able to obtain a comprehensive estimate for this from Dr. G.S. Dhillon, former Chief Engineer of Punjab Irrigation Department<sup>24</sup>. He gave us the following estimate of water use in agriculture in Punjab.

Total water used by the current <sup>25</sup> cropping pattern =	34 MAF
Available from Canals =	12-14 MAF
From Groundwater Recharge (net of recharge in saline areas, in areas like Kandi where extraction is not possible) =	8 MAF
Rest Being Mined from Groundwater	14-12 MAF

What this means is that about 35-40% of the total water for agriculture in Punjab comes from *unsustainable mining of groundwater!* To the matter in perspective – *more than twice the live storage of Bhakra dam is mined from groundwater every year in Punjab.*

If we take into consideration that groundwater is much more productive than canal waters, and assume Dhawan's figures that only 40% of the groundwater recharge is from rainfall, the break up of the contribution to agriculture from various sources that we get is given in Table 8.4.

*The startling conclusion is that - even if we assume 60% of groundwater recharge comes from canals, and we count this as a part of the benefits of canals - the contribution of canal irrigation to total production in Punjab is about 43% - while 43% of the total production comes from areas with completely unsustainable mining of groundwater.*<sup>26</sup>

<sup>24</sup> Personal Discussion. Dr. Dhillon was a member a committee set up by the Punjab Agricultural University to study this. It included 4 other experts.

<sup>25</sup> These figures pertain to 1988-90

<sup>26</sup> If we use figures given in the Johl Committee Report, (Government of Punjab 2002), then the contribution from mining of ground water comes to 35%, the contribution of total canals (including canals direct and canal

**Table 8.4: Contribution of Various Sources to Agricultural Production - Punjab**

	<b>Percentage Contribution to Production</b>
Unirrigated Areas	2.52%
Canal Waters Direct (12-14 MAF)	25.7%
Canal Waters Indirect (infiltration into groundwater - 4.8 MAF)	17.23%
Groundwater Direct (Rainfall Recharge) (3.2 MAF)	11.48%
Groundwater Mining (Unsustainable 14-12 MAF)	43.07%

The figures for water usage in agriculture in Haryana are similar. According to the booklet produced by The Director of Extension Education, CCS Haryana Agricultural University under the World Bank project<sup>27</sup>:

“The total consumptive use of the state for the prevalent cropping pattern, has been estimated to be 3.39 M ha-m and the net irrigation requirement at the field level comes out to be 2.40 M ha-m. The availability of canal and ground waters at field head is 0.6507 ha-m and 0.6813 M ha-m respectively.”

The same information in tabular form is given below:

	<b>In Million ha-m</b>	<b>In MAF</b>
Total consumptive use of the state for agriculture for the prevalent cropping pattern	3.39	27.46
Net irrigation requirement (net of rainfall)	2.40	19.44
Groundwater Availability	0.6813	5.52
Canal Water Availability	0.6507	5.27
Total Available	1.332	10.79
Deficit	<b>1.068</b>	<b>8.65</b>

While it is not explicitly stated in the document whether this deficit is met or not - but since it talks about the consumptive requirement of the *prevalent* cropping pattern, it is clear that the deficit must be being met from somewhere - this somewhere is clearly the mining of groundwater. This conclusion is also supported by the observation that the groundwater level is falling in many parts of the state. *Haryana is mining groundwater more than the total storage of the Bhakra dam every year.*




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infiltration) remains the same, and contribution of rainfall recharge goes up to 19%. This is hardly any less serious a situation.

<sup>27</sup> Kumar *et al* 2000: Page 15

A similar calculation for Haryana as for Punjab gives the following:

**Table 8.5: Contribution of Various Sources to Agricultural Production - Haryana**

	<b>% Contribution</b>
Unirrigated Area	9.23 %
Canal Waters Direct (5.27 MAF)	34.4 %
Canal Waters Indirect (infiltration into groundwater – 3.312 MAF)	13.18 %
Groundwater Direct (Rainfall Recharge - 2.208 MAF)	8.78 %
Groundwater Mining (Unsustainable 8.65 MAF)	34.41 %

We find that 34% of the production comes from areas with unsustainable mining of ground water and over 9% from unirrigated areas! Sustainable groundwater contributes 8.78 % and, with the most liberal assumption that 60% of recharge of groundwater comes from canal we still find that canal indirect contribution is only 13.18% and direct contribution 34.4 - a total of 47.58 %. We may note that Dhawan's figure of 60% recharge coming from groundwater is for Punjab and this will certainly be much lesser in Haryana, but we have taken conservative figures.

### Running the Pumps – Power from the Dam

Before we analyse this contribution further, let us look at the aspect of power generation from the Bhakra project.

It is often argued that it is the power from the Bhakra dam that made it possible to run the tubewells.

The total power generation from Bhakra project is about 6500 MU (Million Units) per year, as per the board at the dam site.

According to Central Electricity Authority<sup>28</sup>, the power generation from the Bhakra Left and Right Bank power houses was 5628 MU in 1995-96 and 1166 MU at Ganguwal and Kotla. So we can take the figure of 6500 as a fairly good representation. Even if we assume that all this power is used for running tubewells (not a valid assumption), the number of tubewells it can run is around 370,000.<sup>29</sup> Even in 1975-76, the number of tubewells in Punjab and Haryana was 450000 and 204736 respectively - total of 654736. Even by this period, the entire electricity from Bhakra could have run only about 56% of the tubewells at best. No wonder, 65,000 and 304,000 of these tubewells in Haryana and Punjab respectively were being run on diesel.

Journals have noted the severe power crisis during this period and have discussed the impacts of this on the agricultural production.

“..precisely because of the current shortage of power and diesel oil, the Governments of Punjab and Haryana have been thinking of drastically lowering their wheat production targets for the current year...”<sup>30</sup>

In 1990-91, the number of tubewells in the two states had gone up to 497571 in Haryana and 800000 in Punjab. This is a total of 1,297,571. Thus, the power from Bhakra was sufficient to run about 28% of these<sup>31</sup>.

<sup>28</sup> CEA1999: *Review of Performance of Hydropower Stations 1995-96*; Central Electricity Authority, Ministry of Power, Government of India. Page 31

<sup>29</sup> We have estimated this, assuming 15% T&D loss, average 10 HP motor, running 10 hours a day for 200 days a year.

<sup>30</sup> Anon 1974b: ‘*End of Wheat Bonanza?*’, *Economic and Political Weekly*, March 9, 1974, Vol. IX, No. 10, March 9, 1974: 393

<sup>31</sup> In fact, about 350,000 were running on diesel.

If we go back to our earlier calculations of the contribution of canals to the agricultural production, we have included the recharging of the groundwater due to canal seepage in the benefits attributable to the canals. In both Haryana and Punjab, the canal recharged groundwater constituted about 24% *each* of the total groundwater pumped out. Since these would not be used till they were pumped out, clearly the energy used to pump these waters out has already been considered within the benefit of the canals. In other words, the power generation benefits have more or less been fully subsumed when we attribute part of the groundwater benefits to the canals.

### CONTRIBUTION OF BHAKRA

Out of the several contributors to the agricultural production, the contribution of the areas with mined groundwater, and of the recharge from rainwater is clearly not attributable to canals. This is 43% (34.41% + 8.78%) in Haryana and 54.48% (43% + 11.48%) in Punjab.

Sometimes the argument is made out as if virtually all the groundwater irrigation is attributable to the canals. The reasoning given for this is that Punjab and Haryana are dry areas with poor rainfall. This is grossly incorrect as we saw.

For one, there are many parts in the two states with good to fair rainfall. Secondly, in many of the drier areas the groundwater is saline, so the benefit of recharge there is lost. Most important to note, however, is that the ongoing recharge by canals has already been fully accounted in the above calculations and has been already counted as the (indirect) benefit of the canals.

The waters which are being mined are from the recharge from natural sources since centuries, and recharge from canals that took place before pumping was introduced on a large scale.

*This recharging of groundwater was already taking place much before Bhakra canals*, due to the diversions canals that were in place in Punjab and Haryana since late 19<sup>th</sup> century.

We have already noted the extensive irrigation in Punjab and Haryana from these early irrigation systems. In many places the recharge from these had led to the problem of waterlogging – testimony to the recharging of groundwater due to these canals.

The Johl Committee Report states<sup>32</sup>:

“Ground water reservoir, which is now being exploited for agriculture production has been built up over the centuries particularly since the mid nineteenth century...”

The World Bank has noted in its India’s Irrigation Sector Review of 1991<sup>33</sup>:

*"The success story of the agricultural development in the northwest ..... was made possible by the major development of surface irrigation in the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Subsequent developments -- the rapid spread under the green revolution of HYVs, fertiliser usage and groundwater development (based on water provisions to groundwater provided by irrigation and used conjunctively with surface irrigation) -- could not have taken place if the irrigation infrastructure had not been there and functioning well." (Emphasis added)*

The other two parts – direct irrigation from canals and the seepage due to canals – are attributed to canals. This is 47.58% (34.4 + 13.18) in Haryana and 42.93% (25.7% + 17.23 %) in Punjab<sup>34</sup>.

<sup>32</sup> Government of Punjab 2002: Page 12

<sup>33</sup> World Bank 1991b: Page 48

<sup>34</sup> To remind readers, this is the proportion from canal irrigated *areas* – the contribution of rainfall is included in this.



What is the proportion of Bhakra in this? We can approximate this in terms of the proportion of the Bhakra irrigation in the total canal irrigation.

In Punjab, this is very small part. In absence of official figures due to the refusal of officials to give us the detailed figures, we can only estimate this from the Statistical abstracts. We estimate the irrigation from Bhakra canals in Punjab will not be more than 25% of the canal areas (in 1989-90). Thus, if the total contribution of the canals to production in Punjab is 43%, then from Bhakra it would be about 11%. This is in all likelihood an overestimate, as our method of estimating irrigation from Bhakra canals is liberal.

For Haryana, if we take the total Bhakra irrigation as 50% of the canal irrigation, then the contribution of Bhakra will be about 24% to the state production.

To Summarise<sup>35</sup>:

<b>Contribution of Bhakra to agricultural production in</b>	
Punjab	11%
Haryana	24%

We emphasise that this includes the contribution due to recharge of groundwater by canals. We should also recollect that as far as food production is concerned, Punjab contributes twice as much as Haryana.

We would like to caution that these figures should not be used as precise numbers; they are more in the nature of broad indicative estimates.<sup>36</sup>

## OFFICIAL ESTIMATES

What are the official estimates? The Bhakra Beas Management Board, BBMB estimates the agricultural benefits of the project to be (the Table below is quoted from BBMB)<sup>37</sup>:

<b>Project</b>	<b>Annual Increase</b>			
	<b>Foodgrains</b>	<b>Cotton</b>	<b>Pulses, Vegetables Oil, Fodder etc.</b>	<b>Sugarcane</b>
<b>Bhakra Nangal</b>	1.57 m tons	0.185 m tons	0.440 m tons	0.365 m tons
<b>Beas Sutluj Link</b>	0.224 m tons	0.051 m tons	0.965 m tons	0.031 m tons

How do these compare with our estimates?

Note that the BBMB figures are for the whole project – i.e. for all the three states of Punjab, Haryana, Rajasthan taken together. For the moment, let us assume that all the above additional production is just in Haryana and Punjab. If we look at the total food production of Punjab and Haryana (in 1999-00), it was 38.26 m tons. *Thus, according to the above figures of BBMB,*

<sup>35</sup> See also ADDITIONAL NOTE 8.1 with this Chapter.

<sup>36</sup> We have not included here the estimates of the food production in Rajasthan due to the Bhakra project as Rajasthan areas form a small part of the Bhakra CCA and the main focus of our enquiry have been Punjab and Haryana. For the sake of records, we may mention that our estimate of the contribution of Bhakra project to foodgrain production in Rajasthan is about 0.46 m tons. Note that this is the total production from Bhakra irrigated areas, and not the *additional* production due to the project.

<sup>37</sup> BBMB 2002a: Page 50

*contribution of Bhakra and BSL together is 4.688 %.*<sup>38</sup> (This percentage will be even smaller if we deduct production in Rajasthan from the figures given in the table.)

What does all this mean? It means that the spectacular growth of agriculture in Punjab and Haryana was driven by the explosive growth in groundwater irrigation, and this did not depend on the Bhakra project! Contribution of Bhakra was rather modest, especially in Punjab.

*One cannot escape the startling conclusion that much of Punjab and Haryana's growth could have still been possible even if the Bhakra dam had not been built. (Though possibly it would be as much unsustainable).*

*As Punjab raced from its pre-independence irrigation base to the HYV era with the explosive growth of tubewell based irrigation and increasingly unsustainable mining of groundwater, leading to spectacular increase in agricultural production, Bhakra happened to be there – in the right place, at the right time; being attributed with things it did not do, being credited with an achievement that was essentially due to something else.* ✍

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<sup>38</sup> Our estimates and the BBMB estimates may look different, but actually there may not be much difference between them. If we see our estimates for contribution of Bhakra, it is 11% in Punjab and 24% for Haryana. Considering that Haryana produces half the food that Punjab does, the weighted contribution of Bhakra in the food production of the two states taken together is 15%. Our estimates are for the *total* production from the Bhakra areas, while BBMB figures are mentioned as *additional output* due to Bhakra.

Note also that our estimates are liberal towards contribution of Bhakra

## **ADDITIONAL NOTE 8.1**

### **CHAPTER 8: GROUNDWATER THE REAL DRIVING FORCE**

In calculating the role of canal and groundwater in the agricultural and food production, there are two important aspects that we have to bear in mind:

1. Some of the groundwater use is made possible due to the groundwater recharge by canals. This has to be legitimately counted as a (indirect) benefit of the canals.
2. Some of the areas are irrigated solely by canals, some are irrigated solely by tubewells. It is fairly straightforward to attribute the production from these areas to canals and tubewells respectively. Part of the area irrigated is irrigated conjunctively by canals and tubewells. It is very complicated to allocate the production from these areas to canal or tubewells.

The first of these aspects, namely the fact that some of the groundwater is due to the recharge of the canals – we have already taken into consideration in the main chapter and have calculated the extent of this. The second issue, also taken into consideration in the main chapter is discussed in some detail here. We also calculate the contributions of canal and groundwater using an alternate methodology.

#### **ISSUE OF CONJUNCTIVELY IRRIGATED AREAS**

The Statistical Abstracts of both the states – Punjab and Haryana, give the following parameters for irrigated areas:

- Net irrigated area
- Gross irrigated area
- Net area irrigated by source (namely by canal, tubewell and so on).

However, the gross area irrigated by source is not given.

Clearly, there is a problem as to how to classify the areas that are conjunctively irrigated – i.e. – irrigated by both canals and tubewells. Should these be called as canal irrigated, or tubewell irrigated? Or should a third category be created called “Conjunctively Irrigated”? As of today, the third category is not there, so we have to make do with only the two categories.

Moreover, conjunctively irrigated areas may have differing contributing from canal and groundwater. On some farms, one watering may be by canal and say four waterings by tubewell. In some cases, it may be the reverse. Others may be in between. Thus, the problem of how to deal with the issue of conjunctively irrigated areas is a difficult one.

We recognised this issue early on in the study as an important one, and explored how we could handle it in absence of data reporting on conjunctively irrigated areas.

The key to handling this issue is to see how the data is collected on the ground.

We have been cautioned that canal areas are often under-reported because the farmers want to avoid paying the water charges. On the other hand, we have also been told that precisely for these reasons, for the reasons of notching up revenue collection targets, revenue officials over-report canal areas. For example, *jiledars* told us in Haryana that even if the watercourse in the farm was used to carry tubewell water, the land was designated as canal irrigated. Thus, there seem to be factors which tend to downplay, and factors which tend to hike up the areas irrigated by canals.

In our field visits in Punjab and Haryana, we made detailed enquires about how the data is recorded and classified. In particular, we asked how an area is classified as “canal irrigated” or

“tubewell irrigated”. We were told, unambiguously, that an area, even if it gets one watering from canal and all the rest from tubewell, is classified as canal irrigated. Indeed, as mentioned above, even if the land does not get canal water but the watercourse is used to carry tubewell water, this is designated as canal area.

What does this mean? *This means that effectively, all the conjunctively irrigated area is classified under canal affected area.* The contribution of canals to agricultural production, calculated with the current figures then creates a bias in favour of canals, since much of the tubewell irrigation benefit that occurs on the conjunctively irrigated areas gets attributed to the canals.

However, allowing this bias helps us address the problem of lack of data on conjunctively irrigated area.

This is precisely what we have done in the calculations in the main chapter. *With this, we have been able to address the issue of lack of separate data on conjunctively irrigated areas; however, it should be noted that our conclusions then overestimate the benefits of canals and underestimate the contribution of groundwater.*

## METHOD II FOR CALCULATING THE CONTRIBUTION OF CANALS AND TUBEWELLS

There is another way to address the problem of lack of separate data for conjunctively irrigated areas. That is to estimate the contribution of canals and groundwater only on the basis of how much they contribute to the consumptive use by crops. The consumptive use by the crops, as the name suggests, is the water directly taken up and used by the crops. We have the following estimates for the same.

### Haryana

	In MAF	In Percentage
Total consumptive use of the state for agriculture for the prevalent cropping pattern	27.46	
This is met from:		
Rainfall	8.02	29.21%
Groundwater Availability	5.52	20.10%
Canal Water Availability	5.27	19.19%
Mining of Groundwater	<b>8.65</b>	<b>31.50%</b>

Source: Kumar *et al* 2000: Page 15

This means that in Haryana, mining of groundwater meets 31.5% of the crop requirement and rainfall meets another 29.21%. Groundwater (sustainable) meets 20.1% of the crop requirement. If we take that 60% of this is recharged from canals, then direct groundwater meets 8.04% of crop requirement and recharge due to canal meets 12.06%. Canals directly meet 19.19%.

Thus, canals can be said to be responsible for (19.19+12.06) 31.25% of crop production in the state.

The method used in the main chapter allows us to account for the higher productivity of tubewell water over canal water, but does not allow us to separate the contribution of rainfall. The second method allows us to separate the contribution of rainfall, avoids the question of the lack of data on conjunctively irrigated areas, but does not allow for the higher productivity of tubewell areas.

*Thus, both the methods over-estimate the contribution of canals.*

## Punjab

We have a data problem with Punjab since the figures for consumptive use of water by crops do not include the rainfall figures. Figures available with us from two separate sources both give the consumptive use of crops net of rainfall. However, if we make an assumption that about 20% of the rainfall goes towards the consumptive use of crops, then we get the following figures.

	MAF	Percent
Total Consumptive Use	38.86096	
Met by:		
Rainfall	4.86096	13%
Canal Direct	14	36%
Canal Indirect	4.8	12%
Groundwater Direct	3.2	8%
Groundwater Mined	12	31%

**Source:** For Rainfall: Dhawan 1989  
For Others Figures Dhillon, Personal Communication  
Data pertains to 1989-90

Thus, 31% of the total consumptive use of crops is met from completely unsustainable mining of groundwater, and 13% by rainfall. Canals (including infiltration) meet about 48% of the crop consumptive use. Note that this data is for the year when the net area irrigated by canals in Punjab was high. Subsequently, this has dropped sharply and groundwater extractions gone up.

Also recollect that these calculations will over estimate the contribution of canals, and understate that of groundwater for reasons given above in Haryana section.

If we now estimate the contribution of Bhakra in this, using the figures from the main chapter of how much of canal irrigation in these two states comes from Bhakra, we get the following:

Contribution of Bhakra project to the agricultural production in:	Percentage
Haryana	15.62%
Punjab	12%

Based on Calculations as per Method II



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## **CHAPTER 8 : ANNEXURE I**

### **Note on Calculations for the Contribution of Canals and Groundwater areas to food production**

#### **METHODOLOGY**

1. Productivity of irrigated areas is taken as 2.5 times the productivity of unirrigated areas.
2. Productivity of tubewell irrigated areas is taken as 1.7 times that of canal irrigated areas.
3. Assuming that tubewell and canal irrigated areas are in a 1:1 ratio in the total irrigated area, we get the following ratios for productivity of various sources.

$$\text{Unirrigated: Canal+ Others: Tubewell} = 540:1000:1700$$

4. Using the figures of net area irrigated by different sources, the gross area irrigated, and the productivity ratios for each of the above, we can get the proportion contributed by each source.

$C$  = Constant

$P$  = total production

$Y_{\text{source}}$  – yield from a particular source

$P_{\text{source}}$  – Production from a particular source

$A_{\text{source}}$  – Area irrigated by a particular source

$$\begin{aligned} P &= Y_{\text{canal}} * A_{\text{canal}} + Y_{\text{tubewell}} * A_{\text{Tubewell}} + Y_{\text{unirrigated}} * A_{\text{unirrigated}} \\ &= 1000 * C * A_{\text{canal}} + 1700 * C * A_{\text{Tubewell}} + 540 * C * A_{\text{unirrigated}} \end{aligned}$$

This gives us the *proportional contribution* of each source in the total production. Then, the contribution of the tubewell area is further divided into three – from normal recharge, from canal recharge, and from mined groundwater – in ratio of these three, which is known to us.

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# 9

## Without Bhakra!

*“There is little doubt that India’s agricultural economy, and therefore the country as a whole would have been incomparably better off if the number of high cost river valley projects had been initially kept down to one or two, and the funds so released were devoted to a great many more small and quick maturing irrigation projects. .... As it happened, India virtually settled for what could give her only the lowest output for very high capital input – with high dams, large investments, slow completion, slipshod irrigation, and indifference to inputs...”*

**Sudhir Sen,**  
First Chief Executive Officer of the  
Damodar Valley Corporation \*



## Without Bhakra!

WE SAW THAT WHILE PUNJAB AND HARYANA HAVE HAD SPECTACULAR growth in foodgrains production, a very limited part of this can be attributed to the Bhakra project itself. The areas that have been served by the project are mainly in Haryana including the areas of Hissar, Sirsa, Fatehbad, and to some extent Jind where the groundwater irrigation is limited and irrigation from Bharka canals has been the main source of irrigation. More generally, the growth has been based on an unsustainable extraction of groundwater or on decades old canal systems based on diversion schemes.

Given this, it is evident that many of the developments in Punjab and Haryana would have been on similar lines as today even if the Bhakra project had not come up. We explore this in some detail in this chapter.<sup>1</sup>

What would the scenario have been without Bhakra? This question is one of the most frequently posed questions in context of the debate on large dams. *Interestingly, this question is mostly posed as an answer!* In other words, this question is most often posed as an argument to justify or argue for the construction of large dams.

It would be instructive to look at what Ramaswamy Iyer, former Secretary, Ministry of Water Resources, Government of India has to write on this aspect<sup>2</sup>:

“A point made by some supporters of such projects is: yes, doing things has a cost; but there is also the ‘cost of not doing’. This argument is often reinforced by the rhetorical question: where would the country have been without Bhakra –Nangal? Many find this line of argument persuasive. However, this is not a new or additional argument, but only a familiar one in a different form. ‘The cost of not doing’ means merely that in the absence of the project, certain benefits would not be available. This is nothing more than the old argument that the benefits justify the costs; .....Further, it is fallacious to equate the non-undertaking of a large project with ‘not doing’. The choice is not between ‘doing a project’ and ‘not doing anything’; there are other things (such as demand management, conservation, local water harvesting etc.) that can be done. As for the question of what we would have done without Bhakra-Nangal, it is a hypothetical one to which only a speculative answer can be given....”

We know from our look into the circumstances in the 1940s, 50s and 60s that indeed there were several other options that the country could have taken at that time.

Iyer continues:

“We know the Bhakra Nangal ‘scenario’ because that is what actually happened; we do not know what the alternative history would have been if it had not come into existence. However, we need not readily assume that there would have been an absence of development on the agricultural front. Understandably, data and information are available only in respect of the routes (of large projects) actually

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<sup>1</sup> This exploration of the "Without Bhakra" scenario in this Chapter is done only with respect to the irrigation aspect.

<sup>2</sup> Iyer 2003: Pages 132-133

taken, and not in respect of the alternative routes that have not been explored. All that one can do is to point to the successful instances of watershed development and social transformations, and say that there is no reason why these cannot be replicated in large numbers.”

We saw that even in the 40s and 50s, there were people pointing to such alternative routes.

The question of “without Bhakra” has several aspects pertaining to the choices at various levels:

1. What could have been the probable developments in Punjab, Haryana<sup>3</sup> and the country if Bhakra had not been built?
2. Whether the districts irrigated from Bhakra (mainly those in Haryana) could have been irrigated or otherwise developed without the Bhakra project?
3. At the larger level of addressing the food production and food security in the country, was Bhakra –and taking waters to the dry regions of Haryana - the optimal option? Were there any other options? What would have been the consequences of these options?
4. What have been the costs paid for the food production in Punjab and Haryana, and in particular for the benefits from Bhakra?

### **OPTIONS IN PUNJAB AND HARYANA**

Let us start with the second question. Unlike the popular belief, the answer to the question is “yes” - the districts getting irrigation from Bhakra had other options.

#### **New Areas to be Irrigated and Additional Water for Old Areas**

We have already seen that the Partition made possible for the waters that were being used for the SVP in Pakistan to be released for use in India. With this, it would have been possible to extend the Sirhind canal system to areas in Haryana as well as provide for additional irrigation in Sirhind areas – which is what the Bhakra project did. If it was felt that instead of extending Sirhind system, new canals should be built to serve Haryana, that could have been done. In fact, it should be noted that even as part of the Bhakra project a new canal system was built originating from the Sutluj (the BML from Nangal). Whether the water comes into this canal from the dam or directly from the Sutluj – it could still serve the areas. Indeed, we will recollect from our discussion of the Sind-Punjab disputes that if the Partition had not taken place, it is unlikely that Bhakra would have been able to irrigate the areas it did. In a way, the irrigation in the Bhakra system was made possible more by the Partition and shifting of waters from the SVP than the Bhakra dam itself.

There were other technical possibilities as well - for example, a canal from somewhere between Ropar and Harike to bring water directly to the districts of Hissar, Sirsa, Fatehabad. Such a canal –to irrigate areas in Sirsa and Hissar - was already proposed in a detailed report drawn up By John Benton in July 1905.<sup>4</sup> It was dropped for reasons unknown, possibly because SVP was given a higher priority.

A similar possibility of taking waters to Haryana from Harike barrage was noted by the then Chairman of Central Water Commission in 1975, in his report on the Reference to him of the Ravi-Beas dispute between Punjab and Haryana.<sup>5</sup>

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<sup>3</sup> We leave out Rajasthan since it forms a limited part of the Bhakra command. However, most of the discussions for Punjab and Haryana will apply to Rajasthan too.

<sup>4</sup> Government of Punjab (1917): Page 49

<sup>5</sup> Quoted in Dhillon 1983: Page 45

*Thus, there is no doubt that large new areas in the two states of Punjab and Haryana could have been irrigated without the Bhakra project, and supplies to existing commands increased.*

One point raised in this context is that such new irrigation would have been restricted to monsoon only and it would not have been possible to supply the new areas in the winter season without the storage provided by Bhakra. Not only this, but it is also said that Bhakra provided a high quality of irrigation. Thus, the quality<sup>6</sup> of irrigation available today would not have been possible without the project.

Three specific advantages are claimed for Bhakra.

1. The project brought new areas under irrigation, and increased the amount of water supplied to areas already irrigated.
2. The project, by providing storage in the dam, made it possible to carryover surplus waters from the monsoon (when the river flows were much higher) to the lean flow seasons. This made it possible to irrigate areas in the non-monsoon season, allowing two crops to be taken.
3. The dam provided regulation, thus allowing delivery of water to the crops when it was needed. It may be pointed out that the timing of water delivery is critical to the efficacy of irrigation and for crop productivity.

We have already seen that most of the extra water – to irrigate new areas, and for additional supplies to already irrigated areas – was made possible as India was released from the obligations to the SVP and other downstream users after the Partition. Let us look at the other issues.

### **Carryover from Monsoon to Winter**

It is often argued that the Bhakra dam was necessary to and helped store excess monsoon runoff of the Sutluj for use in winter and summer, when river flows were less. Without the dam, it was said, the irrigation to the new areas would have remained limited to the monsoon months.

This of course is the specific case of the more generalised justification of large dams in the country. The typical argument for any large dam in a country like India is that the dam is necessary for carrying over water from the monsoon period, when the flows are vastly in excess, to the winter period when the flows are less. Figures normally mentioned are that about 80-90% of the total precipitation occurs in the three monsoon months and hence this needs to be stored in large dams to be used in the winter season.

Let us look at this argument carefully, for this is the core of the justification for the dam.

The need for storage to carry over flows from monsoon to winter comes in *when there is a mismatch between the irrigation requirements and the river flows*. The flow is concentrated in the monsoon months, while irrigation requirement may be more in the winter months when the flow is less.

In this context, we first note that in contrast to the figures presented for many of the peninsular rivers, the flow in Sutluj was more evenly spread-out, partly because it is also fed by snow-melt. The following table gives the flow of Sutluj over the year.

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<sup>6</sup> The quantum, timing and reliability of water delivered is what is broadly referred to as the *quality of irrigation*.

**Table 9.1: Mean Flow in Sutluj**  
[At Rim Station, 25 Year Mean (1921-22 to 1945-46)]

Period	Flow (MAF)	Percentage of Total Flow
April-June	3.2	24%
Jul- Sept.	8.4	62%
Oct. -Dec	1.2	9%
Jan.-March	0.8	6%
Annual	13.6	100%

Source: Gulhati 1973: 452

Thus, the summer months of April to June carry about 24% of the run off and the monsoon months carry 62%.

Let us now look at how much was surplus in the river for carrying over to low flow months. The following table presents the irrigation requirement at Bhakra and the river flows in Sutluj for the filling and depletion periods.

**Table 9.2: Dependable Flow in Sutluj River and Irrigation Requirements at Bhakra**

	Period <sup>7</sup>	Irrigation Requirement (MAF)	Flows (MAF)	Surplus (MAF)
<b>Filling Period</b>				
	1 June to 20 Sept.	4.94	7.93	3.00
<b>Depletion Period</b>				
	21 Sept. to 31 May	9.56	3.10	-6.46
	<b>Grand Total</b>	<b>14.50</b>	<b>11.03<sup>8</sup></b>	<b>-3.47</b>

Flows as per Rao and Ramasheshan 1985a  
Irrigation Requirements as per Rao and Ramasheshan 1985b

These figures show that the irrigation requirement in the monsoon period for Bhakra project was about 5 MAF and the flow about 8 MAF, thus, the surplus available for transfer to the winter months would be about 3 MAF.

However, this is not the actual surplus. As Rao and Ramasheshan point out<sup>9</sup>, “Irrigation requirements given in Table 1 were assessed when the project was planned and were modified only slightly since, although the irrigation demands have changed due to the introduction of high-yielding varieties of crops which require more water.”

Thus, increased water requirements in monsoon would mean that the available surplus would decline below the 3 MAF.

It is assumed (argued) that:

1. This unutilised water flows down waste to the sea, and/or
2. Since water is surplus in monsoon, it can be stored and used in the winter.

The notion that any water in the river that is not being ‘used’ for irrigation or industry is “waste” or “surplus” is a notion that is highly erroneous. The river, as a living ecological entity, needs to be flowing; and this means one can take out only so much and not more water. The “available surplus” is governed by this notion too. If some of the monsoon water was to

<sup>7</sup> Since periods for which flows and requirements are given differ slightly, we have matched them monthwise

<sup>8</sup> Note that the total annual flow in Table 9.2 differs from that in Table 9.1. This is because Table 9.2 gives the dependable flows and Table 9.1 gives the mean flows.

<sup>9</sup> Rao and Ramasheshan 1985b: Page 181

be left for flowing in the river (in modern terminology this is now called “minimum ecological flows”) then we see that the “surplus” would decline further.

Moreover, we will recollect that a significant part of the monsoon flow of Sutluj was being utilised at the Sutluj Valley projects (in India and in Pakistan) and possibly also further downstream.<sup>10</sup> This is why it was feared that the Bhakra project would adversely affect the downstream irrigation in Pakistan (at SVP, at Sukkur). Gulhati says<sup>11</sup>:

“Some of the projects like the Bhakra on the Sutluj, the construction of which has been taken up just before Independence, unless severely restricted in scope, as was the intention of the Government of undivided Punjab, would use up in India some of the waters already apportioned to then existing canals, lower down on the Sutluj, in Pakistan.”

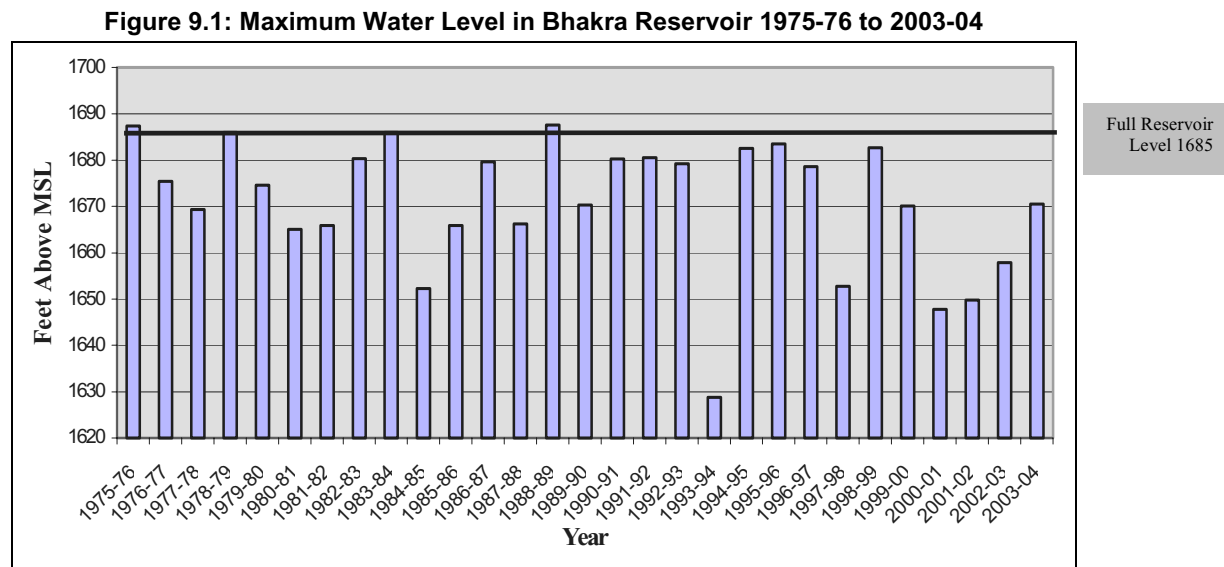
Thus, if allowance was made for this existing use, then there would have been virtually no surplus. Partition allowed this water to be released for use in India. However, even with this water being made available, the two factors described above, namely:

- a) High irrigation requirements in monsoon leaving limited surplus
- b) Need to ensure downstream flows

mean that there would have been virtually no surplus left in the monsoon months to transfer to winter.

The actual performance of the Bhakra dam validates this. The advantage claimed that the dam allowed monsoon surplus to be transferred to winter months when demand was high and flows less – has been a limited benefit.

The figures from the Bhakra Beas Management Board (Figure 9.1) show that the Bhakra dam has not filled up to the Maximum Reservoir Level in most of the years of operation.



As the figures show, the maximum water level in the reservoir has exceeded the designed Maximum level of 1685 only in 4 years out of 29, and the design level of 1680 in only 10

<sup>10</sup> As the Sutluj combined with Beas, and later with the Chenab, it becomes impossible to say whether the waters are of Sutluj or Beas or Chenab. However, each river makes a contribution.

<sup>11</sup> Gulhati 1973: Page 9

years in 29. Note that these are the years since 1975 – from 1977 the waters of Beas had started augmenting the Bhakra reservoir through the BSL.

What are the implications of these figures? One, that the water inflow in the river has been below the estimates. In other words, the dam has been over-designed and the height of the dam was not justified considering Sutluj hydrology. This, we have seen was certainly the case, and the BSL was meant to correct this to some extent. Indeed, looking at the performance, it is evident that the dam height is not justified even after the Beas diversions.

The other explanation is that there was a closer match between the river flows and the requirements of irrigation, and hence the dam did not fill up. This is also indicated from the following observation of Michel, which also shows that the dam had not filled up till 1967<sup>12</sup>:

“Because of the heavy irrigation and power requirements, it has not yet been possible to fill the Bhakra reservoir, nor is it anticipated that it can be achieved until after the Beas-Sutluj diversion via Pandoh tunnel...is completed...”

Another word about the carryover of monsoon storage into winter: this carryover comes with a heavy price tag. The price is not just the massive financial, social and other costs of such dams, but includes the huge impacts downstream of such storages. Such storages are altering the amount and pattern of downstream flows, changing the whole river ecology and economy and today this is recognised as leading to some of the most adverse impacts of such storages. Whatever limited surplus that Bhakra has managed to transfer from monsoon to winter has been at this cost, in addition to other impacts.

### Regulation and Quality of Irrigation

Let us now look at the third aspect, namely, that of the quality of irrigation, particularly the benefit of regulation.

An important benefit attributed to the dam is the regulation that it provides, resulting in better timing of irrigation water. Canal irrigated farmers all over the country are witness to the unpredictability and unreliability of the canal systems, especially for the tail-enders. Bhakra has not been any exception. Indeed, the *warabandi* system of operating the canal network, while providing ease of management and apparent equity, has inherently meant that the matching the time of water delivery to crop requirement has gone awry. Not only did farmers tell us about the unreliability of the canal supply, but several studies also document the same.

For example, a study of the Fatehabad Circle in the Bhakra command found that<sup>13</sup>:

“The problems of distribution and application in the Fatehabad branch canal are representative of similar problems on other projects in the region.

- Rigid irrigation water delivery schedules with almost the same frequency throughout the growing season cannot meet crop demands.
- The water supplied is scarce and the effects of scarcity are more severe in areas with highly saline/sodic groundwater.
- In unlined watercourses about one third of the area toward the tail does not get any water; this leads to the unauthorized practice of sale of canal water.

<sup>12</sup> Michel 1967: Page 207

<sup>13</sup> Tyagi N.K. (undated): *Diagnostic Analysis And Some Approaches For Improving Water Delivery Performance In The Bhakra Canal Command*, downloaded from [http://www.fao.org/documents/show\\_cdr.asp?url\\_file=/DOCREP/003/X6626E/x6626e13.htm](http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/003/X6626E/x6626e13.htm)  
Accessed 21 Jan 2005



- The command areas of watercourses seem to have been fixed entirely on the basis of topography without much consideration for the soil infiltration rate.”

The study also found that there was great variation in the “relative water supply” (the ratio between irrigation water supplied and demand) between the head and tail reaches. It also found that water supply is wanting in timeliness.

Another study reports that<sup>14</sup>:

“The temporal distribution of an irrigation water delivery and demand ratio was used to analyze the performance of an irrigation water delivery system in the Bhakra Canal Command in India. A high degree of mismatch was found to exist between water demand and supply.”

Most important, however, is the fact that in case of the Bhakra areas of Punjab and Haryana, especially Punjab, this regulation, reliability and timeliness of irrigation has been provided largely, and in a much better way by the extensive development of tubewells and groundwater based irrigation. We have already seen this in detail in the Chapter on Groundwater.

## WITHOUT BHAKRA

So what *could* Punjab and Haryana have looked like if the Bhakra dam had not been built? An analysis of the facts emerging so far shows that the developments could and would have been more or less on the same lines as today.

The extra water available from the SVP could have helped augment the water supply in the existing irrigation in the Sirhind Canal areas. New canals could have been extended to bring in more land under irrigation to cover same areas as today. If the volume of water delivered to these (new) areas had been lesser than what it is currently, this is likely to have proved beneficial – since the serious waterlogging and salinisation in these areas today is partly due to excess water. One of the recommendations to control waterlogging is to actually cut down water deliveries in these areas.

Would the absence of a dam have meant that surplus monsoon flows (to whatever little extent these were surplus) could not be stored and hence winter irrigation would be less? This does not necessarily follow.

For one, the waters released in the canals in the monsoon could have been stored *in situ* on (or near) the farmers’ fields and used in non-monsoon months. One study of the Sirsa district in Haryana (in the Bhakra command) points out this was a regular practise in the area<sup>15</sup>:

“In the past, when farmers used to rely mainly on rainfall, it was a common practice to store and conserve as much of the rainfall as possible. However, with the development and operation of the canal irrigation system, the practice of *in situ* conservation of rain water receives less and less attention.”<sup>16</sup>

Such *in situ* storage of waters could have been done not just with the local rainfall but also with the canals waters that could have come in.

Secondly, the waters released into the canals in the monsoon (indeed, any extra waters available in the monsoon) could have been stored as groundwater.

It may be pointed out that one of the biggest benefits claimed for the Bhakra system – that it recharged the groundwater extensively – does not actually depend on the presence of the dam,

<sup>14</sup> Mishra and Tyagi 1988

<sup>15</sup> Dam, J.C. van, and R.S. Malik (Eds.) 2003

<sup>16</sup> We have not been able to study this during our field visits, but this would make a very important subject for more detailed research.

but on the canals. Thus, even if diversion canals – old and new – had come up, they would have performed the job of recharging the groundwater.

The HYV program would still have come in a big way in Punjab and Haryana. (Remember that the IADP was started in Ludhiana which had little canal irrigation). The HYV program would have demanded (as it has done today) increasing use of tubewells. Groundwater recharging due to the decades old canals systems like Sirhind, UBDC, WJC would have supported this, and the recharge from any new diversion canals added to it. A well planned, extensive program of *in situ* storage and rainwater harvesting could have increased the recharge to a great extent, and would have significantly augmented the groundwater availability. It is also possible that the tubewells irrigation would have gone on to extract more than this recharge and have developed in the same unsustainable manner!

*Thus, it is not likely that the scenario in Punjab and Haryana would have been much different without Bhakra.*

Of course, the financial costs, some downstream impacts, the displacement could have been avoided.

One argument is that in absence of the dam, some of the monsoon run-off in Sutluj would be lost, as it would just flow downstream. Normally, this would be considered as positive impact, since this would be critical for the downstream areas. Since much of the downstream is in Pakistan, it may be considered unpatriotic to say that we should allow at least some water to flow into the river to keep it alive!

It could also be argued that if such monsoon flow is lost to the downstream, then there would have been less water for the newly irrigated areas. In all likelihood, this would have a beneficial impact as excess water has created some of the most serious problems in the command.

It is sometimes argued that for the areas like Hissar, Sirsa, with underlain saline groundwater, canal supply is essential as these areas have meagre rainfall, and underground storage is not possible as the recharged groundwater would also become saline. We have already seen that the river flow available in monsoon could have been taken to these areas by new canals. We have also seen above that *in situ* storage was being practised in these areas, and part of this canal supply could have been stored there to be used in winter. Equally, the winter supply of Sutluj, which was committed to Sirhind areas, could have been released for these areas and *in situ* storage of monsoon waters undertaken in the Sirhind areas. There were many possibilities.

Indeed, one cannot take a static view of development. One cannot suppose that if the Bhakra project would not have come up, then nothing else would have been taken up – which is what most “without the project” scenarios implicitly assume. Our analysis shows that even without the Bhakra project, there was ample scope for development of water and agriculture, and we have outlined one possible direction that this development could have taken. Our analysis also tells us that this development could have potentially brought benefits similar to or more than what the developments with Bhakra did (and the high costs/ impacts avoided). They could also have possibly led to some unsustainable practises similar to those prevalent today.

For the sake of argument, let us assume that the waters available for the semi-arid areas of Haryana could have been smaller than today in absence of Bhakra. Possibly, the lesser quantum of water could have led to development of an agricultural cropping pattern more appropriate to the eco-climatic character of the area, avoiding or diminishing in the process the serious impacts like waterlogging that have taken place. There is also ample evidence from other parts of the country that even dry areas with very limited rainfall can use local water and soil management to develop prosperous agriculture.<sup>17</sup>

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<sup>17</sup> Of course, comments on any specifics will require a detailed study of the area.

There is a larger issue here. What is the appropriate (agricultural) development strategy for this area? From the Second Irrigation Commission (1972) to the new National Water Policy, planners espouse that that development of an area should be appropriate to its eco-climatic conditions.

The new National Water Policy 2002 states (as did the earlier one in 1987):

“Economic development and activities including agricultural, industrial and urban development, should be planned with due regard to the constraints imposed by the configuration of water availability. There should be a water zoning of the country and the economic activities should be guided and regulated in accordance with such zoning.”

But the practise has been to implement the same agricultural model in all zones – growing sugarcane even in deserts<sup>18</sup>, so to say. So long as sugarcane cultivation pays much more than say a livestock based economy (which may be more suited to such zones), there is little doubt that the people will demand water to grow sugarcane. In our undertaking, we found ample evidence of the desirability of tailoring the development strategies to the eco-climatic and local conditions. This has a crucial bearing on the country’s agricultural and irrigation policies.

### OPTIONS FOR THE COUNTRY

From the perspective of the country, the question “Without Bhakra” is a different one. The building of the Bhakra dam, canals etc. involved huge costs. Sustaining the production has involved further resources. Would these investments have been more productive if used somewhere else in the country? Would they have resulted in more production, or better distribution, or both? Was it worth building the dam to increase by a small amount the irrigation in some areas in Punjab and Haryana? Or would these resources have yielded better returns elsewhere?

This also brings in a related question. The contribution of Punjab and Haryana to foodgrains production in the country today appears highly unsustainable. Were there, or are there, any ways in which the country’s food problem can be handled in a sustainable manner?

The assessment of this has to start with examining the realities of the claimed “foodgrains self-sufficiency” achieved by the country.

*Perhaps the most serious, thought provoking and disturbing fact has been that in spite of the huge increase in the food production, millions of people go hungry even today.*

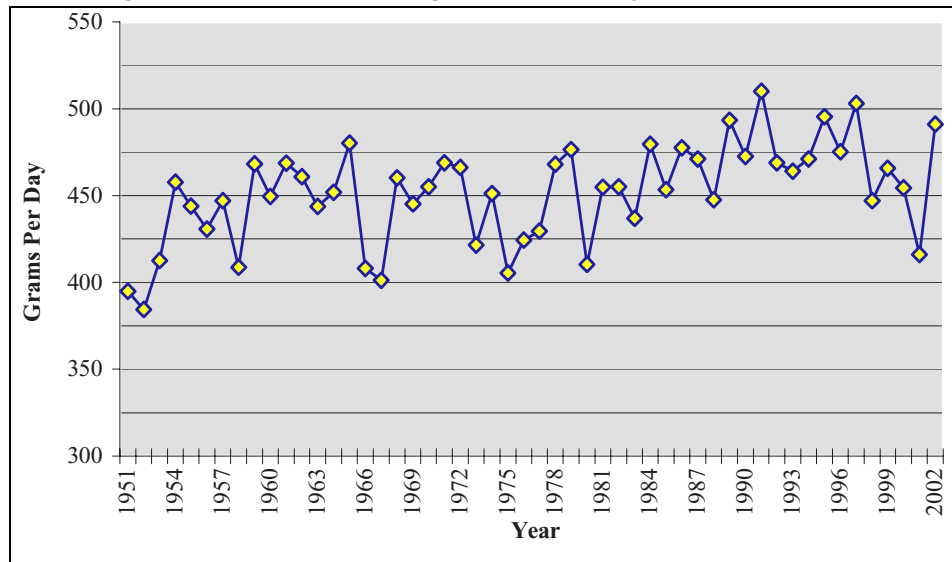
The per capita availability of foodgrains which was 480.1 grams in 1965 (just prior to the Green Revolution) reached a high of 510.1 grams in 1990 but has been declining since then and reached 416.2 grams in 2001. (See Figure 9.2)

Even this is mainly due to rice and wheat, and the per capita availability of other cereals and pulses has declined sharply (See Figure 9.3). Of particular concern are pulses, since pulses constitute a very important protein source for most Indians.

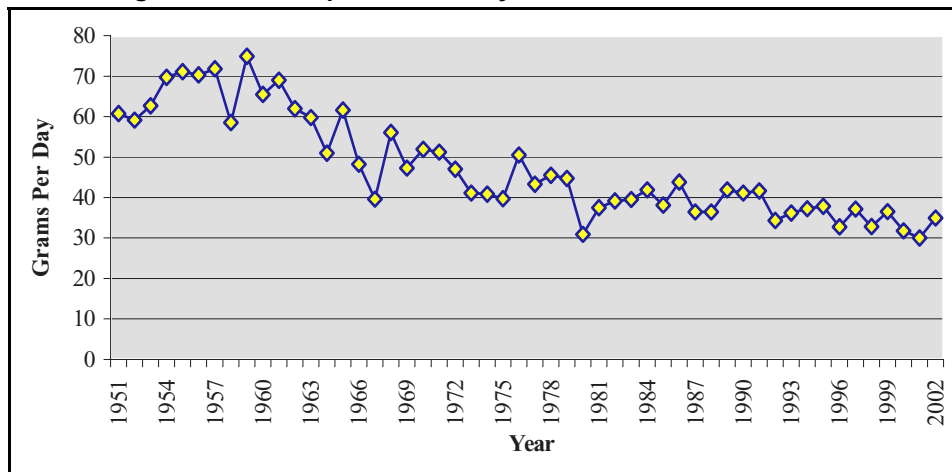
Of course, the population has increased hugely since 1960s, so the availability of foodgrains is not a mean achievement. Yet, it is clear that this has not been enough and it has not kept pace with the population. Population growth cannot be an excuse since any foodgrains policy has to take into account this growth.

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<sup>18</sup> For example, Kutch in Gujarat, where sugarcane is growing in the semi-arid areas, while neighbouring villages are going without even drinking water.

**Figure 9.2: Per Capita Foodgrains Availability in India 1951-2001**

Source: Department of Agriculture Co-operation, Ministry of Agriculture<sup>19</sup>

**Figure 9.3: Per Capita Availability of Pulses in India 1951-2001**

Source: Department of Agriculture Co-operation, Ministry of Agriculture<sup>20</sup>

What is more of a concern is that this availability has been accumulating in the godowns – and now even being exported, rather than reaching the people. The overflowing godowns while people go without food are the grossest perversity of the so-called “self-sufficiency”.

There is little doubt that this can be traced to the policies adopted by the planners for increasing food(grains) production. The two objectives of food(grains) policy were (a) increasing food production, and (b) equitable distribution. The food(grains) policy separated the means of achieving the two. The primary emphasis was placed on the former, the argument being that we need to produce first before we can distribute. The strategy chosen for increasing food production was that of intensification and concentration – focus inputs, investments and resource in selected areas, which can give maximum returns in terms of increased outputs.

<sup>19</sup> Department of Agriculture Co-operation, Ministry of Agriculture website - <http://agricoop.nic.in/statistics2003/chap10.htm#chap101>, Accessed on Oct 7, 2004

<sup>20</sup> *ibid*

The Fourth Plan Document (1969) stated<sup>21</sup>:

“The Foodgrains Policy Committee (1966) postulated three objectives of food policy: to achieve self-reliance in production, to ensure equitable distribution, and to bring about price stability in the context of both production and distribution. The Committee went on to suggest that the latter two objectives could be achieved by planned management of food supplies involving such measures as procurement, control of inter-State movement of foodgrains, a system of public distribution and the building up of buffer stocks.”

This separation of the means by which the two objectives – food production and equitable distribution - were to be achieved has been an important characteristic of India’s food policy, and has directly resulted in the above-mentioned gross distortion. We have seen in the earlier chapters how this was partly a result of the bias of the planners towards the market deficit. A small quote from those days (1958) illustrates this thinking<sup>22</sup>:

“We have 320 million acres of land under cultivation which will require a moderate dose of one maund per acre [of fertiliser]. The total quantity of fertiliser required would be about 11 million tons. Have we got this amount of resources? Supposing that the supply and distribution of manure are assured and 20 to 30 per cent increase in output is recorded, could this increased output be procured and brought to the market for urban population? .....Take for instance a 3-acre farmer who used to produce 27 mds under ordinary condition. With the present amenities, if he is able to increase production by 25%, then the total production would be 35 mds. Is it any surplus to a cereal eating family?”

This line of argument sharply represents the thinking of the planners (whether the author intended it or not).

What does this mean? If a farmer could increase his production and use this for self consumption, was this not an important national goal? To do this, he would need increased supply of inputs. But the policy makers in their wisdom felt that it was better to increase supply of inputs to areas where it could generate “procurable surplus”.

Another reason given for this was that it would be better to focus inputs in areas where they would generate better returns. This was part of the logic of the “intensive” and “selective” strategy which targeted inputs to areas which could give maximum returns, and which could contribute to procurement.

As the Fourth Plan Document noted<sup>23</sup>:

“7.2 The first stage of the new strategy pertained to the Intensive Agricultural District Programme. It was started in 1960-61 in three districts and was subsequently extended by stages to another thirteen. While the performance varied, it clearly demonstrated both the value of the “package” approach and *the advantage of concentrating effort in specific areas*. In 1964-65 and subsequent years, a modified version of the same approach was extended to several other parts of the country in the form of the Intensive Agricultural Area Programme.” (Emphasis added)

However, even assuming that inputs to such selected areas led to higher output than our 3-acre farmer could obtain, was this really a better use of resources? For, how would the extra

<sup>21</sup> Chapter 10 *Food and Nutrition*; Fourth Five Year Plan  
URL: <http://planningcommission.nic.in/plans/planrel/fiveyr/4th/4planch10.html>  
Accessed: Dec. 17, 2003

<sup>22</sup> Dasgupta 1958: ‘*Food Planning*’; *The Economic Weekly*, May 31, 1958

<sup>23</sup> Chapter 7 *Agriculture*; Fourth Five Year Plan : Para 7.2  
URL: <http://planningcommission.nic.in/plans/planrel/fiveyr/4th/4planch7.html>  
Accessed: Dec. 17, 2003

production thus obtained be transferred to the 3-acre farmer so that he could satisfy his deficit? Where would he get higher purchasing power to obtain the surplus grains? The answer provided by the planners was that this would be done through procurement and public distribution- which meant further subsidies, more load on transport and so on – in short, more resources. In the process, the capacity of the 3-acre farmer would remain stagnant, while the intensification of resource inputs in a limited area would create islands of well-being, if not prosperity.

In such an arrangement, the small 3-acre farmer would be remain permanently (or at least for a long period) dependent on the Government.

On the other hand, if there could be ways in which millions of farmers all over the country could boost their production, then it would directly satisfy their needs; if this process of increasing productivity was linked to job creation, this would mean putting additional purchasing power in the hands of millions, as against a limited number in the “selective” strategy.

Such a policy would require (1) enabling access to land for the vast majority (b) increasing the productivity of lands all over the country and (c) generating employment (with much less migration) so that those who were not having access to lands could obtain the purchasing power. This meant land reforms, and linking the means of employment to the means of increasing productivity, in a decentralised manner.

This would address the needs of the millions who were either not linked to the market (subsistence farmers) or could not access the markets due to lack of purchasing power.

One of problems with focussing on “well endowed” areas of course is that this is not just a function of what nature has bestowed. Which areas become well endowed itself is a policy choice. Assured water supply and irrigation is one of the key parameters of an area’s endowment and one that we are concerned with. Thus, irrigation and water policy can play a key role in creating endowments.

Irrigation planning in India has been fixated with large centralised projects. These are proposed and pushed with the argument that there is no alternative, and these create islands of better off areas, which are then chosen as a part of the strategy of selection.

In other words, a *choice* is made to create irrigation facilities in selected rather than widely spread areas; then it is said that the agricultural efforts will have to be focussed in these areas since these are the areas with better infrastructure. This is the direct result of large-scale projects that create pockets of irrigated areas. It must be noted that the decisions to proceed with such projects are a deliberate choice – rationalised by the “there is no alternative” argument. But of course, this argument does not hold. We only need to recollect the recommendations of the Ford team where a detailed case was made for widespread and dispersed efforts as against large-scale projects. Or the recommendations noted in the report of the Congress Agrarian Reforms Committee.

Writing about the Green Revolution and “the failure of the current strategy to bring about the promised agricultural growth and employment....”, C.H. Hanumantha Rao also makes similar suggestions<sup>24</sup>:

“A Rural Works Programme designed to strengthen the capital base of agriculture, e.g. soil conservation and minor irrigation through consolidation of holding as a part of the Plan for achieving the targeted growth of agricultural output would be non-inflationary in character and would provide the basis for sustained growth of output and employment.....”

<sup>24</sup> C.H. Hanumantha Rao; *Socio-Political Factors and Agricultural Policies*; in Economic and Political Weekly, Special Number August 1974 Page 1285-1292

Indeed, time and again, many suggestions were made to take up wide-spread, decentralised programs of soil and water conservation that could meet both, the need of increasing production, and of generating employment.

These belie the claim that India had no options but go for building highly expensive large scale dam projects. It also disproves the oft-repeated claim that such measures as rainwater harvesting and decentralised water management options are recent suggestions and no such alternatives were proposed during that time. The fact is, there were very sound alternatives proposed then, and being proposed now; but the reasons they were rejected then remain more or less the same – that there were very strong interests pushing the large-scale projects and policies of intensification.

How does this apply to Bhakra and Punjab and Haryana?

The intensive / selective strategy for food production came clearly from a bias towards the “marketable surplus” and the urban populations depended on it; but it was also fundamental to the large-scale irrigation projects like Bhakra that came to be called by some as the “modern temples” of India. Such projects, by their very nature, can serve limited pockets of the country. Bhakra represented intensification – or centralisation – in several ways. One was the concentration of investment in a selected part of the country, second was the creation of high levels of irrigation in pockets rather than spread out all over the country, and third was the subsequent concentration of farming inputs into a small area. Equally important was the concentration of the procurement efforts through the use of the MSP and assured procurement.

Parts of Punjab where the canals did not reach but depend on groundwater too saw the intensification and concentration of inputs.

The overall result has been a remarkable expansion in foodgrains production, but without a parallel increase in the purchasing power of the millions. (For a more detailed discussion on this issue, see for e.g. Thakkar 1999). This is quite akin to the jobless “high” growth that is taking place today under the policies of globalisation, privatisation and liberalisation.

In 2002, the Government of Punjab, saddled with huge amounts of grains that were not finding a market, appointed a committee to examine how to handle this crisis. Headed by Dr. S.S. Johl, it is popularly called the Johl Committee. One of its observations is highly pertinent here<sup>25</sup>.

“India has accumulated huge stocks of foodgrains that are not finding market and are proving to be a heavy drain on the state exchequer and the government is obliged to purchase substantial new arrivals at higher and higher prices every season under the system of Minimum Support Prices. Although as per the nutritional requirements of the Indian population, these stocks may not be considered in excess, yet due to the lack of purchasing power with the poor, *supply exceeds demand...*” (Emphasis in original)

This is one part of the story. Just as the strategy of concentration has had an adverse impact on the consumers who are not able to buy the grains, it has had an equal backlash on the producers.

The Johl Committee report continues<sup>26</sup>:

“The situation in Punjab is:.....Market clearance for these foodgrains [rice and wheat] is becoming increasingly difficult both on financial account as well as on handling aspects. The rice-wheat production system in the state has, thus, become, unsustainable on economic, social and environmental grounds and even on political account...”

<sup>25</sup> Government of Punjab 2002: Page 104

<sup>26</sup> Government of Punjab 2002: Page 104

Those who argue that without the spectacular growth in foodgrains production in Punjab and Haryana, without the high yields achieved in these states – essentially based on intensification of all inputs including water – India could not have addressed the problem of food production, forget the definition of “average.” An increase in the average production can be achieved either by very high growth in some parts and low growth in others, or moderate growth all over. The strategy of intensification / concentration led to the former, with all its attended problems in terms of equitable distribution. The strategy of decentralisation was condemned with the use of the TINA factor – but we have seen that the real factors were the vested interests.

*If the country had chosen to plan its development Without Bhakra, or, more precisely, without the approach that Bhakra represented, then it would most likely have chosen land reforms, a decentralised, rain water harvesting, soil water conservation program, coupled with a host of other decentralised measures. All evidence indicates that this approach would have led not only to similar levels of production, but to a much better distribution of that produce, of the income generated, and much smaller adverse impacts.*

It must be remembered that the strategy of intensification / concentration, the Bhakra project, the mining of groundwater and other factors that went into the high growth in Punjab and Haryana – all came with a very high cost. Significant resources – of the whole nation - were concentrated into the two states as part of the policy of intensification. No doubt, the food production went up – dramatically. But then, it cost further resources - in transaction and transportation costs - to take this food to those in other parts of the country; and even then, millions are going without. In the process, we have seen the creation of seeming islands of prosperity, of burgeoning foodgrains stocks, and yet millions without access to food, as they do not have the purchasing power.

The costs of the developments in Punjab and Haryana have been huge. There have been the financial costs of the Bhakra project, the canals, the establishment to manage and run it; and then the costs of the huge groundwater irrigation infrastructure. Moreover, there have been the costs of the inputs – like fertilisers - many of which have been subsidised by the country. While this author strongly supports the need for subsidies in agriculture, the point is that it has to be recognised as a cost to the country and entails a huge opportunity cost.

Then there have been the huge impacts of the dam, the displacement, the impacts downstream and so on.

However the greatest cost that has been paid in the process is the cost paid by the land and ecology of Punjab and Haryana. And now, this cost is translating into the acute unviability of agriculture in Punjab, the increasing costs of inputs and declining returns, costly foodgrains that people cannot afford to buy, falling or stagnant yields and oppressively burdened, indebted farmers. *The whole edifice that has been seen as the climax of agricultural achievement in the country is crumbling. A dream is rapidly turning into a nightmare.* ✍

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\* Sudhir Sen was the CEO of DVC from June 1948 to June 1954, and prior to that Secretary, DVC. The quoted text was written by Sen in 1974. (Sen Sudhir, ‘A Richer Harvest: New Horizons for Developing Countries’, Tata McGraw-Hill Publishing Co New Delhi, 1974. - Quoted in Thakkar 2005). Thakkar, Himanshu (2005): ‘Bhakra Project: Who, When, Where, Why, How? - Many questions, few answers’, draft note, Work in Progress. Used with permission.



# 10

## A Dream Turns To Nightmare Crisis in Punjab and Haryana Agriculture

*“Indo-Gangetic plains lie between the Himalayas and Peninsular India and represent a sag or depression in the earth’s crust which has been filled up with alluvium brought down by the rivers. They constitute one of the most fertile tracts in the world. The alluvial soil of these plains is being cultivated from times immemorial and shows little signs of exhaustion.”*

**First Five Year Plan Document,**  
Chapter on Irrigation and Power, Planning  
Commission, Government of India 1950

*“On the other side, continuous production of wheat and rice in annual rotation in the irrigated areas of Punjab is having a deleterious effect on soil, water, environment and social fabric of the state. Soils of Punjab have become virtually a laboratory culture that requires higher and higher doses of fertilisers, micronutrients, insecticides and pesticides to produce same level of wheat and /or rice. .... The situation is becoming very serious day by day which can very soon proved to be economically disastrous, socially untenable and politically unsustainable, which can turn into man-made national calamity if not dealt with judiciously.”*

**Report of the S.S. Johl Committee,**  
Government of Punjab, Oct. 2002



## A Dream Turns To Nightmare Crisis in Punjab and Haryana Agriculture

IN JUST FIFTY YEARS, SOILS THAT WERE “FROM TIME IMMEMORIAL” SHOWING “little signs of exhaustion” are in a state of collapse. This is part of the price that we are paying for the “spectacular” growth in Punjab. The same is true of Haryana.

For decades, Punjab and Haryana have been idolised as the pinnacles of agricultural achievement, with Bhakra as its centrepiece.

The picture of the smiling turbaned *sikh* riding atop his tractor, waving a coloured scarf, with lush green fields all around is the quintessence of this. A tubewell with water gushing out, or the massive walls of the Bhakra dam in the background complete the image. This familiar picture has been deeply imprinted in psyche of the country, and Punjab and Haryana have become part of the Indian folklore, the Bhakra dam too shining brightly in the reflected glory.

It is said that appearances can be deceptive. One may add, “highly deceptive”. The familiar picture above, alas, is an image from the past. An image that no longer represents the reality on the ground. The colours of the picture are fading. The smile on the face of the proud farmer has been replaced with a frown of worry – of many worries. The lush green fields hide the diseased soils, soils that require ever-rising chemical inputs to sustain production. The tubewell has to pump water from ever increasing depths. The tractor, in all likelihood, is on its way to one of the numerous second-hand tractor bazaars that have sprung up in the towns in Punjab, where farmers bring in tractors for distress sale, hoping that this will ease somewhat the unbearable burden of debt. This, and much more is the reality now of Punjab and Haryana.

“Punjab is in total stagnation. Industry has shut down, agriculture is in doldrums.....Everybody thinks that Punjab is a land of plenty and the farmers are rich. Actually, 52% of our farmers are small and marginal, and they have less than two-and-half hectares. And nobody can survive on holdings that size. We have had 600 small farmers committing suicide in the last few years.....”

Capt. Amarinder Singh, Chief Minister of Punjab<sup>1</sup>

When farmers committed suicides in Andhra Pradesh, there was concern, but it could be understood. After all, these were poor farmers, in a drought prone and backward area of the country. But when suicides of farmers were reported from Punjab, the first reaction was disbelief and denial.<sup>2</sup> However, as the suicides continued, and more reports followed, they become impossible to ignore. The suicides by farmers are a desperate manifestation of the extreme crisis that agriculture faces in Punjab. Haryana is only a step behind.

Several observers have been warning about this emerging crisis for over a decade now<sup>3</sup>, but this was dismissed as over-reaction or motivated. Over the last few years, articles and papers

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<sup>1</sup> Economic Times, Mumbai 11 June 2002

<sup>2</sup> See for example Swami Praveen, *Suicide Stories*, Frontline, April 24, 1998.

<sup>3</sup> Shiva, Vandana (1991): *The Violence of the Green Revolution*, The Other India Press, Goa and Research Foundation for Science, Technology and Ecology, New Delhi.– to give one example.

in specialised journals, reports in the press and in the media have been trickling in, pointing to serious problems in Punjab and Haryana. Yet, these have mostly escaped the country's attention outside of the two states. For anyone who has talked to the farmers in the two states however, it is impossible to ignore what is happening on the ground. The agrarian economies of Punjab and Haryana are in a deep crisis indeed.

Both the states saw an initial burst in prosperity after the advent of the Green Revolution, but within a decade and half, the serious impacts of this began to be felt by the farmers.

In Ladwa, (Tehsil Hissar, Dist Hissar, Haryana) the *pradhan* at the Goushala, the elderly and respected Balraj *ji* told us:

“About Bhakra, the situation is that wherever the waters reached, for the first ten years or so, there was a revolution in crops (*jabardast kranti – fasal mein*) then the downfall started, and the losses. This will happen everywhere like it happened in Bhakra. Now the water of Bhakra is having less impact in the farm. (*kheti mein kam asar kar raha hai*) 50% of the land is degrading. Where the Bhakra waters have reached, the dalhan [pulses] crop has finished.”

The words of Sardar Gurmail Singh, Village Bada, District Ropar, in Punjab echo in our ears:

“All that you can see around in Punjab [the prosperity] all that you have heard about it, please do not believe it. Things are not what they seem. Punjab is on the brink...”

“Things were okay till about 15 years back. All the problems have started since then.”

Sardar Gurmail Singh is a medium farmer, cultivating 20 acres of land together with his brother. In an hour-long discussion, he told us all this and more on the situation of agriculture in Punjab. His was not a unique story – far from it. It was common, no matter who told it, where it was told. In village after village, from small farmer to medium farmer, from social activists, from political workers, from intellectuals, from academicians, in report after report, in Haryana and in Punjab, we heard the same stories. Stories that built a picture of an agricultural system on the verge of collapse, some parts having already succumbed.

This crisis is at once an ecological crisis, an economic crisis and a social crisis. What are the elements of this collapse?

Some of the serious problems can be stated as:

- A. Land degradation, including waterlogging and salinisation<sup>4</sup>
- B. Sharp decline in ground water levels
- C. Loss of diversity in cropping pattern
- D. Stagnant or falling yields
- E. Increasing inputs, declining returns, the worsening economics of agriculture
- F. Indebtedness of farmers

All these problems and issues are interrelated. The ecological problems are translating into the economic and social problems.

Waterlogging and salinisation is one of the most serious problems, and it is virtually impossible to have a lasting solution to the problem on lands that are underlain with saline waters. Much of the area in the Bhakra command in Haryana has bad quality groundwater. We have devoted a separate chapter to this problem, so we will not discuss this here.

## **ECOLOGICAL DEGRADATION AND THE SQUEEZE ON FARMERS**

Some of these problems were being felt in the 80s itself, and in 1985, the Punjab Government set up a committee to look at the problem. It was headed by Dr. S.S. Johl. In 2002, the Punjab

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<sup>4</sup> Land degradation is also taking place due to the extensive and prolonged use of fertilisers and chemicals

Government was to again set up a committee to look at the same issues – headed by the same person! In his report of 2002, Dr. Johl describes *what he had found in 1985*.<sup>5</sup> Among other things:

“Yet there were strong reasons for the state to reduce overall dependence on wheat and rice on ecological considerations also. The two crops system repeating year after year for the past about one and half decade on an extensive scale had made the agro-eco-system of the State extremely fragile in the context of pests and crop diseases, soil health, human health and the overall living environment.

“In short the committee realised that if the situation kept deteriorating at that rate, farmers of the State would suffer an acute economic squeeze and there would be a serious problem of market clearance in addition to over exploitation and increasing irrational use of scarce water resources and deterioration of agro-ecosystem of the State.”

In Haryana, we were told about the transformation brought about by the Bhakra project. Several people told us that the areas of Hissar, Sirsa were arid/ semi arid region, but with the advent of the Bhakra project, the irrigation went up, and the agricultural productivity increased. *However, at every point, this discussion was also tempered with apprehension. A recurrent theme was that there was an initial burst of benefits, then came stagnation and the balance turned. The serious problems and losses followed. Land degradation and the adverse economics of agriculture were the major concerns voiced.*

The reader is reminded that parts of the Bhakra command in this part of Haryana were already covered by the Jamuna canals from the turn of the century or even before. When the Bhakra waters came, they replaced and/or supplemented the Jamuna waters in these areas. It is true that the quantity of the Jamuna waters was limited. In hindsight, it may have been their major plus point.

As we have seen, with the Bhakra canal, additional land could be brought under cultivation in Haryana; but the growth in food production was hardly dramatic. It is only with the Green Revolution phase that the big increases came. With it came also the HYV seeds, chemical fertilisers and pesticides. All this had an impact on the productivity – with an initial burst of increase in production, but now with very serious detrimental impacts, especially on the ecology and economics of the agriculture.

Shamsher Jat, a farmer in village Sulheda, (Tal. Narwana, Dist. Jind), Haryana said:

“The waters have certainly benefited us. The production in our land has gone up. I have 40 acres of land. The production is more than what it was 20 years ago. The tubewells also came in about 20 years ago and that is why the irrigation has increased. 20 years ago, we were getting 20-25 *maan* of wheat per acre, now we are getting 50-60 *maan*. But now even the costs have gone up. So the net savings have gone down.”

Note the reference to the additional irrigation from tubewells. This was a story repeated at many places, with farmers saying that the production has gone up, but the net benefits to the farmers have remained the same or gone down. The small farmers have been affected most severely in this.

Ramchandra Dhansingh Jat is a small farmer in the same village Sulheda. He is cultivating 5 acres of land. He said:

“We have benefited from Bhakra. The tubewells have increased (this is the benefit of Bhakra Canal). But there is also a loss. All *tilhan*, *dalhan* [pulses, oilseeds] crops are gone.”

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<sup>5</sup> Government of Punjab 2002: Page 8

The tubewell irrigation was seen by him as the major benefit of the project. When asked as to how he saw the advent of Bhakra overall, he was vehement and emphatic in saying:

“It was bad. (*bura hua*) All the other crops have been destroyed. Now we have to buy these. Our agriculture has been reduced to two crops only. For example, in case of *chana* [gram], the average yield has remained the same. Say 40 *maan*. It sells at 20 Rs. per kg. Wheat we get 50-55 *maan*, but it sells at 6 Rs. per kg. So we get more in *chana*. And input is less. But we can't grow it now. That other person (Samsher) is a big *jamidar* (landlord). What does he know? He will definitely say that this canal water was a benefit.”

Thus, a clear distinction could be seen in the way the small and the big farmers perceived the benefits of Bhakra.<sup>6</sup>

The very unmistakable indicator of this was what the prevalent description of landless is. A number of times, we asked to speak to landless families, and in many cases we would find ourselves with families that have at least 1-2 acres of land. When we said we wanted to speak with the landless, we were told that in Haryana, if someone has 1-2-3 acres of land, he is considered landless! One would have expected that given what one has heard about the Bhakra project and its highly enhanced land productivity, even 2 acres of irrigated land would mean the farmer would be in a comfortable position, if not prosperous.

In every culture certain symbols are created through popular art. In India, Hindi films often play this role. Certain songs from films have become deep-rooted in Indian culture as symbols. There is one such song from a film made in 1974 - *Upkar*. It goes

“*Mere Desh ki dharti, sona ugle, ugle heere moti*”

(The land, the soils of my country, they produce gold, they produce diamonds)

The timing of the film, its subject and the lyrics leave little doubt that the words were inspired by the Green Revolution and the Punjab.

But the reality is that these soils, once eulogised as producing gold and diamonds, are not even able to sustain a family. Such is the situation of production and prices that small farms are not viable. This has disturbing implications for the sustainability and viability of the whole system.

Mangal is another small farmer in the village— he has 2 acres of land — and he calls himself as landless! He told us:

“The impact (of Bhakra) has not been good. The costs have gone up so much that all [small farmers] have become unemployed, as there is no saving. This is the situation today. When Bhakra waters came, then we got good benefit. But since 10-15 years, this has changed.”

For over a decade now, the farmers of Punjab and Haryana are seeing for the first time that yields from their fields are falling, or at best are stagnant. Agriculture in both these states has been reduced to virtual mono-cropping, with the wheat-rice or wheat-cotton cycle dominating overwhelmingly. In Punjab, wheat and rice together constitute over 75% of the gross cropped area.

In Punjab, average rice yields for the state reached a maximum of 3510 kgs/ha in 1989-90 and have been falling in the subsequent years<sup>7</sup>. The story of cotton can only be described as tragic.

<sup>6</sup> One reason why the districts of Hissar, Sirsa and Fatehbad are not feeling the full brunt of the problems is possibly tied to the comparatively high land holdings in these districts.

<sup>7</sup> Singh Karam, Sajla Kalra, 2002: ‘Rice Production in Punjab Systems, Varietal Diversity, Growth and Sustainability’, in Economic and Political Weekly, July 27, 2002. Provisional figure in the Statistical Abstracts

Both, the production and productivity of cotton in the state have plummeted. According to the Johl Committee Report<sup>8</sup>:

“The State of Punjab has witnessed record production of cotton i.e. 26 lakh bales during the year 1989-90. The average yield of cotton (570 kg lint / ha) in Punjab was also the highest in the country. However, within a span of 10 years, there has been a drastic decline in both production and productivity of cotton. During 1998-99, state could harvest hardly 7 lakh bales with productivity of 206 kg lint/ ha.”

In desperation, farmers are trying to saturate an already overburdened soil with more chemicals, and trying to control the uncontrollable pests with higher and higher doses of pesticides. But to little effect.

The districts of Hissar, Sirsa and Fatehbad grow about 75% of Haryana's cotton. They also have about 75% of its land area under cotton. In some areas, the excess moisture has impacted this crop. In most parts of the two states, the american bollworm has devastated the cotton crop since few years, with near total failure of the crop. Every place we visited had the same, tragic story. Farmers investing huge amounts in the input costs, spraying pesticides up to 30 sprays, and yet the whole crop getting destroyed by the bollworm. This has had in turn a serious impact on the downstream industries like ginning factories, not to talk about the farmers themselves who are getting indebted due to this.

In Hansi, Haryana we were told about how Hansi, traditionally an important cotton area had lost the position. There were 23 ginning factories there, but now most have shut shop. In Malout, Punjab we were told, there were 10 factories, now only two are left.

In Sulehda, the farmers told us about how the small landholders were the worst hit, since the cotton crop was repeatedly failing every year, and the input cost put them into greater and greater debt. The *sundi* (bollworm) was the main culprit, they said. When asked as to why don't they abandon cotton and take up some other crop – they said, what choice do we have? Now pests are affecting every crop.

What is more important than the stagnant or declining yields is that higher and higher inputs are being required to maintain these yields.

Everywhere we went, farmers told us how they have to keep putting more and more fertilisers to maintain yield; more and more pesticides to control the pests. But the soil is not responding. This is not the law of diminishing marginal returns. More inputs are required to maintain the same level of returns.

Reporting about discussions in a seminar held at the Haryana Agricultural university in Dec. 1996, Gupta and Gupta state<sup>9</sup>:

“It was observed that because of declining input use efficiency, almost 50% to 100% more nutrients would be needed to obtain the same yield advantage which were obtained fifteen years back. Also that while the wheat-rice system was a very potential crop rotation for food security, there was an urgent need for maintenance of soil fertility in this rotation....

“A large area in Haryana is affected by the problem of water stagnation, high water table and salt accumulation, bringing the soils under the category of sick soils. There is available evidence that the adoption of intensive monocropping and cereal based cropping and puddling in rice fields .... has resulted in deterioration of the physical

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show higher yields in the last 2 years, but whether this is a change in the clearly visible longer trends is not clear.

In any case, none of the districts show the yields above 4000 kg/ha which had earlier been reached.

<sup>8</sup> Government of Punjab 2002: Page 34. While the production and productivity have picked in the last two years, it is still below the peak.

<sup>9</sup> Gupta and Gupta (2000): 81-82

condition of the soil. Continuous use of high grade NKP fertilisers.. in the absence of organic matter recycling has resulted in deficiency of micronutrients ...”

A farmer described this in his own words.

“In our area, it is known that if the calf of some buffalo is stillborn or dies immediately after birth, then the milk stops. It is said that the buffalo “*bhade ki ho gayee*”. Then we have to feed her much more than normal. We have to cajole her, coax her – only then the milk may start flowing. We now say that “*jammen bhade ki ho gayee hai*”. (The land too has become like this buffalo). We have to give her a lot, do a lot of fuss around her, only then will she give us something.”

Sardar Trilochan Singh, Village Raipur, District Patiala, Punjab

The Johl committee report also substantiates this, as the quote from its Report at the beginning of this chapter shows. We repeat the quote here for ease of reading<sup>10</sup>:

“On the other side, continuous production of wheat and rice in annual rotation in the irrigated areas of Punjab is having a deleterious effect on soil, water, environment and social fabric of the state. *Soils of Punjab have become virtually a laboratory culture that requires higher and higher doses of fertilisers, micronutrients, insecticides and pesticides to produce same level of wheat and /or rice.* This has resulted in declining total factor productivity. The situation is becoming very serious day be (sic) day which can very soon proved (sic) to be economically disastrous, socially untenable and politically unsustainable, which can turn into man-made national calamity if not dealt with judiciously.” (Emphasis added)

It is not difficult to see what has happened. The “miracle” of agriculture in these states is totally based on high inputs. The soil and the plant have been reduced to a virtual conduit for transferring and transforming these inputs into agricultural produce – that too, a very narrow selection of crops- wheat, rice and to some extent cotton. The extent to which some of the inputs have gone up can be seen from the following data.

**Table 10.1: Growth of Production and Input Use in Punjab Agriculture**

<b>Indicator of Growth/Input Use</b>	<b>1960-61</b>	<b>1990-91</b>	<b>Ratio of 1990-91 to 1960-61</b>	<b>Growth Rate (Percent Per Year)</b>
Wheat Output (Lakh Tonnes)	17.4	121.5	7.0	6.69
Rice Output (Lakh Tonnes)	2.3	65.1	28.3	11.80
Wheat Yield per acre (Kgs)	503.0	1503.0	3.0	3.71
Rice Yield Per Acre (Kgs)	408.0	1307.0	3.2	3.95
Fertiliser use per Acre (Kgs)	0.4	65.9	164.8	18.27
Number of Tubewells per 1000 acres sown area	1.6	76.9	48.1	13.73
Number of Tractors per thousand acres sown area	0.5	28.0	56.0	15.16

Source: Shergill 1998

The repeated, year after year cultivation of rice-wheat or cotton-wheat has broken the natural cycles which replenished the soils with vital nutrients. These natural cycles can be completed only if the crops grown are diverse, as different crops draw and contribute different elements to the soil. Also, for generations, people have followed the practice of leaving some portion of the land fallow, so that it can replenish itself.

<sup>10</sup> Government of Punjab 2002: Page (i) in Annexure I



The green revolution struck at both these practises.

A major element in the increased production was the expansion of the cultivated area and multiple cropping. As more and more area was brought under cultivation, less and less land was left fallow.

“It was very good at first [the benefits of the increased irrigation and green revolution]. We had good crops in the beginning. Less fertiliser, good yield. But now, it is like an addict who needs more and more of the drug every day... the land is similarly addicted to fertilisers and wants more and more of it.. Otherwise it does not respond... Then again, in the early days, we used to keep some part of the fields empty so that the land could recover its strengths... now how can we keep the land fallow.... There are so many expenses...”

- Santokh Singh, Village Kotli Khakhya, Dist. Nawanshahar

### **HIGH INPUT COSTS, DECLINING PRICES**

Apart from the ecological costs – in terms of soil degradation - the economic and financial costs of these inputs have been huge – and spiralling upwards. Pesticides, fertilisers, water, energy, machines, labour - agriculture in these two states has been dependent on heavy inputs of all these. The costs of these inputs have been going up, without commensurate increases in the price of agricultural produce.

One of the important inputs whose cost – both real cost and the cost as borne by the farmer - has gone up dramatically is water. According to Pratap Singh, Village Mahas, Dist. Patiala (This village is commanded by canal):

“The plight of the farmer is really bad today. Earlier, the groundwater level was at 5 feet (15-20 years ago), today it is not even available at 60 feet. [Needing more expenditure to pump up, higher power motors and so on.]

“Fertilisers – no matter how much more we put in we are not getting the response.

“In the earlier days, we farmers were happy. The cost of cultivation was minimum, or not there at all. Paddy is not a crop of Punjab at all. Earlier, our main crops were Maize, cotton, bajra, groundnut, chilly and so on. We had very little expenses, and the income was more. With the coming of Paddy, this has been reversed.

“Also, earlier, one can of diesel used to cost Rs. 15/-. Now, it costs Rs. 400. The same is the case with other inputs. But the cost of our agricultural produce has not gone up in the same proportion.”

Kashmir Singh, another farmer from the same village highlighted an important dimension of this.

“While our village is served by the distributory of the Kotla canal, we still have to use the groundwater if we are to sustain agriculture. But the tubewells do not provide water properly for all. Especially the small farmer, who cannot afford to deepen his tubewell as the water level keeps going down. He is virtually without any water then.”

Farmers in every part of the two states we visited repeated a story similar to this. The Johl committee report notes<sup>11</sup> that the groundwater level in Punjab is going down by 30 cms per year. A critical water table depth below 10 m has reached in 28% of the area of the state. Districts so affected include Ludhiana, Sangrur, Jalandhar, Patiala – all part of the Bhakra command. In Haryana, groundwater levels are falling in 48% of the state area<sup>12</sup>. Districts

<sup>11</sup> Government of Punjab 2002: 13

<sup>12</sup> EMCB-ENVIS Node on Water Resource Management at [http://www.water-mgmt.com/en/database\\_haryana6.htm](http://www.water-mgmt.com/en/database_haryana6.htm)

affected include Mahindragarh, Riwari, Gurgaon, Kurukshetra, Kaithal, Karnal, Panipat and Ambala. Thus, several Bhakra commanded districts are in the grip of this problem.

The falling water levels are of great economic concern to the farmers. In spite of canal irrigation, we have seen that agriculture in both the states is based on huge extractions of groundwater. Paddy especially is impossible to grow without this. As water levels go deeper and deeper, farmers are being forced to re-bore and deepen their wells, every few years – at great cost. Small farmers are not able to do this. It may be noted that till 2001, farmers in Punjab were getting electricity free of charge, and now they, along with their Haryana counterparts are still paying only a small cost for it. Without commenting on the desirability or otherwise of this<sup>13</sup>, one would like to point out here that cost of pumping is virtually not included in the farmers costs – he has to bear only the capital cost of pumping equipment, and the cost of deepening. If the cost of power is also to be borne by farmer, his costs would go up even more.

Falling groundwater is a huge threat to agriculture in the two states. In fact, since much of the agriculture depends on mining of groundwater – waters which are not being recharged – it is clear that water levels will keep going down.

“I have three motors [ to pump up water]. In 1970, the water level was 20 feet. In 1987, I had to fit a submersible pump. It had a 7.5 HP motor. Now the water level has gone to 60 feet, and I have changed to 12.5 HP and 10 HP motors. In 32 years, I have had to re-bore 4 times, and the frequency is increasing. I have had to spend a lakh of rupees every time.”

Sardar Meher Singh, Village Thedi, Taluka Kharad, Dist Ropar

“The problem of water is becoming acute. The level of water is going down. We have had to go down by 60-65 feet. The level of water has gone down from 80 feet to 150 feet. Earlier, we could do with a normal motor. Now we have to fit a submersible motor, and that too 10-15 HP. It costs Rs. 100,000 – a lakh of rupees. And this can feed only about 5 acres. How can the farmer afford this continuous cost? And every year the water level falls, so the water delivered goes down.

“At least since last 5 years, power was free for us. But now the Regulatory Commission is considering putting some charges on it. [The interview was before the Commission actually did this]. The Agricultural Price Commission that fixes the Minimum Support Price does not consider the cost of electricity.

“The Government is giving electricity worth about Rs. 300 crores to farmers. But if we see the dues for the big industries, the theft, the dishonest people – it is far more. We farmers are not begging for free electricity. All we are saying is that then give us higher prices for our produce.”

Sardar Gurmail Singh, Village Bada, Dist. Ropar

“Now the water levels have fallen so much, people here are now going in for submersible pumps. Haryana farmers have already done this, now it is our turn. But small farmers can't so easily go in for this. They can afford it only at the cost of piling up huge debts.”

Inderjit Singh, Village Sahauli, Dist Patiala

Even as cost of all these inputs has increased dramatically over the years, and the amount of inputs required have been going up sharply, even to maintain the same yields, the price that

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<sup>13</sup> This author supports a significant subsidy to maintain affordable power tariffs for farmers.

the produce fetches has not gone up in the same proportion. The study on rural indebtedness in Punjab commissioned by the Punjab Government states<sup>14</sup>:

“In the last about one decade (roughly since the mid-1980s) another dimension of the modernisation process of agriculture has appeared in Punjab. It is the continuing stagnation of yields of main crops, despite increasing application of modern inputs and growing expenditure on these inputs. .... it may be seen that in the last about 10 years (1985-86 to 1995-96 ), yield of wheat has grown at a very slow rate, yield of rice has remained stagnant and yield of cotton (American) and cotton (desi) have actually declined. Similarly yields of sugarcane, maize, and potato have remained stagnant. *The information ..... reveals clearly that net value of all crops per acre at (at constant 1980- 81 prices) has remained stagnant over this ten-year period. During the same period cash expenditure, on modern farm inputs incurred by Punjab farmers has been steadily growing and that has resulted in a continuous decline in the net surplus generated from the production of these crops. This has resulted in Punjab farmers increasing dependence on borrowed funds to finance the purchase of their growing use of modern farm inputs. (Emphasis added)*

“In fact, in more recent years, the farmers have been even reporting a decline in the yield of main crops.”

In the case of wheat and rice, the farmer is getting a reasonable price because almost all the produce is purchased by the Government at the Minimum Support Price (MSP). If this was not the case, the market price would be much below this, and it is doubtful whether the farmer would even recover his costs.

“Right now, the Government is procuring the wheat, that is why the farmers are getting Rs. 600 per quintal. But if this stops, then they will not even get Rs. 300 per quintal. Then the farmers will have to give up cultivation of wheat because it will be too costly.”

Dr. Satbir Sura, Agriculture Development Officer, Hansi, District Hissar.

According to Shri H.S. Sidhu<sup>15</sup>:

“...(G)iven the high cost structure of Punjab agriculture, Punjab does not enjoy comparative advantage in either of the two major crops. For instance the 'economic cost' of Punjab wheat to Food Corporation of India is Rs 850 per quintal if transport and storage costs are taken into account [Gulati 2000]. In contrast to this wheat is available internationally at less than \$100 per tonne which works out to be Rs 475 per quintal. Even the best quality American wheat is selling in the international market at \$127 per tonne which works out to roughly Rs 620 per quintal. The Government of India is not allowing free import of wheat from outside and has imposed substantial import duties on agricultural commodities. Thus, but for the government's import restrictions, it would have been extremely difficult for Punjab farmers to sell their agricultural produce. With more than \$54 billion of foreign exchange reserves, India also cannot deny minimum market access in foodgrains under the WTO rules to major wheat exporters for a long time under the pretext of balance of payment problem. Once it happens the high cost Punjabi producer will be in real trouble. Already the marketing of wheat and rice is posing a serious problem both for the farmers as well as for the state-controlled buying agencies.”

<sup>14</sup> Shergill, H.S. 1998: ‘*Rural Credit and Indebtedness in Punjab*’, Institute of Development and Communication, Chandigarh: Page 8. The study was commissioned by the Punjab Government.

<sup>15</sup> Sidhu, H.S. 2002: ‘*Crisis in Agrarian Economy in Punjab : Some Urgent Steps*’, in Economic and Political Weekly, 27 July 2002.

Most farmers also told us that even with the MSP, agriculture is a losing proposition. Ajmer Singh Lakhowal, who heads the Bharatiya Kisan Union (Lakhowal group) told us that they had a one-point demand. Namely, the price given to the farmer should be linked to the Wholesale Price Index (WPI) with 1966-67 as the base year. His argument was that since this was the year in which MSP was introduced, it should keep up with the increase in the WPI. He said that the WPI had gone up 13 times since then, but what the farmers are getting has gone up by only 8 times.

On the other hand, even with these prices, the grains are priced out of the market – especially out of the reach of the poor who need them most.

Many farmers expressed to us grave concern about their future if the MSP is withdrawn and the farmer is left to the market forces. Several academicians, intellectuals pointed out that under the WTO, India will have to open up its market for foodgrains imports by 2005<sup>16</sup>.

### **CHANGE IN CROPPING PATTERN AND ITS IMPACTS**

The several suggestions to meet this crisis include the need to change the cropping pattern. This is not surprising since the loss of diversity in the cropping pattern is at the root of many problems – (1) Repetition of the same crops depletes the soil of nutrients requiring higher chemical input (2) Rice in particular needs very large quantity of water (3) When there are large areas of the same crop, pests can proliferate needing more pesticides (4) Marketing can be a problem when there are only a few crops grown by all farmers

It may be pointed out that the report of the Johl Committee is formally titled “Agricultural Production Pattern Adjustment Programme in Punjab for Productivity and Growth”. In Hansi, Haryana, too we were told by the farmers that there is an emphasis for changing the cropping pattern, moving away from the current virtual mono-cropping.

Unfortunately, it is easier said than done.

It may be recollected that the Punjab Government had set up “a similar committee”, under “similar situation” to recommend diversification of the cropping pattern – in 1985<sup>17</sup>. The setting up of another committee 17 years later testifies to the difficulties in changing the cropping pattern. There are several economic, ecological and other reasons behind it.

Let us try to understand these reasons, the change in the cropping pattern since the 1960s and the implications of the same.

The most dramatic transformation in the cropping pattern is clearly the replacement of a diverse cropping pattern with a cropping pattern dominated by just a few crops. All over Haryana, (and Punjab) the wheat-paddy cycle has come to dominate the cropping pattern. (See Annexure Pages A-29,30, and 46 for the cropping pattern of the two states over the years).

In Punjab, in 1965-66, wheat occupied 39% of the cultivated area, gram 15%, maize 10%, rice 7%. By 1990-91, wheat area was 44%, gram 1%, maize 2% and rice 27%.

Thus, area under wheat-rice went up from 46% to 71% in 1990-91. The actual area increase was much higher if we see that the total cropped area too had gone up in this period. In 2002, wheat-rice took up 78% of the total cropped area of Punjab.

In Haryana too, the case is similar, though less acute. In 1966-67, wheat occupied 18% of the total cropped area, gram 26%, *bajra* 22%, rice 5%. In 1990-91, this was 36% for wheat, 13% for gram, 12% for *bajra*, 13% for rice. In 1998-99, wheat and rice accounted for 57% of total cropped area.

<sup>16</sup> Lahiry Sutapa, Distress in Punjab Agriculture under the WTO Regime: A Brief Note, FreeIndiaMedia.com

<sup>17</sup> Preface of the Johl Committee (2002) Report (Government of Punjab 2002)

This was also the most striking visual impression that we got during our visits. In the first visit, in Haryana<sup>18</sup>, for miles and miles, the only crop we could see in the fields was wheat (being *rabi* season) with a sprinkling of sugarcane and *sarso*. This visual impression was corroborated by a number of farmers and others during the discussions.

We were repeatedly told that the *dalhan* (pulses), *tilhan* (oilseeds) crops were *no longer able to grow* in the area.

There are a number of reasons that seem to have contributed to the change in cropping pattern. These reasons are not in isolation of each other, but are related intrinsically to the type of agriculture introduced by large-scale irrigation and green revolution. Most important of these factors are: the availability of HYV seeds only for a few crops, namely wheat and rice, the availability of proper marketing including support price and procurement mechanism for selected crops, the returns to farmers, the impact of excessive moisture and waterlogging / soil salinity, the intensive use of chemicals in farming. It may be pointed out that while some factors force a choice on the farmer, some make it physically impossible for some of the crops like *dalhan*, *tilhan* to be cultivated even if the farmer wants to.

In the Shri Ladwa Goushal, Village Ladwa, Tal. Hissar, Dist. Hissar, we were told by the *Pradhan* Shri Balraj that wherever the Bhakra waters have reached, the *dalhan* crop has finished. He said that this is because the Bhakra waters come minus all nutrients, which get trapped with the silt behind the dam. He contrasted this with the Jamuna canal irrigated areas, where he said that this was not the case and so *dalhan* was not affected.<sup>19</sup> This may also have something to do with the fact that quantity of water from Jamuna canal was quite less. He also stated that this impact is not due to the excessive use of chemicals. He said that even where this use was not there, but irrigation from Bhakra was there, the *dalhan* was finished. He pointed out that the water levels in and around the area have reached very high levels.

In village Sulheda (Tal. Narwana, Dist. Jind, Haryana) also, we were told that while the Jamuna waters have been irrigating the village since decades, this did not have any effect on the *dalhan*, *tilhan* crops. But it is only with the advent of Bhakra waters when this impact started and now all the *dalhan*, *tilhan* crops are gone. Here however, one may also possibly see a connection with the intensive use of chemicals. We were told that in the pre-Bhakra days, there were no chemical fertilisers, pesticides. All these came with Bhakra waters. The farmers also pointed out that with this package came the new seeds, but only for crops like wheat. It appears that all these factors – excessive moisture, use of chemicals, and the options forced on to the farmers through only selected crops having support prices, and new varieties of seeds – all have played a role in the dramatic decrease of *dalhan*, *tilhan* crops. In Sulheda, we were told that *dal*, *moong*, *chana*, *til* can no longer grow here. The agriculture has been reduced to just two crops.

Waterlogging, salinity and excessive moisture is a very important reason for the change in the cropping pattern. The *dalhan* cannot grow in the high moisture of the irrigated areas. We were informed that earlier, even after the advent of canal irrigation, these were some mounds in the villages where the pulses would be grown. This was because they would not be so moist. As these mounds were leveled, the pulses crops could no longer be grown.

The rice crop was introduced in several parts initially to combat the waterlogging and salinity, but it was adopted widely as the support price made this a profitable crop.<sup>20</sup>

In village Lamba Khedi (Taluka Narwana, Dist. Jind, Haryana), we were told that earlier (before irrigation from Bhakra), they used to take crops like *chana*, *sarso*, *masri*, *moong*, all

<sup>18</sup> Almost all of it in Bhakra command, part in WJC command

<sup>19</sup> We were to hear this from others also; since the Jamuna canal takes off from a diversion structure, it is likely that this brings in the silt with it also. The Bhakra water would not carry the silt as it would settle and be trapped behind the dam

<sup>20</sup> Government of Punjab: Page 12. Also interviews with villagers.

*dals like udad etc., til, turiya, sugarcane, bajra, juwar, arhar, makka, chili, tobacco, shan* (a jute like fiber crop). After 1970-71, these went down. Now, the only crops left are *jiri* (paddy) and wheat. They said that they cannot grow the other crops. Lamba Khedi is severely affected by waterlogging since quite some time. The Bhakra waters came to this village in about 1964.

We heard the same stories in Punjab also. From all these discussions, and other evidence, there seem to be two important reasons for the dramatic decline in pulses. One is the reason of market support and returns – these are the highest in wheat and rice; the other reason is the high level of moisture in the area with advent of large scale irrigation - even when farmers want to grow pulses, they find it difficult.

The first impact of the change in cropping pattern is the non-availability of number of crops to the people. This means that they have to purchase the same or go without them. When we suggested to some farmers that they can grow wheat and rice and purchase the other crops, the reply was that someone somewhere would have to grow these! In Sulheda, one farmer told us that this (growing only two crops and buying the others) is not possible now since the expenses in growing wheat are growing and the profit is declining.

Another impact is that the choice of the farmers has been restricted and this is likely to have big financial implications. In Sulheda, a farmer told us that even though the wheat productivity went up after the advent of Bhakra project, they are net losers. He pointed out that even though the productivity of wheat has gone up to 50-55 *maan* (11 quintals) per acre wheat sells at Rs. 6 per Kg. and this too is the support price. The yield of *chana* may be the same as the what it was earlier – about 40 *maan* (8 quintals), but it sells at 20 Rs. per kg and the input cost is very less. But the problem is that it can't grow now.

This aspect becomes very important in the context of the attempts to diversify the cropping patterns. The very factors that were responsible for the expansion of food production are responsible for these problems too.

The MSP which was offered for rice and wheat made it much more profitable to switch to these crops and thus large areas rapidly shifted to the two crops. Now, any effort to shift back to other crops needs similar kind of support in terms of prices and markets. It was repeatedly told to us by farmers that unless this support is in place, there is little possibility of diversification. The past attempts in Punjab are a testimony to this. Farmers told us about how the Government encouraged farmers to grow potatoes, and when they did this, there were no buyers and huge quantities of potatoes were thrown on the roads by the farmers.

But there is another important issue. Even if the economic support is in place, the ecological factors may not allow the change in cropping pattern.

We have seen how the excess moisture is making it very difficult to grow pulses.

Farmers also told us that once a field has been growing paddy for several years, it is very difficult to grow other crops there. We were told that the growing of paddy requires and results in compacting of the soil, and this creates problems for other crops.<sup>21</sup> In village Mahas, District Patiala, we met farmers who had tried to change over from the paddy crops. We saw the fields where attempts had been made to grow chilli crop, but this had failed year after year. It had been five years since the paddy crop was taken there, but still there was a problem for other crops to grow.

One of the most serious implications of this difficulty in changing the cropping pattern is that this has drastically narrowed the choices for the farmers.

As we mentioned earlier, there is an apprehension– not at all unrealistic – that soon the support prices for wheat and paddy will be withdrawn. Many farmers, intellectuals, social activists

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<sup>21</sup> The Johl committee also notes this. (Government of Punjab 2002: Page 17)

wherever we went, told us that the only thing sustaining the wheat paddy cycle is the support prices. In case of wheat, the price is around 600 Rs. per quintal. They told us that if this is withdrawn, the market price will not even come up to 400 Rs. and wheat cultivation would become un-remunerative, as the input costs are very high. This is a distinct possibility as the WTO calls for removal of the support prices. This is likely to result in large-scale social unrest.

For the farmers, this will be aggravated by the fact that they will not have many other crops to change over to. Thus, the lack of diversity, the fact that it is not possible to cultivate other crops in many areas has made the whole system highly vulnerable to pressures of the type that agriculture is more and more likely to face in the coming days.

As the fear of WTO, the withdrawal of MSP and opening up of the markets to wheat and rice from outside looms over the farmers, the inability to switch over assumes a grave dimension. It limits the farmers' choices and strikes at the resilience of the system.

In other words, the greatly diminished diversity has increased enormously the ecological and economic vulnerability of the system – a system that has been considerably weakened already due to increasing inputs, increasing costs, and lower returns.

### **IMPACT ON FARMERS**

The direct impact on farmers of this increasing gap between costs and returns is increased indebtedness. When the farmer is no longer able to meet the expenses - of cultivation, of running the household – from the diminishing income, debt is the most common way out. In almost every village we went, we found large number of farmers who were in debt – and were trapped in them. Indeed, in spite of asking, we hardly found any farmers who did not have debts.

In 1998, the Punjab Government commissioned a study of the farmers' debt in the state. The findings of the study are eye-opening and reflect all that we heard on the ground. This study states:

“This combination of growing cash expenditure on modern farm inputs and stagnant or even declining crop yields have made Punjab farmers increasingly dependent on borrowed money which many of them are finding difficult to repay out of the meagre and declining net surplus from crop production.” (Shergill 1998)

While we did not see any formal studies equivalent to this for Haryana, the stories we heard from numerous farmers in various parts of the state show that Haryana is only a step behind in Punjab in this matter.

Shergill's study makes a detailed analysis of the issue drawing on comprehensive data from a stratified sample across the whole of Punjab.

The study looks at three different components of the debt:

- A. Short –term debts taken for meeting the recurring seasonal expenses of cultivation
- B. Long-term debt for productive use – loans taken for productive investment like tractors, tubewells, and so on
- C. Loans for non-productive expenditure like marriage, social functions, consumption needs etc.

The data is also segregated as per land holding (rather, land operated).

The important findings of the study are:

- 82.9% of farmers in Punjab were found to be taking short-term loan from different credit agencies to carry out their crop production operations.
- For all farmers taken together, the average amount borrowed per operated acre come out to be Rs. 3590 (short term loan only). Amount borrowed per acre declined as farm size increased.
- The total short-term loans taken by Punjab farmers in year 1997 amounted to Rs. 3119.3 crores. Out of this, 61.31 % (1912.58 crores) were advanced by the *arthis* or commission agents, who charge exorbitant rates of interest. Only 4.71 % of the loans came from Commercial and regional banks.
- 34.43 % of farmers borrowing short-term crop loans failed to repay the entire amount borrowed after harvesting and sale of their crops. The unpaid amount totalled to 696.80 crores Rs. or 22.34% of the total borrowed amount.
- 70% of the small farmers, 40% of the semi-medium, 47% of the medium and 28.30% of the large farmers were not able to fully repay the crop loans taken by them

The study also quantifies the debt burden on farmers in terms of selected parameters. These are:

**Table 10.2: Burden of Debt on Punjab Farmers**

1.	Annual Interest Charges (Absolute Amount) @ 14% on debt due to formal sector agencies @ 24% on debt due to informal sector agencies	Rs. 1102.78 crores
2.	Annual Interest Charges as Percent of Net State Domestic Product Originating in Agriculture as Current Prices	10.96%
3.	Annual Interest Charges Per Operated Acre	Rs. 1073.77
4.	Principal and Interest Charges Per Operated Acre	Rs. 6621.73

Source: Shergill 1998, Page 68, Table 26

The picture that emerges is very serious indeed. Over 80% of the farmers have to take short-term loans to meet cultivation expenses, and 34% of the farmers are not able to repay the amount, which naturally accumulates. Most of these loans are taken from the *arthis*, who have come to dominate the farmers' market interaction. The *arthis* advance loans to the farmers, charging rates of interest from a "low" of 2% (per month) to a high of 5% (per month). Not only that, the farmer is then forced to sell his produce through the *arthi*, and in most likelihood has to buy the pesticides, fertilisers and in recent years even household goods from the traders specified by the *arthis*.

The interest burden works out to be an *average* of Rs. 1073.77 per operated acre, and is much higher in case of small farmers. The debt burden is not only making agriculture a losing proposition, but is virtually strangulating the farmers. Further, the whole edifice of agriculture is standing on the debts – both long-term, and short term.

The IDC study figures relate to 1997. The latest estimates are that the total debt of farmers has touched Rs. 10,000 crores, with the non-institutional (meaning from *arthis*) debt being about 60-80% of this, and the annual interest burden is about Rs. 3200 crores!<sup>22</sup>

The indebtedness of the farmer, how it arises and the impact it has is dramatically illustrated by the village Harikishenpura, District Bhatinda, Punjab – the village that recently captured the attention of the media due to its *Panchayat* passing a resolution putting up the village for sale to liquidate its debts.

<sup>22</sup> Jaijee, Inderjeet Singh *et al* 2002: 'Letter to President of India on "Way to Save Debt Trapped Farming Community"', on behalf of Movement Against State Repression, 26 May 2002, Chandigarh, unpublished.



The following conversation we had with farmers in Village Raipur<sup>23</sup>, Tehsil and Dist. Patiala, shows a typical situation.

<p><i>Q:</i> Has any farmer incurred debt in this village?</p> <p><b>Nachatar Singh (NS):</b> Every house is indebted here.</p> <p><i>Q:</i> But is the loan a burden or is it something that the farmer resorts to routinely?</p> <p><b>NS:</b> If the crop is good, then the farmer can return the loan.</p> <p><i>Q:</i> Has anyone here had to sell land to meet his debts?</p> <p><b>NS:</b> Number of people have sold off land due to debts.</p> <p><b>Sawarna Singh (SS):</b> (Interjecting) Say I have taken 4-5 acres of land on contract / lease for cultivation. I would have to take the money for this from the <i>arthi</i>. Then, I will also incur expenses. But the crop fails. Then I would have to sell my land. From where else will I return the money?</p> <p><b>NS:</b> Say I buy the tractor for the farm. But I see my neighbours house and I make a similar big <i>kothi</i> (house) which is outside my means. Then I will have to sell my tractor. Or, I spend the money for <i>nasha</i> (intoxicants)</p> <p><b>SS:</b> The small landholder – he is bound to lose in this system. It is better that he gives his land on contract. If he farms himself – he will lose.</p>	<p>Look at me, I took 8 <i>bhigha</i> land (1.5 acres) on contract for Rs. 16000. But I could not sow it as there was no water. The land is lying empty. I have taken the money from the <i>arthi</i>. Now the interest is piling up...When I go to buy pesticide, if I have cash, it is still okay. But if it is from borrowed money from the <i>arthi</i>, he will not give me cash but will give me a <i>chit</i> – a slip of paper. I can then take the pesticide only from the shop he tells me, by giving the <i>chit</i>. Why talk about pesticides, now a days even the household goods like tea, sugar, all is done through such <i>chits</i>, at the shop that the <i>arthi</i> tells us.</p> <p>Only if some member of the family is in service can we survive. The family that tries to live only on agriculture – their situation is bad. You can look at me and Trilochan (points to another farmer sitting next to him – that farmer has a government job) and see for yourself the difference.</p> <p><i>Q:</i> You are saying that you are indebted, but if one looks around the village then things seem to be quite okay.</p> <p><b>SS:</b> It is good only to look at. Pucca houses and so on. But inside, the real situation is bad. We know how it is. It is all based on debts now. And what we had earned in the first 10-15 years when things were good</p>
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“Only those who have someone abroad, only those farmers can survive”

Jasvinder Singh, Village Kotli Khakhya, Dist Nawanshahar.

This comment illustrates an interesting aspect of Punjab's economy. The *doaba* region (Bist *doaba*) is well known for people going abroad to work. It is said that there is at least one person abroad from every house in the *doaba*. Indeed, in our visit, all the families we met this was true.

This was the essence of what the farmers told us everywhere we went – in the command areas of Bhakra and also outside - No farmer can survive only on agriculture. The big ones can still manage, but the small farmers are really in a bad state. All the signs of prosperity are based on debts, or the earnings from the good old days in the initial 10-15 years when things were okay. This reference to the fact that things were good in the first 10-15 years and then started deteriorating has been a recurring theme in all our conversations with farmers in both the states.

<sup>23</sup> This is in the Bhakra command getting water via the BML. About 25% of the area is irrigated by canals and 75% by tubewells.

### FARMERS SUICIDES – ACT OF DESPERATION – SYMBOL OF CRISIS

The combination of declining or stagnant yields, increasing input costs, declining prices and the huge burden of debt are strong indicators that things are seriously wrong economically and ecologically in Punjab and Haryana's agriculture. While lakhs of farmers try to come to grips with this phenomenon, number of farmers are taking the most desperate way out -- suicide.

Suicides by those considered as the most prosperous and advanced of farmers in the country are not only a pointer to the desperation of the farmers, but also raise serious questions about the whole agricultural system itself.

The first accounts of suicides by Punjab farmers were met with skepticism, denial and disbelief. But as the suicides continued and so did the reports, there is reluctant acceptance of truth. Now even the Chief Minister of Punjab has accepted this fact.

In 1998, the Institute of Development and Communication was entrusted a study on suicides of farmers and agricultural labourers in Punjab by the Government of Punjab. The purpose of the study was “to investigate the nature, extent and causes of suicides in rural Punjab”. The study brings out some shocking facts<sup>24</sup>.

“There has been a distinct increase in the number of suicides in Punjab since 1993. In 1992-93 suicides in Punjab increased by 51.97 percent. By contrast, the all-India average registered an increase of 5.11 percent only. In the subsequent years, this trend has continued. In 1993-94, there was an increase of 14 percent, whereas in India it was 5.88 percent. In 1994- 95, the increase in the case of Punjab was 57 percent whereas in India as a whole there was a decline in suicides. In 1995-97, the increase in the suicides in Punjab was to the extent of 21 percent, whereas the decline in India to the extent (sic) of 19 percent.”

The same information can be summarised as follows.

**Table 10.3: Growth (Decline) in Suicide Rates – India and Punjab**

Year	All-India (Per Cent)	Punjab (Per Cent)
1992-93	5.11	51.97
1993-94	5.88	14.00
1994-95	Negative	57.00
1995-97	(-)19.00	21.00

Other major finding are:

- Suicide rate among the farmers is higher as compared with that of the non-farmers. Among the farmers, again the most vulnerable sections are the small and marginal farmers and landless labourers<sup>25</sup>.
- For example, in 1993, the suicide rate<sup>26</sup> of farmers was 1.98, while that of non-farmers was 0.9. In 1997, the same figures were 4.49 and 1.82.

#### Suicide Rate in Punjab for Farmers and Non-Farmers

	1993	1997
Farmer	1.98	4.49
Non-Farmer	0.90	1.82

<sup>24</sup> IDC 1998: ‘Suicides in Rural Punjab’, Institute for Development and Communication, Monograph Series-V, Chandigarh.: Page 15

<sup>25</sup> *ibid* Page 22

<sup>26</sup> Suicides Per Lakh of Population

- The districts of Sangrur, Bhatinda and Mansa which have a high share of farmers' suicides also have a higher debt burden.

Many other studies and investigations, most of them done after the IDC study, some of them as late as 2002, confirm that suicides continue and that the economic crisis in agriculture and the indebtedness of the farmer are the main factors. Dr. Jagmohan Singh of Ludhiana, a Professor at the university and a human rights activist and expert on issues of globalisation and its impacts, told us that the cases of farmers suicides are on the rise. They had done an investigation on 79 cases and all were found to be due to economic reasons<sup>27</sup>.

Dr. Gopal Iyer and Dr. Meher Singh Manick conducted a study on the farmers suicides in Punjab. They too find<sup>28</sup>:

“The data clearly establishes that impoverishments and indebtedness have been the major contributory factors to the causation of suicides.”

In their study, Dr. Iyer and Dr. Manick provide the figures for the costs of inputs and returns for the rice and wheat crops in the Sangrur district of Punjab. They find that “the net return per acre of paddy is Rs. 1304 and that of wheat is Rs. 590.”<sup>29</sup> These figures are for 1997, and hence consider irrigation and electricity as free of cost. One can well understand why farmers with 1-2 acres would be known as landless!

Ashish Bose quotes a study whose report was then under preparation.<sup>30</sup> This study, undertaken by agricultural economist Sukhpal Singh from PAU (Ludhiana) and Suchha Singh Gill at Punjabi University Patiala investigates over 100 suicides by farmers. They find that the root cause is indebtedness.

The IDC study too identifies debt as one of the major causes of farmers' suicides in Punjab. The study points out that normally, the reasons behind suicides are multiple, and are a result of the interface between socio-economic and psychological factors. It also points out that certain factors are what can be called “predisposing factors” which create the stress and other factors are the precipitating factors, which, against the background of the stress created by the predisposing factors, precipitate the suicide. Also, a factor which may be predisposing factor in one case may be the precipitating factor in another and vice-versa.

The study also notes, “When asked about the presence of stressful liabilities it was discovered that as many as 74% suicide victims had such liabilities on them....compared with the presence of such liabilities in only 42% of the general sample. Prominent among the stressful liabilities were delay in marriage of children, inability to bear the burden of education of the children, inability to pay dowry, financial difficulties in meeting day-to-day- expense”. Again the presence of financial stress is a major factor.

H.S. Sidhu<sup>31</sup> states:

“There are reports of suicides by farmers because of their inability to return loans. More than one thousand farmers have committed suicide during the last five years or so. [Iyer and Manick 2000] Distress sale of farm machinery, tractors and even land are being reported daily.”

Given that the agriculture in the whole state is in the grip of a crisis, the extent of farmers' suicides mentioned above may be under-estimates.

<sup>27</sup> Discussion with Prof. Jagmohan Singh in Ludhiana

<sup>28</sup> Iyer K.G. and Meher Singh Manick 2000: ‘*Indebtedness, Impoverishment and Suicides in Rural Punjab*’, Indian Publishers and Distributors, Delhi. Page 14

<sup>29</sup> *op cit* Page 34

<sup>30</sup> Bose, Ashish 2000: ‘*From Population to Pests in Punjab: American Boll Worm and Suicides in Cotton Belt*’, in Economic and Political Weekly, 16 Sept. 2000

<sup>31</sup> Sidhu 2002

On 26 May 2002, several people representing the Movement Against State Repression (MASR)<sup>32</sup>, including its convenor, human rights and political activist and former MLA Shri Inderjit Singh Jaijee wrote to the President of India, drawing his attention to the serious situation of the debt trap that the farming community in Punjab finds itself in. The letter, whose subject was “Way to Save Debt-Trapped Farming Community”, says that:

“Debt related suicide figures from the two blocks of Lehra and Andana in district Sangrur, from April 1, 2001 to March 31, 2002 investigated by the MASR and certified by village *panchayat* and verified by civil magistracy stand at 56.....Debt related suicides in the adjoining block of Sunam in District Sangrur and Budhlada block in Mansa District are also very high. Considering that Punjab has 138 blocks and suicides are reported from all parts of the state, the all-state figure could be as high as 4,000 a year.”

The letter enclosed a list of the 56 victims along with details of landholding, debt etc.

Jaijee told us that the suicides began in the late 1980s<sup>33</sup>. He said:

“I brought out the first report of farmers suicides in Punjab in 1990. This was related to the village Gulhani. But it was suppressed at that time saying that I was fanning militancy. Since I was involved in human rights issues, it was assumed that I was supporting militancy. It is only when the suicides were reported from A.P. that my contention was accepted.”

Jaijee also narrated to us how his contentions kept on being met with denials<sup>34</sup>. He told us that he had details of 500 cases in his block itself.

Jaijee ended the discussion on suicides on an ominous note.

“Today the first response of the desperate farmers has been suicide. But sooner or later farmers are bound to think, why should I die. Let me kill .. the *arthiyas* from whom they are taking the loans and who are seen as the most visible cause of their situation. In the last 2-3 months, there have been cases of 3 *arthiyas* being killed, by forcing spray (pesticides) down their mouths. Violence is erupting, will erupt”.

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<sup>32</sup> Jaijee, Inderjeet Singh *et al* 2002: ‘Letter to President of India on “Way to Save Debt Trapped Farming Community”’, on behalf of Movement Against State Repression, 26 May 2002, Chandigarh, unpublished. The letter has been signed by Inderjit Singh Jaijee, Convenor, Justice A.S. Bains, Baljit Kaur, co-convenor, Gurdarsharan Singh Grewal, former Punjab Advocate General, Lt. Gen. K.S. Gill, J.S. Toor, advocate and Dr. Gurmit Singh, advocate.

<sup>33</sup> Personal discussion with Shri Inderjit Singh Jaijee

<sup>34</sup> See also, for example, Swami Praaveen, *Suicide Stories* in, Frontline, April 24, 1998

# 11

## Waterlogging and Salinisation

*“The State of Punjab is experiencing very serious problem of water-logging in the south-western districts namely Faridkot, Ferozpur and Bhatinda, over the past few years. The water table has been continuously rising ....Vast areas of this tract have been water-logged with the result that thousands of hectares of land have gone out of cultivation, buildings have started crumbling down and roads have been badly damaged. It has been estimated that waterlogged areas ...is of the order of about 2 lakh hectares...”*

**Waterlogging, Soil Salinity and Alkalinity:**  
Report of Working Group on  
Problem Identification in Irrigated Areas  
with Suggested Remedial Measures,  
Government of India 1991

*“We pray that it should not rain, so that we can at least get some crops”*

**Farmers in Village Lohgad,**  
Dist. Sirsa, Haryana



## Waterlogging and Salinisation

FOR THE FIRST TIME IN OUR LIVES, WE HEARD FARMERS PRAYING THAT IT should not rain. Even in the best-irrigated areas, rain is always eagerly awaited and much appreciated. Yet, here were farmers praying that it should not rain - not that it should not rain for a few days, but that it should not rain -at all. Their plight was understandable, though. With their lands oozing water, with ordinary farms being transformed into marshland and even ponds, the only chance of their getting some crop was if the season remained bone dry. Lohgad is just one of the many villages in the commands of Bhakra project that have been struck by the disaster of waterlogging and salinisation.

### WHAT IS WATERLOGGING AND SALINISATION

In most simple terms, waterlogging – accumulation of excess water in the soil – occurs when there is an imbalance in the inflow and outflow of water in an area. Every part of land has, over centuries, developed a natural equilibrium between the water inflow – in the form of rain, underground flows etc. – and the outflow, in form of surface and subsurface flows and drainage, evaporation and so on. Massive “non-natural” inflow of external water from canal irrigation without equivalent outflow disturbs this equilibrium and results in rising water tables as the excess water percolates into the ground and accumulates. The accumulating water can come from direct seepage from the canals or from field applications of irrigation.

Another form of waterlogging is the temporary surface ponding of monsoon or flood waters. This can be due to several reasons, including disruption of natural drainage due to construction of canals, roads, blockage of drains etc. Another reason is that when waterlogging - in terms of rising water tables has already taken place, then the capacity of the ground to absorb monsoon waters diminishes and this too can lead to surface ponding.

As water accumulates, the level of ground water rises. When this reaches the crop root zone, it starts to have a serious impact on crop productivity, ultimately making the land totally unproductive and rendering the land into a wet desert.

This water dissolves the salts from the soil, and brings them to the surface, where they are deposited as the water evaporates. This results in the salinisation of the soil, again, affecting productivity adversely. Both these phenomenon normally go together. Another important mechanism of salt deposition is the irrigation water itself - whether from the canals or from groundwater. When the irrigation water evaporates, the salts that it contains are left behind. It is estimated that the canal waters bring 2 million tonnes of salt on the soil in Haryana every year.<sup>1</sup>

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<sup>1</sup> Ghassemi F, A J Jakeman, H A Nix 1995: ‘*Salinisation of Land and Water Resources*’, Centre for Resource and Environmental Studies, Australian National University, Canberra; quoting Rao et al 1990.

## IMPACTS OF WATERLOGGING AND SALINITY

“Waterlogging not only affects the agricultural land and crop productivity but also affects the growth of trees and other plants....

“Waterlogging obstructs or stops the normal circulation of air in the soil root zone inhibiting activity of soil bacteria as oxygen is not drawn in the soil and carbon dioxide liberated by the plant roots cannot be dissolved and carried away. The concentration of carbon dioxide reduces the decomposition of organic matter...lacking nitrogen fixation and thereof nitrogen deficiency. The high water table and waterlogging do not permit room for growth of plant roots....In waterlogged area the agricultural operations are either impossible or difficult. The crop yield is also very poor or negligible.”<sup>2</sup>

According to Bhamrah<sup>3</sup>, the areas which have become waterlogged and salt infested, the crop yields have substantially decreased. He mentions a study which finds yields of paddy and wheat were 41% to 56% lower and net incomes in salt affected lands were 82% to 97% lower than unaffected lands. More generally:

“The adverse effects of water logging and soil salinity / alkalinity render fertile soil unproductive and sometimes even barren. ...According to the Ministry of Water Resources (1991)<sup>4</sup>, an area of 5.8 m ha was suffering from both these problems in the commands of major / medium irrigation projects in our country. This hinders the use of irrigation resources costing about 24,000 crore rupees... an annual loss of Rs. 2800 crores. The loss of foodgrains were calculated as 17 m tones which cost about Rs. 7000 crores.”<sup>5</sup>

Waterlogging does not affect only agriculture. It also has a devastating impact on trees, on roads, buildings and infrastructure. It also leads to much higher flooding as the ground, already saturated with water, does not allow the rainfall to permeate and all of it is converted to run-off.

The phenomenon, according to Ghassemi *et al*<sup>6</sup> is “threatening the livelihood of one million farmers and their families, and having a significant influence on the food grain production of Haryana and in turn of India as a whole.”

### Not to be alarmed?

Vast areas are affected by waterlogging and salinity in Punjab and Haryana including in the command area of the Bhakra project.

Some tend to dismiss the twin problems of waterlogging and soil salinisation as a temporary phenomenon, a by-product that can be “dealt with”, or something that affects a small part of the canal commands.

<sup>2</sup> Tanwar, B.S. 1996: ‘*Water logging and Salinisation in India - Remedial Measures*’, in Varma, C V J (Ed) (1996): ‘*Proceedings of Workshop -Waterlogging and Soil Salinity in Irrigated Agriculture, Karnal, 12-15 March 1996*’, CBIP, New Delhi. & CSSRI, Karnal.

<sup>3</sup> Bhamrah P.J.S. 1996: ‘*Conjunctive Water Use Strategies to Control Waterlogging and Soil Salinity in Irrigated Commands*’ in Varma, C V J (Ed) (1996): ‘*Proceedings of Workshop -Waterlogging and Soil Salinity in Irrigated Agriculture, Karnal, 12-15 March 1996*’, CBIP, New Delhi. & CSSRI, Karnal.

<sup>4</sup> The report being referred to here is India, Government of (1991): ‘*Waterlogging, Salinity and Alkalinity - A Report of the Working Group of Identification of Extent of Affected Areas and Suggested Remedial Measures*’, Ministry of Water Resources, Government of India

<sup>5</sup> Bhamrah 1996

<sup>6</sup> Ghassemi F, A J Jakeman, H A Nix 1995: ‘*Salinisation of Land and Water Resources*’, Centre for Resource and Environmental Studies, Australian National University, Canberra; quoting Tanwar and Kruseman 1985



According to B.G. Verghese<sup>7</sup>:

“The thesis that Bhakra and the green revolution it sustains has devastated the land with waterlogging, salinity and chemical toxicity leading to soil death is patently absurd. There are certain problems of land and water management but these are being addressed. Alarms about salinity and waterlogging have been sounded in India since the development of the Ganga canals 140 years ago. Not that this should breed complacency; but there is little cause for despair.”

But the figures, and official documents, tell an entirely different story.

As per Shri Vinay Kumar, Vice Chancellor, CCS Agricultural University, Hissar<sup>8</sup>:

“In Central and south-western regions of Haryana ..... canal irrigation has led to the problems of water table rise, waterlogging, flooding, and secondary soil salinisation..... A current estimate of saline and waterlogged areas in the state is around 4000 km<sup>2</sup> [400,000 ha] and if suitable measures are not taken, the areas with such problems is likely to increase to about 20,000 km<sup>2</sup> within the next 2-3 decades.”

As the irrigated area of Haryana is about 28 lakh hectare, this means that already about 14% area is affected and this can go upto 70%.

### EXTENT OF THE PROBLEM IN BHAKRA COMMAND

Unfortunately, available data is often not categorised as per project commands; it is often only at the state level, or categorized as per districts.

Tanwar (1996) quotes the following data about Punjab and Haryana (for the whole states) for 1990-91 from Statistical Abstracts<sup>9</sup>:

	<b>Waterlogged Land</b> (ha)	<b>Salt Affected</b> (ha)
<b>Haryana</b>	249,000	197,000
<b>Punjab</b>	200,000	490,000

### Haryana

Latest figures available are district wise and not project wise. The Haryana Government classifies the areas as Fully waterlogged (groundwater level between 0-1.5 m), waterlogged (1.5-3 m) and potentially waterlogged (3-10m). The waterlogged areas in Haryana for the Bhakra commanded districts in 1997 were 107,200 ha as fully waterlogged and 246,000 as waterlogged.<sup>10</sup> Hissar, Sirsa and Fatehbad districts account for 72,000 ha and 124,000 ha respectively out of this.

In 1986, Government of India set up working group, “Waterlogging, Soil Salinity and Alkalinity : Working Group on Problem Identification in Irrigated Areas with Suggested Remedial Measures”. This Working Group submitted its report in 1991. The Working Group

<sup>7</sup> Verghese B.G. 1994: ‘*Minus Bhakra*’ in Verghese B.G. 1994: ‘*Winning the Future: From Bhakra to Narmada, Tehri, Rajasthan Canal*’, Konark Publishers Pvt Ltd, New Delhi: Page 38

<sup>8</sup> Dhindwal *et al*, (Ed) 2000: ‘*Management of Waterlogging Problem in Haryana*’, Director of Extension Education, CCS Haryana Agricultural University, Hissar. July 2000

<sup>9</sup> It is not clear if these figures are only for canal commands, but it is certain that most of these lands will be from the canal commands.

<sup>10</sup> HIRMI *Sinchai Patrika* March 1999: Page 7

reports data for Haryana from June 1986 (when waterlogging is lowest as it is pre-monsoon time) for the *Bhakra Command* as follows<sup>11</sup>:

District	Waterlogged Areas (Thousand Ha)
Kurukshetra	9.218
Hissar	19.0
Sirsa	20.35
Ambala	0.600
<b>Total</b>	<b>49.168</b>

The same report also gives salinity-affected area as 275 thousand hectares in Haryana but no project-wise break up is given.

### Punjab

For Punjab, the Working Group (GoI 1991) gives only district-wise waterlogging figures and not project wise. These are given as:

District	Waterlogged Areas (Thousand Ha)
Faridkot	161.975
Ferozpur	14.85
Bhatinda	21.75
Total	198.575
<b>Say</b>	<b>200.00</b>

Some areas in these districts<sup>12</sup> are in the Bhakra command. The comments of the team are very significant:

“The State of Punjab is experiencing very serious problem of water-logging in the south-western districts namely the (sic) Faridkot, Ferozpur and Bhatinda, over the past few years. The water table has been continuously rising ....Vast areas of this tract have been water-logged with the result that thousands of hectares of land have gone out of cultivation, buildings have started crumbling down and roads have been badly damaged. It has been estimated that waterlogged areas ...is of the order of about 2 lakh hectares...”

Latest figures are not available project-wise.

According to a Punjab Agriculture University (PAU) study quoted by Dasgupta<sup>13</sup>, the estimated waterlogged area in Mukhtasar and Malout districts (which earlier were part of the above three districts) in 1997 was 115,000 ha which increased to 180,000 ha in 1999.<sup>14</sup>

<sup>11</sup> Government of India 1991: Page 48

<sup>12</sup> The then three districts - today some more districts have been carved out of the same region like Moga, Mukhtasar, Mansa

<sup>13</sup> Dasgupta, Kumkum (2000): ‘*Is the Joyride Over?*’ in *Down to Earth*, August 15, 2000: Page 35

<sup>14</sup> A word of caution about the different figures. Many of the figures may not be strictly comparable with each other. This is due to three reasons. One is the timing. Waterlogging is normally measured two times – once in June, before the monsoon and second in October after the monsoon. Secondly, definitions vary across states. Some states may consider up to 3 m level groundwater as waterlogged, others like Haryana may categorise this further in two ranges 0-1.5 m and 1.5 m to 3 m. Thirdly, due to the break up of districts over the years, district figures of one year may not be directly comparable.

## Rajasthan

For Rajasthan, we were unable to find any figures for waterlogging and salinity problems in the Bhakra command. The figures given are mainly for IGNP command area, where the problem is very serious. The Bhakra areas in Rajasthan border the IGNP first phase areas as also the Hissar / Sirsa tracts, and we can expect the problem of waterlogging and salinity to be present here also.

The Working Group (Government of India 1991) figures for Rajasthan are only for IGNP Stage I, and it says that 179,500 ha out of the CCA of 540,000 are affected by waterlogging. This is about 33%.

According to the Director General, Indian Council of Agricultural Research, “despite certain measures taken up in developing the command of Indira Canal, serious problems of waterlogging was observed.”<sup>15</sup>

A recent press reports presents information on how thousands of hectares of lands around Baropal in Hanumangadh district in Rajasthan have been affected by waterlogging<sup>16</sup>.

The data from monitoring of groundwater levels in Rajasthan shows that the groundwater level has been rising every year in the Bhakra command, with the average annual rate of rise of water table ranging from 0.32 m to 0.91 m.<sup>17</sup>

## SOME CASE STUDIES

As always, statistics conceal the individual tragedy. We visited several places in Haryana and Punjab affected by waterlogging and salinity and witnessed the great havoc that these have played with the lives of people. Some of these are outlined below.

### Village Badopal, District Fatehabad, Haryana.

Badopal lies on the NH 10 between Hissar and Fatehabad. Badopal was initially a part of the Yamuna command. Around 1955, the village came under the Bhakra command. Until 1985, the canals were completely unlined. Since the canal here is the Fatehabad branch, it is always flowing.

The waterlogging problem in this village first became evident in 1978. The problem assumed very serious proportions. According to the local *patwari*, the problem was so severe that the water would stand in the field. From 1986 to 1989, it was not possible to take any crop whatsoever. Even after the lining, the problem still remains. It is not possible to take a proper crop in kharif season, and cotton was impossible to grow. The only crop here is the rabi wheat. The people in the village confirmed that since 1978, they had not been able to take the *shravani* (kharif) crop at all. Some people could not even take rabi crop. About 75% of the lands have been affected by waterlogging. As a result of this, about 25% of the people the financial position had become very bad and they were in debt.

Apart from the crop production, there have been other very severe impacts due to waterlogging. The people told us that the houses had sunk into the ground up to 2 feet. The temple that was built just in 1992 has sunk in (*baith gaya hai*). The trees have also died due to waterlogging (*ped bhi jal gaye sem se*). The buildings are also being damaged – they have to be repaired every year. In all the buildings in the village, there is seepage from the sides. At one time the situation was so bad, that the cattle used to get stuck in the ground. If four people

<sup>15</sup> Statement by the DG at the 41<sup>st</sup> Meeting of the Environment Sun-group of the Narmada Control Authority, held on 6 January 2005 recorded in Minutes. Page 6

<sup>16</sup> “Water-logging leads to migration” Amarjit Thind, Tribune News Service, The Tribune, Chandigarh, May 22, 2001. Downloaded from the net from : <http://www.tribuneindia.com/2001/20010522/nation.htm#13>

<sup>17</sup> Government of Rajasthan 2002c: 365

sat on a *khat* (cot) it would sink into the ground. They could not even go for toilet outside – there was no place that was not waterlogged for several kilometres.

We visited a factory building in this village. The whole building is sinking, with differential settlement of the sides. So the owners have put in various types of supports and reinforcements – rods, lintels etc. New buildings are also developing cracks in the village within 2 years. We were also told that the national highway NH 10 had to be lifted some 6-7 feet due to problems of waterlogging – this was in a patch of 3-4 kms.

We also visited the water works of the village which was on the main road. This was supplying water to Badopal and Dharni villages. This was abandoned last year because the waterlogging had come up and destroyed the water tanks. The ground water had seeped into the water tanks. Ground water is saline here.

The village *johad* (tank) was good before, but is now destroyed because of waterlogging. Now even the cattle do not drink from the *johad*. Even the wells are similarly affected.

About 10 years ago, the Government made a monsoon surface water drain. (*sem nala*). Tubewells were installed along the canals in 1994-1995. There has been some benefit of this. Earlier, the water level near the canals was at 1 foot, now it has gone down to 6-7 feet. However, the problem has not been fully solved. The people told us that since last two years, there has been little rain, so the situation is tolerable. However, they are very apprehensive that if there is normal rainfall, then the problem will re-surface.

#### **Village Lohgadh, District Sirsa.**

Lohgadh is a village in Haryana which borders Punjab and Rajasthan. Lohgadh was also a part of the Yamuna command, until it was included in the Bhakra command in 1964.

This village has been badly affected by waterlogging.

Before going to the village, we stopped some way off outside the main village to talk to a number of people of the village and nearby. They told us that the waterlogging problem is due to the canals. The problem is so severe in places that small streams erupt from the soils. (*jameen se jharne bahane lage hai*). This has affected about 1000 ha of land. For one year the Chief Minister put a tubewell there, but there has not been any appreciable difference. Then a drain was built. But again there has been no difference. In fact, the problem is increasing. It has been very severe since last 3 years. We were also told that it is not only the lands near the canals that have been affected but also the low-lying lands. No crop now grows on these lands. Earlier, the cost of the lands was 2,70,000 Rs. per acre, now it is only 100,000 rupees and even 25,000. In some lands, while crops can be grown, the yield is very less.

The lands around the village were devastated. One patch of land had been converted into a pond! Another piece of land had turned totally slushy. We were told that some paddy crop was just harvested from this land, and the combine that had gone to harvest the same had been stuck for 4 days. Now even a tractor cannot go into the land, there is no chance of any crop being planted on this.

One of the woman showed us her land near the drain *nalla* on the way to Malout, and told us that she had only 1 acre of land. For 5 years there has been no yield on this. May be a little *dhaan* (paddy) – about 20% of the normal. We saw the land, it had much water in it - and this was on land next to the drain. On asking how they survive, she said that 2 children have been sent by her to her parents. She does wage labour work and manages. But the persons who are land owners, they cannot even do this labour work, since it is considered very much below status.

From here, we went into the main village. On the way, our guide who knows the area well pointed out to us the empty houses in the village. These people have left the village, as their

land has become unproductive due to waterlogging, he told us. When we reached there, a meeting of the village was in progress with the agricultural extension officers. We joined the meeting to discuss the various problems including waterlogging. We were told by the *sarpanch* that the problem of waterlogging has been here since about 8-10 years, but has become very severe in the last 5 years. About 1000 ha from the total of 9000 ha of the village land has become bad. Another person added that the impact is felt in the whole land area of the village, not just the 1000 ha. In some places it is severe and there is no crop at all, in others the production has drastically fallen.

Shri Sukhdayal told us that he and his brothers had about 35-40 acres land. The whole land has gone out of production. (*puri khatam ho gayi*). He went running from pillar to post all the way to the Chief Minister, but to no avail. (*sabhi door pagalon ki taraha ghoomte rahe mantri se CM tak*) Jaypal Kishorilal Sethi told us that he had 50 acres of land, all of it has gone into waterlogging. He then took some land on contract from someone else, but even on that, the crop did not grow well. He had sowed *narma* (Cotton). In fact, ultimately he lost his own money in it. Kewal Krishna said that he had 8 acres of land. They are four brothers. The whole land has become waterlogged. So now his brothers have gone away to Karnal - due to the waterlogging. There is no work here. We were also told that many of the people have incurred heavy debts, and many have left the village.

In this village also, we were told that the Government has constructed a drain to solve the problem, but this has had little impact. We were told that the drain is blocked because there is no place to empty it into. The drain that we saw just outside the village (on road to Malout) was only half complete, not leading to anywhere. It was very shallow and had stagnant water.

We asked the villagers about how they were surviving if the lands were so badly affected. They told us that the agricultural people (officials of the agriculture department) tell them to start a fish farm, or sow vegetables. But, according to Sukhdayal, these were all trial and error methods. They tried sugarcane also, but it did not work out. Many people also tried to take lands of others on contract basis, but that too was not working out. Ultimately, many have just left the village or landed in debt.

### **On Way to Malout Town in Punjab**

On the way from Lohgad to Malout, we saw the drainage *nalla* near village Fattakheda, Dist. Muktasar Punjab. The *nalla* is encrusted with salt, showing the high salinity of the water.

On the way from Mandi Dabwali to Malout (a distance of 31 km), after about 10 kms or so, the smooth, very good National Highway NH 10 suddenly became extremely bumpy. The jeep's speed had to be reduced drastically. The tar road was like a wave. This was the condition of the road almost all the way to Malout. In about 10 km patch of the road, the tar top had been removed and work was going on to raise and repair the road. All this was due to the waterlogging which had affected the road. Roads in a number of places have been badly affected due to waterlogging.

### **Malout Town, District Muktasar, Punjab**

Malout is a town on the NH10. Malout region has been one of the worst affected areas of water logging. The entire region over 60 kms. from Malout to Faridkot and Muktasar has been affected.

In this town, we met some of the faculty members in the D.A.V. College, a school teacher who is also a union activist, a labour union activist and a journalist with the Punjabi Tribune.

Dr. Baljit Bhullar told us that the problem of waterlogging has been prevalent since last 10-12 years. Most severe impact has been for 2 years. From Malout to Faridkot, Muktasar, the whole patch of 60 kms was severely affected. The *sheesham* trees have been completely destroyed.

(*poore jal gaye*) This has resulted in the loss of hundreds of crores of rupees. Even the most ordinary tree of *sheesham* fetches about 5000-7000 rupees. When even the crops failed, the people resorted to large scale cutting of sheesham trees for fuel. Sheesham was a very important and traditionally abundant tree here. In other parts of Punjab too, we saw in large number of places, the *sheesham* trees completely defoliated, and blackened. (Details later)

Dr. Bhullar gave us an example of his relatives who did not get any crop for 8-9 years. The crop failure was such that they did not get even fodder for the cattle. Since about 4 years, the drain *nalla* has been made, and smaller drains have been put in place in the fields. So now the villages have been drained but still situation is not normal. It took two years to build the drains. Even the JCB (excavators) could not get in to the area – so much was the waterlogging. So this – work on the drain *nalla* - was the only means of livelihood for the *jamindar* (Farmer)

Dalbir Singh, journalist told us that the horticulture has been fully destroyed. Fruits like *kinno*, *amrud*, grapes, all have gone because of the waterlogging. We were also told that the cotton crop of this area has been destroyed due to too much moisture. Now, the farmers get only sugarcane, paddy, wheat. The impact of this is that earlier there were 10 cotton factories, now only 2 are left.

Shri Sudarshan Jagga told us that the situation was so bad that if a tractor was left in the field in the night, it would have sunken in by the morning. Some special machines came into the town to pull out such sunken vehicles. And they were charging huge amounts for this. Total of three cranes were operating in Malout at that time.

All this had a severe impact on the livelihoods of the people. According to Dalbir Singh, for first 15-20 years (after the canal came), the production was good and increasing. But now, after the waterlogging has come, it has started falling. The most severe problem of waterlogging started in 1995. Shri Jagga said that since the area has rich peasantry, they did not land in hunger. (*bhookhmari nahin hui*) But the labour that was coming from outside stopped coming. There were 10 cotton factories, now only 2 are left. In their school the children cannot even afford exam fees, such is the situation. He also added that the smaller farmers were worst affected and they became debt ridden. They had to mortgage their lands. Or, they took land from someone else (like those people who were in service) on contract basis. Dr. Bhullar said that some small farmers started activities like poultry, fish farming. But he didn't know how effective these things were. Others used to come every morning in the *mandi* in Malout looking for *majdoori* – for wage labour. But so much work was not available.

After the drain *nalla* had been put in place, there was some improvement. However, even now, the agriculture has not yet become fully normal. Dr. Bhullar, Shri Jagga and Com. Ramkrishna, all said, though not with much confidence, that if the drain *nalla* is completed, it will be a permanent solution to the problem. However, this was clearly more in a tone of wishful thinking, as their later statements showed. All the three said that normally the waterlogging would just go away automatically, by itself. They also said that they couldn't say that a technical solution will permanently solve the problem. Shri Jagga said that actually, even the work of the drain *nalla* is casually done (*khanapurti*). The thing is that it has not rained since last three years. If it rains normally, then the problem will come up again.

Shri Dalbir Singh expressed the same opinion. He also had a more detailed knowledge of the problem. He told us that the waterlogging had come about due to seepage from the canals. The Government had put up number of tubewells and these pump up the water in to the Sirhand Canal. But people are unhappy about it as the water is saline. A drain *nalla* was also built at great expense. However, this has not been very effective. At most, it can take care of the rainfall run-off. There is also the problem of reverse seepage from drainage *nalla* to the lower lying fields. The situation is somewhat satisfactory since there has been little rainfall in the last two years. Dalbir Singh expressed the apprehension that if the rains were normal, then the problem would arise again. Almost none of the tubewells are working, mainly due to non-

payment of electricity bills. Many people have paid money and got the alignment of the drain *nalla* changed.

Later, we went to see the drain *nalla* just outside Malout. The *nalla* was completely choked up with an overgrowth of water hyacinth. We were also told that the *nalla* is used for dumping effluents and sewage. The water in the *nalla* was stagnant and not flowing.

There have been other very serious impacts of the waterlogging apart from agriculture. The whole town is like a ravaged town. When it rains, water gets into about 70% of the houses. The NH 10 had to be raised at Malout (like in Badopal and other places). Since the rainwater used to enter the city and the houses, people had also to raise the height of the houses from the ground. Even without rains, the waters have seeped up along the walls of almost all the houses. The paint on the walls has peeled off. Almost all the walls in all houses invariably have the bottom 4-5 feet damp and wet because of the rise of water from the ground. There has been differential settling as the foundations have been affected and this has led to extensive cracks and weakening of the houses and even collapse. The houses have to be repaired every now and then.

We visited the house of Dr. Bhullar. Dr. Bhullar's house is a classic example of how the buildings in the town have been affected by waterlogging. He had first got it repaired about 7-8 years ago, and then about 4 years ago, he had got several parts of it raised by few feet. Even now, he has to redo the plastering every now and then. Cracks can be seen in all the walls. About 70-80% of the houses in the town have been similarly affected. Even now, the side walls of his storeroom are damp, and though there is no bathroom on any side of the room, when it rains, water starts filling in in the room. When the GT road (NH 10 is called GT road here) level was raised, he had to raise the level of his house so that water would not come in.

Shri Jagga said that in his school there used to be water upto the level of 2 feet! Now they have raised the level of the school, but still the dampness stays.

#### **Village Lambakhedi, Tehsil Narwana, District Jind. Haryana**

Lambakhedi is 17 kms. from Narwana. The village was earlier in the Yamuna Command, but since 1964 or so, gets its waters from the Sirsa Branch of the Bhakra canal system. The problem of waterlogging started around 1978. The total agricultural land in this village is 2000 acres. Of this 1200 acres (60%) have been completely affected by waterlogging and cultivation of crops is not possible on them. While the remaining 40% is cultivable, there has been a dramatic fall in the crop yields. A pilot project for the control of waterlogging and soil salinisation has been undertaken in this village with cooperation from the Netherlands government. (The Haryana Operational Pilot Project).

Jilar Singh (Retd. SDO, Irrigation, staying at Kurukshetra) told us that the main reason of waterlogging is the canal water. Ground water here is bad. From 1952/53 till 1978 the agriculture was very good. He did not know the situation before 1952. After 1978, it started getting bad and the crops started failing. For many farmers, the failure was total. All three crops would fail.

People told us that the impact of waterlogging has been serious. Farmers try to take both, the rabi and kharif crops, but even where any crop is possible, productivity is very low – less than 50%. Many fields are lying empty. They had been sown, but nothing grew. The crops that used to grow before the Bhakra canal included Chana, Sarso, Masri, Moong, udad, all dals, til, turiya, sugarcane, bajra, juwar, arhar, cotton, makka, chili, tobacco, shan. After 1970-71, these went down. Now, only jiri (dhaan or paddy) and wheat are left. They can't take the other crops. Waterlogging was given as one of the main reasons behind this.

About 20 families have left the village in search for a regular income job due to this.

The Government built a surface drain around 1983/84 and this village was joined to the drain around 1987. While there was some relief and people had some thing to survive on, the impact was limited.

Now the Netherlands sponsored project for sub-surface drainage has come. The project involves laying a horizontal net work of perforated pipes below ground to drain the underground water. This is then collected in a sump and pumped out. Since the underground channels are being laid, the villagers hope that the problem will go away. The drained water from this will be put into the canal. However, the water is saline and there doesn't seem to be any clarity as to where it will actually be thrown, except that it should not be used for irrigation. But this is exactly what is happening.

The lands of this village show visually in a dramatic manner the impact of waterlogging and salinisation. Large patches of land are vacant of any crop; in large areas the crop is growing only in patches. Salt encrustation is also seen everywhere on a large scale.

We then visited the Haryana Operational Pilot Project (HOPP). This project is supposed to be implemented on 10,000 ha in Haryana initially. It was started first in Gohana (Dist. Sonapat) and results were reported to be encouraging. There are 12 such projects in progress in Haryana involving 10,000 ha. (See detailed discussion on HOPP later on)

The Lamba Khedi component of the project is spread over 1100 ha, divided into 22 blocks of 50 ha each. It is one year since this project has started. The cost is Rs. 15,000 per acre or 37,000 per hectare. As of now, the trench cutting and laying machines have been given by Netherlands. The running cost is in addition to this. It needs to be run for about 6-8 hours daily when necessary (8 HP engine). Running cost of diesel is to be given by villagers. Eventually, the whole set up is supposed to be run by the villagers themselves. The estimated life of the project is 30 years.

The project has had some impact as the land was so waterlogged that nothing could grow. Now some wheat and *sarso* has been planted. Some *sarso* seems to have come up well, wheat is sparse. As with the whole project, one of the main issues with this component is about how and where to dispose off the saline water collected in the sump. There is lot of uncertainty about this. As of now, the water collected is being taken by a farmer for irrigation in spite of being told not to. As per the operator, this project is an attempt, not a solution (to the problem of waterlogging).

Since it has not rained well for last few years, no one knows what the impact will be if it rains normally. People are apprehensive that if it rains normally, then the problem will relapse to as before.

### **OTHER IMPACTS OF WATERLOGGING**

One of serious impacts of waterlogging - rather - of the increased soil moisture has been the sharp decline in the cultivation of pulses. While there have been other reasons for decline in pulses - the green revolution policy focused on rice and wheat to the exclusion of all other crops - the high moisture content has made cultivation of pulses physically impossible. Large number of farmers told us this - that it is no longer possible to grow *dalhan* and *tilhan* in these irrigated lands.

The decline in pulses not only has had a serious impact on nutritional balance of food grain production in India, it has also locked the farmers in the two states into the main crops of rice and wheat. In spite of repeated recommendations of expert committees to diversify the crops, it is difficult for farmers to go back to pulses, which can become an economically valuable crop for the farmers with the escalating inputs costs of wheat, rice and cotton. (See the discussion on cropping pattern for more details.)



### Impact on Trees

In Malout we were already told about the impact of waterlogging on fruit trees like Kinnu and also on important trees like sheesham. Almost everywhere we travelled in Punjab and Haryana, we saw that the sheesham trees had blackened and died - except in areas where there was no canal irrigation!

We were told that this is due to waterlogging. Official and other reports corroborate what we have seen.

An activist in Punjab, involved in bio-diversity issues, informed us that “very upright forest officer from Haryana” had been telling her about the “emerging crisis” of sheesham and kikar trees which are dying and it is largely due to waterlogging.

In 1999, the Indian Express dated 13 December reported:

“Sheesham trees are dying, sending forest scientists into a tizzy. The first calls reporting en masse wilting of Sheesham trees came from all over north India North Bihar, Haryana, UP and Delhi. ....

“Over the last one year, the number of calls was enough to get the premier Forest Research Institute (FRI), Dehradun to get worried. Immediately teams were sent to these states that confirmed their worst fears— the Sheesham mortality rate was significantly high.....

“Root samples were brought back and studied and preliminary reports given. In all the dead trees, root seemed to be infected by a fungi called fuserium, which essentially prevents the roots from absorbing the nutrients. Fuserium, though always present in the soil, was attacking the roots because of increased moisture content in the soil. The result: The trees would suddenly dry and then die.

“Scientists are working on various hypotheses. .... In Haryana with canal irrigation, there has been an increase in the water table level, increasing the moisture content in the soil. And Sheesham can only thrive in sandy loam soil.”

A paper by M.K. Sharma and others<sup>18</sup> of *Indian Council of Forestry Research & Education* on the dying of sheesham trees in North India, while stating that the reasons for the phenomenon are not fully understood, makes the following observations:

“During recent surveys to different states i.e. Bihar, Haryana, Delhi, Punjab, Himachal Pradesh and Uttar Pradesh, sissoo mortality was observed to be prominent either in isolated trees or on the plants growing on agricultural bunds, roads and canal side.

“In Haryana, an alarming 30% mortality in the major plantations i.e., Sirsa, Hissar, Rohtak and Gurgaon have been reported.

“Sissoo mortality in natural forests, plantations and agroforestry systems appears to be a complex phenomenon involving a combination of many environmental stresses. The factors responsible for tree mortality are poorly understood.

“In the recent past, a large-scale mortality has been reported from the northern states of India, viz. Bihar, Delhi, Haryana, Punjab, Himachal Pradesh and Uttar Pradesh. Being an important timber species, it has not only disrupted the economic targets of State Forest Departments but also incurred financial losses to big and marginal farmers.

<sup>18</sup> Sharma M.K., R.M. Singal and T.C. Pokhriyal 2000: ‘*Dalbergia Sissoo In India*’. Paper presented at Sub-Regional Seminar “Die-Back of Sissoo (*Dalbergia sissoo*)” Kathmandu, Nepal, 25-28 April 2000. The authors were from Indian Council of Forestry Research & Education, New Forest, Dehra Dun-248006 India

“Sissoo mortality on road and canal sides in Bihar, Haryana and Himachal Pradesh can be correlated with prolonged water logged conditions during rainy season and seepage of canal water.

In 1998, surveys were done in Haryana. In Ginnaur a pure stand of sissoo along the canal bank recorded very high mortality – 400 trees in a block were found suffering from wilt disease (pers. Obsns.). The area was water logged and the site was silty.”

Clearly, waterlogging has played a critical role in the massive destruction of this valuable tree in Punjab and Haryana.

### **Impacts on Roads and Infrastructure**

Waterlogging creates havoc as far as roads and other infrastructure is concerned. We have already described the condition of some roads witnessed by us. In Haryana, official figures state that waterlogging has caused extensive damage to the roads. About 90 kms of state roads and 150 kms of district roads will need to be raised<sup>19</sup>. No mention is made of national highways presumably because they are not the state's responsibility.

Buildings, houses, factories too have been extensively damaged by waterlogging. While we have described this in the reports of Malout and Badopal, unfortunately there do not seem to be any attempts by the official agencies to assess the extent of this damage.

### **REMEDIAL MEASURES**

The obvious question in this context is— whether there are any measures that can halt, prevent and reverse this problem. And, at what costs?

Since waterlogging is a result of accumulation of excess water, the remedial measures all revolve around provision of drainage. Broadly, the drainage measures are of two types - surface drainage and sub-surface drainage.

The simplest type of drainage is to pump out the water. This is called vertical drainage - for obvious reasons. The water that is pumped out can then either be used for irrigation on field (conjunctive irrigation), or added to the canal water (augmentation), or disposed off.

Another form of sub-surface drainage is the so-called horizontal drainage - where a horizontal network of perforated pipes is buried underground, and this draws out excess water from a large area, which is then collected in a sump. This water is then pumped up, to be used for irrigation, or mixing with canal waters or disposed off. (The HOPP described in the section on village Lamba Khedi is an example of this).

Surface drainage normally consists of small field drains that collect excess waters and drain into a main drain. Surface drains are especially helpful in draining away excess or accumulated rainfall. One can give a rough analogy here of arteries and veins for the canal and drainage network - one brings in the extra water and the other removes the excess.

This, in simple terms is the fundamental armour in dealing with waterlogging. We will examine the working and efficacy a little later.

One important way to prevent salinisation of soil is to prevent waterlogging, since waterlogging is responsible for drawing out the salts from the soil. Another important way to prevent salinity is to avoid irrigation with saline ground water. However, it must be noted that all water (canal and ground) contains dissolved salts, in smaller or greater quantities, and these salts are left behind when irrigation water evaporates or is transpired by the plants. These deposited salt also add to the salinisation apart from salts brought up from the soil due to

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<sup>19</sup> HIRMI *Sinchai Patrika*- March 1999 Issue 6 Page 11

waterlogging. The way to address this problem is to leach the salts out, either through rainwater or through canal irrigation. This requires copious amounts of water.

This in conceptual terms is how the drainage works - in practice, there are significant limitations to each of these methods, as well as significant costs.

The problem of waterlogging and salinity is easier to handle in the areas where the ground water and soils are not saline. In such cases, the water that accumulates can be pumped out and used for irrigation or for augmenting canal supplies. This is both a remedial measure as well as a preventive measure. This is what happened in eastern parts of Punjab. According to the Working Group set up by the Government of India:<sup>20</sup>

“The figure of 10,57,000 ha reported as waterlogged area in Punjab reported by NCA 1976 is found to have come down as 2,00,000 ha. This is on account of conjunctive use of surface and groundwater on one hand and provision of drainage component in irrigation schemes and extensive program of shallow tubewells on the other”.

The large scale development of tubewell irrigation in Punjab and Haryana after mid 60s resulted in amelioration of water logging in many parts. This, in many ways is also the reason for the optimism that is displayed that this is a problem that just needs some management and it will go away. In large parts of Punjab and Haryana we heard this optimism expressed in terms of saying that waterlogging problem “will go away on its own” or that “we just need to manage it better”. This, however, is false optimism, not warranted by the situation on ground.

The problem of waterlogging and salinisation becomes extremely difficult to handle in areas that are underlain with saline water - as is the case in semi arid and arid areas. It is precisely these types of areas that constitute a significant part of the Bhakra command area, and are the areas where these twin problems have assumed alarming proportions. As the Master Plan prepared by the Government of Haryana states, “The areas experiencing the rise in water levels are primarily underlain by brackish groundwater”.<sup>21</sup>

The most critical problem with any method of tackling waterlogging and salinity in such areas is what to do with the effluent that is generated. This severely limits the efficacy of all types of measures.

In case of vertical drainage (pumping), it is difficult to use the pumped water for direct irrigation since this will rapidly result in salinisation of the soil. There is also the problem of the salt tolerance of the crop itself.

The excess water seeping in from canal irrigation mixes with the saline groundwater and itself becomes saline. In some case, this seepage from canals which has good quality water forms a layer on the top of the saline water, and can be “skimmed off” by vertical drainage, but this has limited possibilities and can lead to what is called “upconing of saline water”.

Mixing the pumped water with canal waters to dilute the salinity is practiced, but it has serious problems not only because the same canal water is used for irrigation later on, but also because the canal water is used to supply drinking water in many areas. Moreover, this process has its limits as using it again and again can lead to concentration of the salts.

Sub-surface horizontal drainage (HOPP type method) is also advocated as a solution in these areas but faces similar problems. Surface drains too beg the question on the disposal of the effluent.

Leaching out accumulated salts too is difficult since the rainfall in the arid and semi-arid areas is less and large quantities of canal waters may not be available for this purpose.

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<sup>20</sup> Government of India 1991: Page 133

<sup>21</sup> Government of Haryana (1998): ‘*Management of Waterlogging and Salinity Problems in Haryana, Master Plan*’, Prepared by High Level Expert Committee, Government of Haryana, December 1998.

Thus, whether it is pumping out of water, skimming wells, subsurface or surface horizontal drainage - all generate water that is saline to smaller or larger extent. Disposal of this effluent is one of the most serious issues for which no proper solution has been found till date.

The only real solution is to take this out of the area. But obviously other areas are not likely to be enthusiastic for receiving these effluents. Suggested solutions are disposing the saline effluents through very deep underground bores, or in ponds built with impervious sides and bottoms. Most experts agree that the only long term permanent solution is to dispose the effluents in the sea!<sup>22</sup>

### **CONTROLLING AND AMELIORATING WATERLOGGING AND STALINIZATION IN BHAKRA COMMAND & EFFICACY OF VARIOUS MEASURES**

The problem of waterlogging appeared in the irrigated areas of Punjab many decades back. According to the World Bank's Irrigation Sector Review<sup>23</sup>:

“...a particularly serious problem is developing in parts of Northwest India ( large parts of Punjab and Haryana.....). Before irrigation development, water tables were generally at more than 25 metres depth.....the rate of rise of water table since irrigation began in the late 19<sup>th</sup> Century has in some areas been of the order of 25-30 cms/ year. This had no impact until the water table reached the root zone...The first signs of irrigation induced waterlogging and salinisation were reported in early 1920s and the problem began to become widespread in certain districts of Punjab and Haryana from 1950s.”

However, since much of this area was underlain with good quality waters, the advent of large-scale tubewell irrigation in these areas brought the problem under control. We have already mentioned above how the areas waterlogged in Punjab reduced from 10 lakh ha to 2 lakh ha. Indeed, these areas now face the problem of serious depletion of ground water and rapidly falling groundwater levels.

However, the real severity of the problem is in the areas with saline or poor quality ground water. In the semi-arid and arid zones in the Bhakra command, the problem of waterlogging and salinisation is persisting since years, and ameliorative measures are having only a limited impact. The districts in Bhakra command in Haryana that have poor quality groundwater are Hissar, Sirsa, Fatehbad and Jind. In Punjab, the areas with saline groundwater are in districts Ferozpur, Faridkot, Bhatinda, (including Muktsar, Moga, Mansa) – some of which fall in the Bhakra command. These are precisely the areas in both the states seriously affected by waterlogging and soil salinity, where the problem is persisting since years and is refusing to yield to any significant extent to remedial measures.

All the drainage measures (surface, sub-surface horizontal and sub-surface vertical) are normally carried out together, along with range of other measures to control salinity. We will however, examine these separately for convenience.

#### **Vertical Drainage**

Due to the salinity of ground water, it is very difficult to practice vertical drainage. This is why tubewell based irrigation is much lesser in the districts underlain with saline waters than the districts with good quality groundwater.

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<sup>22</sup> See for example Dhawan B.D. 1995: ‘*Water logging and Salinity: Phenomenon, Problem and Solution*’, in Dhawan B.D. 1995: ‘*Groundwater Depletion and Irrigated Agriculture in India*’, Commonwealth Publishers, New Delhi. Page 127

<sup>23</sup> World Bank 1991b

Vertical drainage in saline areas may be useful in the vicinity of the canals, where seepage water forms a layer of good quality water on the top of the saline waters. But this is limited to areas near the canal, and that too if the layer is thick enough. If not regulated properly, this can lead to saline water being drawn up.

The Haryana Government's master plan<sup>24</sup> proposes to install 1200 tubewells along 23 channels at a cost of Rs. 43 crores. It also states that the pumped water will be of reasonably good quality and hence will be put into the canals - and the resultant quality of mixed water will not exceed the permissible limit for drinking water.

We heard of these types of attempts in several places in Punjab and Haryana, but in most places the impact was seen to be limited. In Malout, we were told that 500 tubewells had been sunk to pump up water from the ground and this was being put into the canal. However, this was reported to control the problem only to a limited extent. Secondly, the people complained about putting the water in the canal, since this was saline water. They were saying that the saline water should be sent out to Rajasthan, since large part of the water carried by the canals was for Rajasthan. We were also informed that in any case many of the tubewells were lying idle since the bills had not been paid. This once again brings out one of the main issues in drainage - how to dispose off the saline effluents. It also shows that drainage costs - which are quite heavy - are an important factor.

Even in the poor quality groundwater areas, number of farmers continue to use it for irrigation, aggravating the problem of salinisation. In Hansi (district Hissar, Haryana), during a public meeting, we were told that the problem of waterlogging and salinisation has assumed serious proportions in the district. One interesting co-relation was pointed out here between the economic policies and land degradation. The person told us that since the support price mechanism exists only for paddy and wheat, farmers prefer to grow these crops. Since the canal water is not sufficient for the same, they use the tubewell water which is saline and this too has led to large scale salinisation. This illustrates that addressing the problem of waterlogging and salinity is not merely a technical exercise - there are many social, economic and political aspects, which sometimes can be more critical than the technical aspects<sup>25</sup>.

Some may suggest here, therefore that the solution is to increase the supply of canal waters. However, this itself will lead to more waterlogging. In fact, the Master Plan prepared by the Government of Haryana to address waterlogging recommends a 25% cut in the canal water supply in the districts of Hissar, Sirsa and Jind (in the Bhakra command).<sup>26</sup> (See discussion later on).

### **Sub-Surface Horizontal Drainage**

The Government of Haryana has also tried out sub-surface horizontal drainage to reclaim waterlogged areas. This is the Netherlands Government supported project Haryana Operational Pilot Project (HOPP).

We have already described this in the section under Lambakhedi where we saw that there was some improvement, but people were apprehensive that it may be attributable more to the lack of rains in the past two years than the HOPP itself.

The first HOPP project, at Gohana, was started in 1997 and the Kalayat (Lamba Khedi) in 2001. The official monitoring reports, while mentioning improved soil conditions, reduction in

<sup>24</sup>Government of Haryana 1998. Also, see details of the recommendations of the Master Plan in HIRMI *Sinchai Patrika* - March 1999 Issue 6 Page 11

<sup>25</sup>This example demonstrates the wide range of impacts of farmers in the two states getting virtually locked in into the wheat-rice cropping pattern.

<sup>26</sup>Also, see details of the recommendations in HIRMI *Sinchai Patrika* - March 1999 Issue 6 Page 11

salinity and recovery of fallow land, state the need for longer term monitoring, especially in the view of the continuous drought years.<sup>27</sup>

The Government of Haryana has included such drainage in its Master Plan<sup>28</sup> and this will be implemented on about 47,000 ha in the state. Rs. 257 crores has been budgeted for this. However, the critical problem remains - how to dispose off the effluents that will be brought out by this process. The master plan merely re-iterates that the effluent may be disposed off “into the canals/drains/reservoirs depending on the existing conditions”.

The reports from HOPP itself essentially say that the problem of disposal is a three state problem and is outside the scope of HOPP. In the Gohana project, the effluent is pumped into a drain (Drain 8) which discharges into the Yamuna river, and hence no problems are envisaged. But when the subsurface drainage schemes will be taken up on a large scale this issue is bound to become a serious issue.

We did not see any signs of such schemes in Punjab. However, the HOPP website indicates that the project will be taken up at two places in Punjab.

### Surface Drainage

Surface drains are also an integral part of the drainage system. However, like in most large scale canal irrigation schemes in the country, the drains have not been built along with the canal system. Even later on, only half-measures have been taken. Even where drains have been constructed, the maintenance of the drains is of very poor quality, defeating the very purpose for which they were made.

The Haryana Master Plan<sup>29</sup> proposes to build surface drains “to avoid recurring floods ....in southern and western parts of the state in an area of 14000 sq. km.” According to the plan, “In these areas, the shallow water tables contribute immensely to [the floods] and even light storms can result in flood like situation.” The total cost of the proposed structures is about 1231 crore rupees.

There are several issues here. First of all, the financial cost of these drains is very high. It must also be pointed out that these drains need land - which farmers are reluctant to part with. The land area required for surface drains may be about 15% of the land.<sup>30</sup> Not only does this cost money, this also means land taken out of production.

Everywhere we went, the efficacy of the surface open drains seemed limited. In number of places the drains were choked. For example, we went to see the drain *nalla* just outside Malout. The *nalla* was completely choked up with an overgrowth of water hyacinth. We were also told that the *nalla* is used for dumping effluents and sewage. The water in the *nalla* was stagnant and not flowing.

A senior journalists in Malout, who has also studied the problem of waterlogging, told us:

“The drain *nalla* is only 5 feet deep, so it can't drain below 5 feet. Even the engineers agreed that this will not handle the problem of waterlogging. At most, this can take care of the rainfall run-off. There is reverse seepage from drainage *nalla* to the lower lying fields. The situation is somewhat okay since there has been no rainfall since last two years. If the rains are normal, then the problem would arise again. .... Many

<sup>27</sup> Several Reports on HOPP website [www.hopp-online.org](http://www.hopp-online.org)

<sup>28</sup> Government of Haryana 1998. Also, see details of the recommendations in HIRMI *Sinchai Patrika* - March 1999 Issue 6 Page 11

<sup>29</sup> Government of Haryana 1998

<sup>30</sup> Datta K.K. 1996: ‘Economic Feasibility of Subsurface Drainage’, in , in Varma, C V J (Ed) (1996): ‘Proceedings of Workshop - Waterlogging and Soil Salinity in Irrigated Agriculture, Karnal, 12-15 March 1996’, CBIP, New Delhi. & CSSRI, Karnal.

people have paid money and got the alignment of the drain *nalla* changed by paying money.”

Reluctance by farmers to allow the drain to pass through their lands - to avoid losing land or because they are afraid of the seepage of the saline water in the *nalla* - is a major problem. In Lohgad, in Haryana, we saw drains that were incomplete as the farmers were not allowing them to pass through their lands.

As with all other measures, the major issue with surface drains too remains - what to do with the effluent. This is a serious problem. At places, we saw salt encrustations on the sides of the drain - showing the highly saline waters being carried by it. Several people pointed out to us the issue of reverse seepage of saline water from the drain. Where to put this saline water is an issue that is sure to frustrate the best plans for controlling waterlogging and salinity.

### Other Measures

There have also been attempts to control waterlogging and salinity by “bio-drainage” namely, planting of trees. We saw some experiments at the farm of the CCS Agricultural University at Hissar, where eucalyptus was being grown for this purpose. We were told that this has not been found to be very effective in Haryana. However, the Master Plan proposes plantations on 200,000 ha at a cost of 385 crore rupees. It states the success of bio-drainage in the IGNP (Rajasthan Canal) area as its justification.

While these are measures on the drainage side, there are number of measures which revolve around limiting the supply of water itself to the area. The logic is - if less water is supplied, then there is less water-logging. This is why one of the recommendations of the Haryana Master plan is to reduce the canal water supply to the districts of Hissar, Sirsa (including Fatehabad) and Jind by 25%.<sup>31</sup>

We have seen that the canal systems in Haryana were designed to serve the greatest number of farmers possible by distributing a limited supply of water over a large area. The Bhakra canal system was designed for an irrigation intensity of 62% of the cultivable command area<sup>32</sup>. (i.e only 62% of the total CCA would receive irrigation in an year). Thus, it already has a limited water supply.

Even if one reduces the canal supplies to the levels that closely match the crop needs, this will not eliminate waterlogging. First of all, direct seepage from the canal will continue. Even in a lined canal system, losses still remain. For example, it is estimated in Haryana that lining the whole system -from main canal to the branches etc. - will decrease the seepage from 48% to 12%. So 12% still remains. Importantly, much of the seepage that goes to the ground is from the field application of water - about 30-35%. Hence, even if canal supplies are tailored to match crop consumption, some of the water is going to seep down from the field before the crop can take it up.

A study of the Sirsa Irrigation Circle by Bastiaanssen<sup>33</sup> *et al* points out:

“In spite of leaky canals, or inefficient on-farm practices, nearly all the water that enters into the Sirsa Irrigation Circle is productively depleted by agricultural crops, as shown by the large depleted fraction of the gross inflow (82%). The low value for relative water supply is characteristic of protective irrigation, which intentionally keeps supply low relative to potential demand....

“Despite a high depleted fraction, groundwater build-up at Sirsa continues as a result

<sup>31</sup> Government of Haryana 1998. Also, see details of the recommendations in HIRMI *Sinchai Patrika* - March 1999 Issue 6 Page 11

<sup>32</sup> Bastiaanssen *et al* 1999

<sup>33</sup> *op cit*

of inadequate drainage. .... The addition of salts at a rate of 1.81 t/ha annually should also be of great concern.”

In other words, water supply to the circle is matching the crop consumption, yet, the district faces serious problem of waterlogging and salinity.

There is another important dimension here. If canal supplies are reduced, it will be difficult to maintain the current cropping pattern - something that is already not easy. We have already seen above how farmers are even using saline groundwater to irrigate wheat and rice as canal water supplies are inadequate to maintain this cropping pattern. This practice will increase even more, aggravating the problem of salinity. Hence, reduction of canal supplies will necessarily have to be accompanied by a change in the cropping pattern. In fact, the Haryana Master Plan states that the reduction in canal supplies aims to encourage farmers to grow tolerant or semi-tolerant crops like barley, cotton, mustard, safflower, wheat, bajra, oats, sorghum, maize and guar. Missing, significantly is rice, and wheat is only one of the many crops suggested. What this implies is that the cropping pattern that is counted as a part of the “spectacular success” of Punjab and Haryana's agriculture would need to be changed. Putting it differently, continuing with the same cropping pattern will mean aggravating the waterlogging and salinity problems; in other words, the current pattern is unsustainable.

Let us take a look at the most critical problem of all which determines the efficacy of any and all measures in saline groundwater areas.

#### **The Issue of the Effluent**

We have already said above that three broad means exist for disposal of the effluent - re-use for irrigation in the same area, augmentation of canal supplies and disposal.

In case of re-use, there are several important limitations. First all of, the effluent can't be used if the salinity is not below a certain limit. Secondly, the effluent may be available when the irrigation is not required - i.e. a mismatch in timing of the effluent pumping out and the crop water requirement. In such a case, if it can't be stored, then it can't be used. Thirdly, and most important, re-use does not remove salt out of the area and hence salt accumulation continues. If it can't be leached away (which is the most likely situation due to less rainfall and limited irrigation) then this can lead to aggravation of salinity.

In case of the augmentation of canal supplies, again there are critical limitation. Mixing of the effluent with canal waters requires the salinity of the effluent to be under a limit, especially where canal waters are also used for supplying drinking and domestic use water. Secondly, this shifts the problem of salt accumulation to another part of the command - the canal water will deposit the salts in another part of the command. This solution is not so well suited to tail-ends for obvious reasons. Significant parts in the tail ends of Bhakra canal command are affected by waterlogging and salinity. Also, this may require pumping and long distance pipelines (if the canal is at a distance from the field).

Solutions for disposal include ponds with impervious layers. These will entail costs in terms of construction and land.

The reality is that no permanent and appropriate solution has been found so far to this problem of disposal of saline effluents.

To quote a report of the HOPP:<sup>34</sup>

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<sup>34</sup> Euroconsult BV & WAPCOS (1995): *Environmental Aspects of installing Sub-Surface Drainage Systems – Mission Report*, March 1995 : Pages 17 and 9



“.....options for the - environmental friendly - disposal of drainage effluent (mainly focussing on salinity problems) have extensively been studied and documented over last 15 years or so, but so far a clear-cut solution has not been found as yet.”

And:

“Options for the disposal of salt-containing drainage water in North West India are under study since at least the early 1980’s (e.g. HSMITC- 1984; WAPCOS. 1994), but this issue, in particular the disposal in an “environmentally sound way”, remains unresolved so far.”

As Dr. N.K. Tyagi, then Director Central Soil and Salinity Research Institute, Karnal, points out:<sup>35</sup>

“Conjunctive use however, does not permanently resolve the problem of salinity. It usually postpones the problem, may be for some decades. However, the salinity problem remains *unless and until salts are transported out of the basin from each and every unit.....*for part of the Lower Ghagghar basin in Haryana about 15% of the annual recharge would have to be thrown out of the system to maintain salinity balance at desired level.” (Emphasis Added)

The only place where the waters taken out of the basin can be taken to is the sea, or the desert. This will of course entail huge costs and “financial, technical and inter-state disputes may restrict the construction of drainage carriers to the sea”. (Sharma and Rao 1996)<sup>36</sup> Imagine the cost and complications of taking a saline water channel from Haryana through Rajasthan and Gujarat to the sea!

The reality is that irrigation of this kind, with water intensive cropping pattern in arid and semi arid areas is fundamentally unsustainable and problematic. It will inherently lead to these problems and the only way to address the same would be to radically alter the agricultural practices in these areas. It may be mentioned that the National Water Policy of Government of India, both the original in 1987 and the newly adopted one in 2002 has taken cognizance of this aspects and states<sup>37</sup>:

“Economic development and activities including agricultural, industrial and urban development should be planned with due regard to the constraints imposed by the configuration of water availability. There should be water zoning of the country and the economic activities should be guided and regulated in accordance with such zoning.”

The problems occurring in the western parts of Haryana and Punjab are a direct result of following practices that are in contradiction to the ecology of the area.

## **PARTICIPATION OF FARMERS AND PEOPLE**

To be effective to even to a limited extent, the measures have to be planned and implemented in an integrated manner. They require complex monitoring and management, over a vast area in a decentralized manner- this entails extensive and effective participation of the farmers - something that the current system leaves much to desire.

<sup>35</sup> Tyagi, N.K. 1996: ‘*Conjunctive Use of Rain Canals and Saline Ground Waters*’, in Varma, C V J (Ed) (1996): ‘*Proceedings - Workshop on Waterlogging and Soil Salinity In Irrigated Agriculture- Karnal, March, 1996*’, Central Board of Irrigation and Power, New Delhi and Central Soil Salinity Research Institute, Karnal.. Page 77

<sup>36</sup> Sharma D.P. and Rao KVGK 1996: ‘*Recycling of Drainage Effluent for Crop Production*’, in Varma, C V J (Ed) (1996): ‘*Proceedings - Workshop on Waterlogging and Soil Salinity In Irrigated Agriculture- Karnal, March, 1996*’, Central Board of Irrigation and Power, New Delhi and Central Soil Salinity Research Institute, Karnal. Page 145

<sup>37</sup> *National Water Policy 2002*, Government of India, Ministry of Water Resources; Sec. 15

The first and most important indication of this is that no attempt seems to have been made to take the farmers into confidence about the cause of waterlogging and salinisation.

In many places we went, we found it striking that even after so many years of facing the problem, many common people and farmers were not willing to relate it to the canals. One of the most common thinking we found everywhere was that the problem of waterlogging is something of a transient problem, that it is a moving phenomenon, that the waterlogging comes from “above”, stays for a few years at a place, and then move “down”. While we will not dismiss this off hand since we heard this at a number of places, we also heard from knowledgeable people that this was not the case. What seems to be an explanation is that as the waterlogging problem was controlled in the good quality groundwater area, people thought that it had “moved” down.


What is worrying is that if this is the level of understanding and knowledge among the common farmers who are directly affected by the phenomenon, this shows that whatever may be the official efforts, little has been done by way to involve the people in handling this issue. This does not bode well for the resolution of the problem if any.

Another aspect of the issue was revealed in Lamba Khedi, where the HOPP is in operation. People complained to us that the government is not paying attention to the surface drain. We asked the people that if this was the way the Government was functioning, why didn't they themselves take up the work on the drain and try to solve the problem. They told us that this is not only their problem. The main drain is about 15 kms from the village. It is a question of 4-5 villages. How can they alone do anything? Then also, the Government is always giving promises that things will be solved. Like, for e.g. this project (Netherlands project) is being talked about since 6 years. So no one wants to take the initiative. This attitude that the Government will come and solve everything and the people do not have to do anything was also found to be widespread.

## CONCLUSION

From what we have seen, as well as from discussions in various fora and documents, the efficacy of the ameliorative and preventive measures, in the saline area, in the long term remains highly questionable. Most steps taken remain limited to technical measures, while the actual implementation in practice will depend on social, financial, economic and political factors to a great extent. People's participation is virtually absent. Most important, there is little attempt to go to the fundamental root of the problem – a cropping pattern that is in complete contradiction to the ecology. Thus, even in the most hopeful scenario, the measures will have limited impact. And while waterlogging and salinisation is extracting a heavy price, so will the measures undertaken to control these.

Even an optimistic point of view among the experts strikes a strong note of caution and we can do well to end on this note (Tanwar 1996)<sup>38</sup>:

“The waterlogging problem so far tackled was prevalent in the favorable topographical land terrain and in fresh groundwater regions which did not pose the problem of disposal and the use of drainage water. The problem of waterlogging in the semi-arid to arid saline groundwater regions is highly complex which poses serious limitations for the disposal and the use of saline drainage water. This involves high and expensive technology to tackle the problem without complications of the environmental hazards, wherein farmers participation, is also inevitable.” 

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<sup>38</sup> Tanwar 1996:Page 2

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## Environmental Impacts

*“The state has two large dams and several barrages which have affected both, the terrestrial and aquatic environment. Large reservoirs have been constructed which have led to inundation of areas rich in biodiversity leading to its loss. Further, absence of fish ladders in certain barrages have led to loss of migratory fish species. Furthermore, the dams have lead to decrease in release of water in the river systems during summer months leading to low water availability in down stream areas. As a result, the buffering and self purification capacity (due to pollution) of these rivers is reduced, adversely affecting aquatic life.”*



## Environmental Impacts

LARGE DAMS HAVE ENORMOUS IMPACTS ON THE ENVIRONMENT. SO IT IS THE case with Bhakra. Like any other dam, the major impacts are due to the submergence of large areas of land and forests, the downstream impacts due to the diversion of water at the dam, and reduction in downstream silt flow, the impacts on the riverine flora and fauna – to name a few.

However, the impact of the project is not just restricted to this. The impacts of the canal system and the irrigation delivered, and the effects of the intensification of agriculture are other aspects that are equally part of the environmental impact of the dam.

Evaluating some of the environmental impacts of the Bhakra dam has been a daunting task. The many years that have passed since it was built, the lack of baseline data about the situation prior to the dam and the lack of proper monitoring of these aspects are the primary reason why we have found it difficult to precisely evaluate many of the impacts of the Bhakra dam on the ecological health of Punjab and Haryana.

Particularly frustrating has been the virtual absence of proper and in-depth studies on these issues by the official agencies.

The BBMB has brought out a note titled “Socio-Economic and Environmental Impacts of Bhakra Beas Project – An Assessment”<sup>1</sup>. Among the positive benefits listed by BBMB are employment at the project sites, irrigation benefits, flood control, transformation of desert areas to lush green fields, land reclamation along the sides of the river, pisciculture development and tourism enhancement. Several of these have been examined by us in other parts of this report. We were not able to examine the claimed flood control benefits. *The 6-page note of BBMB does not mention a single negative impact.* Such a cursory treatment of such a vital topic by the project agency betrays a complete neglect of and a casual approach to these issues. It also indicates the quality of the assessments that have possibly been (or not) carried out.

Due to the lack of systematic and detailed assessments<sup>2</sup>, we have had to depend upon various other sources to try and understand the environmental impacts. This has meant that the findings are mainly indicative – but even these show that the impacts have been very serious. We can only recommend and hope for a more detailed study of these.

The most visible and serious impact of the Bhakra dam has been in the submergence area and in the downstream zone.

### SUBMERGENCE AND OTHER LANDS ACQUIRED

The Bhakra dam submerged about 178.75 sq. km (17875 ha) of land area<sup>3</sup>. Another 1000 acres (400 ha) was acquired for the Nangal township.

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<sup>1</sup> Duggal S.K., J.K. Bhalla & R.S. Dogra (2001): ‘Socio-Economic and Environmental Impacts of Bhakra Beas Project – An Assessment’, BBMB, Chandigarh.

<sup>2</sup> Except for some aspects – for e.g. Waterlogging and salinisation, or groundwater depletion

<sup>3</sup> BBMB 2002b: ‘Status Note on Bhakra Oustees’. This note gives the area submerged as 44153 acres – this is 178.75 sq. km. Elsewhere, in other documents, the reservoir area of Govind Sagar is given as 168.35 sq km

The most severe impact of the submergence and land acquisition for the project has been the displacement of thousands of people. This tragedy, faced by the oustees at that time in a touching demonstration of *desh-prem* (patriotism) – only to be paid back in terms of neglect and distress – is discussed in a separate chapter.

The key to understanding the impacts of such a huge project lies in what can be broadly termed as a “baseline study” – what was the environment and ecology like before the project. When baseline studies are not being carried out even in today's “enlightened” days it goes without saying that they were non-existent in those days. What was the “baseline” of the submerged area before the project? The idea that we have of the submergence zone comes from stray reports and the testimonies of the affected people. Both these point to an area that was rich in flora and fauna – both terrestrial and aquatic, heavily forested, with fertile and irrigated lands.

The plains on the banks of the river were extremely fertile. Both the kharif and the rabi crops could be cultivated. Irrigation was done with water from the Sutlej and the large number of natural streams flowing into the plains from the mountains. A variety of crops like corn, wheat and cotton grew there. Most people also owned orchards. There was a substantially large cattle economy in this region. While the people lived in the plains, the cattle sheds were situated in the mountains where there was ample fodder for the cattle to graze on.

Out of the total area submerged, 5,750 ha was forest land<sup>4</sup>. The impact of the submergence of the forests on the flora and fauna has not been estimated.

### IMPACT ON FISHERIES

The river had number of varieties of fish, including the much sought-after *Mahseer*. As the State Biodiversity Strategy & Action Plan for Punjab<sup>5</sup> shows, the *Mahseer* is now lost/threatened. We quote:

“The Fisheries department is also promoting exotic species of fish in an effort to introduce blue revolution at the cost of native species. Four exotic sps have been introduced as a result of which several native sps (especially Mahseer which was a common & delicious native fish of Punjab) have been lost/threatened. Data indicates that 32 sps of fish are near threatened, 20 sps are vulnerable, 12 sps are endangered and 2 sps are critically endangered.”

Earlier, the fishing in the river was more unorganised and informal. After the creation of the reservoir, it is now being carried out on commercial basis, with fishing rights being licensed. The BBMB has stated pisciculture in the reservoir as a positive environmental benefit of the project. It is neither stated by BBMB, nor could we find any figures to show that the output of fish from the reservoir area had increased after the creation of the dam. Since the fishing prior to the damming was informal and unorganised, there may not be systematic records of the produce. It would be important to estimate the production before and after the reservoir to understand the impact in terms of quantity.

We were not able to obtain information about the status of fishing in the river downstream of the dam now and before the reservoir creation. This would also be an important aspect to study. However, since most of the river water has been diverted, it is likely that the fisheries have been drastically affected. For proper analysis of the impact of the dam on fish and fisheries, it would be necessary to look at the fisheries both in the submergence and downstream areas taken together. It is quite possible that fish output may have increased in the

<sup>4</sup> Singh *et al* (2000): 'Environmental and Social Impacts of Large Dams – The Indian Experience', Prepared for the World Commission on Dams by Indian Institute of Public Administration, New Delhi: Page 21

<sup>5</sup> Part of the National Biodiversity Strategy and Action Plan. Downloaded from <http://www.sdnip.delhi.nic.in/nbsap/states/punjab/draftbsap.html> Accessed 14 June 2002

reservoir/submergence area, but may have been offset by the loss of fisheries in the downstream.

Qualitatively, however, the impacts are clear. The species composition in the reservoir/submergence area has changed dramatically, with major portion of the yield coming from less valuable fish. We have seen the Punjab Biodiversity SAP noting that the *Mahseer* is virtually lost. The similar Strategy and Action Plan for Haryana elaborates this<sup>6</sup>.

“In Govindsagar of Himachal Pradesh, common carp has affected the fishery of *Cirrhinus mrigala* (mrigal) and *C. reba* (mori) due to common feeding habits. An analysis of fish catch from Dal lake (Kashmir), Kumaun lake (Uttar Pradesh), Govindsagar (Himachal Pradesh) and Pong (Punjab) reservoirs has shown that the exotic carp has dominance over the more valuable endemic mahseers and schizothoracids (Sehgal, 1989).

“Between 1971-72 and 1978-79, major carps, viz., catla, rohu and mrigal contributed to the bulk of the total production from Govindsagar reservoir. Later, however, with the rise in the population of silver carp, the production of catla was lowered. The feeding and breeding vigour exhibited by silver carp led to its stabilisation at the cost of catla. Increase in silver carp population in the Gobindsagar reservoir catch has not increased the overall production of the reservoir (Natarajan, 1989). *It is just a case of substitution of two high value indigenous major carp species by an exotic carp that is poor in quality fetching lower economic returns.*” (Emphasis added)

The same was told to us in Bilaspur by Sukhdev Sharma - an employee of the Fisheries Federation of Govind Sagar since 1977. He said that before the reservoir, the species caught were the much sought after *Mahseer*, *Gidd*, *Mir Carp*. After the creation of the reservoir, the *mahseer* declined sharply and it is rarely found. The earlier species were replaced by *Catla*, *Rohu* and *Singada*. But now, even that has changed and about 90% of the catch is silver carp whose returns are much smaller.

## HEALTH IMPACTS IN RESERVOIR AREA

The creation of such a huge reservoir also leads to significant changes in the micro-climate, and has several impacts on the health of the people. Again, like most other impacts, these have not been documented. However, we have a note prepared by the Chief Medical Officer, Bilaspur in Himachal Pradesh in year 2000 (month and date is not given) which lists out several significant health impacts of the reservoir. This note, addressed to the Secretary, Health in Government of H.P. appears to have been prepared for submission in a Civil Suit. This note gives the following health impacts of the Govind Sagar reservoir<sup>7</sup>:

“3. The reservoirs [Govind Sagar] covered all the natural water sources and are now depending (sic) on the lake water as well as the water supply scheme provided by the Govt. These water supply schemes become dry during the summer season and most of the people have to depend for water which is not all the time can be consider potable.<sup>8</sup>

“4. In view of the situation as explained above there has been rise in Gastroenteritis, enteric fever and viral hepatitis incidence due to scarcity of potable (sic) water for the people residing on the both side of bank reservoirs. From the record available with

<sup>6</sup> Strategy and Action Plan for Haryana under the National Biodiversity Strategy and Action Plan (NBSAP) Project; October 2001 Chapter on Conservation of Fish and Fisheries:

URL: <http://www.w3.org/TR/REC-html40> Accessed 13 June 2002

<sup>7</sup> Note No. HFW (BLP) PH/99- H.P. Health and Family Welfare Dept. Distt. Bilaspur, prepared by Chief Medical officer in response to D.O. No. HFW-B(C)17-1/95-II dated 6 March 2000 of Secretary Health, Shimla with Subject : Impact of Reservoirs in Satluj-Beas Basin and Sundernagar Hydrel Channel on Hydrology, Environment and People in H.P.

<sup>8</sup> Verbatim, as in original, through out

this department the incidence of these diseases has increased despite on-going health programmes.<sup>9</sup>

“5. The reservoir provides favourable conditions for mosquito breedings and hence the incidence of malaria has also increased.

“6. Whole of the reservoirs and surroundings areas is covered with fog which last upto 11 to 12 hours in a day during winter and the respiratory diseases are also on increase.

“The fog reduces the visibility leading to more incidence of accidents. Half of the normal health budget is being spent to tackle these diseases....”

Clearly, this is only a glimpse and this aspect requires much more extensive and systematic study.

### **DOWNSTREAM IMPACTS**

As we have already seen, Bhakra dam – like many others – was built with the express purpose of ‘utilisation’ or ‘prevention from going to the sea’ of the last drop of water. Project authorities probably feel that it is just an unfortunate consequence that in preventing the last water drop from reaching the sea, it is also prevented from reaching significant riparian areas between the dam and the sea.

This had a huge impact on the areas downstream of Bhakra. As mentioned earlier, critical to understanding this impact is the baseline information. No such study exists. In the case of the Sutluj, it is even more difficult to re-construct the precise condition of the river when it was free flowing. This is because significant diversion started from the river in 1887 with the opening of the Sirhind Canal. Significant changes in the ecology downstream must have occurred then. It may be noted that it is not only complete drying up of the river that has an impact: substantial diversions can result in significant changes in the quantum and patterns of the downstream flows – both with serious consequences. It would be of considerable value but would require meticulous and painstaking research to build a picture of the free flowing Sutluj and its ecology. However, since such a task was beyond our resources, we leave it noting that when the Bhakra project was being built, the Sutluj must have already been altered from its pristine state. The nature, extent and impacts of these alterations are not known.

But Bhakra was to be an order of magnitude higher transformation. With only the Sirhind Canal (and a few other inundation canals like the Grey canals) large quantities of water were still flowing in the river past Ropar, at least in the summer/monsoon. However, it was clear even as the last of the project proposals was put together that the Bhakra was going to result in virtually drying up the Sutluj below Ropar.

R.L. Anand mentions this, saying “With the completion of the Bhakra Dam the Grey canals would cease functioning as such, because there will then be no water left in the Sutlej below Ropar.”<sup>10</sup>

We have already seen in the discussion on the command area of the project that some of the areas were included in the project command precisely because the drying up of Sutluj was to deprive them of their existing irrigation – the Zone II areas.

Talking about the increase in the proposed storage at the project after the Partition, K.N. Raj says, “it was also clear that the river would almost dry up below Ropar ...”<sup>11</sup>

<sup>9</sup> This lack of proper drinking water source for oustees of the Bhakra dam, living on the banks of a huge reservoir, is one of the most tragic aspects of the absence of rehabilitation of the oustees and is dealt with in more detail in the chapter on displacement.

<sup>10</sup> Anand 1956: Page 52



The water balance figures for the Sutluj river<sup>12</sup> show that in a mean year, out of the total of 17 MAF water flowing into the Govind Sagar (13.3 MAF of the Sutluj, and 3.82 MAF Beas waters through BSL, net of losses), about 16 MAF is diverted at Ropar and the BML. Barely 1.4 MAF is left in the river, *over the whole year* to flow down to Harike. This is just about 8% of the total inflow into the reservoir.

It is sometimes mentioned that the awareness of environmental issues was absent during the early years of dam building, and hence they were not considered. This is not really true. For example, it is simply not possible that intelligent men who design such dams would not know what would happen downstream when a river dries up. It is another matter that they may not care, or not care enough. In case of Bhakra, they knew well that the drying up of the river would render useless the Grey canals, and they made alternative provisions. But nothing seems to have been done about other aspects – the needs of the villages and towns on the Banks, the fish, the other aquatic flora and fauna, the diminishing capacity of the river to wash away pollutants and so on.

The First Plan document makes it very clear that the planners were aware of the needs to protect the downstream – in 1950!. The Chapter on Irrigation and Power states<sup>13</sup>:

“12. The total quantity of water flowing in the rivers, a rough quantitative indication of which has been given in paragraph 8 above, is not wholly available or needed for irrigation.

This is due mainly to the following reasons :—

.....

iv. Certain quantities of water must be allowed to flow in rivers for hydro-electric development, for purposes of navigation, *conservancy* and water-supply for towns and villages.” (Emphasis added)

In spite of this, the project was designed in a way to wholly use up all the water.

This is sure to have had huge impacts, though as mentioned above, it has been difficult for us to evaluate the impacts of the dam in the areas between Ropar and Harike – the main stretch of the river in India – due to lack of baseline data and our resource limitations. We have already talked about the need to assess the impacts of the dam on the fishing in the river downstream of Ropar. The other downstream impacts are equally important to assess.

A significant downstream impact of the dam was the virtual end of the bountiful flood plain agriculture. When we visited Ludhiana, Prof. Jagmohan – a university professor and social activist told us that in the days before Bhakra the floods in the river would recharge the groundwater in the areas around the river and deposit silt that made the soil extremely fertile. Since the land was inundated almost annually, only one crop could be taken. But this required minimum input since both water and fertiliser were deposited by the river. When the dam was built and operational, slowly the waters stopped and the recharging ended. As the floods and waters diminished, more land became available for cultivation, and people started taking more than one crop. The construction of embankments exposed even more land. In fact, many people started cultivation even inside the embankment. However, now the farmers have had to resort to tubewell irrigation and large doses of chemical fertilisers. This has ultimately meant that the net returns to the farmer have remained the same.

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<sup>11</sup> Raj 1960 : Page 49

<sup>12</sup> Rao 1985b: Page 208

<sup>13</sup> Chapter 26: *Irrigation and Power*; First Five Year Plan

URL: <http://planningcommission.nic.in/plans/planrel/fiveyr/1st/1planch26.html>

Accessed: Nov 25, 2002

This is the other side of the benefit mentioned by BBMB of “reclamation of land”. The Board put up at the Bharka dam site mentions that “Canalisation of Sutluj yielded 80,000 ha of land which was barren hither-to-fore”. It is difficult to accept this claim at the face value. As with most flood-plain agriculture all over the world, the land on the floodplains is very fertile, and while flooding may restrict agriculture to a single crop a year, the production is abundant and free from costly inputs.

It appears from the description at the Bharka site that this (80,000 ha) was essentially riverbed land. If drying up the river and the cultivation of exposed land is a benefit, then one can only marvel at such a way of thinking<sup>14</sup>. We would state that only an in-depth examination of the extent of land use in the floodplains and the economics of the same before and after the dam would give the true picture how much of a benefit this has been.

The quantitative, or at least order of magnitude assessment of impacts of the dam on the flood-plain agriculture, as also on the fish and fisheries of the river would be an important aspect to be taken up for detailed research.

The diversion of the Beas at Pandoh, to take the waters to Govind Sagar through the BEAs Sutluj Link (BSL) has also had several serious impacts downstream of Pandoh. The Citizen’s Council Mandi (CCM) has launched a campaign against the BSL demanding that 20% of the water be released from the Pandoh reservoir into the Beas so as to flow down on to Mandi. The CCM has said that the Pandoh dam stopped water in the river downstream of the dam, and the aquatic life has been destroyed after the commissioning of the project in 1977<sup>15</sup>.

It should also be mentioned that major impacts of the Sutluj river drying up have also been felt in Pakistan. With the allocation of the three eastern rivers to India in the Indus Water Treaty, India got down to use all the waters of the Sutluj (and Beas) in the country. After leaving India, the Sutluj has a course of about 350 kms (approximately) in Pakistan before it meets the Chenab. This stretch of the river is now completely dry and sees waters only in exceptional years. While the irrigation from this stretch of the Sutluj was replaced from other sources through the Indus Water Treaty, the riverine economy, ecology and culture are heavily impacted.

The data for the River Suttlej collected at Sulaimanki (Pakistan) for the 40 years before Indus Water Treaty i.e. 1922-61, ten years after the treaty i.e. 1985-95 and recent year completed i.e. 2001-02 depicting drought conditions is as follows:

**Average Annual Flow (in MAF) of Sutluj at Sulemanki<sup>16</sup>**

1922-61	1985-95	2001-02
14	3.6	0.02

While this impact may be discounted by Indians because it is in Pakistan, it still remains a very significant impact of the dams on the Sutluj and Beas.<sup>17</sup>

This is not to say that Pakistan has shown any more exemplary behaviour in managing its own rivers. The construction of the Mangla dam on the Jhelum, the Tarbela and other storage dams on the Indus, and the large number of other barrages, weirs and diversions on the Indus and its tributaries in Pakistan have had a huge impact on the downstream areas, especially on the coastal areas in Sindh, including destruction of mangroves, salt water intrusion and so on.

Among the severe impacts have been those on the mangroves in the Indus delta.

<sup>14</sup> In our country, with tanks and lakes in the urban and peri-urban areas being filled up rapidly to create “valuable land”, this kind of thinking can well be understood.

<sup>15</sup> Report in the The Tribune, 6 July 2004 as quoted in *Dams, Rivers and People*, Aug-Sep. 2004.

<sup>16</sup> Ref: <http://www.waterinfo.net.pk/pdf/riversutlej.PDF> Visited on 23 Aug 2004

<sup>17</sup> See Additional Note 12-1 at end of chapter for details of this.

“Mangrove forests in the Indus Delta spread over 650,000 acres and are the sixth largest in the world. The water, nutrients and silt deposited by the Indus when it discharges into the sea, sustains the mangroves. .... The forests support many species and are a source of timber, fuel-wood (18,000 tons each year), fodder, wild life (porpoises, jackals, boars, reptiles, migratory fowl birds, and 3 dolphin species), herds of camels (16,000 at certain times), and 44 fish species. The mangroves act as windbreakers and prevent storms from reaching inland. They also are a major breeding area for shrimps and crabs that earn \$68 million a year in foreign exchange. .... About 100,000 people are directly dependent upon mangroves in the delta. The number of people, including the fishermen, indirectly dependant on the mangroves may run in millions.

“The mangrove forest area has reduced from 263,000 hectares in 1977, to 158,500 hectares in 1990, showing reduction of 38%. Even the remaining area is being progressively degraded. *About fifty to sixty years back, 80-105 MAF of water was discharged to the delta depositing up to 400 million tons of silt. Due to dams and water diversion upstream, the water outflow has been reduced significantly. Only about 20 MAF outflow reached the delta from barrage releases before 1991 depositing only 36 million tons of silt per year.* However, the 1991 Water Accord [an internal accord among the provinces of Pakistan] put an interim limit of 10 MAF outflow and even that limit has not been met. For nine to ten months of the year no freshwater flows out at all. The silt deposits are estimated to drop way below 30 million tons per year if the outflow remained 10 MAF or lower.”<sup>18</sup> (Emphasis Added)

According to a recent study by International Union for Conservation of Nature (IUCN)<sup>19</sup>, the flow in the lower Indus river decreased from 105000 MCM (85 MAF) in 1932 to 43000 MCM (34.8 MAF) in 1970 as a result of number of schemes on the Indus and tributaries; Bhakra was one of them, and contributed to this. In the 1990s, the flow has gone down to 12000 MCM (9.7 MAF). The paper documents the huge environmental impacts of this. In particular, the following comparison is interesting:

“From an **economic** perspective the natural resources used in the Indus Delta have an estimated value of 120 million US\$. This excludes the unquantifiable value of environmental aspects such as biodiversity, habitat provision and coastal protection. In comparison, releasing 25% of the Tarbela Dam water for floods, thus making it unavailable for irrigation or power generation, would cost 38 million US\$. Any loss of irrigation or hydroelectric power, therefore, is likely to be more than offset by financial benefits remaining with communities in the Delta from natural-resource use.”

It would be very illuminating to make a similar study for the downstream areas of the Sutluj.

## SEDIMENTATION AND SILTATION IN BHAKRA RESERVOIR

*“Percentage Loss of Storage Capacity*

*Total silt deposited in Bhakra reservoir ...is 15.02% of gross storage. Silt deposited in dead storage.... is 31.30% of the dead storage capacity. Silt deposited in live storage ...is 9.70% of live storage capacity”*<sup>20</sup>

<sup>18</sup> Memon, Altaf A. 2002: ‘An Overview of the History and Impacts of the Water Issue in Pakistan’; Presented at the International Conference on “Sindh, the Water Issue and the Future of Pakistan” , The World Sindhi Institute, Washington, DC, USA

<sup>19</sup> “The Lower Indus River: Balancing Development And Maintenance Of Wetland Ecosystems And Dependent Livelihoods” accessed on 2 Oct 2004 at <http://www.waterandnature.org/flow/cases/Indus.pdf>

<sup>20</sup> Paper by Duggal S.K (Member, Irrigation, Bhakra Beas Management Board), Bhalla J.K. Chief Engineer, Bhakra Dam and Bhatia N.K. presented at All India Seminar on Flood management, Chandigarh April 2002 (Duggal *et al* 2002)

When the above figures were presented at a conference, an engineer from the Ministry of Water Resources, Government of India dismissed the impact of siltation at the Bhakra reservoir saying that a 10% reduction in live capacity in 50 years is very good indeed. When we met a senior retired engineer from the Punjab irrigation department, he described the siltation in the Bhakra reservoir as “alarming”.

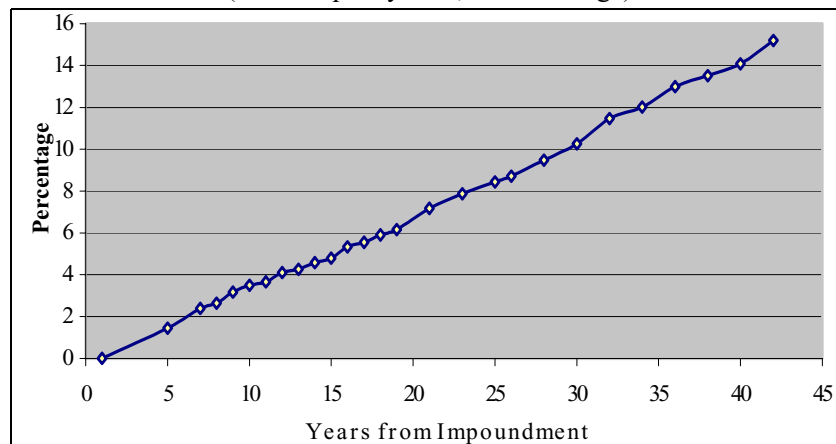
So how does one view the sedimentation and siltation in a reservoir? One of the most heard arguments in the context of sedimentation of reservoirs (from all the players in the debate) is regarding how sedimentation affects the life of the reservoir. Dam builders throw around figures of 200-300 years for life span of most dams to dismiss concerns about the impacts of siltation. It is argued that even if siltation reduces the lifespan by 50%, we still have over a century or more.

How one interprets these figures depends a lot on one’s perspective. A person with a lifespan of about 60-80 years couldn’t care less what happens in the 81st year, let alone in the 300th. For the succeeding generations in the river basin, the vision of a dam silted to the brim is scary and worrisome. What will happen when a dam is silted up completely? How high will the river then flow and how much will it spread? What will happen on the downstream side? These questions are increasingly being asked. The issue of siltation of dams and what is likely to happen when the life of a dam is over is one of the many in the category of questions which an ostrich-like humanity has decided to bequeath to the coming generations to ponder over. These include questions like what will happen to nuclear power plants after their lifespan is over, questions of nuclear waste disposal, of toxic landfills, of climate change and so many others.

However, the issue of sedimentation of a reservoir is an issue that goes just the life of the dam. That is and remains a serious concern; but it must be remembered that the impact *during* the life of the dam is as important, as sedimentation will influence the performance of the dam.

As pointed out at the start of this Chapter, the project has lost 9.7% of its live storage to sedimentation. A look at the chart plotting the cumulative loss of capacity against the year from impoundment shows a steady, uniform rate of loss of capacity (Figure 12.1).

**Figure 12.1 Cumulative Loss of Capacity at Govind Sagar (Bhakra Dam)**  
(Total Capacity Lost, in Percentage)



Source: CWC 2001

What are the implications of a 10% reduction in live capacity? A loss of capacity means that the very justification for the dam is being lost. After all, the very rationale for the dam is that it can store “excess” water from one period for use in a period of scarcity - for e.g. - from the monsoon and carry it over to the winter months.

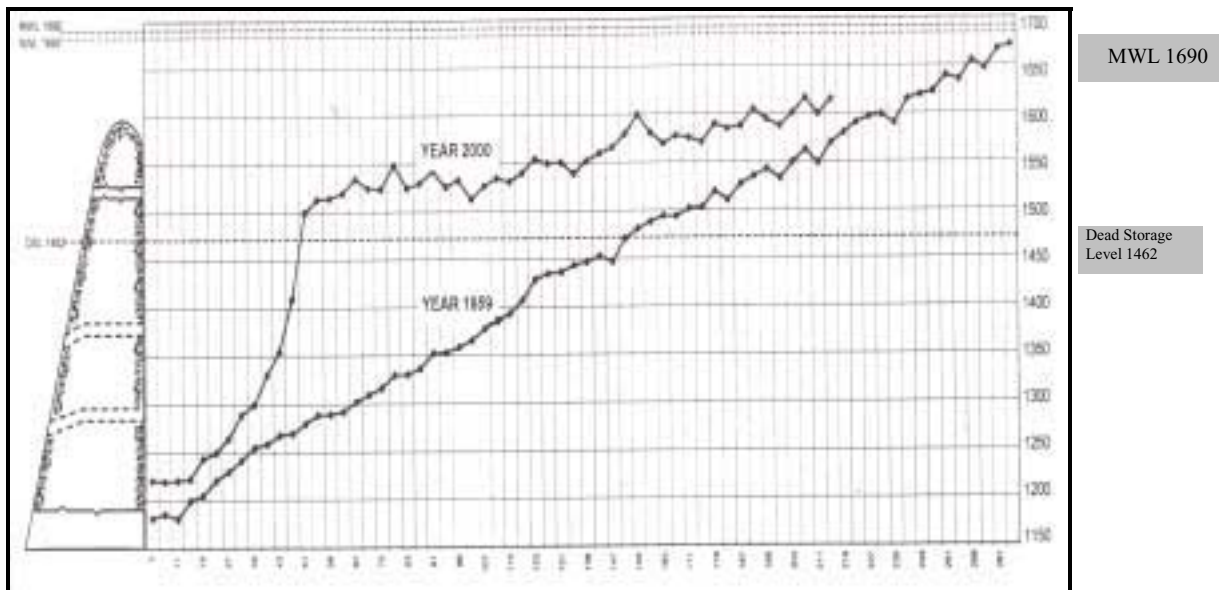
What is more critical in the case of the Bhakra reservoir is not just the amount of sedimentation itself, but the nature of the deposition that has taken place. According to Duggal<sup>21</sup>:

“There is hump formation from RD 51 to RD 91 from Bhakra Dam, which is acting as a silt barrier and preventing movement of silt into the dead storage.....In this context, the operation of the reservoir needs to be reviewed judicially.”

In simple words, what it means is that the silt is not going into the dead storage as planned<sup>22</sup>, but is occupying the live storage. Not only that, but it is preventing the further movement of silt into the dead storage area, and new silt is getting deposited in the live storage. It is clearly an alarming situation. We have also been told that the silt has reached the level of the inlets.

The figure below (Figure 12.2) shows the cross section of the reservoir, the dead storage level, the maximum reservoir level, the original river bed and the silt deposition.

**Figure 12.2 Longitudinal Section of Bhakra Reservoir Main Channel Showing Silt Deposit Profile**



Source: Duggal *et al* 2002

What are the implications of this? According to Duggal, “The deleterious effect of hump formation is early reduction of live storage capacity”<sup>23</sup> and “the operation of the reservoir needs to be reviewed judicially.”<sup>24</sup> What this means is not explained. However, if we look at some other cases, we can get an idea of what all *could* be implied.

The case of the Tarbela dam in Pakistan (on the Indus river) is very interesting. Tarbela is similar to Bhakra in many ways. It too is a “rim station” dam - built on the river just before it leaves the mountains and comes onto the plains. To manage the sedimentation, the dead level of the reservoir has been raised by 21 m in 25 years!<sup>25</sup> While this was in the original plan of the project, it still means a huge loss in capacity.

<sup>21</sup> Duggal *et al* 2002: Page 196

<sup>22</sup> Not a well behaved dam!

<sup>23</sup> Duggal *et al*: Page 200

<sup>24</sup> Duggal *et al*: Page 196

<sup>25</sup> Asianics Agro-Dev. International (Pvt) Ltd. 2000: ‘Tarbela Dam and related aspects of the Indus River Basin, Pakistan’, A WCD case study prepared as an input to the World Commission on Dams, Cape Town, [www.dams.org](http://www.dams.org) : Page 43

We are not saying that same thing will be required at Bhakra. It is just to indicate what are the types of adjustments that can possibly be required. It is important that BBMB make public the measures it is taking and the changes if any in the reservoir operations that may be required to address the issue of siltation.

What is being done to handle the problem? That the issues were recognised early on is clear. BBMB said, in 1988<sup>26</sup>:

“The general loss of green cover over the vast expanses of Himalayas which form its watershed may be a potential danger for the premature loss of useful life of Bhakra reservoir if the situation is allowed to drift any longer. Fortunately, the government of India and State of Himachal Pradesh are keenly aware of this problem. ...”

A number of measures undertaken are mentioned. It appears that these measures have had little impact, since in 2002 – 14 years later, the situation has not changed much.

Duggal points out that increased developmental activities in the catchment have maintained a high average rate of siltation, and that “The average annual percentage loss of gross storage capacity comes out to be 0.36% and is practically constant...”. The graph given earlier in Figure 12.1 also shows this.

BBMB had also mentioned, in 1988 that<sup>27</sup>:

“But the main problem is about the silt which has already entered into the reservoir and it is extremely difficult, rather appears practically impossible, to remove or dispose of these deposits. Actually, the deposits of silt for years together have created a big hump which acts as a silt barrier within the dead storage....and the silt does not find its way through the dam openings thereby entrapping silt to the extent of 99.4% thus reducing the useful life of the reservoir.”

This hump still remains a major problem, as we have seen above.

It is clear from the above that the issue of siltation in the Bhakra reservoir is very serious issue, that impacts the very benefits of the projects. It is also likely that serious measures will need to be taken to deal with the sedimentation which would have further impacts on the project benefits.

In the longer term, the sedimentation of dams means that large scale hydro / irrigation dams are not a sustainable technology. The filling up of live (and dead storages) mean alternation of the river landscape beyond recognition. No one can fully comprehend the implications of such filling up of dams. However, the issues are so grave that number of people, dam operators, government agencies are already talking about dam decommissioning.

### **IMPACTS ON PUBLIC HEALTH IN THE COMMAND AREA**

There are some other very serious issues that are now engaging the minds of the people in Punjab and Haryana. These include the health impacts of the long-term, continuing and increasing use of chemical fertilisers and pesticides, and the resultant pollution and contamination of water resources and toxicity in agricultural and dairy products<sup>28</sup>. Even though these impacts raise very serious concern for public health, it is unfortunate that these have received little attention at the official level and there has been little effort at documenting and investigating these. However, several NGOs, groups and even individuals have done very important work in trying to fill this gap.

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<sup>26</sup> BBMB 1988: Page 273

<sup>27</sup> BBMB 1988: Page 276

<sup>28</sup> The concerns about the long-term impacts of use of chemicals in agriculture on *agriculture itself* have already seen by us in the earlier chapter.

At this point, it is important to clarify how these tie up to the Bhakra project. Some people argue that the dam is not responsible for the impacts of the chemical fertilisers and pesticides used in agriculture. This is a specious argument. If irrigation from the project is glorified by pointing to the spectacular increase in the agricultural production, then it needs to be recognised that this production was made possible due to the heavy use of chemical inputs along with the HYV seeds. It is a package that has worked together. Indeed, it is an important question whether without the kind of productivity that these chemicals brought in, the dam itself would have been financially or economically viable<sup>29</sup>. Hence, the effects of the extensive and intensive use of chemicals and also the erosion of bio-diversity due to the very limited variety of seeds being used are part and parcel of the total cost of doing business with such irrigation projects. To the extent that the same combination is used with other means of irrigation, these will add to the environmental costs of those particular means too.

The ongoing efforts of the groups mentioned above offer some insight into the problem. Kheti-Virasat, an organisation in Punjab, has been working since many years to highlight the problem caused by the extensive use of chemicals in Punjab agriculture and is also trying to promote sustainable organic agriculture.

Recently, Kheti Virasat was involved in a survey testing of the impacts of pesticide use on children's mental health and development. This was a survey carried out in various locations of the country by Greenpeace<sup>30</sup>. In Punjab, the survey looked at impacts on children in Bhatinda district, where the use of pesticides is very high. The sample was compared with a reference group in other parts of Punjab, which, "as could be expected from a state like Punjab, ..was not fully free of pesticides ...but.....the quantum of use of pesticides ...[was] starkly less."

The survey administered several tests to test the mental ability, tactile perception, motor abilities, concentration and memory, stamina etc. These were administered to the sample and reference groups for two sets of children – age group 4-5 years, and 9-13 years. The findings of the study are serious.

"Overall, out of the 23 tests administered to the two samples in age group of 4-5 years in Punjab, in all the tests, the less exposed children performed better, and with a statistical significance in the case of 20 of these tests.

"When it comes to 9-13 years old children, 20 tests were administered, out of which the less exposed children were better in 18 tests. Out of these, 17 tests showed statistical significance. In the remaining two tests, the study group fared better but without statistical significance".

In simple words, these tests showed that pesticides have a serious deleterious impact on children's mental and physical development.

A note prepared by Kheti-Virasat as a backgrounder to a workshop "to sensitize & educate doctor, epidemiologist and Agriculture scientist on the issue of impact of agro-chemicals on human health in Punjab" and to "prepare broad base network on a bio-medical scientific platform to study the impact of agro-chemicals on general health of people in Punjab" among other things, highlights some of the impacts<sup>31</sup>:

## "2. OUTCOME OF THE STUDY CONDUCTED BY KHETI VIRASAT IN PUNJAB ON IMPACT OF PESTICIDES ON HUMAN HEALTH

The excessive use of chemical fertilizer like urea, DPK, NPK, etc and pesticides (insecticides and weedicide) have resulted in the disorders of endocrine glands e.g.,

<sup>29</sup> Even *with* this productivity, the economic viability of such large dam projects is increasingly being questioned.

<sup>30</sup> Greenpeace 2003

<sup>31</sup> Kheti-Virasat 2002: '*Concept paper of Medicos' workshop to be held in Oct. 2002*'; Personal Communication

thyroid, parathyroid, pituitary, kidneys and adrenals. The incidence of cancer, asthma and diseases of kidney, skin and digestive tract has increased by 20-25% in Punjab. Youngsters at the age of 25-30 are suffering from heart ailments and male infertility. Along-with suffering humanity, the soil is also sick with severe deficiency of micronutrients. Decreasing carbon content of soil has resulted in decrease in water & nutrient holding capacity. In addition organisms like bacteria, fungi and earthworms have disappeared. Furthermore, selenium levels in Punjab are very high at toxic level.

The food we eat, the water and milk we drink are contaminated with one or other chemicals. So much so that traces of BHC, endosulphan, DDT & HCH the banned pesticides have been found in the most safe & sacred mother's milk in many cases in Punjab. Due to use of Endosulphan in Punjab as in Kerala, increase in birth of mentally retarded (MR) children.”

The note cautions that

“..... recently it has been postulated that long term, low exposure of these chemicals are increasingly linked to human health effects such as immuno-suppression, endocrine disruption, reproductive abnormalities and cancer.”

The Strategy and Action Plan for Haryana under the National Biodiversity Strategy and Action Plan (NBSAP) Project also notes that this is a serious health hazard<sup>32</sup>:

“..... the widespread use of selective herbicides had a toll on proliferation of flora because the growth varied plant species which were considered weeds were suppressed/controlled by these herbicides. The continuous use of these chemicals resulted in shift in flora, the earlier species giving way to the exotic species earlier unknown in the region. The exotic species later on acquired resistance against the herbicides and even the wheat cultivation was endangered because of the exotic weed, *Phalaris minor* (mandosi). New chemicals were invented to control the resistant species which toll of the biodiversity (sic).

“The pesticides residue in food stuff are generally higher than the concentration considered to be safe for human/animal consumption as prescribed by the WHO. The sole reason behind the high residual concentration is indiscriminate use of chemicals. These chemicals have adversely affected the population of beneficial insects and wildlife. Recently, large population of peacock, a National Bird, was reported to have been killed due to indiscriminate use of pesticide. Therefore, emphasis is laid now a days on integrated pest management which essentially means reducing the dependence on chemicals.”

While it is only now that the extent, nature and seriousness of these impacts is being acknowledged in India, it is regrettable that still scant attention is being made to most of these issues.

One ray of light in this darkness is that the Central Water Commission has desired to conduct an Environmental Impact Assessment of the Bhakra project. The earlier-referred BBMB note on the Environmental impacts of Bhakra Beas project states<sup>33</sup>:

“Central Water Commission (CWC) ,Govt. of India set up a specialised EIA Directorate in 1995, when it was decided that Water Resources Development Projects constructed prior to 1978 as well as those constructed between 1978 and 1994 need to be evaluated selectively for their impacts on environment. Since 1997 five such studies have been initiated by CWC, out of which three are complete. *CWC has now*

<sup>32</sup> Strategy and Action Plan for Haryana under the National Biodiversity Strategy and Action Plan (NBSAP) Project; October 2001 Section 4.4 URL: <http://www.w3.org/TR/REC-html40> Last Visit 13 June 2002


<sup>33</sup> Duggal *et al* 2001: Page 5



*desired to include Bhakra Dam Project for EIA studies and BBMB is proposing to give the study to CWC as a test case of EIA for big dams.” (Emphasis added)*

Of course, unless the study is conducted by an independent agency with credibility, and in an open, transparent and participatory manner, there is a danger that it would end up just as a window-dressing.

Giving the study to CWC would be disastrous as a project developer and dam builder can hardly be expected to be independent in analysing the environmental (especially negative) impacts. It is the closed attitude of the dam builders that has resulted in the virtual shoving aside of these issues in the first place. We can do no better than end by a quote that eminently demonstrates the attitude of the BBMB in this matter<sup>34</sup>.

“As the Bhakra and Beas Projects were completed before 1978, there was no need to have the environmental clearance from the then Deptt. Of Science and Technology<sup>35</sup>..... However, BBMB has been adhering to all the guidelines issued from the Ministry/ Deptt. from time to time. In spite of certain provisions enacted by the Govt. of India for the polluting industries...the Multi-purpose projects managed by BBMB used to be considered environmental and eco-friendly.....Then suddenly in 1993, the Central Govt. included Power (Hydro) Generation in Schedule I ...to the Water (Prevention and Control of Pollution)..Act...Consequently, once considered the most environments (*sic*) friendly source of energy become the polluting industry all at once.” 

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<sup>34</sup> Duggal *et al.*: Page 5

<sup>35</sup> There was no Ministry of Environment and Forest at that time. The functions were carried out by this Department.


**Additional Note 12-1****SOME IMPACTS OF THE DRYING UP OF SUTLUJ IN PAKISTAN<sup>36</sup>**

**1. Depletion of underground water resources and mounting scarcity:** Sutluj river was used to re-charge the aquifer in the Cholistan desert where otherwise the ground water is very low. Since the complete stoppage of Sutluj River, the rate of ground water depletion is very alarming. The aquifer of this desert like region was immediately recharged when the area received heavy floods in 1988.

One note worthy adverse impacts of the depletion of ground water resources is the deterioration of drinking water quality. Underground water in the Bahawalpur region is contaminated with arsenic element and thus causes problems in terms of human health. Previously, fresh water supplies from Sutluj River was playing balancing act. However, the issue of water contamination with arsenic element has become very serious.

**2. Livelihood Impacts:** There were vast grazing lands available to local communities when the area was used to be flooded before 1970. Livestock was one of the important livelihood asset. Similarly, fishing and forest resources were commonly available to local communities. Traditional, low inputs based food crops irrigated by flood operations did also vanish.

**3. Decrease in Soil Fertility:** Most of the area in Bahawalpur region is like desert. This region is almost tail of the Great Rajasthan Desert that extends to Thar region in the Sindh province as well. The soil fertility in this region was also very very low. Flooding of Sutluj River was natural fertilizing process in the region. Since the Indus Basin Treaty and subsequent abrupt stoppage of Sutluj River, the soil fertility decreased many times and local farmers are compelled to use chemical fertilizers and pesticides to compensate this ever mounting soil fertility in the region.

**4. Adverse impacts on pastoral communities of Cholistan:** Cholistan desert is adjacent to the main channel of Sutluj River. Major livelihood of local communities in Cholistan was live stock rearing especially large cow herds. In case of any drought in Cholistan, local pastoral groups used to migrate to the riverine belt of the Sutluj River. Migration to the Sutluj riverine belt in the time of drought was one of the major coping strategy for these pastoral groups. However, they have now become very much vulnerable because they don't have alternative grazing lands. 

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<sup>36</sup> Personal communication from friends in Pakistan based on *their* interactions with people in Bahawalpur area.

# 13

## Displacement, Uprootment, Rehabilitation: The Forgotten People

*“...the residents of villages around Bhakra, Nangal Dam, .....and numerous other developmental sites are better off than people living in the villages in whose vicinity no development project came in.”*

**Observation in the Majority Judgement**  
of the Supreme Court of India  
in NBA vs. Government of India & Ors. Case  
WP 319/1994

*“But the first dam to be built in India ...at least the fundamental problem of the oustees of this dam should be resolved. We are not asking for irrigation, nothing. We only want drinking water...”*

**Capt. Omkar Singh Chandel,**  
Oustee of the Bharka Project,  
in Year 2001 – 50 years after his displacement



## Displacement, Uprootment, Rehabilitation The Forgotten People

POSSIBLY THE MOST IMPORTANT THING ONE CAN SAY ABOUT THE PEOPLE displaced by the Bhakra dam is that even today, 50 years after their displacement they are still struggling to put their lives back on line.

Numbers cannot convey the immense human tragedy, the long drawn suffering and most importantly, the sense of betrayal felt by the oustees of Bhakra. But numbers are important and we will first look at them.

According to the BBMB, the Bhakra dam submerged 44153 acres (17876 ha ) of land due to which 371 villages were displaced.<sup>1</sup> BBMB further states that 7206 families were affected comprising about 36,000 persons. But these were only the land-owning families. There is no reckoning of the landless people in these numbers. This is quite simply the practice with most of the large dams in the country. Out of the total land, 23863 acres was private land.

The town of Bilaspur, capital of the Raja of the Bilaspur State was also submerged and this affected 4000 people. The resettlement is very neatly tallied by the BBMB as follows:

Settled By H.P. Government in its own area	2395
Paid Cash Compensation and resettled according to own choice	2632
For remaining, Rehabilitation Committee established and land acquired for resettling them in the command area in Hissar	2179
<b>TOTAL</b>	<b>7206</b>

The BBMB Status note says “oustees had indicated their preference for lands on areas which were to be irrigated by Bhakra canals. As such, Bhakra Dam administration...acquired approximately 13200 acres of land in 30 villages of Hissar district...”

In all, the picture painted by the Status Note is of an enlightened and fair policy, well organized resettlement plan, executed by a sensitive machinery, and well settled people. Nothing could be further from the truth.

We visited two resettlement sites established in District Hissar (Haryana). In these sites we met with large number of oustees, individually and in groups. We also visited the original submergence villages, where the oustees who had “settled according to own choice” were living, on the slopes of the hills. Here again, we had meetings individually and in groups. We visited (New) Bilaspur town and talked with a number of people. We also met social and political activists, journalists and others who had / were working with the affected people. We

<sup>1</sup> BBMB 2002b: ‘Status Note on Bhakra Ousteers’, unpublished.

had access to fair number of Government notifications, papers, discussions of meetings, memoranda submitted by the oustees, news reports all from the earliest years of displacement till up to recent times. We also had the advantage of the detailed reports of an earlier fact finding visit to the Bhakra dam oustees by SANDRP<sup>2</sup>, an organization based in Delhi. The only official document that we could get from the authorities is the above mentioned Status Note. By far the most important of all these was the voices of the people themselves.

We heard the anguished and poignant stories of people. The period of building Bhakra was the time of a newly independent nation –there was a mood of patriotism, sacrifice and nation building. We heard in people’s voices the feelings of pride that their sacrifice was to contribute to the country. But the stories also told of the enormous sufferings of two generations to get back their lives on track – and not yet fully successful in this. We sensed the often unarticulated feelings of being subsequently betrayed, then simply forgotten by an ungrateful nation.

From these testimonies of the people, from the official and other papers we have, we have tried to piece together a picture of the process of displacement, uprootment and “resettlement” of the Bhakra oustees. The picture that emerges is not a pleasant picture. It is a picture that should make us hang our heads in shame. But most of all, it should stir us into action, to try and remedy, to correct and to complete a process that is 50 years over-due. And to ensure that the story of the Bhakra oustees is not repeated in other parts of the country.

### **SITUATION PRIOR THE CONSTRUCTION OF THE DAM**

The submergence zone of the project lies nestled in a breathtakingly beautiful valley, with forested mountains rising high on the side on the river (now reservoir).

The project was being planned since the early 1900s. Right from then, the villagers never believed that a river could be dammed, that the flow of water could ever be controlled by the human race. They would say '*Dariya ko kaun rok sakta hain? Na kiseene roka hai, na rok sakega*'.<sup>3</sup> According to Roshanlal Chandel of the village Bhakra, the people had never seen nor heard of a dam and did not know what the damming of a river entailed.

Farming was the major occupation. The plains on the banks of the river were extremely fertile. Both the kharif and the rabi crops could be cultivated. Irrigation was done with water from the Sutlej and the large number of natural streams flowing into the plains from the mountains. A variety of crops like corn, wheat and cotton grew there. Most people also owned orchards there. The corn that was cultivated in the region was sent to Punjab and Haryana. They never used synthetic fertilisers or pesticides. They sold the fruit from their orchards. The people told us that they never had to buy foodgrains and were completely self sufficient with regards food for themselves and for their cattle. The only things that they had to buy from the market were clothes and salt.

Apart from income from agriculture, there was a substantially large cattle economy in this region. Each family owned 25-30 heads of cattle. Ghee was made and sold widely. While the people lived in the plains, the cattle sheds were situated in the mountains where there was ample fodder for the cattle to graze on.

A number of people were employed in the army. This was a source of pride for the community as well as being a source of income.

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<sup>2</sup> South Asian Network on Dams, Rivers and People, New Delhi [www.narmada.org/sandrp](http://www.narmada.org/sandrp) and [www.janmanch.org](http://www.janmanch.org) (SANDRP 2001)

<sup>3</sup> Who can stop the mighty river? No one ever has, no one ever can.

## RESETTLEMENT POLICY

The displacement *seems* to have occurred in two stages. Initially the people upto 1280 feet level were displaced. It appears that they were not given any choice about opting for land based resettlement. They were given only cash compensation.

The people affected above 1280 feet up to 1700 feet level, were given a choice to either accept land or cash compensation.

Those getting cash compensation only were left to fend for themselves. Most of these were oustees who chose to continue to live in Himachal Pradesh itself – simply moving up the slopes of the hills on the side of the river – as they had no other place to go.

The facilities provided for those settling in Himachal Pradesh, according to BBMB, were – free fishing licenses in Govind Sagar for three years, new ferries, roads and village paths in lieu of those submerged, gainful employment on the dam.

Ousteas desirous of getting land were given land in Hissar district (which is over 200 kms away from their original homes). The policy was that no oustee would be given more than 25 acres of land, but also not less than his acquired holding, *subject to his compensation amount being adequate to meet the cost*. In other words, it was not really a land-in-lieu-of-land policy. The oustees were paid cash compensation, and they were to pay for the new lands from this. It also appears that a cut was placed on the compensation given to the oustees. However, the oustees were not to be given any proprietary rights to these lands till they had “fulfilled all the conditions of resettlement” and paid all sums due from them. Among the conditions was that if any Court decision led to increase in the price of lands allotted to them, the oustees would compensate the Government for the same.<sup>4</sup>

Landless tenants were also declared eligible for allotment of land equal to the extent of their submerged tenancy subject to a maximum of 5 acres. The price of the land allotted to them (including 15% Compulsory Land Acquisition Charges) was recovered in 20 equal half yearly installments with a 5.25% interest.<sup>5</sup>

It was also decided to allot ½ acre of land free of cost to each artisan and labourer of the rural area who did not own or cultivate land *provided he shifted and settled to the Hissar district. The price of such land was recovered from the other oustees allotted lands through a 1% surcharge!*<sup>6</sup>

Some rudimentary facilities were also given to the oustees at the new sites in Hissar.

The town of Bilaspur was to be fully submerged. A new town was therefore built on the slopes of the adjoining mountains. The markets were situated at the foot of the mountain, while the government offices and residences were built higher up the mountain. Each family was given a plot of land. There were 3 categories of plots. House plots (10x10 sq. ft.), Commercial Plots and House cum Shop Plots (37x38 sq. ft). While the cost of plots was Rs. 4000, the families were charged Rs. 226 per plot. The families were given rehabilitation grants for the construction of their new homes.

## WHAT REALLY HAPPENED

The policy was hardly fair or adequate, both, in its conception and implementation – as we shall see in detail.

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<sup>4</sup> From "Scheme for Allotment of Land to Bhakra Ousteas" given in the Application Form to be filled in by the oustees for getting land. Interestingly, the form – at least the copy we got – was in English. We were not able to find out if the form was also available in Hindi or the local language.

<sup>5</sup> BBMB 2002b

<sup>6</sup> BBMB 2002b

What is really extraordinary is that in spite of this, the oustees themselves were remarkably understanding, cooperative and accommodating at every step even as they went through enormous hardships – an attitude that remains even today, even as the oustees are into the third generation; albeit, with a tinge of the feeling of being betrayed.

Even while pointing out some of the serious problems with the policy and implementation, the oustees repeatedly told us that this was the first dam in the country, and the Government did not have any experience in this field. So, the oustees told us, how could it be expected to have an ideal resettlement plan? The Government was learning, they said, and the oustees willingly gave it the benefit of this.

This rather touching faith in the Government was slowly to erode as the years went by and the oustees realised that it was not the “learning” that was responsible for the bad resettlement but the insensitivities.

Another important factor, as already mentioned above was the mood in the country – of nationalist sentiments, of sacrifice for the nation. The oustees too were infected with this mood.

This did not mean that the oustees just accepted what had been offered to them. They made large number of suggestions, demands, through their memoranda to the authorities; and they felt that these would be accepted in the same spirit as they were accepting their displacement.

#### **RESETTLEMENT OF OUSTEES SHIFTED TO HISSAR DISTRICT**

On 8th Nov. 1953, the “Bhakra Dam Sufferers' Association” presented a sheet outlining “Our Demands”<sup>7</sup>. This note clearly seems to be addressed to the then Prime Minister Jawaharlal Nehru, who apparently visited the site on this date. Among the several demands are:

“1. The displaced persons should be rehabilitated on lands to be irrigated by the new canals and almost (sic) settled at one place...

“2. Compensation of land and house property to be submerged should be settled in consultation with the Representative of the sufferers.”

It ends with a hopeful plea:

“It is prayed that your honour will order immediate instructions ... and thereby save us from the uncertainty and insecurity in which we are placed at present. Let your visit give peace to our disturbed minds and remove our sufferings”

As per the demands of the oustees, a representative team of the project-affected persons was taken to Haryana (Hissar) and shown the sites proposed for rehabilitation. The team was not in approval of these sites. These sites were mainly consisting of bad quality land, overgrown with bushes and undergrowth. It was also spread out in many places.

The people instead had asked for 11000 acres of grassland that they had seen near Fatehabad in Haryana. The project affected persons had expressed a desire to be settled as a community so that they would be able to maintain their culture and methods of living. We saw this demand in the above memorandum. This demand was repeated by them at every stage. They had even written a letter to the then Prime Minister of India, Pt. Jawaharlal Nehru, demanding the same. Their demands were denied and they were forced to settle on the sites shown to them. The villagers are of the opinion that they were not settled as a community since the government was afraid that they would unite and fight the government for their rights. Finally, the people were settled in 33 villages spread over a wide area.

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<sup>7</sup> Copy obtained by us and available in our records.



The people in the two sites visited by us - Ahlisadar and Ratta Tibba- told us that the land they were given was covered with thick overgrowth of wild vegetation. There was also thick and rampant growth of a wild form of grass, locally called *Dila*. This grass has thick nodes/knots and is difficult to uproot. It took 15-20 years of backbreaking work for the people to make the land cultivable. An entire generation spent their life just trying to make the soil arable. There were also many wild animals and snakes, making habitation on these plots very dangerous. This was not the case of just these two villages, but almost with all the resettlement sites.

A question needs to be asked at this point – why was such land chosen to be given to the oustees? The oustees had asked for lands in the Bhakra command – but certainly not for uncultivable, overgrown lands. At least, we have not come across any memorandum or letter of the oustees asking for bad and unproductive lands.

It may be also worth recalling here that Hissar was the worst off part of the command. It was placed in the Zone III. We have seen in the Chapter on the Command Area that Hissar of 1950s, comprising of today's Hissar, Bhiwani, Sira and Fathebad districts – is described as follows<sup>8</sup>:

“Situated ....on the fringe of Rajasthan, it partakes of the features of a desert; dry hot weather, dust-storms, and shifting monsoon sand-dunes.”

On the other hand, there were many areas in the command, especially those in Zone I “which lie near the hills and receive good rainfall during the monsoons as well as during the winter months”.<sup>9</sup>

These included areas near and around Patiala – which means they were much closer to the original villages of the oustees. The areas where the oustees were resettled were over 200 kms away from their village. The areas in Patiala or other parts of the command like Samrala, Rajpura in Zone I were less than half the distance.

It may be further noted that land was available in these areas. We have seen that Patiala was the district in which most new land was brought under cultivation next only to Hissar. Between 1953-54 and 1958-59, 144000 ha of new land was brought under cultivation. Could part of this land not have been given to the oustees?

The reason why the oustees were given land in Hissar may be deduced from the BBMB Status which states that the Rehabilitation Committee found suitable land in Hissar district at “cheaper rates”. It was obvious that unarable land, covered with thick overgrowth, in a relatively semi-arid zone would be cheaper than better lands in a better agro-climatic zone.

So we had on one side the oustees who were readily agreeable to sacrifice for the nation, placing a touching faith in the authorities; and the dam officials who did not care to even find good land for the oustees. This thinking has persisted all through these years and even today, the oustees of dams in the country are treated like second-class citizens – for whom second-rate arrangements will do – even if this is a question of their lives and livelihoods. In the spirit of cooperation and understanding the oustees did not demand lands in the Zone I areas. Yet, they did repeatedly ask for settling together as a community<sup>10</sup>. This too was not respected.

According to Ajmer Singh Chandel, formerly from village Bhakra, now settled in Bardana, Haryana, all families were given 16 *Marala* (1/10<sup>th</sup> acre) for house plots<sup>11</sup>. The value of these house plots was deducted from the amount of compensation that had been determined. Land

<sup>8</sup> R.L. Anand; *Punjab Agriculture Facts and Figures*; Economic and Statistical Adviser to Government of Punjab; 1956 Page 4-5

<sup>9</sup> Raj 1960: Page 49

<sup>10</sup> For example, letter of the Bhakra Dam Suffers Association dated 14 March 1956 written to Pt. Jawaharlal Nehru. Unpublished document, copy available in our records.

<sup>11</sup> BBMB figures work out to 20 marala

worth the remaining money was acquired and allotted to the project affected families. An upper ceiling for land allotment was established at 25 acres. However, there was no stipulation regarding the minimum amount of land that should be allotted.<sup>12</sup> The result being that some received 2-3 acres of land, some far less than this – even 2-4 *marala*! Since all families received 16 *marala* for house plots, there were cases when the land received for the house plots was greater than the agricultural land received.

Ajmer Singh – who was for 15 years the president of the oustees’ association – continued with the explanation for this. The amount of compensation was determined based on the value of land that each family owned in the original village. Valuation of land was done as a 5- year price average, which was extremely low compared to what it was actually worth. This is because trading in land in this region was not done regularly. There are 2 reasons for this: One, that there was never really a need to sell land, since most landowners were farmers. The other, that it was a social stigma to sell land. The average of the 5-years prices was therefore low. Another problem was that while land was acquired in 1946, according to rates prevailing at those times, land acquisition for resettlement was done only in 1956, by which time, land prices had increased.

The oustees were not to be given land-for-land, but only whatever land could be purchased with their compensation. Due to the two factors given above there was a gross difference in the quantity of land lost and the land they were able to purchase. According to Jagatsingh Chandel, an oustee of Sloa village – only 60 families out of 1700 got about 25 acres of land; most people could get only 2-3 acres.

Added to this was another serious issue. The landowners in Hissar from whom land had been acquired for resettlement of oustees were dissatisfied with the compensation given to them, and went to Court. In many cases, the Courts granted substantial increase in the prices. In these cases, the Government asked the oustees to pay the arrears! The oustees pleaded that this increase should not be passed on to them. They said that in all good faith, and in national interest, they themselves never moved the courts to get *their* compensation enhanced, even though it was so low. But their pleas fell on deaf ears, and the oustees who were stuck with bad lands now had the additional burden of paying the enhanced compensation to the former owners.<sup>13</sup>

In a note attached to the Agenda for the 48<sup>th</sup> Meeting of the Bhakra Rehabilitation Committee to be held on 2 May 1961, Shri K.R. Chandol, Dy. Commissioner, Bilaspur, (H.P) suggested that this matter to be included in the Agenda. He wrote:

“As a result of the decrees of Civil Courts in reference to petitions under section 18 of the land acquisition act 1894, the prices of the land allotted to the Bilaspur oustees<sup>14</sup> in Hissar district have been enhanced and the allottees are being asked to pay the same. ....The Bilaspur oustees have been hard hit and request that they may be exempted from the payment of the enhanced prices.....”

<sup>12</sup> In fact, the minimum stipulation *was* there – of land equal to the land acquired from them – but this was subject to the oustees having adequate compensation left to meet the cost of the land. This virtually made this stipulation into a farce.

<sup>13</sup> We see that while BBMB claims that the lands acquired for rehabilitation were “cheaper”, this was because the lands were purchased in poorer quality areas like Hissar as compared to Patiala, and because the initial compensation given to the farmers was lesser. In the end the lands were more expensive than they had thought. The brunt of this fell on the oustee who was sandwiched between less than fair compensation for his lands, while having to pay much more for the resettlement lands. It may be argued that buying lands for the oustees in Patiala would have meant that the lands would be even costlier, but this is a specious argument. In reality, the whole policy of asking the oustees to buy land with their compensation is a faulty policy. The policy should be that the Government buys for them land equal to the lands they have lost, with a minimum guaranteed economic land area.

<sup>14</sup> All the oustees were known by the generic name “Bilaspur oustees” or even the derogatory *bilaspurias* in the resettlement area.

What was the response of the project authorities? Pointing out that the matter had already been considered in an earlier meeting (the request of the Bilaspur Dy. Commissioner was for re-consideration), the Additional General Manager, Bhakra dam says<sup>15</sup>:

“..all cases, in which price is enhanced by the civil courts are fully examined, and wherever it is legally advisable appeals are lodged in order to reduce the enhanced price. The cost of such appeals is already being borne by the Government, which is a big concession and as such, it is only fair that the enhanced price should be paid by the allottees.”

Jawaharlal Nehru, in one of his speeches during a visit to Bharka has declared that the oustees are going to another land; but we will make such arrangements for them that they will forget their homeland...we will give them water, school, electricity, roads.....<sup>16</sup>

“But when we came here, there was nothing.” Ajmer Singh told us. He continued:

“We had asked that we all be settled together in one place. But the Government refused. So they acquired the land for us. When we came here this was all a jungle. There was overgrowth and thick bushes. The land was completely uncultivable. There was also thick and rampant growth of a wild form of grass, locally called *Dila*. This grass has thick nodes/knots and is difficult to uproot. It took us 15-20 years of back breaking work to make the land cultivable. An entire generation spent their life just trying to make the soil arable. There were also many wild animals and snakes, making habitation on these plots very dangerous.

“There was no facility of even drinking water. There was no electricity. We were shifted in 1956, we got electricity in 1972.

“When we came here, all that each family got was a tent each for shelter. Some places some huts were constructed. There were also many wild animals and snakes, making habitation on these plots very dangerous. Apart from these there were numerous episodes of theft; except one –two houses everybody had to face the theft. There was no one we could even complain to.

“Many of the oustees had to live off the cash compensation they had got. Several families even had problems about managing a square meal”.

There were also no schools, colleges, or dispensaries. The lack of post offices in the region made communication with their original homes very difficult.

Land had been allotted under the Colonisation Act, 1912. They had therefore not received title deeds for their lands. Most of the people received proprietary ownership only in 1980. Due to this, they were not able to get loans against the land, and could not invest in the land because of the uncertainty.

Irrigation – which was the reason why they had demanded and had been given land in the command – was also to prove elusive. Irrigation facilities were provided to the people only after about 15 years. Even after that there were problems as the areas were at the tail end of the system.

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<sup>15</sup> Notes for Agenda of 48<sup>th</sup> Meeting of Bhakra Rehabilitation Committee to be held on 2 May 1961: Item No. 13

<sup>16</sup> As recounted by the oustees.

A letter written by the Dy. Commissioner, Resettlement, Hissar to the Chief Engineer (South) Irrigation Works, Haryana dated 6 April 1968 is telling (Language verbatim, as in the original):

“The difficulty of lessor (*sic*) or even not supply (*sic*) of canal water for irrigation is being faced in almost all the villages of Bharka oustees. In certain cases of a few different village the level of the land of the oustees is some what high and hence it cannot get water even at all or in little allowance. ...The holdings of most of the allottees are small and the duration prescribed for the supply of water is so short that an allottee of few bighas or even a couple of acres can get a very little advantage of irrigation in as much as the short period time for water is available just to reach their fields. Thus small land holders are not able to get water for irrigation of their whole fields and cannot meet their requirements from the small holdings.”

Apart from confirming the situation of irrigation that the oustees narrated, this letter also highlights the point that many oustees had got very little land. Thus, the oustees were deprived of the two major benefits that the dam had generated – electricity and water.

Serious problems were faced even with respect to the house plots. In many cases, the house plots were forcibly occupied by the residents of the original villages. When the oustees complained against this, the locals lodged false cases against them, and the whole administrative machinery being in favour of the locals, resulted in a lot of harassment to the oustees. Even till date, there are plots that continue to be forcibly occupied, we were told.

What is worse, for many years the oustees did not get the land titles in their names and even till date, large number of cases remain outstanding. The oustees told us that 2456 oustees remain for getting proprietary rights. Clearly the issue is serious enough for the BBMB Status note of 2002 to mention that proprietary rights for the plots allotted to the oustees “have been conferred to 2212 nos. till 31.12.2001 out of 2285 nos.”. The responsibility for the backlog of 73 is laid on the oustees.

Due to all these serious problems, a number of families who had opted to resettle in Hissar either did not come or went back after trying to survive in those difficult circumstances.

### **Economic and Social Impacts**

The entire economic and social structure of this population was completely disrupted with displacement. Long arduous years were spent trying to scrape up enough for minimum sustenance. The families, when they came here initially survived on the partial cash compensation that was given and the little money that the people had brought with them. Agriculture was extremely difficult, and there were no other jobs. There are no reservations for oustee families in the case of government appointments. In Himachal at least one person in each family was employed in the Dogra regiment of the army. (This regiment recruits cadets from Jammu Kashmir and Himachal Pradesh only). They have no reservation in the army anymore. While being in the army proves as an alternate income, there is also a fierce sense of pride in being in the army. Consequently, not being able to serve in the army is not only a loss of income, but is disheartening for the community.

There have also been several other social repercussions. In Himachal, according to Shri Sansar Chand Chandel, anyone who owned less than 10 acres of land was considered poor. Now that they own 2-3 acres in Haryana, it makes the people feel they have lost their economic standing in the community. People who were thus held in high esteem in Himachal feel shame faced in Haryana.

The women mentioned that arranging marriages has become difficult. Since there has been a loss of esteem that a family enjoyed, parents are hesitant in marrying their daughters into these families. Families living in Himachal do not prefer their girls to be married into families

settled in Haryana. Girls who do marry into families settled in Haryana, have problems in settling in these villages. The climate in Haryana is very different from that in Himachal. The soil in Haryana is loose and there is a lot of dust. The heat here is high and unbearable. Relatives still living in Himachal do not visit Haryana very often because of the drastic change in the climate. Cost of travel between Haryana and Himachal is also a factor.

The women when in Himachal had more freedom of movement and could be out of the house till as late as 2.00 in the night. But in Haryana, there is the fear of being in a strange land among strange people and therefore their movements are restricted.

The people said that they were far healthier when they were in Himachal. Food intake was high and nutritious. There never went a day when they were hungry. The women said if today they could go back, they would even if they had to eat dry roti with salt. (*Yadi vahan aadhi roti ke saath namak bhi khana ho, tho who isse achha hai*).

The women of Ahlisadar told of moving circumstances, when the elders passed away not having once gone back to their homelands. Families were broken, daughters never met their parents again. The elders died having lived a life of strife, struggling to stay alive and to make the lives of their children easier. They passed away in alien lands among alien people and alien customs, always wishing they could go back just once.

So deep-rooted is this longing for their homeland that some of the women broke down when narrating all this to us.

Even 50 years after they moved to Haryana, the project-affected families still feel they are the outsiders there. They are derogatorily called '*Bilaspuria*'. (Since they are from the Bilaspur district of Himachal). They have not been able to merge with the local communities in Haryana.

The oustee families have no political representation since they are in the minority. The oustees in the Ratta Tibba resettlement site mentioned that they have not been able to elect their member to the Panchayat ever since they have settled here, making them politically weak. Their grievances are therefore neither heard nor acted upon.

They still face ostracism and severe repression at the hands of the local communities. They have not been able to build relationships here. The women say '*Hamen nahin lagta ki ye hamara gaon hai. Log alag hai hamse, sanskar alag, bhasha alag, jaati alag*'. The people feel trapped - no more being a part of their own community in Himachal, nor being accepted by the local people and not being able to adjust to the life in Haryana.

Till date the economics of their lives have not been ironed out. They still struggle to keep up with the growing expenses of agriculture in Haryana. They repeatedly emphasized the increasing cost of inputs and declining returns of agriculture. For example, they said that where good quality groundwater was available, the water levels are going down. Earlier, they could do with a 5 H.P. motor, now they need 20-25 H.P. motor.

The people told us of how the agriculture in their home villages was possible without all these inputs. They told us of how they could take two crops there and also would get fruits from the orchards. They also said that most of the oustees, many of whom already had small pieces of land, have been reduced to very small landholdings due to the division in two generations. They said that while the division would have also taken place in their original villages, there was space to expand by bringing more land under plough. Also, there was scope for jobs in the army. The feeling that came across sharply was that while there would have been problems in their homelands too, it was much easier to address them due to more resources and the confidence and support that comes from being in one's own community.

They are also still struggling to access basic facilities. Ratta Tibba receives its drinking water from a nearby village, which let the waters out irregularly. If an argument erupts between the

two villages, the host village does not supply water to Ratta Tibba. They are presently trying to get the government to build the water works in their village also.

They have also formed an organization called the 'Purushartha Committee' to try and address the problems of the oustees. This Committee was formed in 1990 "with a view to achieve proper rehabilitation of the Bhakra dams displaced persons."<sup>1</sup> It is a telling commentary on the state of affairs that even 50 years after the displacement, the oustees are fighting for proper resettlement and they still have to have an organization dedicated to this.

### **SITUATION OF OUSTEES SETTLING IN HIMACHAL PRADESH**

As we have seen, a number of oustees were given no option, or opted to take cash compensation. Part of this was driven by the fact that those wanted to opt for land would have to go off to far off, alien lands of Hissar. There were many who opted for land, went to Hissar, and then returned due to the enormous hardships there.

The people who took cash compensation were left to fend for themselves. Most moved up along the slopes of the mountains where they are still residing. They were not to get any land. However, after much struggle, the Himachal Government did try and allot some land to the oustees staying in the state.

Those who had returned from Haryana and some others who had demanded land for land, were allotted land in the mountains under the 'Nau Tod' policy. That is, government land that was for the first time "broken" and allotted to families who had been affected by the dam. But this too were very small patches of land not more than one acre or so, according to the oustees.

The people who moved into the mountains, received cash compensation at the rate of Rs. 100-500 per acre depending upon the quality of the soil. There were no banks at the time when the compensation was given. Many of the people therefore deposited their money with the local *Sahukars* (money lenders) who the villagers claim never returned their money to them. Several families in effect were left penniless. Some people were allotted approximately 4-5 bhigas land per family in the Naina Devi Sanctuary nearby. However, according to Shri Batansingh Chandel this was not arable land and therefore the agricultural land lost was not compensated for. The landless labourers who did not receive any lands were given a token sum of Rs. 200.

The villagers were given nominal amounts for the orchards and trees that were submerged. Subsequently some people did go to the Courts to get their compensation enhanced – but it is not clear if all were able to follow up on this. One case shows the level of underestimation of compensation for trees. In 1961, one Daulat Ram went to Court and got his compensation for trees enhanced by Rs. 12385.00 – a large sum in those days<sup>2</sup>. The compensation for the wells was given to the government.

Since the people who settled along the mountain slopes had no lands, they faced serious economic difficulties as the major source of their income was acquired. Jobs then became the main source of survival. Some people got work at the dam site; some continued to get jobs in the army as per the tradition of the area. People told us that it is only through this that they could survive.

According to Gyansingh, oustees of village Bhakra:

"Those who were employed on the dam site were able to scrape in some money to be able to survive. With our lands gone, our only means of income was taken away. People either laboured on other people's fields (those people whose fields were not

<sup>1</sup> Annual Report 1999-2000 of the Bhakra Dam Ousteas Purshartha Committee, Ratta Tibba (Bhakra Dam Ousteas Purshartha Committee 2000)

<sup>2</sup> From the Judgement and Order of the Court. *Court of Judicial Commissioner, H.P. at Simla: Judgement in Civil Appeal No. 21 of 1962 dated 10.12.63 By Om Prakash, Judicial Commissioner.*

submerged) or by working on the dam. Work on the dam site however was not easy to come by. There was a general belief that the local people were inadequate when it came to working with construction material. Pathans were brought in from the North Western Frontier since they were believed to be more hardworking and as people who were skilled at working with stones and the construction of structures. There was also no policy at that time which would ensure that at least one person from each family would be employed with the BBMB, either as office help or as construction labourers. I worked on daily wage basis for 11 years and was only then regularised. In spite of the difficulties, I managed to educate all three of my children, but now there are no jobs for them.”

After some time, the H.P. Government also made attempts to provide some lands to these people.

But the living conditions were abysmal. The whole infrastructure has been disintegrated due to submergence and displacement.

The biggest problem was, and *continues to be* water. It is ironic that the people displaced for such a huge reservoir, living of the banks of the same continue to suffer from such a serious water problem. For example, the following noting from the Agenda of the Rehabilitation Committee Meeting held on 2 Sept. 1966 makes the situation of water clear:

“The oustees have been resettled in the demarcated forests/charands of Bilaspur District from time to time and besides other difficulties, the major problem which they are facing is scarcity of drinking water for their animals and human beings. This difficulty assumes serious shape when the waters in Gobind Sagar starts rising with the onset of rainy season. When the water goes down the old springs and wells come out and the oustees feel easy in drawing water. But with the rise of water the springs and wells get submerged and with no provision of water at the places of their settlements they have to tread for miles to get drinking water and in some cases they have to cross the mighty Gobind Sagar to fetch water from sources at other side. And it is very dangerous when there is wind....”

This was more than 10 years after displacement, more than 3 years after the dam had been dedicated to the nation by the Prime Minister. But the most disturbing aspect is that even today, drinking water continues to remain a major problem.

The note by the Bilaspur Chief Medical Officer quoted earlier in the Chapter on Environmental Impacts shows the situation of water today. We repeat the relevant paragraph<sup>3</sup>:

“3. The reservoirs [Govind Sagar] covered all the natural water sources and are now depending (sic) on the lake water as well as the water supply scheme provided by the Govt. These water supply schemes become dry during the summer season and most of the people have to depend for water which is not all the time can be consider potable.<sup>4</sup>”

According to “Captain” Omkar Singh Chandel of Bhakra village:

“Our biggest problem is water. We can see the water of the Govind Sagar reservoir in the distance below us, but we do not have water. Forget about irrigation, we do not even get water properly for drinking.”

<sup>3</sup> Note No. HFW (BLP) PH/99- H.P. Health and Family Welfare Dept. Distt. . Bilaspur, prepared by Chief Medical officer in response to D.O. No. HFW-B(C)17-1/95-II dated 6 March 2000 of Secretary Health, Shimla with Subject : Impact of Reservoirs in Satluj-Beas Basin and Sundernagar Hydrel Chennel on Hydroplgy, Environment and People in H.P.

<sup>4</sup> Verbatim, as in original, through out

Since the people are living on the mountain slopes it is an arduous task to go down to the river (reservoir) to get water. Even if they do it, it is a big problem since the rights to the water in the reservoir are with the Punjab and Haryana Government and according to the oustees, they do not allow the waters to be lifted by people in Himachal. Though now the authorities *tend* not to stop people from taking water for drinking, they draw the line at irrigation withdrawal.

The people had for long to depend on the mountain streams which do not necessarily flow all the year round. In 1978, the Himachal Government prepared a water supply scheme for the oustee villages, but this has not been able to cope with the requirements. And the houses which are higher up on the slopes do not even have this facility. So they have to rely on the streams, and some handpumps which are located on the roadside. But the situation becomes very difficult in the summers. We were told that during the summer, the water supply is often through tankers. The BBMB does not even allow the filling of these tankers from the reservoir.

Gyansingh of Bhakra village told us:

“Water is serious problem here. There is now a pipeline to supply water – it came only in 1988. But it is highly unreliable – sometimes water does not come even for 4-5, even 10 days at a stretch.”

Even today, drinking and domestic water remains a problem. The people used to use the Sutlej waters and those of the streams flowing into the river for drinking purposes also. Sutluj water is not accessible due to reasons given above. The streams in the hill are far and dispersed and have also reduced in number. Some of them have also dried up. We saw a small pool that had been made to collect stream waters. This dries up in a couple of months after the monsoons, since the quantity of water which accumulates in it is negligible. The people have to now climb down steep slopes to reach a water source sometimes having to go as far as a kilometer or two to fetch drinking water. The government has installed taps at several points mainly along the main road, but the water received is inadequate. In the summer months the village receives no water at all.

In spite of giving up their lands and livelihood for a project to generate electricity, the oustees themselves did not get the benefit of this for years. There is a legendary story about Shri K.L. Rao in this connection. The oustees at Bhakra narrated the story to us. Shri K.L.Rao, then central Irrigation Minister visited the Bhakra site. A person from the village, Hawaldar Dhunichanji went to him in the day with a lit lantern and told him '*Deep tale andhera*', (darkness under the lamp) meaning that while the dam site was heavily lit in the night, the village in which the dam was built did not receive electricity that was being generated there. The reason given by the BBMB for Bhakra village not having electricity was that the village had no roads and therefore the electricity poles could not be installed. BBMB also indicated that this (supply of electricity) was an unfair burden on the project. Shri Rao immediately proclaimed that the village would definitely receive electricity and that there would be no charge for it. The village received electricity finally in 1970; they had to pay for it.<sup>5</sup>

K.L. Rao himself narrates this incident in his memoirs<sup>6</sup>.

“..... It was many years later, during one of my visits to the dam site, that I found that the new village of Bhakra had neither drinking water nor electricity, though surrounded by blazing brilliant lights. This was indeed unfair and I asked the Bhakra Management Board to supply both power and water to the village. Even then, there

<sup>5</sup> Other villages got electricity even later according to the oustees.

<sup>6</sup> Rao, K.L. 1978. *Cusecs Candidate : Memoirs of an Engineer*, New Delhi: Metropolitan Book Co., quoted in Rangachari, R., N. Sengupta, R.R. Iyer, P. Banerji and S. Singh ( 2000): '*Large Dams: India's Experience*', a WCD case study prepared as an input to the World Commission on Dams, Cape Town, [www.dams.org](http://www.dams.org)



were objections. The Management Board thought that this was not a proper charge on the Project. This indeed was an absurd approach which I overruled.”

Another major problem for the people living on the mountain slopes is that of landslides. People believe that a major factor to have precipitated this is the massive blasting activities that have been undertaken in the region. Whatever may be the reasons, there has been a big increase in the incidents of land slides that have occurred. The people refer to this phenomena as 'Sliding and Crushing'. Sliding is when the land beneath or below the house slides; crushing is when land above slides and crushes the house. There has been wide spread damage to property and life due to this. Several homes have sunk in upto 10 feet. Many others have been crushed by these landslides. Part of Shri Omkar Singh Chandel's house was once swept away in one such episode. While the authorities were willing to pay some families whose houses had been grossly damaged a sum of Rs. 5000-10000, this is a paltry sum compared to the cost of building. In 1988, the villagers wrote to the government demanding that they be resettled in safer zones. The government has received in all 1500 applications. In December 2001, 2 of these 1500 people received notices from the government mentioning that they would be given land in another area. While one of these 2 people has passed away, the villagers are not able to recognise the identity of the other person.

Several lands near the reservoir also became difficult to access and dangerous to live on since they were surrounded by water on three sides. These patches of land, slide lower into the reservoir every year. They have approached the government, asking them to take over their lands and consider them to be part of the oustee group and therefore being entitled for rehabilitation. The response of the government was extremely discouraging. They were told that they would be bound to accept the amount of compensation that the BBMB would decide upon and that they would have no say in the issue. Also, they would not be allowed to retrieve the material from their old houses. Considering their past experiences with the BBMB, the people did not trust that they would be compensated in a just manner and therefore have resigned themselves to a fate of living in danger and in being completely submerged at any point of time.

Another serious problem was that many of the local roads, paths, ferries were cut off due to the reservoir. The authorities had promised that other paths would replace these. But this was not done for a long time, and even today, the people have to travel much longer distances in many cases.

Apart from the dislocation, the oustees are also paying the price for living in a place of “national importance”. There is restriction in the access to the villages. If an outsider wants to enter the Bhakra and neighbouring villages, permission has to be sought from the BBMB office in Nangal. Entry after nightfall is also restricted. There have been occasions when a marriage procession was detained in Nangal, since they arrived after nightfall. Till some years ago, this rule was applicable even for people who live in the village. A person living in Bhakra village had to apply for a permit to enter his/her own village! The people opposed this and expressed their discontent through a *dharna* at the dam site, only after which was this rule relaxed for those who lived in Bhakra village.<sup>7</sup>

## FISHERIES

We were not able to meet any of the fisherpeople themselves. The information that we have obtained is from the other oustees and from a senior employee of the Fisheries Federation.

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<sup>7</sup> Of course, this will be justified by the dam authorities under the name of security measures. They should then also be aware that there are stories rife about how, if one does not have a pass, a few crisp notes are an equally acceptable substitute. The standard request from the guards is “*Mundenu kuch...*” and an appropriate response allows unencumbered entry.

Fishing was essentially carried out in an informal and unorganised manner before the dam. Hence, there is little record of the amount of catch. After the construction of the reservoir, the activity was transformed into a commercial activity with no one being allowed to fish without a license.

However, the government did not allow fishing activity in the reservoir during the first 2-3 years after the construction of the dam. This proved detrimental to the fishing communities in the region (the Daud's and the Rana's). Finally in 1972 (as per what oustees told us), licenses were given to fisher families at the rate of Rs. 50 per license. The BBMB Status note states that free licenses were granted to the oustees for a period of three years but does not mention the year. This though did not prove as a solution to these communities, since method of fishing in a reservoir is different from that in a river. They had to be trained in this new technique of fishing, for which fisherpeople from Bengal had come. These Bengali fisherpeople settled here. New apparatus had to be obtained and new methods learnt; several families could not go back to fishing. Some of them now ferry boats across the reservoir, while others till the little land that they have received as compensation.

In 1972, the families who owned licenses were organised into societies. There are in all 5 societies in the Gobind Sagar Reservoir area -3 of these in Bilaspur district and the other 2 in Una district. The members of these societies shared the profits earned. In 1976, a federation of the 5 societies was formed. Though the fisherpeople could sell only to the Federation, the Federation itself contracted the marketing to private contractors for a long time. Initially only fishing communities were given fishing licenses. Later on people from non-fishing communities were also granted fishing rights. It is said that many people, who had been employed in the fisheries department of the BBMB, quit their jobs, took licenses and started fishing in the reservoir. Now, in the past 2-3 years, only oustee families from the fisher community have been given licenses. Today there are a total of 2000 members in 13 societies. The boundaries in which each society can conduct fishing are clearly demarcated. Even the size of the net that a fisherperson can use is defined. The management of the federation is elected by its members, the societies, which also comprise people with non-fishing backgrounds. The fisheries department of the BBMB also conducts fishing in the reservoir.

There have been several hurdles in this entire process. With the entry of non-fishing communities in the fishing activity, it soon became just another business, which was conducted for profit making - very often sidelining the well being of the fishing communities.

The turnover of the Federation has gone up in the last 10 years or so, after the Federation took over the marketing from private contractors. Since figures before the dam are not available, we are not able to compare the increase in output if any. However, the composition of the species of fish has undergone a dramatic change. The earlier much sought after delicious native varieties like *Mahseer* are now almost gone and an overwhelming part of the catch has been replaced by the exotic silver carp, a low value fish. (See Chapter on Other Environmental Impacts.)

These two communities of Rana and Daud apart from fishing also ran water-run wheat flour mills along the banks of the river. There are 700 such project affected families. With the damming of the river, the wheat mills had to shut down. They were not allowed to conduct fishing in the reservoir for the first 10-12 years. These communities therefore lost their means of income in their entirety. These communities were given some lands for their homes and some agricultural land. These lands were however reported to be not arable.

We have not been able to estimate how much of a role fisheries played in making a livelihood available to the oustees, and how many oustees benefited. This will need a longer and more in-depth study. However, given that the (1) the old method and accouterments of the fisherpeople were no longer useful in the reservoir (2) that the fisherpeople from outside came in many years after the reservoir was created (3) fishing was closed in the initial years - it appears that

the fishing could not have played a substantial role as an economic support activity for the fisherpeople in the initial 15-20 years.<sup>8</sup>

## **BILASPUR TOWN**

The town was the capital of the Bilaspur princely state ruled by Raja Anantchand, at the time of construction of the dam. This state was also one of the last states to be merged in the year 1954. The town has several ancient temples and palaces. The entire old Bilaspur town was submerged in the reservoir.

The present (New) Bilaspur town was resettled in 1954. The town was to be resettled in a completely different region – in areas that are now in Pakistan. However, the people insisted that they be resettled in the same area. The new town was therefore built on the slopes of the adjoining mountains. The markets were situated at the foot of the mountain, while the government offices and residences were built higher up the mountain. Each family was given a plot of land. There were 3 categories of plots. House plots (10x10 sq. ft.), Commercial Plots and House cum Shop Plots (37x38 sq. ft). The families were given rehabilitation grants for the construction of their new homes.

According to Shabbir Qureshi, a journalist in Bilaspur, this grant was too small, and so was the compensation given to the oustees for the properties submerged. So it was very difficult for people to construct houses in the new town. So the Government gave loans – which the people were not able to return for several decades. Ultimately, part of these loans was forgiven by the Government.

As in the villages, there was the joint family system operational here. Hence, the same phenomena of non-inclusion of adult sons in the list of project affected families is seen here. With families growing with every generation, the people feel the need either for larger homes or for more homes to be constructed. In the report on Bhakra oustees written by Vimal Bhai for SANDRP, the people say, '*Hamare vishal gahron mein se in machis ke dibbi mein le aye*'.<sup>9</sup> At the time of displacement, the population of the town was 3500. The new town was planned to accommodate a population of 4000. Today the population exceeds 10000! Before submergence there was space in the adjoining areas for the town to expand. But now there is the reservoir on one side and the hills on the other, thus congesting the town.

Besides this, several families from the villages are now demanding rehabilitation in the town since living in the villages has become unsafe and agriculture is no more economical. According to the SANDRP report, the government's Rehabilitation Committee had declared complete the rehabilitation process in 1983, 20 years after the completion of the dam and 27 years after actual displacement! In 1999, the Rehabilitation Committee was again called upon to look into the 3000 applications that had been submitted by the Bhakra oustees. On scrutinising these applications, 787 were considered valid by the Committee. (The parameters for scrutiny are not clear). Of these 787, 153 families have been promised land for land lost.

While the town was planned, with schools and other amenities provided for, Shri Shabbir Qureshi was of the opinion that the new town lacked the infrastructure that the old town had. A college had been built in 1954 just before submergence and was reconstructed only in 1964, 10 years after the development of the new town. The new town also received electricity only in 1960. But there was no electricity in the old Bilaspur and they saw electricity in the new town only.

<sup>8</sup> We were also told that there was a long gap of 10-12 years (over and above the first 2-3 years when fishing was not allowed) when there was no fishing activity in the reservoir, but we have not been able to confirm this.

<sup>9</sup> "From our huge houses we were brought to these match boxes."

The old town had natural sources of water. There was a live spring (*Kharsi ka pani*) in the region as also a spring and fresh water lake (*Naun talaab*). The old town received its water supply from these 2 live springs. Incidentally, these springs were not submerged and the town still receives water from one of them. The town is currently facing severe water problems, especially in the summer when the water in the spring and the lake reduces. Tankers have to be brought in, to supply water.

With the presence of the reservoir, distances have also changed. A villager who lives 40 kms away before impoundment has to now travel a total of 120 kms to reach the town. Boats were used to cross the river before impoundment. Now, with the high silt deposits, the area has become marshy and dangerous for people and animals to traverse. In the summer season, students, government employees find it extremely difficult to cross over to the town. The government was to build bridges at 3 different places to enable free travel across the reservoir. While only one is built, the other 2, after 50 years of the existence of the reservoir, are yet to be constructed!

As in the rehabilitation sites and the villages, the economics of this town has been affected. However, this might have been tempered since there were some alternate opportunities of income. Also, many people had job opportunities in the army which continued. Today the economy is dependent on the shops and the commercial outfits that have sprung up in the town. A large number of people are employed in the government and the army. Some of those who were economically well off earlier, lost their old wealth and have slid down the economic ladder. While some families moved into the new town immediately after it was built, some families had waited until the waters actually started filling up. The families who had moved in to the town later, took far more time to settle in and to establish themselves financially.

### **CONCLUSION ?**

The 50 years long story of the suffering and anguish of the Bhakra oustees is not yet over. What is significant is that even today, the oustees have not been fully settled and continue to battle it out in their own way. The Government too has been making some intermittent and sporadic efforts. It is too little, too late, but in such matters, it is better late than never. What is required is for these efforts to be stepped up dramatically and a comprehensive plan needs to be prepared –with an initial status survey and then identification of the measures necessary. A time bound program then needs to be made, and the funds for this unquestionably have to come from the project.

Bhakra project was implemented under unique circumstances. Circumstances due to which it got not just the cooperation of the oustees but also their blind faith to the extent that no other project in India got. This was accompanied by a condition which is impossible for any other project in India to get - that at least the resettlement part of the project was completely free from any corruption. Almost each and every oustee made it a point to tell us about the absence of corruption in the Government rehabilitation machinery in those days. Such were the unique circumstances that the Bharka project authorities had.

Unfortunately, these were squandered off. There was a unique opportunity to carry out the rehabilitation in a manner that would have got the authorities the enduring trust of the oustees. Unfortunately, this was not to be – this is one of the greatest tragedies of Bhakra – the breaking of the trust the people had in a newly born nation.

As a whole generation of oustees battled against severe odds to even ensure survival, the sense of betrayal grew in the minds of the oustees. On one hand, the oustees told us of the early days when the dam officials would tell them that the dam needs to be built to provide food for our country, and “we also thought, if this so, it is okay... the whole mood was like that”. The same oustees are now asking very different questions.

One oustee told us, “The freedom fighters who sacrificed for the country are getting pensions<sup>10</sup>. We also made huge sacrifices. But we only got hunger.”

Another oustees told us “Regarding the irrigation benefits, we get the same amount of irrigation as the original residents of this area get. So there is nothing extra for our sacrifice.....”

A pained Omkar Singh Chandel says:

“We are not asking for irrigation, or any such benefits. *Par Hindustan ka pahala bandh jo bana hai, unki mulbhoot samasyaoka to hal ho. Hum to sinchai bhi nahi maang rahe, kuch nahi, aur kuch nahi...sirf peene ka pani chahiye..*”<sup>11</sup>

The words of Shri Roshanlal, another oustee reflect the squandering away of the enormous goodwill by the project authorities.


“*Jo bhi dam se ujadte hain, unhe nuksan hi hota hain. Koi phayda nahin hota. Jin logon ne qurbaniyan di, unka kya hua?*”<sup>12</sup>

We can never forget the following exchange between two of the oustees that took place in our presence.

Shri Batansingh, an oustee, said that they had asked the BBMB to at least adopt the village from which the dam gets its name – Bhakra, but BBMB was unwilling to do so. He also says ‘*Dam se phayda hua, anaaj mila, industries lagin, par visthapith ko kuch nahin mila*’. (The dam produced benefits, foodgrains, industries, but the oustees did not get anything).

The response of Captain Omkar Chandel is remarkable – it exhibits not a just a biting sarcasm, but also the intense sense of humour that seems to have helped them endure the sufferings of the last 5 decades. He replies

“*Hamen to vo ek hi cheez mili- jiske liye saari duniya tadapti hai- naam. Bhakra naam sabhi jaante hain.*”

(We have got that one thing which the whole world craves – name – recognition. Today, everyone knows the name Bhakra) 

<sup>10</sup> The Government of India had declared a life long pension and free railway travel for all those who had fought in India’s freedom struggle and had gone to jail.

<sup>11</sup> “But the first dam to be built in India ..at least the fundamental problem of the oustees of this dam should be resolved. We are not asking for irrigation, nothing. We only want drinking water....”

<sup>12</sup> “Those who are ousted by a dam, always end up suffering – they are always the losers. They get no benefit. What happened to those who made this sacrifice?”

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# 14

## In Conclusion: Behind Bhakra, Beyond Bhakra

*“More ... that is what we need. All the problems  
can be solved if we have more water.”*

**Comment by a participant in a public meeting  
in Narwana, Haryana**

*“The proposed plan will not fully satisfy  
either side. No plan could do that; there is  
not enough water to fill all demands.”*

**Eugene Black, President of the World Bank,**  
writing to Prime Ministers of India and Pakistan in  
1954, urging them to accept the plan proposed by  
the Bank to resolve the  
Indus Water Dispute.





## In Conclusion

### Behind Bhakra, Beyond Bhakra

#### BEHIND BHAKRA

DEDICATING THE BHAKRA PROJECT TO THE NATION ON 22<sup>ND</sup> OCTOBER 1963, Pandit Jawaharlal Nehru was moved to say<sup>1</sup>:

“Bhakra Nangal is something tremendous, something stupendous, something which shakes you up when you see it. ....”

It does. I still remember my first view of the dam – breathtaking, even overwhelming.

Yet, for all this, our study found the Bhakra dam and project to be a most ordinary project, an ordinary dam much like any other large dam – with all its flaws and blemishes.

We saw that the design of the dam was driven by the need to strengthen negotiating positions in the interstate disputes - first between Sind and Punjab, and later India and Pakistan – than the need to address the dry areas. This is a phenomenon that is seen in many other projects. We saw that while the justification being given was to take waters to the dry areas of Hissar tracts the priority was given to augment the SVP. The areas proposed to be irrigated by the project had also been highly exaggerated – a familiar phenomenon in large dam projects.

Most dam projects, by the very fact that they store water that otherwise would have flowed on further down, work to transfer water from the downstream areas to the upstream. In the case of Bhakra, this was taken to the extreme, and the areas benefited by the project are actually a transfer of irrigation from downstream (SVP areas) to the upstream.

We found that the anticipated foodgrains production from the project – a crucial part of its very *raison d’etre* - had not been properly worked out but only some general estimates made.

In these and in many other ways the Bhakra project was just another dam. Nor was it much different as far as performance went. Indeed, its performance has been at gross variance with its larger-than-life public image.

We started with the widespread public perception that Punjab and Haryana are the granaries of the nation and that this is due to Bhakra. The “Punjab=Bhakra” (and to a lesser extent “Haryana=Bhakra”) is an equation entrenched in popular mind in India. We soon found that this was far from the truth. Irrigation in the Punjab and Haryana had begun many decades before Bhakra. This was from diversion schemes including the Western Jamuna Canal, the Upper Bari Doab system, the Sirhind canals, to name only the major systems.

As far as Bhakra is concerned, 20% of the total cultivable area of Punjab is commanded by Bhakra. For Haryana, the same figure is 31% . *Punjab and Haryana are much more than Bhakra.*

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<sup>1</sup> BBMB 2002a: Page 9

One of the issues that this brings up is whether there is any difference between the irrigation from the diversion systems and storage systems. The advantage claimed for a storage structure is that it can provide better regulation, and especially help augment irrigation in winter, when river flows are smaller, by transferring excess monsoon water to winter months. But this is at the manifold costs including displacement, downstream deprivation and so on. A diversion structure, by its very nature, causes less disruption in the flow of the river. This is especially true of the monsoon or the high flow season. The weir or barrage will cause much less submergence and displacement as compared to a storage dam that creates a reservoir.<sup>2</sup> Thus, the major impacts in terms of displacement, submergence of forests, and severe downstream effects are avoided. There will be some impacts downstream – to the extent of the diversions taking place; but overall, the impacts are much smaller. The financial cost is also normally much less than a storage dam.

The irrigation developed in the Indus basin through these diversion schemes had much smaller social and environmental impacts. Much of the irrigation in the two states comes from such systems.

Even if we assume the contribution of an irrigation system to the production in the two states is in proportion to the area covered by it, Bhakra would not be responsible for more than 31% of Haryana's production and 20% of Punjab's. This is a far cry indeed from the public perception of Bhakra's role.

However, we found that this would be a gross misrepresentation. Between the two states, Punjab's production of foodgrains is twice as much as Haryana. And in Punjab, Bhakra has made little dent. An analysis of the command area reveals that much of the Bhakra command in Punjab was already irrigated, or was in well endowed areas. And the irrigation from Bhakra canals played a limited role in these areas. In Punjab, irrigation development after the mid-1960s really took off with the explosive growth in the groundwater irrigation through tubewells. We may recollect here that the Bhakra project was designed to irrigate, at best, a maximum of 62% of the culturable command area annually. In Punjab, even this was not achieved.

In Punjab, even in the Bhakra command areas, tubewell irrigation has been the overwhelming major source. *If there is one thing our study has exposed – it is that “Punjab=Bhakra” equation is a big myth.*

The growth of tubewell based irrigation was mirrored in Haryana.

We saw that the real jump in foodgrain production came after the advent of the Green Revolution, with the coming of HYV seeds. While Bhakra is strongly associated with the Green Revolution in public mind, we need to note that neither the Green Revolution nor irrigation came to Punjab/Haryana with the Bhakra project. Irrigation was there over a hundred years before Bhakra, and the Green Revolution came in only 12 years after the irrigation from the project had begun. The Green revolution is quite distinct from Bhakra.

There is little doubt, as our study clearly shows, that the driving force behind the Green Revolution was the tubewell based irrigation. This was true of Haryana, and certainly of Punjab. The high rates of growth in the foodgrains production, and the cropping pattern that includes large area of rice could be achieved only by massive extraction of groundwater – far beyond the normal recharge.

So rapid has been the growth in the groundwater extraction that a huge part of Punjab and Haryana's production today comes from the areas dependent on unsustainable extraction of groundwater – 43% for Punjab, and 34% for Haryana. This is based on water which is not being recharged, which had accumulated through decades or even centuries. *The miracle of*

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<sup>2</sup> Dam builders sometimes say that the weir or barrage will cause no submergence, but this not strictly true as it can affect areas through higher backwater during times of flood.

*Punjab and Haryana is in reality highly unsustainable, and now is in the process of a collapse.*

Our calculations show that the contribution of Bhakra project – including the benefit of the groundwater recharge due to the canals – is 11% in Punjab and 24% in Haryana. Compare this with the above mentioned figures of production dependent on unsustainable mining of groundwater.

Our study has found that the impact of the Bhakra project was mainly in Haryana, that too in the drier districts of the Hissar tracts. The contribution of these areas - the areas served by Bhakra, has been limited. This limited contribution has come with huge costs. The costs of the dam – financial, social, ecological, the land degradation in the command areas, large scale waterlogging and salinisation of the soil which seems very difficult, if not impossible to manage, the deprivation of the areas downstream, the displacement of thousands of people, the impact of the prolonged and extensive use of chemicals and so on. These costs have been enormous, long-term and in all probability irreversible.

What is perhaps equally important is that these costs are translating into serious economic problems for the agriculture of the two states, threatening its very viability. Yields are stagnating, and more important, more and more inputs are being required to get the same output. *Margins of farmers are being squeezed; grains are too expensive for the people of the country to buy.* As the Johl committee Report points out<sup>3</sup>:

“India has accumulated huge stocks of foodgrains that are not finding market .....Although as per the nutritional requirements of the Indian population, these stocks may not be considered in excess, yet due to the lack of purchasing power with the poor, supply exceeds demand....On the other side, the farmers, especially the farmers in the surplus producing areas, are experiencing an economic squeeze due to the decreasing margins between their costs of production and the prices they receive. Punjab in particular is in catch twenty two....”

These declining margins have created massive indebtedness among the farmers, leading many to be caught in a debt trap. In several cases this has even led the farmers to the extreme step of committing suicide.

Neither the farmer is happy, nor does the consumer gain. Was this the desired goal of the project?

Some may be quick to argue as to what has this got to do with the project. Was the project responsible for all these problems? We would pose a counter question – how is it that the project did not prevent this? That such a situation has arisen in spite of the project?

Also, if irrigation from the project is glorified by pointing to the spectacular increase in the agricultural production, then it needs to be recognised that this production was made possible, among other things, by the heavy use of chemical inputs along with the HYV seeds, a policy of Minimum Support Price and large scale assured procurement. It is a package that has worked together. Indeed, it is an important question whether without the kind of productivity that these chemicals brought in, the dam itself would have been financially or economically viable<sup>4</sup>. Hence, the effects of the extensive and intensive use of chemicals and also the erosion of bio-diversity due to the very limited variety of seeds being used are part and parcel of the total cost of doing business with such irrigation projects.<sup>5</sup>

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<sup>3</sup> Government of Punjab 2002: Page 104

<sup>4</sup> Even with this productivity, the economic viability of such large dam projects is increasingly being questioned.

<sup>5</sup> To the extent that the same combination is used with other means of irrigation, these will add to the costs of those particular means too.

After all, no one is interested in the dam for its own sake.<sup>6</sup> The dam is a means to using the water resources for development –ensuring at the minimum adequate and affordable access to food for people and a reasonable livelihood for the farmers. If the long-term impacts result in these very goals being negated, then this necessitates some rethinking.

Large storage dams with extensive canal networks are among the most expensive of irrigation systems. To justify such an expensive interventions, the returns should be as much or more. With the current paradigm, such high returns (in terms of food or agricultural production) are possible only with the massive use of chemical and other inputs. This has led to the problems of soil degradation, threatening the long term well-being of the system. It is quite possible that cheaper means of irrigation (or, more generally, of increasing crop productivity) will not require such high returns to make themselves viable, and can thus manage with lesser inputs, leading to lesser economic and ecological problems. Since they would also be decentralised, they would address in a better way the problem of equitable distribution.

Will such systems meet the problem of food production? We will address this issue in the next section in detail; but it may well bear repeating that the issue to be addressed is not just of food production – but also of food security and access to food. In terms of all three, we have no doubt that other means are more effective than large storage dams.

It is clear that the early dam projects – taken up immediately prior to or just after independence – hardly looked at this issue of the economic viability. The First Five Year Plan notes<sup>7</sup>:

“A number of projects – some multipurpose and others only for irrigation – were sanctioned soon after the end of World War II. On some of these, works were started before the completion of detailed investigations and of economic studies necessary to obtain a correct appraisal of the technical and financial aspects of the projects....”

K.N. Raj is even stronger<sup>8</sup>:

“There had been no appraisals, of this scope<sup>9</sup>, attempted in India either for the Bhakra Nangal or for any of the other proposed investment schemes. The project reports, on the basis of which the investment decisions are taken, give certain standard technical details and some estimates in very general term of the probable effects on production; these are supplemented by surveys and reports in regard to particular aspects of the projects, but the information given is usually fragmentary and analysis of the data does not add to anything like economic appraisal.”

So what does this mean – that such projects are never viable? That we should never build a (large) dam? This is a huge debate that is of enormous contemporary relevance and significance, but it is not our intention to go into it here.<sup>10</sup> We will touch this debate in one

<sup>6</sup> Except possibly the contractors.

<sup>7</sup> Chapter 26 *Irrigation and Power*, First Five Year Plan

<sup>8</sup> Raj 1960: Page 3

<sup>9</sup> What the words “*of this scope*” imply is noted in the paragraph previous to the one quoted and we reproduce the same here: “In the case of Bhakra Nangal project, several aspects of it would strike one, even at a first glance, as raising issues of considerable importance of economic point of view.....The implications of all these clearly deserve to be pursued, and judged alongside the merits of the scheme, in a comprehensive economic appraisal. Once this is done with reference to explicitly stated criteria, and the project ranked in order of preference with other competing projects of a comparable kind, non-economic considerations, as also the economic imponderables, can be introduced and seen in better perspective.”

<sup>10</sup> We would like to point out that a very important process, involving eminent experts representing all sides of the large dams debate, in the form of the **World Commission on Dams** has addressed very comprehensively, very convincingly this question. The WCD with 12 members representing dam builders, engineering companies, NGOs, affected peoples movements etc. was set up in 1998 to assess the development effectiveness of large dams worldwide and come out with a set of criteria and guidelines (only) under which large dams should be built. The unanimous report of the WCD was published in Nov. 2000 and provides a set of core values, strategic priorities, policy principles and guidelines under which new dams should be built. See [www.unep-dams.org](http://www.unep-dams.org)

respect though – and that is, the use of the Bhakra dam project as a model to justify large dam building programs elsewhere in the country. Proponents of large dams point to the spectacular success of the agriculture in Punjab (and to an extent in Haryana) and attribute it to the Bhakra project. This is then used as an argument to advocate, justify or otherwise push for other large dam projects. It is an argument that is brought into play to counter (wish away?) the adverse impacts of large dam projects. The Bhakra project, used as a proxy for the agricultural “success” of Punjab is used as an argument to end all arguments against large dams. So entrenched is the perception of Agricultural Success=Punjab=Bhakra that this argument often succeeds.

*Our study has shown that this argument is widely off the mark.* The agricultural success of Punjab and Haryana has been a short burst of prosperity that is not only stagnating but is plunging into economic, ecological and social crisis. And even this short burst has had little to do with Bhakra. Hence, the use of Bhakra as an argument to justify other large dams is a highly specious argument.

At this point we may also mention that apart from this basic flaw, the use of Bhakra to justify other large dams is problematic also because it is often not recognised that Bhakra was built under circumstances very different from what obtain now in other parts of the country. Let us recollect some of the more important circumstances that were unique to Bhakra.

First of all, it should be noted that the Bhakra project did not create any new irrigated areas; it simply transferred the areas being irrigated by the SVP in Pakistan to India. Bhakra could provide irrigation to Hissar tracts only by drying up the whole of Sutluj below Ropar.

Secondly, Bhakra was built in the days of the newly-independent-nation euphoria. This euphoria, and the accompanying outpouring of patriotic sentiment was to push aside many problems with the project. We have already seen the attitude and approach of the oustees who were ready to put up with many serious shortcomings in the resettlement program.

The lack of corruption, certainly in the resettlement process (reflecting in all probability the lack of corruption overall) –at least in the early days – was another rather unique condition – never again to be seen in India. These two sets of circumstances made building the Bhakra much easier as it helped push aside major issues and problems.

Thus, using Bhakra as an argument to justify more large dams is a seriously flawed argument. Yet, Bhakra has been thus used countless number of times without understanding the facts behind it. *Raag Durbari*, the hilarious and hard-hitting satire has captured this very well<sup>11</sup>:

“..... इस देश के निवासी परम्परा के कवि हैं। चीज़ को समझने के पहले वे उस पर मुग्ध होकर कविता कहते हैं। भाखड़ा-नंगल बाँध को देखकर वे कह सकते हैं, “अहा! अपना चमत्कार दिखाने के लिए, देखो, प्रभु ने फिर से भारत-भूमि को ही चुना।”<sup>12</sup>

## BEYOND BHAKRA

The Bhakra project represents, in a way, the climax of irrigation development in the Indus basin. The fascinating course of irrigation development in the Indus basin began with the advent of the Harappan age, starting with the *sailaba* agriculture, then the earliest inundation canals that needed to re-built every year, the evolution of these canals to long channels with an

<sup>11</sup> Shukla, Shrilal 1968: ‘*Raag Darbari*’, Rajkamal Paperbacks, New Delhi :Page 16

<sup>12</sup> Can be translated as: “The denizens of this country are by tradition poets. They get captivated by a thing before even understanding it and compose poetry to it. Looking at the Bhakra Nangal dam they can say “Aah! God has once again chosen the land of Bharat (India) to display his miracles” ”

elaborate network of distributaries, to the construction of permanent headworks to enable perennial irrigation.

With the headworks the system changed from being an inundation system to a diversion system, with better control on the diversions from the river. Each of these phases was marked by increasing abstractions from the rivers. Yet, for long, these were small enough not to cause any significant change in the river flows.

With the advent of the British era, developments took place at a rapid pace, and as more and more diversion schemes came up, an interesting phenomenon that was not in the picture so far made its appearance. For the first time, the abstractions from the rivers started reaching such a point that the areas lower down started feeling the reduction in flows. This typically manifested itself in disputes between separate political entities when the two areas fell in distinct political divisions – the Sind-Punjab dispute is an example of this. Words like ‘upstream’ and ‘downstream’ started to take on a different meaning. Areas downstream began to feel concerned that “their” flows were being taken away.

Still, the concern so far was limited to the “lean season” flow, as the existing weirs and barrages could divert only limited quantities of the monsoon flows. Much of the floods would pass over the weirs or barrages and flow on downstream. Of course, as the number of points where the river was “tapped” increased, a larger portion of even the monsoon flows began to be diverted.

Around this time, the idea of storing the monsoon flows began to be floated. It was an enticing idea – to those who saw the waters running “away” past them. Little thought was given, of course, to the fact that this water that was flowing past them, was flowing on to someone else. As technology made it possible to translate this idea into reality, the era of large storage dams began. Bhakra was the first of the storage dams in the Indus Basin, soon to be followed by other like the Pong on the Beas, the Mangla on Jhelum and Tarbela on the Indus. The storage dams brought with them a quantitative change in the abstraction of waters from the rivers.

At some point along this evolution, the abstraction turned into exploitation. *At some point, to use a modern term, the system became unsustainable.* At what point do the withdrawals from nature start becoming destructive and detrimental? This is one of the most heatedly debated, most contentious issues of today. This is the issue that lies at the core of our study.

The progression of increasing withdrawals from the rivers in the Indus basin was paralleled by similar developments in other areas.

The use of the bucket and rope and the *shaduf* to draw waters from the wells gave way to the Persian wheel. More water could now be drawn from the ground. The advent of diesel and electric motor pumps and tubewells led to a huge jump in the capacity to extract groundwater. For the first time in human history, human beings had at their disposal the means to bring out water faster than nature was recharging it.

Storage dams put for the first time the capacity in human hands to dry up rivers.

Settled agriculture was a step ahead in “taking” from the soil as compared to mere hunting-gathering. Double cropping, multiple cropping increased this. With the HYV seeds came hugely increased capacity to take up from the soils – to the extent that the nutrients contained in the soils were not enough to feed the “hunger” of these seeds. Heavy inputs of chemical fertilisers were necessary to make possible the high productivity of these seeds.

The progressively increasing withdrawals in all these systems are at the heart of the dramatic growth of agriculture in Punjab and Haryana. *All these systems have passed the point of sustainability.*

Every element in the “success” of the agriculture in Punjab and Haryana is based on over-extraction. The states are pumping more groundwater than is being recharged. The seeds are

drawing more from the soils than there is; and the dams are diverting away more water from the rivers than they should – all of it at huge social, ecological and economic costs. Clearly, if we want that a vast nation be fed from a limited area – then we will have to extract far more from this small part. If we want to develop agriculture that is going against the grain of the geo-climatic make up of an area, we will have to provide the inputs externally.

When and why does the level of extraction become unsustainable? Clearly, there will not be one answer. No one person can set a limit and say that this level is okay and not beyond this. But there are some broad parameters that can be our guide in this.

Nature is designed with cyclic processes. Various elements go through a cycle, getting transformed, transported in the process, but coming back to the original state. The water cycle is well known, as is the carbon cycle. These cyclic processes are highly interlinked and are in a state of dynamic equilibrium.<sup>13</sup> In contrast, most human designed processes are linear in nature – on one side are the inputs, which transform into outputs, and there are by-products. The outputs and by-products ultimately become “wastes” often creating serious problems of disposal. In nature, there are no wastes – because outputs or “by products” of one process are inputs for the next stage of the cycle.

Human interventions in the nature often tend to disrupt the natural cycles. *We would say that the extent to which human interventions lead to deviations from these cycles and disturb the equilibrium is a good measure of unsustainability.* To ensure sustainability on the other hand, we need to be as close to the natural cycles as possible.

If we look at the irrigation and agriculture development in Haryana and Punjab through this perspective, we can understand what is happening. The river that was earlier flowing into the sea is now being diverted somewhere else. In parts this water is now accumulating in the soil causing waterlogging. The groundwater that had been recharged since centuries is being taken out, with no replacement. The nutrients that are taken from the soil do not get back to it. Instead, we are pouring in chemicals, themselves extracted by disrupting other cycles.

All these have consequences that even now we are not fully grasped of. But those we *can* see are serious enough.

Some say that these are merely problems of management. Better management, better technology and more money can set these problems right. This approach is often called the ‘technological fix’ approach.

We see more fundamental issues at the heart of the problem<sup>14</sup> – the essential unsustainability of these unlimited extractions. We believe that solutions will need a shift in the way of working. The need is to address the root cause of the problem – namely, the shift away from and the disruption of the natural cycles. *In fact, this approach is not to be limited only to Punjab and Haryana, but should be the guiding norm all over the country.*

In case of irrigation, this approach would mean starting with soil water conservation measures and local rainwater harvesting, as this is what would cause minimum disruption. Groundwater use would have to be limited to the amount being recharged – though the amount being recharged can be increased through several measures. In case of agriculture, this approach would mean organic agriculture, with minimum of chemical inputs. It would also mean diversity of crops, it would also mean agriculture that is in consonance with the geo-climatic set up of the area.

Would these imply only moderate increase in yields of foodgrains? Even if it did, it not would be of concern if this meant moderate increase over large areas. Of course the increase may not necessarily be moderate. People working on such lines have achieved yields that are

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<sup>13</sup> At least, were in dynamic equilibrium till large scale human interventions disrupted them.

<sup>14</sup> Sometimes we are ridiculed as being “doomsday-ers”.

remarkable. During our visit to Haryana, we visited Sukho Majri, a place that is now famous nationally and internationally for its rainwater harvesting and soil water conservation efforts. Sukho Majri was in complete contrast to what we had seen in rest of Haryana. We saw large variety of crops. We saw great use of organic manure. The yields here were comparable with what is achieved elsewhere in the state – in fact, the farmers claimed that the yields were higher. Few farmers in the village were in debt. Here we saw farmers who were not complaining of higher input costs. And Sukho Majri is nowhere near a fully organic based agriculture.

Certainly, Sukho Majri has a different climate than say Sirsa. But the same *principles* can be applied anywhere.

It is often argued that if we are to feed the millions in the country then we need to step up our yields even higher. There is little doubt about this. But it is often forgotten that the average yield can be increased either by (a) very high yields at one point and low yields elsewhere, or (b) a moderate increase all over.

We have seen the problems with the former – the need to increase inputs vastly in small areas, (and hence extract them excessively, or transfer them from long distances and transfer the output back again), leading to increased costs, and other ecological problems that ultimately impact on the extractions themselves. On the other hand, the latter strategy has the advantage of requiring moderate increases in inputs, meaning not only moderate disruptions in natural cycles – but also decreasing substantially the cash burden on farmers. The output too would be relatively more equitably distributed.

A question can be raised – should be raised – will this be effective in meeting our food and other needs?

Before we look at this, we would like to emphasise one thing. Whether the approach above can meet our needs or not, one thing is certain – the current approach, as exemplified by Punjab and Haryana certainly cannot. It is ecologically, economically, financially – and hence socially and politically - unsustainable.

Coming to the alternative approach – there is little doubt that a moderate increase in yields and productivity spread out over large areas can meet our food requirements.

A look at the overall figures will be instructive. In 1997-98, the all-India area under foodgrains was 123.85 m ha, and output was 192.26 m tons. (Rice and wheat accounted for 56% of this). This is equivalent to an average yield of 1552 kg/ha. If we can achieve an increase of 100 kg/ha in this, we will get an additional output of 12 m tons. The area in Punjab under foodgrains in the same year was 5.951 m ha (93% of it under wheat and rice). To get an increase of 12 m tons output, yields would have to increase by 2050 kg/ha. Reasonable increases in yields can be obtained by a variety of measures that will also need only reasonable inputs, with moderate impacts. Extreme increase in yields will need excessive increase in inputs, with large impacts. Of course, this calculation is only indicative of the broad principle, and actual planning would have to take into consideration the differences in land quality, crops other than wheat and rice and so on. But there is little doubt that a decentralised approach can work, and meet our requirements with only moderate impacts.

Indeed, *only such an approach* can meet our needs. And meet it at lesser costs – both capital and recurring, and lesser ecological costs.

### **More...– How Much is Possible and How Much is Enough**

Of course, such a system may not create islands of prosperity and opulence in midst of poverty. It may not lead to “showcase” agricultural systems of “spectacular” (though unsustainable) performance. It will certainly not help grow sugarcane or rice in deserts.



Take rice – rice is a crop that can and is grown without irrigation in Kerala or Chattisgad. Yet, in Punjab it cannot grow without huge extractions of groundwater. If we insist on growing rice here (for reasons of higher returns or other reasons), there is no other way but to keep extracting more, and more – till may be one day there is nothing left. At that point, the catastrophic collapse of the systems would play havoc.

Yet, this is precisely the approach we are following. At a public meeting in Haryana, held to help us interact with the people on these issues, the problems facing Haryana's agriculture, including groundwater depletion were presented. One person got up and said "All our problems are because we do not have enough water. We need more. More water and all our problems will be solved." This, when Punjab is consuming 35 MAF of water and Haryana 27 MAF every year in agriculture.

It is not just an individual, we saw that this belief was widely prevalent. The groundwater levels are falling – so bring in more water – problem solved. Simple. Deceptively simple. Deceptive because it does not answer the question – bring from where? And even if there is an answer today – what when *that* source reaches its limits? Deceptive because it looks at only the supply side – no thought is given as to why the groundwater levels are falling; and whether the cause for that (rice in Punjab to continue our example) is justified. Deceptive because it hides the fact that unless you put a limit to the cause behind falling groundwater, no matter how much you bring in from outside, it won't be enough...ever.

In other words, unless we also pay attention to how (and how much and for what) the water is being used – we will always need more and more water – which means higher and higher extractions, which will be then justifications for large dams, over-extractions of groundwater and so on - unsustainability.

No system can be sustainable – ecologically, economically, socially – unless it pays attention to this "other side" – namely, use or consumption – and thinks about the limits and ranges for this.

One dimension of this is the justification of the end use, and whether this end use is the optimal use of resources. For example, growing rice – on the large scale as is being done today in Punjab – is this justified? Is this the optimal use of water resources? *Only if this end-use is justified can the extractions be justified.* In general, trying to grow crops unsuited to the agro-climatic conditions would be unjustified – or at least, a sub-optimal and high cost strategy.

The other dimension of this is that any system, whether the end-uses justify it or not, will have its natural limits<sup>15</sup>. This means that we have to live with a recognition that our consumption would eventually have to have some limits. What these limits are, how these will be defined, and what are the implications of this for our production processes are some of the most critical issues that humankind needs to address.

Some people would say that this is an anti-development view, and will quickly pounce on this statement saying – Ah! So you want India to live in the dark ages. You don't want development. But this would be a distortion of what we are saying. We are not against development – or consumption. But we want to emphasise that this will have limits – must have limits. (And that development is not just about increasing consumption). That we will have to make a distinction between needs that are basic and needs that are – for the want of a better word – luxury. We believe that the former can be comfortably met – that sustainable prosperity is possible. But it will be difficult to meet the needs of luxury without crossing the limits of sustainability. Without paying huge costs.

We agree that "More" is a legitimate element of the goals of any development process. But we would say that development is not simply "more and more". And that there are types and types

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<sup>15</sup> These limits may not be sharply defined points but rather fuzzy boundaries which would be a function of the costs – financial, ecological, economic, social.

of “more.” After all, Oliver Twist also asked for “More”. And in recent years, “*Yeh Dil Mange More*” is sought to be projected as the aspiration of the nation<sup>16</sup>. But these two refer to two very different types of needs. This distinction should be recognised as also the fact that there will be limits to the needs that can be met. And that there will be costs in meeting these needs, costs that will escalate sharply as we reach the limits imposed by nature.

The irrigation/agricultural systems in Punjab and Haryana show what can happen as we reach these limits, and the kind of costs - financial, economic, ecological, social – that we have to pay to push these limits. They raise fundamental issues in terms of how much, how and for what to extract from nature. The developments in Punjab and Haryana show the close interdependence between ecological, economic and social sustainability. In this, they exemplify the biggest developmental challenges to India – and also show the possible directions for the country to meet its developmental objectives.

We believe that this is the most important message offered by our study.



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<sup>16</sup> For those not familiar – this has been for long the slogan of a Pepsi ad campaign in India. It translates to “The heart asks for more”.