

***Tail-enders and Other Deprived in  
the Canal Water Distribution***

**Final Report**

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**THE DEPRIVED  
IN THE COMMAND AREA OF AN IRRIGATION SYSTEM  
(AN EXPLORATORY STUDY)**

Development Support Centre's (DSC) experience in promoting Participatory Irrigation Management (PIM) in command area of Sabarmati Reservoir Project (Dharoi) revealed that the tail end villages are getting water that would provide irrigation to much less area in their command--Rangpur received maximum irrigation on 53% of the command, Thalota 51%, but Kiyadar 18%, Pudgam 13%, and Paldi 10%. DSC assumed that such deprivation of farmers' entitlement would be only at the tail end. Situation would be much better in the head and middle reaches of the project. Field research brought out that villages which are not at the tail end can also be deprived of their right on account of system failure. Water is available in the distributory, but the conveyance system is not capable of taking it into the farms through the minors, sub minors and outlets.

Thus the 'deprived' could be the farmers at the tail end, not only of the main canal system but could be in various parts of the system and "other deprived" on account of the system failure. DSC decided to look at another project, Mahi Irrigation Project, which had a large command area of more than 2,00,000 hectares with ample water to irrigate all the land in the command. In fact, the project has surplus water that is let out into the sea. Exploratory visits, however, brought out that even in Mahi project the farmers are deprived of their share of water either because they are at the tail end or are "other deprived" due to system failure. To make sure that the sample was representative enough, DSC made field studies in 28 villages of Mahi project located in the head and middle reaches and at the tail end.

This is an exploratory study and we feel that it would be equally true for other major irrigation projects in Gujarat, and in India.

**THE FINDINGS**

## **Overall Picture**

In the Sabarmati Reservoir Project, the overall tail end deprivation is 37%, with head reach (30%) and middle reach (36%). The "other deprived" are overall 22%. The other deprived are spread almost uniformly throughout the system to the extent of 1/3 of the command area. In case of Mahi Irrigation Project, the over all tail end deprivation is 7% but it is higher in middle reach (18%) and head (8%) reach. "Other deprived" are overall 20 % though in the head reach (28%) and middle reach (56%). This shows problems of system management in Mahi Irrigation Project.

## **Policy Issues**

### **Capacity to Discipline**

In the irrigation systems in deficit area such as Sabarmati Reservoir Project, only a portion of land in command area, say 50%, is to be supplied water for irrigation. If the farmers in the earlier reaches irrigate more area there will be increasing shortage as the canal proceeds. Partial serving of command area, desirable from equity consideration demands better disciplining capacity than what the department presently has been able to demonstrate so far.

In designing irrigation system, the planners assume certain cropping pattern and water requirement for different seasons. If the farmers raise more water intensive crops like paddy, the water requirements would be more than the carrying capacity of the system. If the farmers in the head reach take all the water they need for water intensive crop, the farmers towards the middle and tail end would be left dry.

### **Water Rights**

Apart from the capacity for governance, there is also the issue of need for deciding the share of water for every piece of land in the command depending upon its size on one hand and availability of water in the system on the other. Experience has shown that if Water Users Association (WUA) manages the system at the local level, each association would insist on securing its share of water depending upon the share of the land in its command area. Department will be then forced to enforce discipline on the farmers taking more than their share.

### **Design Faults**

Wrong planning at the design stage may create perpetual problems. The farmer's knowledge of the local terrain needs to be utilized in designing the system at local level.

### **Pricing of Water on Volumetric Basis**

Most logical and not impractical way of dealing with conflict between requirements of water for different crops and for right to water of all farmers decide pricing of water on volumetric basis. This has already been tried in several projects promoted by Non Governmental Organisations (NGOs) in Maharashtra and Gujarat.

### **Grant for Maintenance and Operations**

Availability of funds for maintenance is getting reduced all the time because larger share is allocated for salaries of irrigation staff. However, whatever repair grant is available seems to be used in an inequitable manner, some getting their share regularly and some not getting at all even though need for repair may be acute. Introduction of PIM may ensure use of funds in more equitable manner.

### **Uncertain Supply, Waste and Non-payment of Water Charges**

Uncertainty when and how much next watering will be available induce farmers to use maximum water when it flows to their farm. They are also reluctant to apply for irrigation requirement in time because of the uncertainty and just take water with impunity when it is passing near their farm. Undependability of water supply explains to some extent the mounting arrears of water charges. Experience of well-managed PIM system is more satisfactory.

### **Monitoring**

The report discusses several issues emerging about monitoring system of the irrigation projects:

- At present, even if one watering is given the area is considered to be irrigated. An alternative system is suggested.
- The study could identify a number of problems through scrutiny of the information and reports made available by the department. The irrigation officers if they also study their information, should be able to quickly identify problem villages, visit them, and take remedial measures. However, it would be good to associate non-departmental stakeholders like NGOs and academics. A monitoring committee with multi-source membership is recommended.

### **Redressing Grievances**

Detailed study of the system for tackling complaints revealed absence of system. The case study of handling of complaints in one office clearly brings out that the department has not developed either system or sensitivity to quickly respond to problems conveyed.

### **Lifting of Canal Water---Authorized Nominally, Unauthorized Substantially**

Lifting water by pump sets from the canal is a serious problem. Even the farmers who are authorized to lift water from canal, if they lift much more water than permitted, the department is not able to discipline them nor does it take into account the impact of such diversion of water on the availability of water in the authorized command area. This is one more contributory factor to the deprivation of the farmers in the command area.

#### **An Overall Lesson Emerging from this Exploratory Study**

*Taking care of the “Deprived” of the irrigation system, preferably through participatory management, is the surest way to reform the irrigation sector.*

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# MAHARASHTRA

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## **BACKGROUND OF THE STUDY**

The Society for Promoting Participative Eco-system Management (SOPPECOM) has been raising the issue of deprivation in the command areas of irrigation projects. Moreover, we always found that there was a dearth of studies focusing on the issue. Hence, when Shri Anil Shah of Development Support Centre (DSC) invited us to take up this study in Maharashtra as part of an all India effort to understand the issue of deprivation in irrigation commands, we were very happy because it gave us the opportunity to address this issue systematically. As part of this study SOPPECOM took up three projects – one major, one medium and one minor – in Maharashtra. Our overall feeling after the study could very well be paraphrased by what K. R. Datye, senior member of SOPPECOM, often says -- 'what irrigation (especially major projects) could have done, but could not do' – this expresses both the problems and potential of irrigation sector today.

While irrigation and irrigated agriculture have played a significant role in creating self-reliance in food, especially in terms of production at a national level, many problems continue to plague the irrigation sector. They range from under-utilisation of potential created, the mismatch between actual and potential productivity of irrigated agriculture, increasing gap in cost recovery, poor quality of services, deterioration of the physical system because of lack of adequate maintenance, lack of control and participation of the users, etc. One of the most important problems is that of tail-enders and other deprived sections within the irrigation service areas -- a problem which is universal in its presence as it cuts across regions and size and type of projects.

This is even more important in the case of Maharashtra. Though Maharashtra has the largest number of large projects, only about 17% of the cropped area is irrigated while the all India average is about 26%. It is estimated that even if Maharashtra develops all its water potential it would be sufficient to irrigate at most about 30% of the total cropped area. In view of this the question of tail-enders and the deprived in the command forms an important issue if irrigation is to benefit the largest number of people.

## SCOPE AND METHODOLOGY

The central research question explored by the study is the issue of deprivation or non-access to irrigation water in major, medium and minor surface irrigation systems in the northern, eastern, southern and western regions of India. It includes the problem of the 'tail-enders'. This may then be broken down into the following sub-questions: i) identifying who the deprived are; ii) how deprived they are; iii) why they are so deprived; iv) what is the impact of this deprivation; v) what they have tried to do to overcome this deprivation; and vi) how others have reacted to the issue and efforts to resolve the issue.

The Maharashtra study focused on deprivation in the following projects: Major project – Mula in Ahmednagar district; Medium project – Mangi in Solapur district; and Minor project – Walen in Pune district. In the Mula major project we selected 10 minor-level sub-commands, 2, 4 and 4, respectively from the head reach, middle reach and tail reach for the fieldwork. Sub-commands were selected to capture the variations within the zones in terms of head and tail reach. In the case of Mangi medium project we selected 8 sub-commands of which 5 are located on the Right Bank Canal (RBC) and 3 on Left Bank Canal (LBC) covering the head, middle and tail reach of both RBC and LBC. Since Walen minor project mostly serves only one village, we have included the entire command in the sample.



In the light of the discussions at the Hyderabad meeting and the whole project design (both in terms of time and resource available for the study), it was decided not to use individual, questionnaire-based, quantitative data collection tools. The emphasis was on qualitative and participatory methods. The primary data collection was more directed towards exploration of issues and a qualitative understanding of the issues. Most of the quantitative data have come from secondary sources. We conducted a series of participative discussions and appraisals in the form of walk through surveys (WTSs) and focussed group discussions (FGDs) as part of the primary data collection in the villages. In addition we had a series of discussions with the Maharashtra Krishna Valley Development Corporation (MKVDC) and Marathwada Godavari Irrigation Development Corporation (MGIDC) officials.

## **PROFILE OF THE PROJECTS AND SELECTED SUB-COMMANDS**

### **The Major Project: Mula Irrigation Project**

The Mula Project is located on the Mula River, a sub-tributary of the Godavari. The dam has a gross storage capacity of 767 Mcum and a live storage of 609 Mcum and has a planned capacity to irrigate 80,800 ha in 149 drought prone villages in Ahmednagar district. The project serves the command area through two main canals, the MLBC (Mula Left Bank Canal) and the MRBC (Mula Right Bank Canal) and their branch canals serving an area of 10,100 ha and 70,700 ha respectively. The MLBC was mainly intended to strengthen and stabilise the command of Pravara right bank canal and so the study concentrates on the MRBC.

The minors and direct outlets taking off from the MRBC itself serve an area of 28,075 ha. The first two branch canals taking off from the MRBC serve an area of 33,215 ha. The third branch, known as the Pathardi branch, takes off at the tail end of the MRBC and runs for 53 km serving an area of 11,400 ha, but only for eight months (July to February). The command area of the MRBC is divided into 5 sub-divisions known as Rahuri, Newasa, Ghodegaon, Kukana and Amarapur sub-divisions and we may take Rahuri sub-division as comprising the head reach, Newasa and Ghodegaon as comprising the middle reach and Kukana and Amarapur as comprising the tail reach of the project. (Can you place a map here?)

The approved design crop pattern comprises 5% area under perennials (mostly sugarcane), 20% two-seasonals, 30% Kharif seasonals, 42% Rabi seasonals and 3% Hot Weather (HW) seasonals. The rainfall in the command area is scanty, the average rainfall being below 600 mm. It is not uniformly distributed over the monsoon period. The formation of Water Users' Associations (WUAs) has proceeded to a relatively much larger degree within the Mula system -- 61 WUAs have been registered so far and about 56 have started functioning. About 14 WUAs are in the process of getting their registration.

### **Medium Project: Mangi Irrigation Project**

The Mangi medium irrigation project is located at Mangi village in Karmala Taluka of Solapur district. It is constructed on Kanoli River which drains into the Sina river and forms part of the Bhima sub-basin of Krishna basin. The construction work started on the site in 1897 as a scarcity relief work but was subsequently abandoned. It was again taken up and in the drought year of 1926 and later abandoned. Another drought year 1952 saw the construction being restarted, and this time the work was continued and construction of the tank was completed by 1955. The Left Bank and Right Bank canal systems were completed in 1966. The total ICA is 3,117 ha. The main cropping season is Rabi and accounts for about 2,500 ha of the total ICA. The length of RBC and LBC is 29 km and 9 km and the ICA under them 2,307 ha and 809 ha respectively. Lifting of about 20% is allowed from the dam storage – 6% under the regular quota and 14% under the drip scheme. So far no WUAs have come up on the Mangi project. However efforts are on to form the WUAs and at least 2 WUAs are under different stages of formation.

### **Minor Irrigation Project: Walen**

Walen Minor Irrigation Tank is located in Mulshi taluka of Pune district. The project consists of an earthen dam across Walki River which is a tributary of the Mula River in the Krishna basin. Originally planned to irrigate 270 ha, the tank is now designed to store 5.11 Mcum and irrigating 918 ha. It has a mixed cropping pattern of Kharif and Rabi. The single canal on the left bank is 3.10 km long, has 11 outlets and a discharge capacity of 10.47 cusecs. The command area mostly falls in Walen village. The water users have already decided to form a WUA to take over the management of the system. They have

constituted the promoters body and are in the process of completing the necessary procedures and documentation required for registration.

### **The Selected Sub-commands**

Ten sub-commands were selected from the command of the Mula Project. Of the 10 selected sub-commands, the first two are in the head reach, the next four are in the middle reach and the last four are in the tail reach of the project. Within a reach, care was taken to cover head and tail portions. Two sub-commands with WUAs were also included. Eight sub-commands were selected from the Mangi Project. And for Walen, the entire command area was included.

### **MAIN FINDINGS**

A summary of the main findings for all the sub-commands for all the projects is given in the table comprising Annexure 1. Some of the broader trends are summarised below.

#### **Inflows at the Dam Site**

Decennial averages for the last forty years for the Mula project indicate a distinct trend towards reduced inflows at the dam site, though they fall significantly below the designed storage capacity in only a few years. However, it should be noted that a) the trend exists, b) that it is more pronounced in the last 20 years (in 9 out of 20 years the inflows fell below the design capacity), and c) though this may not have substantial impact on Mula storage, its overall impact, especially downstream, needs to be taken into account.

A lot of catchment protection and watershed development work has taken place upstream of Mangi. Inflows at the Mangi site show a peculiar behaviour. In good rainfall years inflows are not greatly affected, but in bad years inflows are drastically reduced in the recent years, which indicates that though the impact of upstream activity may not be of much significance in good years, it needs to be taken into account in bad years.

Walen, being situated in a high rainfall area does not show significant problems in availability of inflows at dam site.

#### **Physical State of the System**

In both Mula and Mangi, the state of disrepair of the system is significant and reportedly the degree has risen significantly since the formation of the GMIDC and MKVDC. The

degree of disrepair is generally the higher the more we move towards the tail reach of the project, or the distributary or the minor. In Walen, the main problem faced is that of water logging and canal seepage due to crab damage, a common problem in the Konkan. The problem is so severe that the Walen farmers have come together to demand that no water should be released from the dam until this problem is rectified.

Field channels are not well maintained and this has often caused deprivation. The minor has been breached in many places and farmers draw water from the breach. Many farmers in the head reach of the minors (especially, minors lying in the tail reach of the project) draw water through pumps or take it directly into wells in an unregulated fashion.

### **Degree of Deprivation**

The issue of quantification of deprivation in different ways is taken up separately below. Here we may have a look at the degree of deprivation expressed as percentage of planned area not receiving canal water and as corresponding percentage of area receiving neither canal nor well water.

We may see that even at project level, the degree of deprivation is significant, except in the hot weather. If we take into account the indirect delivery of project water through wells on an equal footing, the figures are modified somewhat and degree of deprivation decreases. However, there is significant variation between head, middle and tail reach of a project and the proportion not served by canal or wells increases. This may be seen from the tables in the following section on quantifying deprivation. Significant tail-end deprivation is therefore present in all these projects.

**Table ES.1: Percentage of Area Not Receiving Canal or Well Water**

Project	Period	Season	% of planned seasonal irrigated area	
			Not receiving canal water	Receiving neither canal nor well water
Mula	1995-96 to 2000-2001	Kharif	80	52
		Rabi	70	39
		Hot weather	-16	-163
Mangi	1998-99 to 2000-2001	Kharif	70	-7
		Rabi	67	47
		Hot weather	24	-14
Walen	1998-99 to 2000-2001	Kharif	67	N. Ap.
		Rabi	29	N. Ap.

There is a clear trend in shift towards hot weather crops in a big way. This creates significant departures and even though the hot weather irrigated area is often in excess of the area planned, the water supplied by the project is often not sufficient to meet crop requirement.

### **Reasons for Deprivation**

Some of the important reasons of deprivation are as follows:

- The state of the physical system. In many places, especially towards the tail of the sub-commands, the system has lost capacity and water cannot reach further.
- Field channels have not been maintained.
- Heavy and unregulated drawals in the head and middle reach. Installation of pumps in the channel.
- In the Mula system head reach, well water has turned saline and this has restricted the number of crops that can be taken.

- Reduction in number of rotations.
- Shift in crop pattern towards water intensive crops like sugarcane and other perennials and towards hot weather crops.
- Reduction in inflow at dam site.
- After experiencing deprivation, or becoming defaulters, farmers tend not to apply for water.
- Many of these factors combine to form a vicious circle. Since water does not reach, field channels are not maintained, system falls into disrepair, because of which water does not reach, etc. This deprivation reinforcing effect is one of the most formidable barriers to system improvement.
- Generally, conditions were found to be more favourable in sub-commands where WUAs were present. Shortages were there but were shared more equitably.

### **Quantifying Deprivation within the Command**

The issue of deprivation is here contextualised to a) the farmers who have been designated as beneficiaries of irrigation within the command and also, b) deprivation in terms of access to irrigation water. The next problem is that of quantifying deprivation.

The problem about quantifying deprivation is that there is no natural measure of deprivation. Different methods and criteria will measure different quantities. There also need not be a single measure of deprivation and many different types of quantification may be needed to explore different aspects of deprivation. There is also the issue of how we take into account the water indirectly delivered through canal seepage and recharge of wells in the command. In the following we have made an attempt to explore different types of quantification for the Mula project sub-commands for which there is much more detailed information available and see how they affect the issue.

The following quantitative norms were explored for comparison:

Norm 1: Deprivation seen simply as number of farmers not receiving water.

Norm 2: Deprivation seen as the area not receiving canal water in a season as a proportion of the area planned to be irrigated.

Norm 3: Deprivation seen as the area neither receiving canal water directly nor indirectly as well irrigation expressed as a proportion of the area planned to be irrigated.

Norm 4: Same as norm 2 except that we now take into account the actual number of rotations and the number of rotations planned as part of project design.

Norm 5: Same as norm 3 except that we now take into account the actual number of rotations and the number of rotations planned as part of project design.

Norm 6: Same as norm 2 except that we now take into account the actual number of rotations and a `pragmatic' number of rotations possible in the present state of affairs.

Norm 7: Same as norm 2 except that we now take into account the actual number of rotations and a `pragmatic' number of rotations possible in the present state of affairs.

On this basis the comparison of these different kinds of norms is given below.

**Table ES.2: Deprivation by different norms compared**

Sub-command	Location within Project	Location within Reach	Location on Dist.	Norm used for deprivation						
				Farmers	Only canal water			Canal water and well water		
					Norm 1	Norm 2	Norm 4	Norm 6	Norm 3	Norm 5
Dy1M1	Head	Head	Middle	83.09	69.37	84.99	69.98	-43.87	28.07	-43.86
Dy2Tail	Head	Middle	Tail	95.06	92.53	96.22	92.44	40.54	70.77	41.53
SDyM3L	Middle	Head	Middle	75.56	73.76	87.49	74.98	16.22	64.87	29.74
Dy5M1	Middle	Tail	Middle	91.50	84.26	92.64	85.28	65.58	83.13	66.27
Dy1M9	Middle	Middle	Tail	98.78	95.97	98.24	96.47	79.11	90.85	81.70
Dy4M1	Middle	Tail	Head	58.90	65.33	82.59	65.18	45.17	72.00	44.01
Dy1M3	Tail	Head	Head	98.14	96.80	98.22	96.43	-4.97	45.89	-8.22
Dy3M5-WUA	Tail	Tail	Tail	64.27	90.45	94.73	89.46	86.81	92.58	85.16
Dy3M5-D	Tail	Tail	Tail	N.Av.	85.02	92.29	84.57	66.26	82.52	65.04
TDyM4	Tail	Middle	Middle	88.80	70.24	84.10	68.20	33.01	66.11	32.22
PBCDM10	Tail	Tail	Tail	62.34	92.68	96.74	93.48	87.41	94.37	88.73

In our opinion Norm 5 gives the closest correlation with tail-ender deprivation.

## **BROAD CONCLUSIONS AND EMERGING ISSUES**

### **Reduced Inflows**

The study indicates a trend towards reduced inflows at the dam site for two out of the three projects under consideration. The existence of the trend itself is not so much related to the size of the project but has more to do with the characteristics of the agro-climatic zones where the projects are located, the stability of the rainfall regimes, and the

type and extent of upstream development of new storages like percolation tanks, minor irrigation tanks, nallah bunds and other soil and water conservation measures. This factor has an impact on deprivation since a fixed and expected schedule cannot be followed, even for a sizeable component of water. The large project shows a greater resilience in face of this trend; so that only in very bad years does it result in a substantial shortfall. For the medium project, however, its sensitivity to low rainfall years seems to have increased as upstream development has taken place in the catchment. The study also points to the need for an integrated planning of water resources at the basin level in the long run in which watershed development works and surface storages of different sizes are planned together. In the short term, what immediately needs to be taken up and can be taken up as part of conventional command management, is to re-assess the present inflow after giving due allowance for catchment area development and redesign the service according to this assessment.

### **The issue of groundwater and wells**

The other aspect of integration is the integration of surface and ground water. The study clearly brings out that the degree and character of deprivation radically changes with access to well water within the command. It is quite well known that wells in the command areas are primarily recharged with the percolation from canals and irrigated areas. However, in present practice, canal water and well water are both treated and managed separately – the canal water falls in the public domain and well water is treated as a private property. There is a need to bring in well water in the command areas under the public domain.

In fact, in Maharashtra, till recently there was an explicit understanding against integration of wells and canal water, under what is known as breaking the paat-mot sambandh (the paat, that is, canal and mot, that is, the traditional device that lifted water from the wells, relationship). Ironically, actual developments today, implicitly accept and even assert this relationship! As we have seen earlier, in the Mula project, when announcements are made inviting farmers to fill in forms for water demand, for the last few years the announcement is generally that 'all those who have access to well water would be given two rotations during rabi'. This effectively means that only those who have access to well need to apply for canal water. Though it does not say so, all those who do not have access to water are discouraged from applying. This is a device the ID (Write out fully) has come up with to forestall legal actions like those in the past where

users have gone to court against the ID demanding crop loss compensation because they did not get sufficient water to raise their crops and had to incur crop losses. It is tantamount to shirking the responsibility of providing sufficient water for farmer's crops. Moreover, the announcements do not remedy the situation – they only accentuate deprivation as access to canal water gets restricted to those who have wells or those who can gain access to well water. This, in a way, institutionalises deprivation.

In the absence of such integration, even the data that is available on irrigation gives a very distorted picture of the impact of irrigation projects. In the case of Maharashtra, irrigation on wells account for more than 50% of the total irrigation and as Maharashtra Water and Irrigation Commission (1999) reports about 40% of the reported area under well irrigation is in the irrigation command itself. Similarly, the degree of deprivation is likely to be overstated if we do not take wells in the command decisively into account.

### **The Physical State of the System**

The study brings out very clearly that the physical status of the system is a factor contributing to deprivation. It would be an understatement simply to say that the distribution systems have not been maintained properly. None of the distributaries and minors has the capacity to carry water as per the design capacity. No financial allocations have been made for repair, maintenance and improvement. It is reported by the people and admitted by ID officials, that the situation has worsened in the last 5 years after the formation of the different corporations like MKVDC, GMIDC, etc. Even field channels are not maintained properly by farmers. While at one end of the spectrum we have lack of maintenance, on the other we have things such as active modification of the system like pumping of water from the canals directly to the fields or into wells, siphoning off canal water through pipes into wells, making pits within the canals on the lines of intake wells to facilitate lifting water directly from the canal, blocking of minors and breaching of channel banks to divert water to their fields. Here the study shows that WUAs do make difference as the physical system is relatively in better condition in WUAs areas as compared to non-WUAs areas.

### **The crop pattern: need to shift to volumetric quotas**

Another important issue which needs serious consideration is the crop pattern, as it exists today in the command areas. The study clearly brings out the disproportionate

shift towards HW utilisation – in fact many times more than planned or as envisaged in the approved cropping pattern. In effect this means that a much larger proportion of the actual water is used in the HW and similarly a much larger proportion is used for sugarcane and this is bound to deprive certain portions of the command of access to water. Here the best way is to decide on water quotas rather than crop patterns, shift to volumetric supply and leave it to the users to decide what crops they want to take, provided they operate within the water quota allotted to them in the different seasons. This will simplify management issues between the department and the farmers. The WUAs can be an instrument to bring this about. Efficient project management requires the management of variable supplies, especially, shortages. Today shortages lead to intense unregulated, individual competition that accentuates deprivation.

### **“Why apply?” -- the Tail-enders' Mental Block**

The study also brings out that there are many people in the designated commands, who do not bother to apply for water and their proportion is much higher in the tail end of the project command as well as of the sub-commands. Since year after year they have not been getting water they have got into a mental state where they do not even demand their due share. Here being at the physical tail end matters very much. Another reason for this mental block is that once they apply for water and the application is sanctioned then they are often forced to pay the water charges, whether they get water or not, or however much they get. Here again forming WUAs can help them in getting their due share as once the WUA is formed, the ID has to fix the water quota for the WUA and also give them a share proportionate to the availability of water.

### **Water logging, salinity and other related problems**

Apart from not getting access to water, there are other types of deprivation. For example not getting enough water or rotations for the requirements of different crops in different seasons is one of such types. The second example is of timeliness of water delivery. The third aspect is water logging and salinity which is more prevalent in the upper reach of the commands. Along with land even the wells have been affected. In new projects care should be taken to see that water is applied much more scientifically taking the soil characteristics, etc., into account. Canal seepage is something which needs to be tackled as lot of areas close to the canals are getting waterlogged because of

percolation. Also sufficient emphasis is not given for constructing and maintaining proper drainage. In many parts of the commands natural drains have disappeared after the projects have come up and the gradients are flat and so there is no outfall from where the water can flow out.

### **Tail to head not sufficient**

Very often it is suggested that tail to head irrigation can take care of the tail-end problem. This is only partially true. The study shows, the need to strictly follow any one of the methods; otherwise it creates deprivation in other reach, especially in the middle reach, as seen in the case of Mangi project. Here the lesson learnt is: whatever system is followed, it should be well understood by both the supplier and the user and both should follow a common discipline in its implementation.

Certain simple measures, as discussed below, could address some of these issues:

- a) To avoid excess supply or use of water, especially in the upper reach of the system, water quotas be allocated equitably and adhered to in all sub-commands.
- b) Once the quantity of water available for irrigation is assessed, the supply or distribution needs to be decided by the ID and the farmers together, especially the number of rotations, the opening and closing of canal seasons. WUAs would greatly facilitate this process.
- c) More number of rotations is always good for light and medium soils in the command. However, farmers need to control their water use to between 40 and 60 mm at a time if more rotations are to be possible with the same amount of water. WUAs could motivate the farmers to do this and initiate a dialogue between the farmers and the officials.

### **WUAs are an important part of the solution**

Finally, the formation of WUAs is an important component of the solution to the problem of deprivation. Experience in Maharashtra does show that participatory irrigation management through WUAs can be an institutional way to take care of many aspects of deprivation. This is corroborated by the experience of the WUAs in this study as well. However, we also need to emphasise that WUAs can perform better only if both the parties, that is the ID and the WUA, are willing to respect their responsibilities and

discharge them seriously. The Government of Maharashtra has taken a policy decision of bringing the entire irrigation in the state under participatory management and has also declared that farmers would not get water if they do not form WUAs by 2003. However, if this initiative has to be successful as well as meaningful, we have to address the following issues and take appropriate steps:

- a) There is a need for training and capability building of both the ID officials and the irrigators.
- b) There is also a need for the government to collaborate with experienced NGOs in this field.
- c) There is a need to distinguish between turnover and acquiring permanent water rights over present quantum of water use and to treat present water use as a provisional right subject to later study and negotiation.
- d) There is a need to go for successively higher levels of organisation like a distributary level federation of minor level WUAs and so on, ultimately forming an apex body at the level of the project itself to tackle problems like scheduling of rotations, resolution of conflicts between WUAs in upper and tail reach, or between farmers who are dependent on direct lifts from the backwaters of the dam and farmers who are dependent on the canals, etc.
- e) There is a need to bring wells in the irrigation commands under the jurisdiction of the WUAs.

It is true that the formation of WUAs and turn over of the system after system rehabilitation and improvement goes a long way towards tackling deprivation within the command. However, to tackle the issue of deprivation in the full sense, as something which goes beyond the existing designated commands, then the WUAs have to become instruments for the integration of water sources, sustainable use and equitable access. This is an issue outside the purview of the present study, but important enough to be taken up as a separate study.

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*'Tailenders are second class citizens'*

*'Tailenders are treated as second class citizens by Irrigation Department, traders and money lenders'.*

## **INTRODUCTION**

Over the years, studies in irrigation sector have shown that those farmers who are in advantageous locations in the system reap disproportionate benefits of the irrigation infrastructure. There is a gap between the head reach farmers and tail end farmers at all levels of the system causing social differentiation among farmers. The situation exists in all categories of irrigation systems in a varying degree. The farmers particularly those fully dependent on agriculture for their livelihoods, are severely affected and pushed into the poverty trap. The deprivation is not only due to non-availability of sufficient water but also due to other negative impacts like salinisation, alkalinity and water logging.

## **SCOPE AND METHODOLOGY**

This study explores the magnitude of deprivation in relation to entitlements as derived and perceived by State and users in policy and practice. The reasons for deprivation and the strategies adapted to overcome the deprivation by various actors are the central attention of the report. The study was carried out in two tanks and two major irrigation systems in Karnataka.

The report discusses the concept entitlement or water right as recognized by the State in its policy documents and the actual realisation of the same by the local traditional institutions and other formal and informal institutions. It examines the impact of these as deprivation on particular farmers at different levels of the irrigation systems. The study focuses on 1) the factors responsible for deprivations, 2) the extent of deprivation, and 3) strategies adapted by various institutions engaged in the irrigation domain.

We feel that an analysis of deprivation and its impact on crops and livelihoods would make the study more meaningful for understanding the social inequalities between the privileged and deprived in the same system.

The study started in the month of January 2002. The fieldwork was completed in the month of April 2002. It covers two minor tanks and two major irrigation systems. The two minor tanks are Belagumba tank in Magadi taluk of Bangalore rural district and Hirekere tank in Chikanayakanahalli taluk in Tumkur District. The major irrigation systems are Vanivilas Sagar project (VVS) in Hiriyyur taluk of Chitradurga district and the Tungabhadra irrigation system in north Karnataka. The study covers project, distributary, sub distributary and outlet level, and villages benefited by it, to understand the macro and micro level dynamics of irrigation management.

The study was carried out with a checklist for various actors involved in the irrigation sector. The study employed field observation method with open-ended conversational interview techniques. Village meetings were conducted in four villages representing two tanks, and twenty-two villages in the major systems. Field observation method was adopted to document systematically the strategies adopted for reducing deprivation, like the rotation system by the managers and farmers. Rapid rural appraisal was employed to study the extent of deprivation, the actual canal condition of distributary 54 and the water distribution practices. A fair number of case studies were conducted through random sampling to assess livelihood issue in different reach of the systems. In Belagumba and Hirekere tank 12 and in Vanivilas Sagar 34 and Tungabhadra 16 cases studies were documented.

## **PROFILES OF THE SELECTED PROJECTS AND COMMAND AREAS**

### **Belagumba**

Belagumba tanki is located about 40 kms from Bangalore and 7 kms from Magadi town constructed by the Government. According to 1991 census, Belagumba village had a population of 1116 and as per 2000-2001 land survey the total geographical area of the village is 918.37 acres (1 hectare=2.471 acres) of which road, natural drain, waste land, etc. is 387.06 acres. The cultivable area is only 531.33 acres of which 400.01 acres dry land that is rain fed agriculture and only 131 .32 acres is under the command of the tank. Most of the farmers in the command area belong to one caste i.e. Vokkaligas, which is a dominant caste in the State.

### **Hirekere Tank**

Hirekere tank is located in Kandhikere village in Chikkanayakanahalli taluk of Tumkur District. Hirekere tank has a history of 300 years. The tank has a command area of 121.72 hectares, of which the official localization pattern is 47.21 ha for garden and 74.51 ha for wet crops. Tank is under the control of village traditional institution. The localisation particulars of the tank command area are registered only in the government document and have no relevance to the people of Hirekere tank under the present management practices.

### **Vanivilas Sagar Irrigation System**

Vanivilas Sagar project is located in Hiriur taluk of Chitradurga district. It was completed in the year 1907 by the erstwhile Mysore Wodeyar and named after queen Vanivilas. The dam is constructed across Vedhavathi River. The project caters to the villages of Hiriur taluk. The project has a dam and functions through pick up weir at Kathrikenahally village about 8 kilometers from dam site.

### **Tungabhadra Irrigation System**

Tungabhadra irrigation system is the largest protective irrigation systems in Karnataka State, and was constructed in the year 1953 across Tungabhadra River. The objective of a protective irrigation system is that water is thinly spread over a large area and a large number of farmers, in order to protect crops against drought and farmers against famine. The Tungabhadra system was designed for the cultivation of mainly light crops like sorghum, millet, and local variety cotton. The cropping pattern has been enforced by law in the 'localisation system'. This a form of land use planning which prescribes which crops farmer are allowed, and not allowed, to grow in which season.

### **Distributary 54 in Tungabhadra Left Bank Canal**

The sub-distributaries of distributary 54 in Tungabhadra left bank canal were selected for the purpose of the study. D54 lies in the middle reach of the main system of the Tungabhadra left bank canal (TLBC). Distributary 54 of TLBC is the biggest distributary under Tungabhadra left bank project canal system, with a total command area of 87,084 acres and 41.34 km. in length. The distributary has been divided in two reaches for water management

## **MAIN FINDINGS**

### **General**

Karnataka, one of the southern states in India has total area of 191,791 km<sup>2</sup> with a total population of 52,733,958. In 1998-99 the total area sown was 12, 311,594 hectares, of which the net area sown was 10,489,220 hectares and 1,822,374 hectares were sown more than once. The overall net area irrigated during 1998-99 from different sources shows that the area irrigated under canals is larger than that of other sources of irrigation. An area of 952,021 ha is irrigated from canals, 254,965 ha from tanks, 478, 818 ha from wells, 449,674 ha from bore wells, 98,215 ha from lift irrigation and 258,178 ha from other sources, all these add up to 2,491,871 hectares under irrigation in the State. At the end of March 2000 the total irrigation potential created was 36,22,921 ha including groundwater. Karnataka has 36000 tanks spread all over the state of which a major portion is in the Southern parts of the state.

### **Entitlement**

Entitlement refers to any recognised claim that somebody may have to irrigation water. Entitlements can be identified in various ways, Examples are localisation of the land for a particular crop, the design characteristics of the system, the title deed of the land document, periodic notification from concerned authorities, social norms prevailing in local institutions and State policy.

### **Localisation under State**

Localisation is the land use pattern adopted while designing the irrigation system, to calculate the canal capacity and potential of the system. This land use pattern specifies details like the type of crops that is allowed to be grown on a particular piece of land in a particular season.

### **Localisation under Traditional Institutions**

Dams of different size and canals are under the authority, control and management of State departments. In its practical operation and management there are traditional institutions that are engaged successfully in some places. These institutions have their own rules and decision making based on local specific needs. These rules and regulations tend to be more effective, well accepted and followed by the community. The intervention of well-established institutions like line departments has not changed the values, rights and responsibilities attached to the water bodies by the local people.

### **Policy Reforms**

In order to make the best utilization of available water, the State in June 2000 amended its Irrigation Act of 1965. The amendments emphasise irrigation management turnover from the irrigation Department to Water Users Associations at primary, distributary, project and State level. At present there are about 3000 WUAs registered under the Cooperative Act in the State and making progress in forming project level federations in major irrigation systems. Command Area Development Authority (CADA) carries out the task of forming WUAs. The State has launched a tank development programme under two schemes funded by the State government and the World Bank.

The Amendment that was promulgated in the year 2000 empowers water users associations to carry out several activities provided that an irrigation work is entrusted to a Water Users Society. Chapter IX A highlights the Functions of Water Users Society. Item 2 says one of the powers of a WUA is "To procure water in bulk on volumetric basis from the Irrigation Department or Krishna Jala Bhagya Nigam or Karnataka Neeravari Nigam and distribute it to the land holders in accordance with the principles laid down by the General Body for equitable distribution of water".

WUAs are empowered to decide upon cropping pattern, prepare a water budget and financial budget, levy and collect water charges and service charges from landholders who are members and non-members as decided by the general body of the society.

## **Extent Of Deprivation**

Extent of deprivation is assessed based on localisation pattern that entitles share of water for particular crop on piece of land. In addition the returns which an head reach farmers is benefitting from making use of extra water than his share is taken into consideration while assessing the deprivation.

### **Belagumba Tank**

In the tank command area there are 26 farmers with an area of 32 acres and 20 guntas out of total 116 farmers with a total area of 173 acres and 12 guntas, which are deprived of water both in normal and scarcity periods i.e. totally deprived. These farmers and the area do not have any other source of water but to depend on the tank water through the canal. Among the 26 farmers only one farmer is a big (Definition of a big farmer?) farmer and there are two farmers who also have lands in the upper reach. There are 19 farmers who are in the category of marginal farmers. These farmers do have small land holdings (Definition of a small land holding?) outside the command area where ragi is the main crop. Ragi is a staple food in the region. There is a difference between the land outside the command and within the command in terms of crops, yield and returns.

## **Seasonal Deprivation**

The data reveals that there is about 25 per cent of the area in the head reach that could easily cultivate paddy even when  $2/3^{\text{rd}}$  of the tank is filled. The upper reach farmers consider such situation as normal season as they are hopeful of harvesting one paddy crop. Thus facing seasonal deprivation.

### **Deprived but Having an Alternative Source**

In the total command area, 87.20 acres has alternative arrangements and lift water for irrigation purposes from the drain with the help of irrigation pump sets. The source of water to the drain is rain, and seepage and leakage from tank and canal. The drain flows in the middle of the command area in deep cutting, which easily pulls water from the canal and tank.

### **Hirekere Tank**

It is clear from this sample tank that there is no violation of cropping pattern prescribed by the village institution (though it violates the department cropping pattern) or

unauthorized irrigation. The deprivation due to scarcity thus arise out of rainfall failure, is shared equally. There is no tail end deprivation. The entire command area is divided into three parts and the number of plots undertaking irrigation depends on the quantum of water available in the tank. When the water is above half the tank it is one part, when  $3/3^{\text{rd}}$  two parts and full only two parts can irrigate. The deprivation of parts is in rotation. Once the block is decided for irrigation, there is no fear of losing a turn or share of water for irrigation purpose.

### **Vanivilas Sagar**

The agricultural practices in the Vanivilas Sagar project area reveal that there is a different crop pattern than envisaged in the original design of the project. The project is unable to cater water for wet irrigation in the full command area. If this can be viewed as deprivation from design point of view, then it is all farmers of the command area who are deprived of irrigating wet crops through canal water.

In the entire Vanivilas Sagar command area the most affected farmers are marginal and small farmers who are dependent on agriculture for their livelihoods and do not have garden crops like coconut and areca nut. Such deprived farmers can be seen in main canal, distributary, sub distributary and outlets. The analysis shows that these categories of farmers have taken up rainfed crops like millets. For the semidry/light crop, there is a wide gap between the 'localised' area and actual crop sown area. Hence, the farmers who were dependent on crops like wheat and groundnut are deprived in the command area. The irrigation pattern, i.e. the number of watering and the duration between watering is not encouraging to opt for semi-dry crops. The irrigation season is mainly in summer to protect the standing crop. During 1997 and 1998 water was provided only twice and that the priority of the project is to protect the existing crops and not to irrigate a full crop season. The extent of deprivation varies from 5 to 100 per cent in different canals with an average of about 40 per cent in command area.

### **Tungabhadra**

In general the performance of the Tungabhadra project in terms of water utilisation over the years seemed to be promising when compared to the extent of silt accumulation and

the conditions of the canal. The average actual irrigated area is around 95 per cent to the total localised area at the project level.

This project performance i.e. 95 percent to localised area cannot not be taken on face value by itself that the area irrigated is in relation to crop water duty estimated to deliver to crops in the system based on the localisation. The assessment of the quantum of canal water and number of watering given to crops is not prepared by the concerned authorities. In command area there is also practice of lift irrigation schemes which re uses the canal water. The contribution of rainwater is another factor that is not accounted while assessing the area sown in command area. In addition, State and farmers have started setting up small balancing reservoir, which are filled during surplus and rains. Hence, the actual are irrigated in command area cannot be attributed to canal water alone.

#### **Distributary 54**

In second reach of D 54 out of 23867 acres and 20 gunta, area of 1656 i.e. about 7 percent of the total irrigated area is from lift irrigation during rabbi. In Kharif out of 28566 acre and 14 gunta, an area of 2168 acre and 19-gunta i.e. about 8 per cent of the total irrigated area is under lift irrigation. This sets an example of re use of water in the canal, which is taken into consideration while assessing the area irrigated in command area.

The major crop in the command area is paddy and paddy cultivation is increasing over the years. The localisation is spread across three districts and several taluks, where as the actual irrigated is more in the head reach of the main canal, distributary, sub-distributary and outlet level. The tail-end distributaries like 106, 105 and 104 do not receive water. In addition, many sub distributaries in major distributaries are also not benefitting irrigation.

The observation shows that most of the area irrigated is concentrated in the head reach and distributaries in the tail end of the system are suffering from severe water shortage. There is a considerable extent of area under double cropping. It can be said from our earlier research that there is also seasonal variation in deprivation. In Rabi season the deprivation is more than in Kharif as the canal water is also substituted by rainwater

during Kharif season. However D106 does not even get irrigation water for light crops in the Kharif season.

### **Self-made Deprivation**

There is self-made deprivation in the command area, through ignoring of the irrigation department's notification regarding the availability of water and the crops to be grown. Farmers take a chance and grow paddy in Rabi crop and sometimes incur a major loss. Though paddy is not localised for Rabi, still paddy is grown on a large scale. The trend in paddy cultivation is increasing over the decade causing water scarcity in the tail reach. The clipping from the daily newspaper given below shows the extent of deprivation during the study season.

It is observed that in distributary 54 water at present with great difficulty is reaching upto Ch 11085 from here further down till the end of main distributary there are two outlets and two sub distributaries with an area of 14126 acre i.e. about 20 percent is deprived of water. In Ch 1034/LS out of total localised area of 1673 acres only 150 acres get irrigation that to incurring additional expenses in fetching the water for irrigation purpose by guarding the canal.

As per the latest assessment made by Irrigation department out of 69000 acres of localised area in second reach about 36 470 acres is found to be suffering from non-availability of canal water.

The first and the second reach should be getting design discharge of 306 and 288 cusec i.e. 5.8 feet and 5 feet depth of canal respectively at their off take point. The design discharge on an average during 2000-2001 is 5.45 and 4.23 feet with an average deprivation of 0.35 and 0.77 feet of water in first and the second reach respectively. In first reach there is excess sown than localised area, over past eight years average area is 29474 about 165 per cent as shown in index table 5.3.4. In the second reach an average of 40358 is less than the actual area irrigated i.e. 58 per cent under deprivation.

In 2001, system managers in their assessment of suffering area show that 36470 acres i.e. 52 per cent of localised area in the second reach of D54 is suffering from non-

availability of canal water. From the above discussion it can be concluded that overall there is a deprivation of about 50 per cent in Distributary 54.

### **Livelihoods**

In Belagumba tank, at present in the 32.20 acres of totally deprived lands in the atchkat ragi (millet), mulberry (sericulture) and eucalyptus are cultivated. These are dependent on the rains. The livelihoods of this group also depend on agricultural labour. Some of them have taken up businesses and jobs in Magadi town and Bangalore City, which are in the close vicinity of the village. The dependency on agriculture is gradually declining over the years. The younger generations see no scope in agriculture in the village.

The years when Hirekere tank is filled act as assured bonus income for the farmers of Hirekere. The scarcity year as defined by villagers where only part of the land goes for irrigation there is deprivation to the farmers of lands that are earmarked for irrigation. As in the case of Mr. Nanjundaiah with 8 members in the family dependent on agriculture is able to earn a sum of Rs 10,100 per year in command area as sharecropper and agricultural wage earner. The situation is grimmer during the years when there is no even to one part out of three parts of lands in command area. This household would be losing income of about Rs 1000 during such years and make a living with income from ragi and wage earned from non-agriculture family which is insufficient. The income from agriculture labour Nanjundaiah says in addition to 10 to 13 bags of ragi he require 360 kg of rice per year for the household consumption. The considerable share of grains produced in own land and sharecropping is used for self-consumption.

It is observed that the livelihoods of the farmers in the tail end of D54 are miserable when compared with the head reach farmers. Head reach farmers are growing two crops paddy where as tail-enders are deprived of canal water for even single crop. Tail-enders are dependent mainly on rain fed agricultural crops sunflower, Jowar and local variety cotton. Marginal and small farmers are banking more on agricultural wage earning in addition to own farming. The income is high from agricultural labour than own farming.

The comparison between the farmers of sub distributary 3 R and 25 R shows that the farmers in 25 R are in disadvantageous position and are severely affected by

deprivation. The total lands of the farmers in SD 3 R whether localised or non-localised is put to use for double cropping i.e. paddy in Kharif and Rabi.

The crops grown in tail end are not remunerative as compared to head reach farmers. The net return per acre of cotton grown in tail end is about Rs 290/- and in Jowar it is on lower side. The average agricultural wage income per person per year is about Rs 6300/-. Most of the farmers here also work as agricultural labour, which is the main cash income for livelihoods.

### **Box 1**

The deprivation in general has serious repercussions on the marginal and small farmers dependent solely on the system for irrigation purposes, as agriculture is the main source of their livelihoods. Farmers, particularly in drought prone areas, are forced to migrate to neighbouring towns and cities in search of livelihoods. As in the case of Tungabhadra, farmers in the tail end area are economically backward when compared with the head reach farmers. Farmers in the head reach successfully harvest two wet crops in a year, whereas farmers in the tail reach are deprived of even one wet crop per year. The living standards of the upper reach farmers are better in terms of food, clothing, transport, electronic and luxury equipment, where as the people in tail end are surviving on nominal standards.

## **REASONS FOR DEPRIVATION**

### **Policy and Enforcement**

Lack of comprehensive policy that encompasses the legal right over one's share on the water. Total failure of compulsive legal enforcement in terms of localisation/cropping pattern and collection of water charges.

### **Availability of Water**

The data shows that one of the major reasons for deprivation in the region is the shortage of water accumulation in the reservoir in all samples studied. This is due to neglect of catchment treatment and silt deposits in the reservoir.

In Vanivilas Sagar project, since 1906 till today reservoir has been filled only once i.e. in 1933. In Tungabhadra, system managers say that the reservoir is silted up on a big scale and nearly 100 TMCft of water cannot be stored in the reservoir. The silt problem is also found in the canals and other levels of the system. These affect the discharge capacity.

### **Unauthorised Irrigation**

In Tungabhadra, there is unauthorised irrigation practiced in the head reach of the system. Farmers cut banks and siphoning they take water for the area non-localised in the system. It is observed that farmers in the head reach cut bank even on other side of

the command area, fill the water in the open well and with the help of pump sets irrigate the lands. The department is unable to control such farmers and these socially, economically and politically influential farmers.

### **Violation of Cropping Pattern**

There is increasing trend in violation of cropping pattern; the area under paddy has increased from 334 per cent to 818 per cent in 1999-00. The double cropping and paddy cultivation concentrates the water in a part of the command area.

### **Poor Maintenance**

The systems are in poor conditions and suffering from leakage and seepage from the canals occur on a large scale. The main canal, distributaries and sub distributaries are not lined and in the tail end areas they are even difficult to locate. Seepage and leakage is a growing problem in the Tungabhadra irrigation system. The area being black cotton soil, the structures often collapse. In addition farmers in the head reach manipulate the structures like demolishing, tampering, punching the aqueducts to get water.

### **Shortage of Funds and Regular Staff**

The department is facing a financial crisis and cannot take up all the repair works. The works that are taken up are done through contractors, whose work is reported to be of poor quality. The water distribution is undertaken by employing temporary workers during the irrigation season. It is said that these temporary workers are not effective, as they do not have any commitment to the department and the local elite easily influences them. The available funds do not allow officials to employ labourer in required quantity.

### **Lack of Night Irrigation**

Farmers in the region do not practice night irrigation; as a result there is lot of water going into river unused. The rotation pattern does not permit system managers to store night water.

### **Slow Progress Of WUAs in the Region**

It is said that the Irrigation Department undertakes the facilitation of the formation of WUAs and so far the project has not benefited from Command Area Development Authority funds. There is slow growth in the WUAs in the region.

### **Supply to Non-agricultural Sector**

Over the years there is increasing demand for drinking water for the adjacent towns of the irrigation systems. The quantum of water diverted to urban areas has increased manifold in the past decade.

## **STRATEGIES ADAPTED to OVERCOME TAIL-END DEPRIVATION**

### **Water Management**

Over the years the accumulation of water declined and was not sufficient to provide irrigation for fresh crops. This forced the system managers and users to change the irrigation pattern.

In Vanivilas Sagar, at present the main purpose of the system is to provide irrigation to protect the standing garden crops as noted above. The decision to release the water and the rotation pattern are charted out in the Irrigation Consultative Committee. This consists of system managers, users, politicians and the District Commissioner (DC). Any change in the practice has to get approval from the DC, who heads the committee.

The rotation schedule is again flexible on the lines that as and when there are rains in the command area the gates in the dams are closed to save the water. This is possible as the entire command area is in one taluk and it is relatively easy to get information about rainfall in the command area. The farmer's opinion regarding the closure of the dam is collected in main villages and permission from the D.C is obtained to alter the rotation schedule. This happened during the study period. The second watering was postponed by five days because of showers all over the command area.

### **Rotation Schedule**

In Vanivilas Sagar, the rotation schedule in water management has been practiced for several years. Water is released for a specified quantum and duration, which is counted as number of waterings. Usually the number of days the water is provided ranges from 12 to 15 days depending on the number of waterings given and the area under cultivation. This is published in the form of pamphlets that are distributed to farmers, and is also orally communicated to farmers during their meetings.

In Tungabhadra, the rotation schedule is introduced and carried out with close monitoring by system managers guarding the outlets. Day and night patrolling on the canal with assistance of task force workers (who are taken through contractors on a temporary basis) is the common scenario during the irrigation period.

### **Lift Irrigation**

In order to solve the water deprivation in the command area, the government has set up ten lift irrigation schemes to the river. All the ten lift irrigation schemes were run by the State department and helped farmers in the region to irrigate their lands. At present all the ten lift irrigation schemes are defunct.

The failure of State run lift irrigation schemes is one of the reasons for individual irrigation pump sets to come up. At present there are a number of irrigation pump sets all along the canal particularly in the tail end area of the command where two rivers meet.

### **Informal Organisations**

Farmers in some pockets of the command area, particularly where there is the influence of Tamil farmers, organise themselves into informal groups and have adapted Vant system i.e. rotation system. In some cases the Vant system is found at different levels of the system like distributary and sub-distributary and outlet level. The available water is distributed among the farmers based on the number of acres divided by total hours of water availability and allocated to the farmer. He has a right over the water during his/her turn. However, the capacity to guard the outlet and bring the water during the turn lies with the farmer of that particular turn.

There are informal committees that are organised at the project level that raise issues related to the project and suggest alternative solutions for the problem. One such informal group is called 'Vanivilas Sagar project welfare association'. It mobilises people at the grass roots, giving representation to the government regarding the problems in the project, holds public meetings, protests etc. The committee is demanding the government to link the Bhadra canal to the VVS reservoir so that the water problem in the command area is solved, and the irrigation facility can be extended to a few more taluks further down the existing command.

### **Water Users Association**

Under the new irrigation policy the government is promoting water users associations in the command area. There are five WUAs identified in the command area of which two are recently registered and are still in the process of establishment. These WUAs are not yet taken over the water management from the Irrigation Department.

### **Salinisation**

The Tungabhadra system is affected by salinity, water logging and alkalinity. This is a major problem for the farmers who are in low-lying areas. These lands become unfit for cultivating semidry crops. As a result farmers try to take more water to grow paddy, which survives on these affected lands.

### **CADA**

The Command Area Development Authority (CADA) is promoting water users associations to transfer the management from the Irrigation Department to users associations.

### **Farmers**

Farmers at the field level do adopt strategies like rotation at outlet level, and organise into informal groups to guard and patrol the canal. In addition there are some project level farmers organisations working for the welfare of the users in the command area giving representations to the department and organising farmers meetings. Some of the farmers in the tail end area invest in irrigation pump sets as an alternative source of irrigation. In addition there are considerable cases where farmers dig ponds to store the water in their own lands depending on the land holding and use it during scarce period.

## **NGOs**

NGOs like Institute for Studies on Agriculture and Rural Development (ISARD) and Sahayoga worked in the area to bring about changes in water management practices. ISARD undertook the action-oriented programme in water management and formation of WUAs in distributary 36. Sahayoga conducted meetings with representatives of WUAs discussing issues related to policy reforms.

## **CONCLUSIONS**

Localisation in its present form does not give legal rights to farmers to realise his entitlement over water. It can be derived from above discussion that realising localisation in practice has been a difficult task with all the strategies adapted by system managers, farmers and other stakeholders. It is a dynamic factor that changes due to compelling forces like poor rainfall and in effective management practices. It cannot be taken as the base to assess the deprivation factor common to all systems. It has no relevance as it has no practical significance. Localisation prepared also on the basis of soil characteristics and altitude of land enforced by system managers discriminate the farmers in the region. The present localisation pattern has left out some of the farmers and areas in command area. It does not include or give share of water to non-localised farmers. This in itself reflects the inequality in water distribution and socio-political discriminatory attitude in design characteristics, which is again a policy decision.

Farmers located in the disadvantageous parts of the command area are deprived of their share of water when compared with farmers closer to canal water. The benefits of irrigation are reaped by the category of farmers closer to the water at various levels of the system. They have better accessibility compared to farmers in distant locations. This unequal distribution of water is found among the systems (sample studied) that are managed in principle and in practice by the State department irrespective of their size of operation. The Irrigation Department manages the large systems. In tanks the possibility of users controlling the entire system can be seen in the case of Hirekere tank with participation of users in small scale.

Access to credit is poor among the farmers in the tail reach area. There is a higher number of defaulters in the bank and traders and private moneylenders do not extend

loans to farmers in the tail reach. The standard of living is critical in the tail reach of Tungabhadra, as the region is a drought prone area. The source of income of the deprived farmers is rainfed agriculture with local varieties of crops, and agricultural labour.

The extent of deprivation is unequal and varies across the systems. In a tank system like Belagumba, about 25 per cent of the farmers are always deprived of their share of water. The most deprived part is the tail end part and includes mainly marginal and small farmers. The medium and big farmers invest in irrigation pump sets costing Rs 35,000 to 50,000 and incur additional costs for crop production.

In Hirekere, the deprivation is shared on a rotation basis on an equitable basis. The study shows that, out of three parts, one part of the tank command is always deprived of irrigation but this part rotates over the years. This tank has inbuilt norms regarding the tank management and sets a difference with tanks constructed by State during post colonial. The chances of violating the 'traditional' rules in this tank are much lower than in Belagumba tank.

Vanivilas Sagar project is an almost century old irrigation system and is suffering from severe shortage of water availability in the reservoir. The priority of the project has shifted from wet irrigation to garden crops, along with drinking water to two major towns (Hiriyur and Chitradurga). The small and marginal farmers fully dependent on agriculture are severely affected by the number and duration of waterings. These farmers are unable to grow semi-dry crops, which is their major source of income. In the head reach there is violation and unauthorised irrigation that the department is unable to control. In addition, the canals are suffering from poor maintenance and the department is unable to attend to all the works due to shortage of funds.

The Tungabhadra irrigation system, which is half a century old, is also suffering from poor maintenance. The project, which is located in the drought prone area of the State, was put up with the principles of protective irrigation. Over the years, the violation and unauthorised irrigation in the head reach has caused deprivation on a large scale in the lower reach. Moreover, the trend in paddy cultivation in the project area is an increasing

trend. This would after some time result in concentration of water only in a few distributaries and sub distributaries, causing a greater amount of deprivation.

The strategies adopted by system managers and users are able to give some relief to the farmers in the lower reach, if not in the tail reach. The rotation system of water distribution is able to supply water to lower reaches to some distance. Otherwise the magnitude of deprivation would be much more problematic in the lower reach. Despite of paddy, which is a heavy water duty crop cultivated on a large scale, the actual area irrigated in Tungabhadra on an average since last decade is around 94 per cent of the localised area.

The amendment to the Karnataka Irrigation Act of 1965 empowers water users associations to take over water management and distribute among its members and non-members as decided by the general body of the water users association. WUAs and Irrigation Department will enter into Memorandum of Understanding regarding water management prior to the season. The Water Users Associations are empowered to decide their own cropping pattern, and fix and collect water charges from users.

Though the State is making considerable progress in the formation of WUAs in some projects, in the study area their existence and effectiveness is less. The tail end farmers aspire to form water users association whereas there is not much enthusiasm in the head reach for the reason that they will have to give up all the additional benefits they are getting in the present condition.

The Command Area Development Authority (CADA), the implementing agency of the WUA programme, in itself does not have sufficient staff and funds to form WUAs on a big scale and the participation of NGOs in canal irrigation is also very poor. This can be seen in the Tungabhadra irrigation system, that there is a vast difference between the number of WUAs identified and actually formed. However, the new programme of irrigation management turnover is seen by tail-enders as relief programme over deprivation in days to come.

The reform processes in Karnataka recognises the volumetric supply of water to WUAs through entering into an agreement with WUAs enables the users to decide upon the

usage and distribution of water among the members. This would enable to share the resources on an equitable manner by the users. Provision is made to benefit non-members by empowering the WUAs to decide upon the same.

### **EMERGING ISSUES: RESEARCH AND POLICY**

How do we get accountable leadership at local level system in a democratic process?

Users are excluded from the research process. This has to change. Users need to be involved in knowledge generation and development.

Factors affecting the success and failure of traditional institutions and how to integrate with formal management of systems.

Research on linkages between irrigation and livelihoods to know more about the role irrigation plays in the food security and livelihoods of irrigators especially weaker sections.

Analysis of bundles of rights connected to irrigation water in different systems.  
How to create enforceable water rights and rights based development?

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***“Why do you waste the water by supplying it to tail ends which are barren and grass lands?”***

Remarks of head reachers to irrigation department.

### **OBJECTIVE OF THE STUDY**

The ‘Tail-enders and other deprived’ study is undertaken with the main objective to explore why some water users / irrigators in major, medium and minor irrigation systems are deprived of water. The study is also concerned with the magnitude of such deprivation, characteristics of the deprived / better endowed persons and the strategies adopted by them in coping with the situation. In addition, it deals with related issues like linkages between access to water and livelihoods. The study attempts to explore what kinds of entitlements (as related to access to water supply) exist in different irrigation systems, and how they are realised. Entitlements and deprivations are defined for the purpose of the study as what farmers are supposed to get and what they receive actually.

### **SCOPE OF THE STUDY**

The following are more specific questions investigated in the study as regards entitlements and deprivation.

- Area localised<sup>1</sup> by season and crop and actual realisations during normal and scarcity periods.
- Specific locations having deprivation / tail-enders problem in the system with details about extent of area, whether problem is recurrent, who are affected in terms of caste and class.
- Differences in area, yield, and cropping intensities between head and tail area.

The study also has investigated the reasons for the deprivation and the factors associated with it. It has also analysed, the role that irrigation water plays in the

livelihoods of the affected people. In other words, to what extent they depend upon irrigated agriculture for their livelihoods, and what is the share of income from irrigated agriculture to total income of the household.

## **METHODOLOGY OF THE STUDY**

### **Selection of Sites**

#### **Selection of systems**

It is our understanding that tail-enders/ deprived problems will vary depending upon the size of the systems, techniques of water control and socio-economic conditions of the region. Hence we have selected sites for the study from major, medium and minor irrigation projects. These also represent different agro-climatic and socio-economic environments.

In Tamil Nadir, Parambikulam Aliyar Project (PAP) and New Kattalai High Level (NKHLC) are projects selected for the study from major and medium projects respectively. In addition, two rain fed tanks were also selected from different agro-climatic conditions.

#### **Selection of distributaries**

The canal systems were divided into three different reaches as head, middle and tail based on the length of the main canal. The length of the canal was equally divided to make head, middle and tail reach of the system. A few distributaries were selected from each reach of the system. The selection of the distributaries is based on the technique of the irrigation practised (canal / tank and well), familiarity with the area, distributaries with differences in socio-economic aspects like caste, economic conditions, irrigation organisation etc. A relatively higher number of distributaries were selected in the tail end of the system to capture details about their characteristics and problems of the tail-enders.

#### **Selection of villages**

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<sup>1</sup> Localisation and localised command area by government in the South Indian context refer to the designation of certain areas/cadastral units for irrigation of particular crops and /or in particular seasons.

The selected distributaries were further divided into head and tail. Two villages/ tanks (one each from head and tail) were selected for detailed study. In case of NKHLC, tanks were selected from the distributaries and in PAP, the villages were selected from the head and tail end of distributaries. Totally 25 villages (18 from NKHLC and 7 from PAP) were selected for the study purposively to capture the impact of different factors on the tail-enders problems. Two villages from rain fed tanks were also studied for minor irrigation projects.

## **Collection of Data**

### **Discussion with System Managers**

To start with, details were collected about the systems from the Irrigation Department, especially from the divisional officers. Discussions were held with executive engineers and junior engineers to understand the operation of the system, and their perspectives on the tail-enders' problems.

### **Discussions with System Level Farmers Organisation and Their Leaders**

Discussions were held with the leaders of farmers' organisations at the system and district levels, political parties, individuals knowledgeable about the operation of the system, problems faced by the farmers, implications of the problems to tail reach farmers in the access to water supply, timeliness, adequacy, their efforts to solve the problems and the result.

### **Discussions with Farmers' Groups at the Village Level**

The discussions with irrigation department and farmers organisations in the system gave a good idea about the problem areas and their concentration. To get more details about the tail-enders/ deprived problems, the reasons for, and the consequences of, discussions were held with a group of knowledgeable people in the selected villages.

### **Case studies on Livelihoods of Tail-enders / Deprived**

Detailed case studies of individual farmers were conducted to know about the role of irrigation in the livelihoods of farmers belonging to different categories such as small, marginal, medium and big farmers. The details collected include the number of members in the household, their occupation, total income of the family, income from agriculture,

income from irrigated agriculture, the variations in the income from irrigated agriculture in different years, especially in normal and drought years.

## **PROFILES OF THE SELECTED PROJECTS**

### **New Kattalai High Level Canal (NKHLC)**

#### **Design of the System**

NKHLC is situated in Tamil Nadu, South India. It was built as part of the extension programme of irrigation under the five-year plans, which were the main vehicle for the Government of India to achieve development goals. Completed in 1960, the canal is about 85 miles long, of which the first 40 miles is not utilised for irrigation. This area is provided irrigation by a nearby canal. NKHLC is meant for supplying water to a chain of about 106 tanks. The total command area of the tanks is about 12,000 acres (1 hectare=2.471 acres) spread over 50 villages in Trichirappalli and Thanjavur districts. In addition, canal irrigation is also practised to the extent of 8622 acres, which fully lies in the head reach. NKHLC is one of the four systems under Kattalai Irrigation Scheme fed by the Kattalai bed regulator across the river Cauvery. This canal is entitled to last priority of right on the water available from the bed regulator. Irrigation under this canal is meant for a single paddy crop for the duration of 4½ months in a year, usually from 1st August to 15th December.

#### **Land use and Agriculture**

As far as land use is concerned only about 40% of the cultivable area is used for agricultural purposes. The agricultural lands mainly depend upon irrigation. A very significant percentage (75%) of cultivated area is under irrigation. This indicates that cultivation is carried out predominantly through irrigation. The reason is that dry lands are mostly salt affected and hence are not cultivated in many parts of the region except in some villages in the tail reach. The main reason given for this problem is a natural change in atmosphere for over the past centuries, which has affected the soil in the area. Hence agriculture in this region depends mainly upon irrigation water.

Paddy is the only irrigated crop grown in the command area served by the NKHLC system. Relatively less area is under paddy in the tail reaches as compared to other reaches. This

is due to problems faced in securing adequate water supply from the canal in the tail end of the system.

### **Supplementary Source of Irrigation**

Though canal water supply is unstable, well irrigation, as a conjunctive source has not been developed. The reason is that the groundwater in this region is highly saline, though it is available within 10-25 feet below the surface and the water table is steady throughout the year. Though ground water availability is relatively better in some villages especially in the tail reach, well irrigation has not developed because of a) high cost involved in digging as the area is rocky b) most farmers are small and can not afford to invest. It is noted that about Rs.100, 000(USD2000) is the cost of digging of a well in the area.

### **Land Control in the Region**

A striking phenomenon of the system area is absence of big landlords with large land holdings. This does not mean that land concentration has not taken place. There are inequalities in the ownership pattern of both irrigated lands served by the system and of the total land holdings. The degree of concentration of inequality is more pronounced in the head reach area of the system than in other reaches.

### **Socio-economic Environment of the Region**

In general, farmers in the head reach are stronger in terms of social, economic and political status than the tail reach farmers. In the head reach out of 7 villages, Udayars and Gounders are dominant in 6 villages and the remaining village is dominated by Scheduled Caste. Whereas in eight villages in tail reach, Kallars are dominant in five villages and Scheduled Caste and others in the remaining areas.

### **Irrigation Institutions in the Area: Local Irrigation Organisations**

There are two types local organisations:

- a) tank /channel organisation and
- b) village organisation

The tank level organisations are called 'Kulam (tank) Panchayat' and the village level organisations are called 'Oor (hamlet) Panchayat'. These are traditional irrigation organisations functioning as a part of informal village administrative structure evolved historically .At the lowest rung of the ladder of the village/tank level organizations are the professional watermen and watchmen

One of the striking features of the micro-organisations in NKHLC is that every organisation has its own funds. Of 18 villages studied in NKHLC, 16 have tank / village specific organisations which are involved in water management. In addition, there are other organisations like political parties, temples and churches that take interest in irrigation related issues. They intervene only during crises like inordinate delay in opening of the canal, non- receipt of water for a long period in a season, inter -village conflicts etc.

### **Irrigation Bureaucracy in the Region**

As in all public surface systems, the state bureaucracy has the responsibility for management of NKHLC. The officials of the Public Works Department (Irrigation) are supposed to take care of the maintenance of the system. They also have the responsibility to regulate water allocation up to the distributary outlets in the case of canal irrigation and up to the tank supply sluices in the case of tank irrigation.

One of the main problems faced by the irrigation bureaucracy is inadequate staff for effective management of the systems and non-availability of adequate funds for maintenance work. Generally the staff available, especially the number of watchmen (*lascars*) is found to be inadequate. Each *lascar* is normally supposed to look after two miles of canal but at present his responsibility extends upto 6 to 8 miles. The infrastructure facilities available to the bureaucracy are also found to be inadequate.

## **Main Findings**

### **Water Insecurity in NKHLC System**

As noted earlier, New Kattalai High Level Canal is having only last priority of water rights i.e., water is supplied to this canal only after meeting the needs of older channels. The irrigation under this canal is meant for 4½ months, i.e., from 1st August to 15th December. The system is meant for both direct (canal) and indirect (tank) irrigation.

According to the government rule, the supply will be given whenever surplus is available from the river from 1st August onwards (that is storage in the reservoir should be above 94 feet). Due to unstable nature of the system, there were delays in opening of it in most of the years.

### **Water Regulation in NKHLC System**

As per the rule, whenever the canal is opened for irrigation, the water should be allowed to reach the tail end first and filling up of tanks should be undertaken one by one from tail reach to head reach.

Though the prescribed rule advocates filling up of tanks from tail reach to head reach this is seldom followed in the system. Whenever water is released, all distributaries are kept closed in order to let water reach the tail end. Once water reaches the tail reach all the shutters are opened simultaneously. When the opening of the canal is delayed farmers in some distributaries open the shutters by breaking the locks. Since the bureaucracy is not involved in regulating the filling of all tanks systematically, those tanks situated in the tail reach of the main canal receive inadequate water supply.

### **Role of Farmers Organisation in the Water Distribution from the Main Canal to Distributaries/Tanks**

As far as the role of these local organisations is concerned, we note that invariably all of them are involved in the task of appropriation of water supply for their distributaries/tanks. It is found that the degree of involvement of these organisations is more in scarcity periods than normal periods.

During scarcity times, stiff competition exists between distributaries and within a distributary across different reaches. In this process, apart from the technical features, socio-economic and political factors play an important role in the relative degree of success of an irrigation organisation in the appropriation of water supply for their distributaries /tanks. Appropriation of water becomes more problematic when the tail reachers belong to minority/scheduled castes and when they are less powerful than head reachers, economically and politically. Only powerful irrigation organisations (represented by leading landowners with political power) thrive in the competition for a secured water supply. The head and middle reaches of the main canal have the advantage of technical factors (most of tanks have direct supply from distributaries, instead of tank- to -tank supply) and with strong economic and political power (landlords with ruling party political backing are found more in these reaches). Hence they have relatively better access to water supply conditions than others.

## **Impact of Water Management on Tail-enders and Other Deprived**

Indicators of deprivation

We have used three indicators to analyse the deprivation of tail-enders and others affected.

- a) area irrigated ;
- b) period of water supply;
- c) productivity.

### *Deprivation in Area Irrigated*

It is seen that on the whole there is an increase in the command area to the extent of about half of the original command area. However the increase in command area is significantly more in the middle and tail reaches than in head reach. The reasons for this development are not known. It may be due to more opportunities for expansion like contiguous lands available to the wetlands under tanks.

### *Deprivation in Water Availability and Productivity*

As already noted the prescribed period of water availability from the system is 4 ½ months, however it varies across different places. Many factors influence the availability of water supply in a place like topography, socio- political strengths of farmers in a command area. we have obtained responses about the general water availability in a tank under a normal season during a last five year period and also the yield rate of paddy which is the main crop grown in the system.

### *Water Availability*

Water supply condition is poorer in tail reaches than the head and middle reaches. Out of seven tanks, six tanks had a deficit in water availability of about 25-30 days in a crop season, where as the deficit (in terms of number of days) is less i.e. 15-20 days in head and middle reaches.

### *Productivity*

The differences in water supply conditions are also reflected in the average yield rates under tanks in different reaches. The productivity is highest in the head reach and the lowest in the tail reaches of the system. While there is not much difference in the productivity between head and middle reaches, the productivity in the tail reach is significantly lower than in other reaches. There is a difference of about 5 bags in the yield per acre between the two reaches. Thus it is clear that tail reachers in the main

canal are in a disadvantageous position as regards water availability, which is reflected in the overall productivity of the crop also. We also noted earlier that the water supply conditions are poorer in tail reach compared to head reach area.

Not only there is a difference in productivity across the main system but also within a tank/distributary. Such difference can be observed between (a) command area under head and tail end in a tank (b) high level and deep level sluices of a tank.

#### *Livelihoods of Tail-enders*

For most farmers irrigated agriculture depends upon canal water and only a few have wells as a source of irrigation. All farmers who own wells are big farmers. Thus most of the small farmers depend upon canal water for their agriculture and thereby food security.

Most farmers are indebted as their agriculture is affected often by water scarcity and drought and there is no other source of income. Most of them are in a backward living condition with dilapidated tiled houses. Some farmers have also reported sale of lands to real estate businessmen, especially those lands on the roadside. Thus most farmers in the area are living on subsistence agriculture as canal water is inadequate and rainfall in the area is unreliable. The insecurity in irrigation and continuous drought conditions make many indebted and thereby losing their lands.

#### **Summary**

NKHLC system itself is relatively insecure in terms of priority of water rights as it is entitled to only the last priority of supply compared to old channels fed from the Cauvery River in Tamil Nadu. The problem is compounded by unreliable water availability in the Mettur dam on the Cauvery leading to reduced supply over time, especially after 1985, because of the dispute among the riparian states. This has affected all the canal systems under Cauvery in general, but NKHLC in particular as it has only last priority from the dam. Within the NKHLC, the tail reach of the main canal has been affected every year. Inadequate maintenance by the PWD has resulted in silting up of branch canals affecting a sizeable area in the tail end and also to some extent the head reach of the system. The problem intensified in recent years because of encroachment especially

in the branch canal and tank foreshores. Also increase in the area under unauthorised cultivation has added to the problem.

Overall the tail reach of the main canal is in a disadvantageous position, compared to those living in the head reach of the main canal. As regards the characteristics of tail enders /deprived, in general there are not many differences in terms of caste and class. In some areas there are exceptions, where the tail reachers happened to be scheduled castes who were denied water.

Collective action by tail reach farmers as regards appropriation of water from branch canals is very common. They spend a substantial amount of money and labour for guarding the water flow in the main canal and avoid interruption of feeding of the tanks by head reach villagers.

Traditional village organisations are quite active in many tail reach villages and they undertake de silting of feeder channels to the tanks. Appointment of waterman for irrigation of fields is observed in times of water scarcity when the farmers hope that they can take a crop. When there is severe scarcity and when there is no hope for adequate water, watermen are not appointed. These institutions play an important role in reducing the risk and uncertainty in agriculture especially to tail end farmers. Recently, these farmers have started to adapt to water scarcity condition by growing short-term paddy varieties.

Overall there is not much of conjunctive use of canal and well water in the area in spite of the insecure nature of canal supply. This is mainly due to saline ground water, financial problems, land fragmentation and unviable land holding.

The tail-end farmers mainly depend upon canal water for their livelihoods. Absence of alternative source of irrigation and employment from other sectors in the tail reach has forced them to pursue their efforts to get water at least for one crop. Violent agitations like blocking the road traffic by tail reach farmers joining together from about fifteen villages happen regularly and became a law and order problem for the district administration. Hence they are forced to take action for provision of water especially in times when one irrigation is crucial for saving of crop. This is also used by the competing

political interests for gaining electoral benefits, promising of different solutions to tail-enders problems.

## **PARAMBIKULAM ALIYAR PROJECT (PAP)**

### **Design of the System**

The Parambikulam Aliyar Project (PAP) is designed to harness the waters of several rivers originating in the Anamalai Hills situated in Coimbatore district of Tamil Nadu. Though all these rivers originate in Tamil Nadu, several of them eventually flow westward into Kerala. Before the PAP came into being, the waters of these rivers were utilised on a very limited scale. The PAP system consists of eight reservoirs and weirs constructed in different periods.

### **Water Management under PAP**

The Thirumoorthy reservoir, which has been taken up for the study is the last storage work in the series of reservoirs under PAP. It was constructed across the river Palar in 1967 and has a capacity of 1.9 TMCft. The original command area of the project is about 180,000 acres. However, extension of the command area has taken place at different times and the total command area under these canals is increased to about 380,000 acres.

### *Irrigation and Agriculture*

The irrigation under these canals is meant for four and a half months and mainly for dry crops. Wet cultivation is restricted to low-lying area. The system was designed to have 80 percent of the area under dry crops and the remaining under wet cultivation. Though irrigation is mainly localised for dry crops, in actual practice the cropping pattern is different. It is reported that the area under wet crops constitute about one third of the total command area.

### **Irrigation Management**

Irrigation under the canal is meant for once in two years. In other words, the entire command area is divided into four zones and covered under irrigation once in two years at the rate of two zones in a year. Normally irrigation is meant for two seasons in a year that is (a) 1 August to December 15 (b) 16 December to 30 April. When the monsoon fails or water could not be released to any particular zone in a particular spell, water supply will be

given to that zone in the next spell. A turn system of seven days will be adopted for water supply among distributaries. Continuous water supply will be given in the main canal from head to tail to enable recharge of wells and cultivation of dry crops during non-spell period.

## **Main Findings**

### **Problems in the Operation of the System**

Water supply under Thirumurthy dam is meant for seven days in each turn. The command area under each zone is divided into two parts for the purpose of adopting a rotation system. Under this, each part is given supply for 7 days and closed for another seven days so as to facilitate supply of water for the other part. It is learnt that this system of supply was adopted without many problems earlier. However with the extension of command area, severe problems have come up in the implementation of turn system of 7 days supply and seven days closure. And in actual practice, the area under irrigation is much higher than what is contemplated for irrigation. Thus on the one side there is an increase (about 40 percent) in the command area and on other a reduction in the water availability - both of them made the system management ineffective in implementing the rotation system. Hence after each turn period of 14 days, the dam has to be closed for some days to head up the level in it as the water supply has already been depleted so that the next turn system cannot be implemented unless water supply is improved by closing it.

### **Impact of Water Management (four zone pattern) on Local Water Supply**

#### **Conditions in Different Reaches**

The introduction of the four-zone system by extension of command area has brought about a number of changes in water supply conditions and agriculture at the field level. As we have noted already there is an increase in command area in spite of a reduction in water supply to the dam. Consequently it is clear that water supply condition at field level would worsen. Indeed, this is the case and the scarcity has affected different segments of the command area differently.

#### *Head Reach*

Under the four-zone system, the head reach of the PAP both on the left side (Udumalpet region) of the canal and right side (Pollachi region) are affected, but the severity of the problem is relatively less compared to the tail reach Kangayam area. This shows that the

conventional operation of the system where head reachers are in an advantageous position has not changed much.

*Left bank (Udumalpet) Region*

This region consists of the head reach of PMC and the whole command area under Udumalpet canal. Both are situated on the left side of the system. Paddy is the main crop grown in this region. However, the relative significance of the crop is stated to have come down after four-zone pattern. The problem has especially affected the tail-end villages. The main problem is that the extension canal is not lined and hence takes much time to get supply. Within each branch canal the extension command area which is located in the tail reach is more affected. Not only extension command area but also old command areas in the tail reach of a branch canal are affected by water scarcity.

The problem is further compounded by the illegal tapping of branch canals, erection of unauthorised sluices, cross bunding of the canal resorted to by the head reaches. This has led into a number of inter village conflicts between head and tail command irrigators. As the policing by PWD is ineffective due to shortage of personnel (lascars), the problem assumes significance.

*Right Bank (Pollachi) Region*

The command area in the head reach on right side of the canal constitutes Pollachi region. Traditionally coconut is the main crop of the region, which is about 60-75% of the command area. Groundnut, paddy, maize, sunflower are other important crops grown in the region. Though water scarcity has occurred since the introduction of the four-zone system, the effect is relatively less in this region, as coconut requires less water than paddy. Moreover, being a perennial crop it has got conjunctive supply from wells, which are significant in number in this region. Hence it is reported that only other irrigated crops like paddy, and groundnut are affected by scarcity. As noted earlier, the worst affected are tail-enders in a branch canal. This is especially in an area where the zoning pattern is such that water supply is not available for a long time in the branch canal itself and hence there would not be recharge of wells in that area.

### *Tail Reach*

The tail reach area consists of Dharapuram and Kangayam taluks where the largest majority of command area is constituted by extension. A new branch canal is dug to provide water supply for the extension area. It is to be noted that the whole extension in this region has taken place at the end of the main canal i.e. about 125 km from the reservoir.

As the area is in the tail end of the main canal and the branch canals are not lined the water supply condition in this region is poor. Of the 7 days turn system; it takes minimum 3 days for the water to reach the tail end and only 4 days the water supply is given. As the quantum of water available is also less, it is hardly enough for a wetting of the lands. Hence the water is used for recharge of wells, for domestic purposes like drinking water, and water for cattle. In areas where there is some reliability in water supply, dry crops like Sesamum and grass are grown. The latter is used as fodder for cattle for which the area is known well. Sheep rearing and dairying is an important occupation of the area. Paddy is grown only in low-lying areas with wells. Paddy is mostly kept for self-consumption. As the head reach of the extension distributaries are mostly uplands, cultivation is not done, as water cannot reach. Agriculture is done only in the tail end of the distributaries. Hence, there is a considerable loss in seepage before water reaches the tail end. This also adds to the already scarce water supply. However farmers are happy that the extension of PAP has solved one of their old basic problems, that is drinking water.

### **Extent of Deprivation across Different Reaches**

#### *Deprivation at Field Level*

Deprivation is noted at the field level with regard to area irrigated, water supply condition, cropping pattern and productivity of crops across different reaches of the main canal under PAP.

#### *Area Irrigated*

On an average about 80% of the area is irrigated in the head reaches whereas it is about 50% in the tail reach.

#### *Water Supply Conditions*

As we have already noted that the canal water is meant for 135 days but the turn system of '7 days on and 7 days off' is adopted to provide supply to a zone. Thus an area is entitled for a supply of 67 days. Of these, head reach villages receive water for about 60 days in a season and tail reachers for about 22 – 25 days. Thus tail reach villages are seriously deprived in terms of a number of days of irrigation. Diversion of water by the head reach farmers and ineffective water regulation by the bureaucracy are stated to be the reasons for the poor water supply condition in the tail end. The problem is also noted to be worse in the tail end of the distributaries as they are not lined. It is reported by farmer's councils that some of them have not received more than one or two spells of irrigation.

#### *Cropping Pattern and Productivity*

The differences in water supply conditions also result in variations in cropping pattern and productivity across different reaches. It can be seen from the table that in head reaches water intensive crops like paddy and coconut are grown significantly, whereas dry crops like sorghum, groundnut and Sesamum are dominant in tail reaches. Within the tail reach there is not much variation in cropping pattern. However, in areas water supply conditions are good a small extent is grown with coconut. This is mostly seen in the head reach of the tail end distributary. Canal water is generally used for growing fodder crops like sorghum and grass in the tail reach area, as dairying is an important occupation in this area. Sorghum is mostly used for grazing by milch animals.

#### *Productivity*

There are clear differences in the productivity of groundnut and coconut between head and tail reaches of the main canal system. For groundnut, which occupies about 20 percent in both regions, the productivity difference is quite clear. In the head reach area, the yield rate of groundnut is about 20 bags per acre, whereas in the tail reach it is about 10-15 bags. Within distributaries in the tail reach, a clear difference exists across the reaches. In general it is noted that the productivity is about 40-50 percent in the tail reach, and this is mainly attributed to lower water supply there. We have already noted that in the tail reach area, the available meagre water is used for growing fodder crops and thus agricultural production is backward compared to the head reach where high value crops like coconut and paddy are grown.

### *Livelihoods of Tail-enders*

Tail-enders as such constitute a separate class in PAP compared to head reach farmers in many aspects. Agriculture is considered to be a secondary occupation by them as they are depending mainly on sheep rearing and dairying for their livelihoods. Water from PAP is mostly used for growing fodder crops, which is essential for sheep rearing and dairying. Only those who have wells are growing irrigated crops like coconut, groundnut, and Sesamum. In addition, they also get employment from non-agricultural occupations like spinning mills, oil mills and power loom weaving. On the whole, tail-enders do not depend much upon PAP water for their livelihoods. However, water is found to be useful for recharge of wells which takes care of domestic water needs and for cattle, which was a long pending problem as it is a drought prone area.

### **Summary**

The PAP is a complicated system in many respects. It was originally designed for dry crops and also for a command area of 180,000 acres. The system has undergone many changes. The command area was doubled and the area under wet crops has increased. There was also an explosion in the number of wells in the command area, which get recharge from canal water. On the one hand there is an increase in the command area, on the other there is a secular decline in the availability of water in the reservoir. The area under the PAP command was extended by different governments for political reasons, without taking in to account the original design of the system. This has resulted in the creation of an artificial 'tail-enders' category in the system. The state and the court also supported it, which has created conflicts between head and tail reaches resulting in agitation, court cases and personal enmity. However it should be noted that the 'extensive' irrigation policy has solved one of the fundamental problems of the tail-enders: drinking water. It has not helped much for agriculture, but indirectly helped sheep rearing and dairying by helping the villagers to grow fodder crops. The extension has also created tail-enders: in the head reach of the system, but they are far better off than the tail enders of the main system.

Thus the State's policy of 'Extensive Irrigation' has created an artificial tail-enders category whose livelihoods have improved by the canal water though it is unreliable. In that sense they cannot be called 'deprived'.

## **MINOR IRRIGATION PROJECTS: CASE STUDIES OF RAIN-FED TANKS.**

Two tanks were selected for the study to know about the tail-enders problems in the rain fed tanks. Both are located in different regions in terms of agricultural and socio economic conditions.

### **Impact of Water Management on Tail-enders Problems**

Farmers reported that there are no significant differences in water supply conditions and productivity across different reaches in the tank command area even during scarcity times. The same is the case as regards high level and low-level sluices in the tank. It is also reported that there are not many differences in the water supply condition on the basis of caste status of farmers due to the presence of institutional arrangements for water management in the tank.

### **Livelihoods of Farmers under Tank Commands**

Farmers in these villages mainly depend upon the irrigated agriculture for their livelihood. It is reported that most of them own lands in the tank command area, which provides some food security. On dry lands, generally prosopus trees are grown which are used for charcoal making. In addition there are employment opportunities in the gem cutting industry in the area. Thus, the tank irrigation is an important source of livelihood and tail-enders and low caste people share water scarcity equally thanks to the institutional arrangements in the village.

### **Summary**

The case studies on rain fed tanks show that institutions are important in reducing tail-enders problems in irrigation. In both cases, there are some institutional arrangements for regulation of water from the tank and maintenance of irrigation structures. In the Vengaram tank, we can see that the waterman is involved in watering of the fields. This may be due to the reason that agriculture depends on tank supply, as the scope for well irrigation is less. Hence regular desilting of feeder canal and efforts for diversion of water from the natural drain is noted. There is an incentive for making all these arrangements, as there is better chance for receiving water supply to the tank as it has an independent

catchment. In the case of former tank, the prevalence of significant number of wells in the command area may be a reason for not involving waterman in the irrigation of fields. Also there is a great deal of insecurity in the receipt of water to the tank as (a) it is situated in the tail-end of the tank chain system (b) and there is less rainfall in the catchment area.

### **OVERALL CONCLUSIONS FROM THE STUDY**

The study was done basically to understand the problems of tail-enders and other deprived in Tamil Nadu in two canal irrigation systems and rainfed tanks, which are different in technology, agriculture, and the social and economic conditions. The study reveals that tail-enders and other deprived problems are affected by the system characteristics, social and economic conditions of the region. In both canal systems, access to water is influenced by the relative strength of these factors in an area. Generally, head reachers are more powerful in terms of social and economic conditions than tail-enders. In the canal systems, there are powerful big farmers who gain more access to water supply by influencing the bureaucracy and other means (like cross bunding) in the head reach. In addition, the inefficient method of water allocation by bureaucracy and standard of maintenance of the system (e.g. lined canal) are favourable to head reachers. In both systems tail-enders in the main canal are more deprived of water compared to others. Inefficient management of the main system by the bureaucracy is one of the main reasons noted for the problem. Poor standard of maintenance of the system and inadequate supervision of water allocation are the major problems noted in the tail reach. However, the bureaucracy is constrained by an inadequate number of field staff for water regulation and inadequate funds for maintenance of the systems. All these contributed to poorer water supply conditions in the tail reach of the main canal.

The problem is seen not only in the main canal but also in the distributaries and tanks though with a lower degree of intensity. This is more significant in distributary canals than in tanks. In the tanks, the tail enders problem is taken care of by the strong institutional arrangements for water distribution. This is seen not only in system tanks but also rain fed tanks. The presence of institutions is also possible because of the control over water in the tanks by the communities. These tanks act as local reservoirs. Even in the canal system the tail enders problem seems to be less in area where there are some organisations present (like the farmers council in PAP)

The extent of dependence of tail-enders on irrigation for their livelihoods depends up on the availability of conjunctive use of wells and other opportunities for income. In areas where opportunities for the conjunctive use of wells are less, the tail-enders are deprived much. The problem also becomes worse when there is a lack of other income earning sources like dairying, employment in factories etc. Complete dependence of tail-enders on irrigated agriculture creates social unrest (like in NKHLC) when their irrigation problems are not solved.

In both canal systems the tail-enders problems were intensified /exacerbated by the extension in the irrigation area over and above the original design of the system. In NKHLC this happened through unauthorised methods by farmers themselves, and in PAP by legal means supported by the State. Both were used for gaining political support for the parties in power.

### **EMERGING RESEARCH AND POLICY ISSUES**

The study brings out the following issues for debate and further discussion both for research and policy purposes:

- ◆ How to create enforceable rights in surface irrigation systems in order to empower tail-enders and other weaker sections? How to involve farmers' organisations and irrigation department in the process of entering into contracts/agreements between the State and users?
- ◆ The desirability of 'extension irrigation' as a method of entitlement (with out taking into account the original design of the systems) needs to be debated. More specifically whether extension of irrigation can be undertaken when there is already deprivation to the existing irrigators is to be discussed
- ◆ The tail-enders problems have close relationship with main system management. Hence improvement in the main system management is the sine qua non for better performance irrigation. It is more important to discuss about the methods of effective involvement of farmers' organisations in the main system management. It is seen that users' organisation especially traditional irrigation institutions are more efficient in managing the scarcity problems, especially tail-enders problems, than other

organisations including bureaucracy. Hence they also to be recognised and involved in the system management.

- ◆ There is a need for better understanding of the livelihoods of tail-enders and other deprived especially the role irrigation plays in their food security and livelihoods. It is also important to have a proper understanding of the linkages between irrigated agriculture and non-farm income sources. This will help in understanding the methods of improvement of livelihoods of tail-enders.

Research Study No.2003/1

## Executive Summary

# **TAIL-ENDERS AND OTHER DEPRIVED IN AN IRRIGATION SYSTEM IN HARYANA**

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## **Introduction**

The issue of measurement of deprivation in warabandi system has received very little attention. Although it is known that distribution of canal water is unequal, what is not well known is the extent of disparity between the head reach and the tail end farmers. The situation is further complicated as according to recent research findings the shortage of water is felt not only at the tail end but also at the head and middle reach. Considering the overall scarcity of surface water in Haryana, the distributive aspect assumes further importance in view of (a) poor quality of ground water in the majority of the districts; (b) falling water table in several districts on the one hand, and rising water table (with increasing salinity) on the other; and (c) the existence of large gap (approx. 29%) between the irrigation potential created and its utilization in Haryana.

Some farmers get lesser water than their entitlement due to being at the tail-end i.e., they suffer because of their locational disadvantage. Some others also get lesser water than their entitlement not because of location but due to other reasons, such as obstruction of water flow due to growth of weeds, defective slope of the channel, excessive seepage, theft of water by the upper reach farmers, etc. These factors adversely affect even the middle and head reach farmers. The farmers who are located at the head and middle reach and get water less than their entitlement fall in the category of 'other deprived' (Shah, 2001). Assuming that these problems are of external nature to a given location and to the farmers in that location, it is imperative to know the nature and magnitude of deprivation of farmers and to understand how far the deprivation is due to locational factors and how much can it be attributed to system failure on account of technical and managerial factors in addressing the genuine problems faced by the farmers. If shortage of water is a persistent phenomenon, how do farmers adjust to this situation? Does it affect their choice of crops? How far the irrigation administration is responsive to the complaints of the farmers? These aspects need a careful study. The present study addresses these questions based on field work carried out in the state of Haryana.

## **Objectives**

The main objectives of this study are:

- (i) To identify tail enders and the 'other deprived' in the two major canal irrigation systems.
- (ii) To measure deprivation in canal water distribution.
- (iii) To quantify the consequences of being a tail ender in terms of land productivity and crop income.
- (iv) To understand the mechanism of grievance redressal of tail-enders and others.
- (v) To identify issues for policy research and advocacy.

## **Scope and Methodology**

The head-tail difference in water availability can be studied along the main canal and distributaries (secondary system) and also within the tertiary system/units (chak). As is well known that the irrigation system up to the secondary level (distributory) is managed by the

State and below it (tertiary level), it is managed by the farmers. This study attempts to measure the head-tail differences in water distribution at the tertiary level.

An important issue in this empirical exercise is to choose appropriate sites for the study of tail-enders and other deprived. The selection of study sites has been done keeping in view the overall characteristics of the surface water system in Haryana. The information on agro-ecological conditions and the quality of ground water has been super-imposed on it. Three sites have been selected based on scientific criterion to give a broad picture of the deprived in the two most important canal systems, viz; Bhakra Canal System and the Western Yamuna Canal (WYC) System. One site from Bhakra Canal System; viz, Balsamand Minor in Hissar District and two sites from WYC system viz, Mali-Saman Link (Jind district) and Asan Minor (Rohtak district) were selected.

The information has been collected at three levels viz. village, watercourse and farm through appropriately designed questionnaires. Frank discussions were held with village leaders on the problems relating to the availability of canal water and its distribution. Their suggestions for plausible solutions have been noted. In addition, wherever necessary, relevant information was collected from the officials of irrigation department and also from the Command Area Development Authority (CADA).

A detailed information was also collected at the farm level on the following aspects: (i) cropping pattern and irrigated area; and (ii) ownership of tube wells and water markets. At the watercourse level, data on the existence and the working of Water Users' Associations (WUAs) was gathered. Information on the nature of complaints about unequal water distribution and the grievance redressal mechanism was discussed with the village leaders, farmers and also with the officials of the irrigation department.

### **Warabandi**

Haryana as most parts of North West India, follows the warabandi system of management of canal water. The water distribution is managed by the farmers at the chak level through a roster of fixed turns for each farmer. The unit time for rotational running of channels is 8 days, or 168 hours. The running time of 168 hours of the outlet is divided amongst the landholders in proportion to their cultivable command area with minor adjustment for filling and emptying time of the watercourses. The entitlement of each farmer to receive water during one week's running of the outlet is determined in terms of hours, minutes and seconds. Thus, each farmer is entitled to receive water for a predetermined length of time on a specific week day and at the specific time, including night time. Although in principle, Warabandi aims to ensure equitable distribution of scarce water at tertiary unit level, in actual practice this is far from reality. The Warabandi roster does not correct for seepage losses which increase with distance from the head to the plot. This loss is substantial, particularly for the tail-enders.

### **Deprivation Index**

Deprivation is understood in terms of getting lesser canal water than one is entitled to. Since the volumetric measurement of canal water is not being practiced (even not feasible in the present circumstances), what is being quantified is the number of times the canal water is availed by a farmer in a given location and the number of turns he/she is entitled to.

Time (for canal water) allocated to a farmer varies in proportion to the size of his holding and the number of turns he is entitled to. This reduces the deprivation index ( $I$ ) to a simple expression, i.e., unity minus the ratio of number of turns of canal water availed in a season ( $T^*$ ) to the entitlement ( $T$ ), [ $I=1-T^*/T$ ]. The overall scarcity of water experienced by farmers in a given site arising due to the factors such as low release of water by the irrigation authorities is caused by forces which are exogenous to the site and affect adversely all the farmers in that area. It is, therefore, desirable to isolate this effect while measuring deprivation. This can be accomplished by replacing  $T$  by  $T_{max}$  ( $T_{max} < T$ ), where  $T_{max}$  is the maximum number of turns availed by any farmer at a given site in a season. Thus, the new index for the  $i^{th}$  farmer can be written as  $I_i = 1 - T_i^*/T_{max}$ , ( $T_{max} \geq T_i^*$ ). Note that  $T_{max}$  is fixed for a given site in a season. In other words, the deprivation index which abstracts from the exogenous effect of overall water scarcity is nothing but unity minus the ratio of number of turns actually availed by a farmer to the maximum number of turns availed by any farmer on that site. The deprivation index falls between zero and unity.  $I = 0$  means non-deprivation; and  $I = 1$  implies total deprivation. The value of  $I$  between zero and unity would indicate how severely a farmer (or a group of farmers) suffers from deprivation.

### Canal Command Area

Haryana has three main surface water resources:

- Yamuna River,
- Bhakra Supply and
- Lakes.

Since lakes contribute less than one per cent to the irrigated area of Haryana, they are not considered in this study:

At the Tajewala headworks, water from Yamuna river is diverted to feed two canals, viz; Western Yamuna Canal (WYC) and the Eastern Yamuna Canal. The former supplies water to Haryana and the latter to Uttar Pradesh (UP). The WYC partly irrigates the districts of Ambala, Kurukshetra, Karnal, Sonapat, Rohtak, Bhiwani, Gurgaon, Mohindergarh, Jind and Hissar of Haryana. The discharge into WYC varies significantly between seasons from 50 M<sup>3</sup>s in January–February to more than 300 M<sup>3</sup>s during the monsoon period.

**Bhakra Supply:** Bhakra dam system consisting of two integrated units (viz; Bhakra dam and the Nangal dam (3 km down stream) is the source of water to Bhakra reservoirs. Surplus water from the Ravi-Beas system is diverted to the Bhakra reservoirs through the Beas-Sutlej link.

**Gravity and Lift System:** The canal water received from Yamuna River, Bhakra and ground water reservoirs is distributed throughout Haryana by two systems:

- Gravity Canal System
- Lift Canal System

The major part of surface irrigation is covered by the gravity canal system in Haryana. Given the time and resource constraint, this study focused entirely on the gravity canal system. It does not include any site in its sample from the lift canal system, as the latter requires a separate study to understand the intricate problems of tail-enders in that system.

Commands in operation under Gravity Canal System are:

- Western Yamuna Canal System
- Bhakra Canal Command
- Gurgaon Canal Command

It is well known that, in Haryana, tube wells play an important role in supplementing surface water for irrigation. This is happening in spite of poor quality of ground water in most parts of Haryana. Conjunctive use of water (mixing canal water with ground water) to dilute the negative effects of salinity of ground water is a common practice in many districts of Haryana. The districts in this study have been selected in a manner so as to reflect the use of tube wells along with the dominant role of canal water in irrigation. This also allows to represent an element of variation in the quality of ground water.

**Agro-ecological Regions:** The districts of Haryana fall in two of the twenty agro-ecological regions defined by the National Bureau of Soil Survey and Land Use Planning (NBSS & LUP) as:

- Hot arid with desert and saline soils.
- Hot semi-arid with alluvium derived soils.

For the sake of simplicity, we call them ‘arid’ and ‘semi-arid’ regions (see map-A). The districts selected from these two regions show wide variation in soil quality conditions as well as rainfall (table-S1). Hissar is the worst of the three districts in terms of quality of ground water, which is saline even for shallow and high saline for deep ground water. The quality of ground water of Rohtak is somewhat better than that of Jind. The district chosen are spread over two different major canal command systems. While Hissar is under the Bhakra system, Jind and Rohtak districts belong to the command of Western Yamuna Canal System.

As regards cropping pattern, Hissar has wheat-cotton dominance, followed by pearl millet. Rohtak’s main crops are wheat, Jowar, rice and pearl millet. What is common to all the districts is the dominance of wheat in the cropping pattern. The second most important crop (next to wheat) is different in the sample districts. It is cotton in Hissar, paddy in Jind, and jowar (sorghum) in Rohtak. Major part of Haryana being in the arid zone, it is not surprising that coarse cereals and fodder crops (e.g. pearl millet, gram, Jowar, etc.) do occupy important place in the cropping pattern of these districts.

The sample districts capture the diversity of Haryana’s agriculture quite meticulously in terms of agro-ecological regions including the extent of rainfall, relative contribution of surface (canal) and ground water (tube wells) to net irrigated area, quality of ground water and cropping pattern. Moreover, the districts also represent the two main canal command systems (Bhakra and Western Yamunal Canal) of Haryana (table-S1).

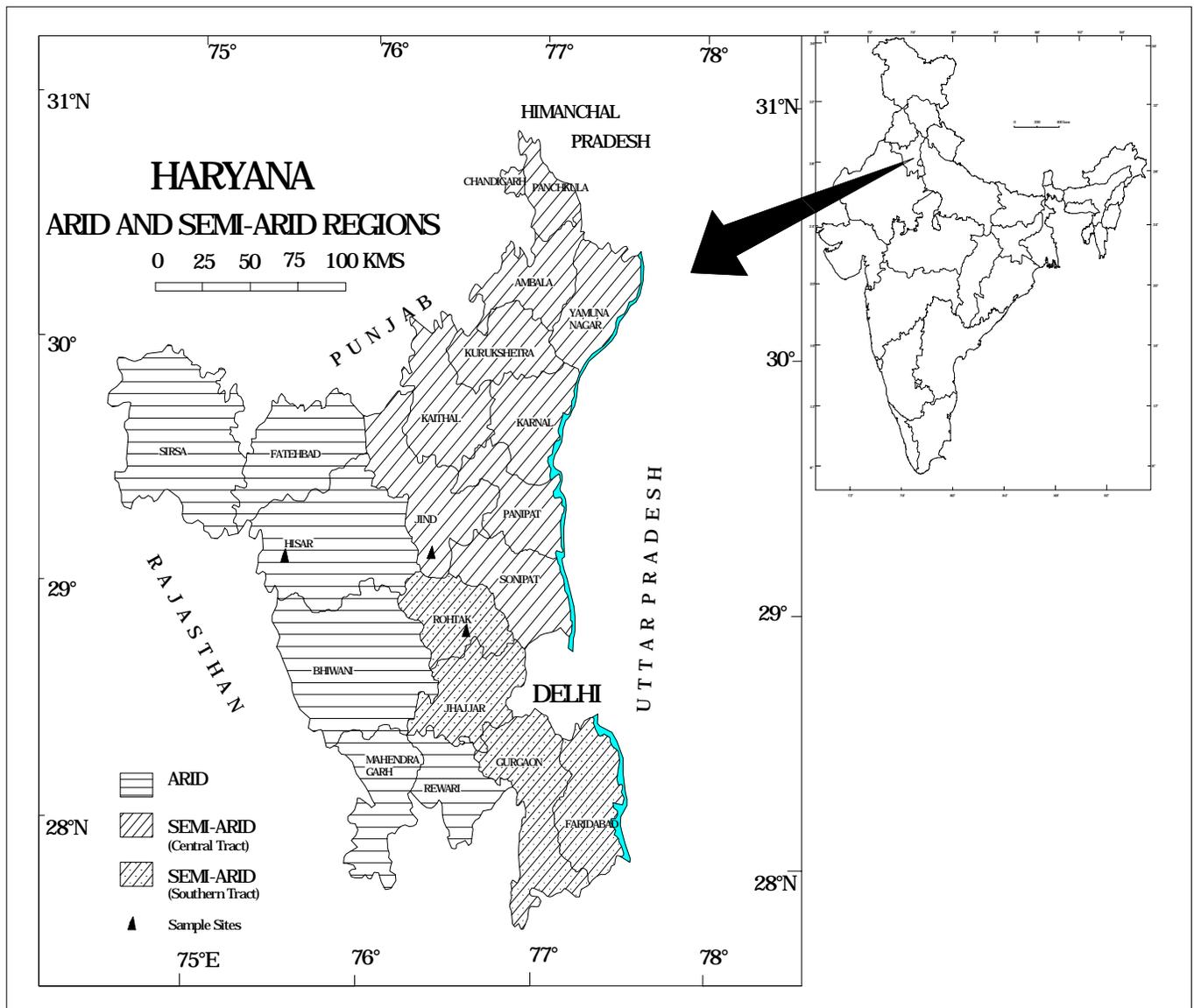
**Table-S1**  
**Major Characteristics of Sample Districts in Haryana**

SI. No.	District	Main Canal System	Agro-ecological Region	Annual Rainfall (mm)	Ground Water Quality	Contribution of canal and tubewell to net irrigated area (%)

						Govt.Canal	Tubewell
1.	Hissar	Bhakra	Arid	Less than 300	hallow – saline eep – highly saline	95	5
2.	Jind	WYC	Semi-arid	300 - <500	hallow – Marginal to aline eep – highly saline	61	39
3.	Rohtak	WYC	Semi-arid	500 - <650	hallow –fresh to saline eep – saline	85	15

Note: WYC – Western Yamuna Canal.

Map-A – Haryana (Arid & semi-arid Region)





## Results on Deprivation

### Site and Season

- Mean deprivation index is the highest in Rohtak, followed by Jind and Hissar. This spatial pattern of deprivation is observed consistently for seasons as well. For Kharif, the deprivation index is 0.54, 0.37, and 0.27 for Rohtak, Jind and Hissar; for Rabi the index is 0.39, 0.29 and 0.22, respectively for these districts (table –S2).
- Mean deprivation is higher in kharif than in rabi in all the three sample districts. As expected, the level of deprivation increases with the proportion of area not receiving water as per its entitlement but not necessarily in the same proportion (see the way deprivation is measured). In kharif, 74 per cent of area in Rohtak, 75 per cent in Jind and about 81 per cent in Hissar does not get water as per its entitlement; the corresponding area in rabi for these districts being 72 per cent, 69 per cent and 60 per cent, respectively (Table-S3).
- The severity of deprivation is not clearly revealed through either mean deprivation index or the area not receiving water as per entitlement. This fact is highlighted by more disaggregated information on deprivation index confined to those farmers who either do not receive water at all or if they receive, it is less than fifty per cent of their entitlement. The deprivation is serious in such cases and the percentage of these farmers (receiving less than fifty per cent of their entitlement) in the sample villages of the three districts in the two seasons is as below:
  - Kharif: Rohtak (64%), Jind (31.3%) and Hissar (5.5%).
  - Rabi: Rohtak (36%), Jind (1.9%) and Hissar (2.7%).

### Reach / Location

The results on deprivation by reach/location of farmers bring out a sharp contrast in the degree of deprivation of tail-enders and that of head reach farmers. Some of the main results are:

- The mean deprivation level is much higher among the tail-enders than among the middle and head reach farmers. This is true irrespective of site and season (Table-S2).
- Tail-enders are the worst sufferers in Rohtak than in Jind and Hissar. Although the mean level of deprivation is the highest in Rohtak, the gap in the level of deprivation between the head reach and the tail-enders is the maximum in Jind and the minimum in Hissar. This holds true of Kharif and rabi as well.
- Further analysis reveals that the mean deprivation is quite high even among the middle and head reach farmers. This group of 'other deprived' (other than the tail-enders) is found in all the three sites in both the seasons, but it is most conspicuous in Rohtak where the incidence of even 'severe' deprivation (50% or more area getting less than its entitlement) is high. For example, in Kharif, the percentage of area of 'other deprived' getting lesser water than its entitlement is 62 in Rohtak, 71 in Jind and 76 in Hissar. The relative image of deprivation in the three sites is reversed if the focus is shifted to 'severe & complete' deprivation (i.e. 50% or more area getting water less than its entitlement). Based on this criterion, the percentage of area for 'other deprived' in Kharif is 34.3 in

Rohtak, 7.5 in Jind and nil in Hissar (Table-S3). Thus, the 'severity' of deprivation is quite high even among the middle and head reach farmers in the semi-arid region as compared with the arid region.

## S2. Mean Deprivation Index for Sample Households by Season and Location

Reach	Rohtak		Jind		Hissar	
	Kharif	Rabi	Kharif	Rabi	Kharif	Rabi
HEAD	0.47	0.31	0.19	0.18	0.24	0.11
MIDDLE	0.42	0.33	0.37	0.14	0.28	0.16
TAIL	0.85	0.55	0.70	0.52	0.28	0.33
ALL	0.54	0.39	0.37	0.29	0.27	0.22

## S3. Percentage of Area Not Getting Water as per Entitlement By Location and by the Level of Deprivation

Deprivation Level \$	Deprivation Index	Kharif			Rabi		
		'Tail-enders'	'Other' Deprived	All Locations	'Tail-enders'	'Other' Deprived	All Locations
<b>Rohtak</b>							
▪ <b>Deprived</b>	$I > 0$	94.6	62.3	74.1	75.7	69.4	71.7
- Marginal + Significant	$I < 0.5$	18.8	28.0	24.7	29.3	58.7	47.9
- Severe + Complete	$I \geq 0.5$	75.7	34.3	49.4	46.4	10.7	23.8
▪ <b>Non-deprived</b>	$I = 0.0$	5.4	37.7	25.9	24.3	30.6	28.3
<b>Jind</b>							
▪ <b>Deprived</b>	$I > 0$	81.1	71.2	74.7	92.9	55.4	68.8
- Marginal + Significant	$I < 0.5$	0.0	63.7	40.9	62.5	55.4	57.8
- Severe + Complete	$I \geq 0.5$	81.1	7.5	33.6	30.2	0.0	10.8
▪ <b>Non-deprived</b>	$I = 0.0$	18.9	28.8	25.3	7.1	46.6	31.2
<b>Hissar</b>							
▪ <b>Deprived</b>	$I > 0$	87.2	76.1	80.5	90.2	40.2	60.2
- Marginal + Significant	$I < 0.5$	79.1	75.9	77.2	88.6	40.0	59.6
- Severe + Complete	$I \geq 0.5$	7.9	0.0	3.2	1.5	0.0	0.6
▪ <b>Non-deprived</b>	$I = 0.0$	12.8	23.9	19.5	9.8	59.8	39.8

\$ { Marginally deprived  $0 < I \leq 0.25$   
Significantly deprived  $0.25 < I \leq 0.5$

Severely deprived  $0.5 < I < 1.0$   
Completely deprived  $I = 1.0$

## Cropping Patterns

The difference in cropping patterns of head reach and tail-enders at different sites can be briefly stated as below: In Rohtak, head reach farmers grow coarse cereals, sugarcane and pulses (arhar) in Kharif, and wheat, sugarcane and mustard in rabi. The tail-enders do not grow sugarcane in either of the seasons. The area under coarse cereals and fodder is usually much higher for tail-enders than for head reach farmers. In Jind, head reach farmers grow cotton, jowar and paddy in Kharif, and wheat, mustard and barseem (fodder) in rabi. Tail-enders in Jind also grow cotton and coarse cereals in Kharif, and wheat and mustard in rabi. Tail-enders in Jind do not grow paddy at all and a substantial portion of gross cropped area of these farmers remains fallow in both the seasons (34% in Kharif and 13% in rabi). In Hissar, cotton, bajra (pearl millet) and moong are the main crops in kharif for the head reach farmers, and wheat and mustard are the main crops in rabi for them. For tail-enders also, cotton and pearl millet are the main crops along with fodder in Kharif. In rabi, although tail-enders grow wheat in Hissar, but the second main crop for them is gram and not mustard. The main differences in cropping patterns of head reach and tail-enders can be briefly stated as below:

- The head reach farmers are able to grow more water intensive crops (or at least have larger part of area under these crops) as compared to their tail-ender counter parts at a given site. It is not common for tail-enders to grow paddy or sugarcane even in the semi-arid zone.
- In semi-arid zone (Jind), the tail-enders attempt to cope with acute water shortage by leaving a substantial part of their land as fallow.
- In arid zone (Hissar), although the cropping pattern of head reach farmers and that of tail-enders seemingly appear to be similar, the latter have very little area under mustard and have a larger proportion of area under less water intensive crops such as *gowar* (fodder) and gram.

## Productivity Differences

Crop income (gross revenue minus paid out expenses) and land productivity per hectare have been worked out for different sites and for different reach of farmers. Some of the observations are noteworthy.

- Land productivity is reported to be the highest in Rohtak (Rs.13578/ha) as compared with that in Jind (Rs.11490/ha) and Hissar (Rs.7129/ha).
- The productivity differences across sample sites (also arid and semi-arid zones) are directly reflected in the differences in cropping patterns of these sites. Rohtak and Jind (semi-arid zone) have relatively more water intensive and profitable crops than Hissar (arid zone). The share of irrigated crops to total crop income is 95.7 per cent in Rohtak, 91.8 per cent in Jind and only 68 per cent in Hissar.

- The differences in land productivity of head reach farmers and the tail-enders are very significant in all the three sites. The ratio of land productivity of head reach and tail-enders is 2.89 in Rohtak, 1.64 in Jind and 5.0 in Hissar.
- The pattern of relative deprivation (head reach vs. tail-end) in the distribution of canal water observed for the sample sites is not necessarily reflected in the differences in their land productivity. For example, the difference in deprivation level of head and tail-end farmers is much narrower in Hissar than in Rohtak, the opposite being true of the differences in their land productivity in the two sites. What explains this phenomenon?
- The differential availability of irrigation in different sites is perhaps, the key to offer an explanation to the opposite pattern in relative deprivation of canal water and that of the land productivity of head and tail-end farmers in the sample sites. Tube well density is much higher in the semi-arid zone (both at the district level and also for the sample farmers) than in the arid zone. This helps raise the relative contribution of irrigated crops in the total crop income. The ownership of tube well is much higher among the head reach farmers than among the tail-enders, giving a clear advantage of higher land productivity to the former vis-à-vis the latter. However, the lack of ownership of tube well does not necessarily put a farmer at a serious disadvantage, as the existence of market for buying tube well water (time) from the neighborhood farmers helps compensate to a larger extent, the lack of tube well ownership. It is for this reason that in spite of high degree of deprivation of canal water in Rohtak and Jind, the tail-enders are able to catch up, to some extent, with their head reach counterparts.

### **Reasons for Deprivation**

Respondent farmers were asked to list the reasons for deprivation. Reasons for deprivation differ only marginally across sites. Some of the reasons which are most often cited by the farmers are (in order of descending order of importance): overall scarcity of water, theft of water by upper reach farmers, seepage due to unlined water courses, blockage in water courses due to weeds, and technical faults in water courses (e.g. defective slope of water channels). 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. Most of the farmers put forward their complaints to the irrigation authorities through their local political representatives (or MLAs) hoping that their complaints would be redressed soon. Unfortunately, even going through MLAs does not seem to be a great advantage to farmers at all sites. Their perception is that MLAs are selective in taking up some cases forcefully and putting the rest at the backburner. The irrigation authorities seem to be acting on complaints as per the priority indicated by the politicians/elected representatives.

Although there does not seem to be a distinct difference in ranking of reasons of deprivation as indicated by head reach farmers and the tail-enders, there is an ample evidence that (i) tail-enders suffer a lot due to water theft by upper reach farmers; and (ii) head reach farmers also suffer but it is mainly due to insufficient flow of water on account of technical flaw in channels and growth of weeds, excessive seepage in unlined channels, etc.

However, both head reach farmers and the tail-enders suffer on account of loss of water arising due to the problems of technical and managerial nature.

The reasons cited in the Box below give a direct feed back from the field enquiry on deprivation in the distribution of canal water.

## Why Tail Enders Continue to Suffer?

**Tampering with Channels:** In several places, water channels got extended and/or modified by the locally influential people without giving due consideration to the feasibility of uninterrupted water supply. This aggravated the already unequal distribution of canal water. In another case of undue interference, in Assan village of Hissar, a drain was made by cutting the channel into two parts which totally obstructed the flow of water to one side of the channel, resulting in farmers' fields going dry. On the side of the channel, the influential farmers managed to draw water by siphoning it off.

**Lack of Escape Routes:** Some villages in Kurukshetra district\* get too much water in the rainy season as there is no escape route for the excess water. Ironically, these very farmers suffer from shortage of water in the summer season. Neither the local leaders nor the irrigation authorities have bothered to offer a solution to the problem of these villages. The tail-enders are the worst sufferers in this scenario.

\* (This is not part of our sample sites. We came across these cases during the course of our field trips),

**Institutional failure for grievance redressal:** When direct complaints of theft of water and related issues with the irrigation authorities are not paid attention, people tend to air their grievances through the MLAs of their area. Not all the cases are effectively taken up by the MLAs. The complaints of those who are closely associated with the leader are taken up first; other cases are relegated to low priority. It seems that the local institutions such as Panchayats are not effective in taking up the grievances of the people relating to the distributive aspect of canal water. Two aspects emerge in the context of redressal mechanism of theft cases (i) there is lack of direct interface of people with the irrigation authority (which in turn, may have developed due to apathy of the irrigation authorities); and (ii) it is not the genuine suffering of a case but the proximity/association of the complainant with the leaders and/or irrigation bureaucracy which attracts their attention in complaint redressal.

## Deprivation and WUAs

What is the role of Water User Associations (WUAs) in reducing the deprivation gap between the head reach and the tail end farmers in a given site? Feedback from field revealed that no WUAs existed in Rohtak and Jind until the end 2001. In Hissar, WUAs have come up only very recently in 1999, 2000 and 2001 in the three sample villages of Hissar.

An interface with villagers showed that there was hardly any discussion in WUAs on issues relating to deprivation in distribution of canal water. The WUAs met only occasionally. There was no NGO working with WUAs in Hissar. Given the slackness in working of WUAs, and its very recent origin in Hissar, it is doubtful that their presence contributed to reducing the gap in deprivation of canal water between the head reach farmers and the tail-enders.

If WUAs have not made any significant contribution to reducing relative deprivation of canal water in Hissar, what explains a lower deprivation in this district vis-à-vis that in Jind and Rohtak? A plausible explanation of the above phenomenon is as follows:

Dependence on canal for irrigation in Hissar is very high (95%) as compared with that in Rohtak (65%) and Jind (61%). The supplementary role of tube well irrigation is much higher in Rohtak (15%) and Jind (39%) than in Hissar (5%). Because canal irrigation is the lifeline in Hissar, the pressure on irrigation department for better maintenance of water channels has been maintained. Perhaps, farmers have also cooperated in running the system, as

their stakes are high in canal system. The stake holders' cooperation is better in Hissar not because of existence of WUAs which are of recent origin only, but because people have learnt to run the system better as compared to other areas where tube wells have played a much more important role in supplementing canal irrigation. Another plausible reason which complements this argument is that with much more exploitation of ground water (through deep tube wells) farmers in Jind and Rohtak have been able to increase area under more water intensive crops, particularly paddy since mid eighties. This has been achieved at the cost of fast depletion of ground water resources at most locations (certain locations are exception where water table has gone up in Rohtak). This may have made farmers desperate to grab more water from canal (particularly at the head reach) for sustaining paddy and sugarcane crops. Unauthorized diversion of canal water for conjunctive use (mixing up canal water with underground water pumped through tube well) may have led to higher degree of deprivation in the distribution of canal water. It seems that the quest for maintaining high level of profit or income through paddy-wheat rotation (also cultivation of sugarcane in certain locations), coupled with replacement of coarse cereals and fodder crops by oilseed crops (mainly rapeseed-mustard) induces farmers to draw unauthorized volume of water from canal. Thus, private profit is being maintained not only at the cost of fellow tail-ender farmers but also at the cost of depletion of natural resource i.e. ground water. The situation in Rohtak for using canal water out of turn (siphoning off canal water) seems much more desperate than Jind due to loss of considerable cultivable area because of large scale water logging. The drainage system in Rohtak is worse.

### **Paradox in the Semi-arid Region**

#### **Paradox:**

Distribution of canal water is unequal in both arid and semi-arid regions; it is much more skewed in the latter region than in the former. The semi-arid region poses a paradox: coexistence of inequality in the canal water distribution and low disparity in farm income between the head reach and the tail-enders. (The reverse is observed in the arid zone: relatively low inequality in canal water distribution and high degree of disparity in farm incomes of head reach and tail enders).

#### **Hypothesis:**

Extraction of ground water by tubewell owners and availability of water to other cultivators (those who do not own tubewell) facilitated by the prevalence of water markets is instrumental in reducing disparity in farm income between head reach and tail enders in the semi-arid region in spite of high degree of inequality in canal water distribution in this region vis-à-vis arid region. Further, conjunctive use of water partly mitigates the negative effect of inequality in canal water distribution. This achievement is unsustainable as its social / environmental cost is high because of depletion of natural resources (ground water) induced by subsidy on power and absence of user charges for ground water. This phenomenon does exist in arid region too but to a much lesser extent, the deterrent being limited conjunctive use of water due to salinity of ground water.

Canal system is the lifeline in Hissar (arid region) as ninety five per cent of area is irrigated by canals. Since the community has high stake in running the system, cooperation among farmers is somewhat effective even though the WUA is of recent origin. In contrast, in the semi-arid region, the farmers who grow water intensive crops want to maintain their level of profit/income at any cost, even by managing canal water more than their entitlement and by over exploiting ground water as well. This myopic vision is likely to spell disaster in not too distant future. It is in this context that the awareness and education about preserving natural resources is most desirable. This also needs to be supplemented by (a) implementation of user charges for water and appropriate price policy for major crops to encourage crop diversification; and (b) considerable investment in reclaiming land rendered unfit for cultivation due to water logging.

## Concluding Observations

This study attempts to quantify the mean level of deprivation as well as the severity of deprivation in the distribution of canal water in Haryana. A comparative picture of the tail-enders and 'other' deprived with respect to the level and severity of deprivation, and the factors responsible for it has been presented for different sample sites. Spatial differences for seasons (Kharif and rabi) are also highlighted. The sample sites are drawn from the two major surface irrigation systems viz; Bhakra Canal and the Western Yamuna Canal (WYC) in such a manner that they also broadly capture the variations in the agro-ecological conditions (arid and semi-arid), including the quality of ground water.

If the effect of exogenous factors (e.g., low release of water in the minor from the branch canal) is removed, the deprivation index is the ratio of number of turns actually availed by a farmer to the maximum number of turns availed by any farmer on that site. This index lies between zero and unity indicating no deprivation and complete deprivation, respectively.

Some of the main findings on deprivation are:

- (a) Mean deprivation is much higher in the semi-arid region than in the arid region in both the seasons, viz; kharif and rabi.
- (b) Mean deprivation in kharif is higher than in rabi irrespective of the location of the site i.e., whether it lies in the arid or semi-arid region. A disaggregated information on deprivation shows that in kharif, deprivation is of serious nature.
- (c) Mean deprivation is much higher amongst the tail-enders than amongst head and middle reach farmers. This holds true of kharif and rabi as well.
- (d) Contrary to the general impression, the deprivation among the head and middle reach farmers is also significant. Severe deprivation is significant among the head and middle reach farmers in the semi-arid zone but not in the arid zone.
- (e) The land productivity or crop income per hectare is much higher in the semi-arid zone than in the arid zone [e.g. Rohtak (Rs.13578/ha), Jind (Rs.11490/ha), and Hissar (Rs.7129/ha)]. The share of irrigated crops to total crop income is also much higher in the semi-arid zone than in the arid zone.
- (f) Notwithstanding lower gap in deprivation of head reach and the tail end farmers in the arid region, the productivity differences between them are very large as compared to that in the semi-arid region.
- (g) The head reach farmers grow more water intensive and profitable crops (or have a larger proportion of their holding under such crops) than the tail-enders irrespective of the agro-ecological zone where the sample site is located. Even in the semi-arid zone, tail-enders are not able to grow paddy or sugarcane. In fact, they have compulsion to leave a substantial part of their land holding as fallow.
- (h) In the semi-arid zone, two distinct forces are in operation in opposite directions, which result in productivity differences between the head reach and the tail-enders. Influential

farmers at the head reach draw excess water from canal and siphon it off to their fields. This helps them to maintain their income and profitability at the cost of tail-enders who are already deprived in the system. This deprivation further widens the productivity gap between the head reach and the tail enders. This is particularly conspicuous in areas where wheat-paddy rotation is prominent which encourages conjunctive use of surface and ground water. The other force which helps tail-enders to catch up with productivity difference is the development of water markets (borrowing water or hiring tube well time from tube well owners). Since the tube well density is high in the semi-arid region, the excessive drawing of ground water even by the tail-enders leads to depletion of natural resources. A similar phenomenon exists in the arid region as well, but to a much lesser extent. In the arid zone, a combination of the following factor act as some deterrent to indulgence in theft of canal water and over-exploitation of ground water resources: tube well density, high salinity in ground water, absence of paddy and sugarcane crops, and much higher dependence on surface water than on ground water for irrigation.

- (i) The field investigations have revealed that apart from theft of water by influential farmers, the main reasons for deprivation are (in order of importance): overall shortage of water (low release of water by irrigation authorities), excessive seepage in unlined water courses, reduction in water flow due to growth of weeds in water channels, defective slope of channels, etc. These factors, no doubt, affect tail-enders more than others but they do have adverse effect on farmers at all locations. Except the issue of overall shortage of water, other factors leading to deprivation need technical and/or managerial solutions.
- (j) The institutional mechanism dealing with the alleviation of deprivation is quite revealing. It has two important features. One, the complaints about theft of water and other problems of technical nature through the public representatives (MLAs) is of little consequence as the latter are selective in pursuing the cases depending on the proximity/association of the complainant. Local bodies such as Panchayats are not active in such matters. Two, WUAs are virtually non-existent in the sample site lying in the semi-arid region (Jind and Rohtak). WUAs exist in Hissar, which are of recent origin only. They are not effective in taking up the problems relating to deprivation.

### **Emerging Issues: Research and Policy**

Some of the issues which have a direct bearing on research and policy, may be pointed out as below:

1. The complaints by the farmers regarding water thefts and other problems of technical nature reach the irrigation authorities through the local representatives (MLAs). This mechanism has not resulted in redressal of grievances in any significant way. Unfortunately, a direct interface between the people or the Water Users' Association and the irrigation authorities is missing. The problems faced by farmers at the grass root level do not get enough attention and priority in the meetings of senior officers at the circle level. The local bodies (Panchayats) are also not effective in this matter. WUAs need to be formed whenever they do not exist and need to be strengthened wherever they are either of recent origin or are lying in a dormant state. The involvement of NGOs in activating WUAs may be explored.

2. Paucity of funds is often cited as the main reason of not undertaking cleaning and lining of channels. For cleaning of channels what is required is more of labour than of capital input. If WUAs or Panchyats are active, they can mobilize manpower for this purpose. As far as lining of channels is concerned, either the WUAs have to do it on cooperative basis or the State has to raise water charges to finance at least part of the expenses for lining. Raising water charges is a politically sensitive issue which the state government has to undertake later or sooner. The issue can not be postponed indefinitely. Since the stakeholders involvement in getting the channels cleaned is high, the state government may also consider transferring some of the funds earmarked for development purpose for the Panchayat to the WUAs.
3. The tube wells located in the command area of canal system help supplement water requirement for irrigation. They are also indirectly instrumental in inducing, given the minimum support price policy, withdrawal of excess groundwater for water-intensive crops (e.g. paddy and sugarcane). The tubewells in a command area may be brought within the purview of regulation by the WUAs. The latter is likely to protect the long-term interest of the community by discouraging excess withdrawal of groundwater. The proposed arrangement presumes that WUAs would play an active role. Unfortunately, this aspect has remained illusive in the state of Haryana. This issue needs to be taken up for advocacy.
4. Appropriate incentives may be devised to attract private investment for reclamation of land rendered unfit for cultivation due to water logging. This should serve as a supplement to public investment.
5. In Haryana, lift irrigation plays an important role, especially in the arid region. There may be some special problems of tail-enders and those of 'other deprived'. These problems need to be studied separately.

## Executive Summary

### TAILENDERS AND OTHER DEPRIVED IN AN IRRIGATION AREA- THE CASE OF ORISSA IN EASTERN INDIA

*Rajkishor Meher  
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Agriculture forms the backbone of the Orissa economy with more than 80 per cent of the state's population directly and indirectly dependent on it. According to 1991 census, 73 per cent of the main workers of the state are directly dependent on agriculture, either as cultivators (44.31%) or agricultural labourers (28.68%) as against 65 per cent directly dependent workers in this category at the all-India level. Unfortunately, in such a scenario the agricultural economy of the state is highly underdeveloped, characterized by low productivity, subsistence farming and fluctuating trend of production due to erratic rainfall across space and time. Nearly 62 per cent of the cultivable land is rain-fed and exposed to the vagaries of the monsoon. Added to this, in the recent years there has been a marked decline in the per capita availability of cultivable land in the state. This has declined from 0.39 hectare in 1950-51 to 0.14 hectare in 2000-01. According to the Agricultural Census 1995-96 out of the total 39.66 lakh operational holdings, 32.52 lakh (82.00%) are held by the small and marginal farmers (Government of Orissa 2000:4/1). Although there has been a declining trend in the percentage share of primary sector income in the gross/net domestic product at the all-India level depicting occupational diversification and sectoral change in the composition of national income, the share of the primary sector in the NSDP of Orissa was as high as 46.88 per cent in 1999-2000 as against 27.50 per cent at the all-India level (Government of Orissa 2001: ANX- 5; Government of India 2001:S-5). It is because of the greater dependence of the population on the primary agricultural sector economy and significantly much lower contribution of Orissa to the food grain basket of the country, about 2.54 per cent in 2000-01 as against a population share of 3.6 per cent according to 2001 census, the gap between the per capita income of the state and the country has increased over the years. According to 1999-00 survey of the NSSO, the head count ratio of poverty in Orissa is 47.15 per cent, the highest in the country as against 26.10 per cent at the all-India level. Interestingly in between 1993-94 and 1999-00, while the poverty at the all-India level diminished from 35.97 per cent to 26.10 per cent, in the case of Orissa this diminished from 48.56 per cent to 47.15 per cent only.

#### **1.1The Problem:**

Needless to say, the highest incidence of poverty and backwardness of the state's economy is mainly due to the greater level dependence of population on the backward agriculture with poor irrigation infrastructure and uneconomic size of holdings frequently exposed to the problem of inadequate, erratic and unequal distribution of rainfall across time and space. The percentage of net irrigated area (NIA) to the net sown area (NSA) of the state before the commencement of the First Five Year Plan of the country was only 3.76. After the commencement of the state centred planning, the state has made steady progress in its NSA as well as NIA. By the end of 2000-01, a year before the completion of the Ninth Plan, the percentage of NIA to NSA in a scenario of diminishing NSA was 42.53 in Orissa. It may be noted that the ultimate potential of irrigation in the state according to CMIE (Centre for Monitoring Indian Economy) is 59 lakh hectares (CMIE, 1992) and by the end of 2000-01, the total irrigation potential created in the state was 25.20 lakh hectares (42.71%). In the year 2000-01, however, the percentage of net irrigated area to net area sown in Orissa was 42.53 and the percentage of net irrigated area to gross cropped area was only 39.26 with a cropping intensity of only 124 per cent (Government of Orissa 2002:4/7). It is found that in recent years there has not only been a marked fall in the net area sown, but also a marked decline in the cropping intensity in spite of the fact that net irrigation potential created in the state through different types and sources has remarkably increased over the years.

Over the period 1991-92 to 2000-01, the net irrigation potential in Orissa increased from 20.78 lakh hectares to 25.20 lakh hectares, whereas the cropping intensity, which was at a peak of 159 per cent during 1993-94, has become more erratic and shown sharp decline since then. The cropping intensity reflecting net area sown to gross cropped area, diminished to 138 per cent in 1996-97 and increased to 141 per cent in 1997-98. In the succeeding year 1998-99, this diminished to 139 per cent and then further increased to 140 per cent in 1999-00. After that in 2000-01, this further registered a marked fall to 124 per cent (Government of Orissa 2002:4/7). Interestingly in a scenario of rising NIA, the cropping intensity, which is a key indicator of agricultural development has not only become more erratic particularly since early 1990s, but also it has shown a diminishing trend. This clearly implies that there exists a wide gap in the official statistics relating to the creation of irrigation potential by various sources and the actual coverage of land under the assured irrigation. This mismatch between the official record of irrigation potential created and the effective coverage of land under irrigation in rural Orissa has been found out from many village studies conducted by the researchers in the past. This according to some of them is due to improper maintenance of the canals, drainage channels,

silting of the water reservoirs and the like. However, beyond such techno-economic barriers, there are many sociological reasons behind the widening gap of CCA (Culturable Command Area) and the actually irrigated land area in different large, medium and minor irrigation projects of the state as well as the country in general. A recent study made by the Development Support Centre (DSC), Ahmedabad clearly shows that in the command area irrigation system, the tailenders are not only deprived persons due to water scarcity, but also there are many other deprived villages/persons at the head reach and middle reach of a command irrigation area. Such problems arise due to several social, economic and technological factors and those need to be studied in more detail across space and people. Thus, followed to the findings of the DSCs study relating to the deprivation of tailenders and others in an irrigation area and its outcome on the irrigation management system and crop productivity vis-à-vis socio-economic conditions of farmers, attempt is being made to understand the management system of flow irrigation water in the command area of Orissa covering major, medium and minor irrigation projects and their impact on the land located at different reaches of the canal, crop productivity and the farmers' socio-economic conditions.

## **2.0 The Study Area:**

The study in order to give a representative state picture of irrigation in Orissa and the Eastern region covers one major, medium and two minor irrigation projects of the flow irrigation system in the three old and undivided districts of Sambalpur, Bolangir and Puri. In the reorganized set up of these three districts the areas cover under the study are present Bargarh and Sonepur districts for the Major Irrigation Project in the Hirakud Comand Area, the present Nayagarh of the undivided Puri district for the Kuanria Medium Irrigation Project and the Ghagara Minor Irrigation Project and the present Khurdha district for the Deras Minor Irrigation Project. It is found that according to the latest available data in the year 1999-2000, the percentage of gross irrigated area as percentage of the gross cropped area was 27.98 in Orissa, whereas in the case of undivided Sambalpur and Bolangir districts those figures were respectively 38.07 and 30.77 and in the case of undivided Puri district this was 32.22. Rank wise because of the Hirakud Command area the undivided Sambalpur district comes at the top and the rank positions of undivided Bolangir and Puri districts are respectively sixth and fifth in the descending order. Thus, considering the importance of the Hirakud multipurpose project, the largest canal irrigation system in Orissa and Kuanria medium irrigation project being located in

the highland region of the undivided Puri district, it was decided to confine our study to these two old undivided districts of Western Orissa and undivided Puri district in the coastal region.

The water distribution problems and access of farmers to the irrigation water in the head reach, middle reach vis-à-vis tail end area of the villages of major, medium and minor irrigation projects are studied in greater detail to find out both qualitative as well as quantitative pictures of deprivation and income loss of the farmers across different reaches and underutilisation of the created irrigation potential due to water mismanagement and poor maintenance of the irrigation infrastructure.

Needless to say, Hirakud Command area is the largest major irrigation project in the state and the Hirakud dam on river Mahanadi was one of the first multipurpose dam projects undertaken by the Government of Independent India in the early 1950s. Similarly, the Kuanria Medium Irrigation Project on river Kuanria, a tributary of river Mahanadi was planned to provide protective irrigation coverage to the farmers of a relatively backward region like Dasapalla of old Puri district, which is an advance coastal district because of the state capital, Bhubaneswar. The Deras Minor Irrigation Project near village Kantabada of present Khurdha district in the periphery of the state capital Bhubaneswar was built to develop the agricultural economy of the area in the wake of rapid urbanisation of the region. Another minor irrigation project, Gaghara Bandha located at village Nuapada of Gania block was initially conceived to provide protective irrigation coverage in the backward and drought prone tribal pocket of the present Nayagarh district.

### **3.0 Objectives:**

The main objectives of the study are:

- (i) To find out the problem of tailenders vis-à-vis other cultivators in the head reach and middle reach of major, medium and minor irrigation projects of Orissa state in the eastern region of India.
- (ii) To assess the socio-economic conditions of farmers in head reach, middle reach and tail end area of major, medium and minor irrigation projects in the selected study area of Orissa and to find out whether deficiencies in the irrigation system has led to wide disparities in the earning level and productivity level of farmers in the three different source of accessibility points of irrigation.
- (iii) To learn about who are tail-enders in different types of irrigation projects such as major, medium and minor in Orissa.

- (iv) To find out the consequences of being a tail-ender- in terms of productivity, social, economical and political implications.
- (v) To get acquainted with the attempts made to deal with the issues of tail-enders by farmers, officers and public leaders.
- (vi) To identify the related issues for public debate to create awareness among the farmers, academics, experts, leading NGOs and policy planners of the country.
- (vii) To identify issues and organisations for policy interventions.
- (viii) To work on possible solutions for tail-enders, with emphasis on issues for which policy advocacy is required.

#### **4.0 Methodology:**

The method chosen to address the issues is case study of some villages in the command area of the flow irrigation projects covering both the coastal and highland districts of Orissa, namely the Khurdha and Nayagarh of undivided Puri being served by one medium and two minor irrigation projects, Bargarh of undivided Sambalpur and Sonepur of undivided Bolangir districts under the largest major irrigation project of Orissa, the Hirakud Command Area. From the command area of these four irrigation projects different categories of villages from each reach-- head reach area, middle reach area and tail end area -- are being selected by following simple stratified random sampling method.

After making three/four preliminary visits to the project sites in these three undivided districts finally selection of the villages was made according to the following criteria. From the Hirakud Command Area, 18 villages covering three distributaries in the head reach, middle reach and tail end area of the three branch canals in the head, middle and tailend region of the Bargarh Main Canal were chosen at random. The three distributary canals in the head, middle and the tail end of the Bargarh main canal of the Hirakud Command Area taken up in the present study are: (i) Attabira branch canal in the head reach region covering present Bargarh district of undivided Sambalpur; (ii) Barpali branch canal in the middle reach region covering a portion of Bargarh district and a portion of present Sonepur district of undivided Bolangir; and (iii) Bhimtikra branch canal in the tailend region covering villages of Sonepur district only. From each of these three branch canals, we have selected three distributary canals in the head, middle and the tail end reaches. It may be noted that each of these branch canals is itself a main canal having its own head reach, middle reach and tail end area in the CCA. From each reach of the distributary canals of these three branch canals two villages with proper geographical spread are selected at random. Thus altogether 18 villages from the Hirakud

Command Area are being studied covering the present Bargarh and Sonepur districts of undivided Sambalpur and Bolangir respectively.

In Kuanria Medium Irrigation Project, there are two canals namely, the left distributary and the right distributary. From these two distributaries we have selected two villages from each reach by following simple random sampling method. Accordingly, 12 villages from this medium irrigation project are being covered. In the case of the minor irrigation projects by following the same criteria, two villages from each reach of the canal were selected at random, thereby covering 12 villages from the two aforesaid projects. Hence, altogether 42 villages in the major, medium and minor flow irrigation projects of Orissa are being covered in the present study. For a comprehensive understanding of the problem the study has relied on several sources for collection of information such as: the officials of the Irrigation Department, Panchayat Samiti Offices, records in the Police Stations and the nearby Revenue Offices to know about irrigation related cases, and also from the people of the concerned villages in focused group situation. After making a resource appraisal of the village's agricultural economy and its existing socio-economic structure through focus group discussion, the Principal Investigators and the Field Investigators held separate discussions and interviews of different segments of population in the sample villages to go deeper into the technical aspects and sociological problems of differential degree of access to irrigation water in the different reach areas of these three categories of irrigation projects. While doing focus group discussion the investigators used a village schedule suitably designed to cover different aspects of the village economy and agricultural holdings, social structure, cropping pattern, irrigation infrastructure, irrigated land versus unirrigated land and the like to collect and note down the quantitative information. Apart from that many types of issues observed and descriptive information elicited from the focus group discussions held with the different strata, castes and community groups of population in the surveyed villages relating to irrigation water distribution and its sharing and its impact on the agricultural economy of the area were being noted down by the investigators while doing field study in the village.

### **5.0 Command Area Irrigation: The Field Scenario**

It may be recapitulated that the main objective of the present study is to find out the problems and causes relating to unequal distribution and use of irrigation water in the different reaches of the command areas of different types of irrigation projects and the consequent deprivation of the irrigation water across space and people. For the purpose the study used PRA and focus group

discussion method and all total surveyed 42 villages in the command areas covering 18 villages in the head, middle and tail end reaches of a large irrigation project, 12 villages each from a medium irrigation project and two minor irrigation projects in Orissa.. With a view to getting acquainted with the social capital base of the people in the villages in different project areas and the political economy frame of distribution of various common property resources including irrigation water across the different caste and class groups, the study made a focus not only on the PRA and focus group discussion of different categories of farmers, but also the spot verification of the problem through direct observation method. In the following subsections, the primary field data of the studied villages relating to the socio-economic profile of the people and their livelihood, the present status of the agricultural economy, the status of irrigation infrastructure and its access across space and people are analyzed.

### **5.1 Social Profile:**

It is found that the 42 villages covered in the various reaches of the command areas of major, medium and minor irrigation projects of the present study consists of 9754 households. Out of this, 20.24 per cent are scheduled caste households, 8.24 per cent are scheduled tribe households, 62.31 per cent are OBC (Other Backward Castes) households, 7.26 are upper caste households and only 1.95 per cent are minority households, who are mostly Muslims. This shows that the villages covered under the study are predominantly resided by the OBC households in all the three different types of irrigation projects areas. This is because the traditionally cultivating castes of Orissa such as Kultas, Chasas, Dumals, Goudas, Malis, Agrias, Udias, etc come under OBC category and the Khandayats, Paikas etc under the SEBC (Social and Economically Backward Castes) category. When we look at the distribution picture of different categories of caste households in the head, middle and tail end reaches of the command areas, it does not show any marked difference. On the other hand, tail end villages of different categories of irrigation projects have relatively higher percentage (11.48) of upper/general category households such as Brahmins, Kshatriyas and Karans. However, needles to say among the different cultivator castes of Orissa, Kultas are the dominant caste in the Hirakud command area and the Chasas and Khandayats are the dominant castes in other three medium and minor irrigation projects taken up in the study and also in the coastal districts of the state.

In the villages of the study areas, it has been observed that apart from the traditional cultivating castes like Kultas, Chasas, and Dumals in the villages of Hirakud command area, the Brahmins

are the major land owners and they usually rely on the services of other lower castes including scheduled castes and scheduled tribes for all types of agricultural operations. In quite a few cases they keep regular farm servants called **Halias** on annual contract basis to undertake all sorts of agriculture related work under their close supervision. The landless category of households in the village mostly the scheduled castes, scheduled tribes and other lower castes including Goudas (Milkman), Luhuras (Blacksmith), Malis (Gardener), etc usually work as their farm servants or as tenant cultivators. It has been observed that in the study areas, although a few among the scheduled caste and scheduled tribe households own some lands in the command area, those are mostly inferior category uplands and having little provision for access to the irrigation water of the canal. Particularly in the Hirakud command area some among the scheduled caste families do illegal cultivation on the acquired land of the canals on both sides of the embankments by encroaching the land. This often generates caste conflict between the encroachers and the land owning community of the village as such cultivation affects watering of lands of other farmers in the command area.

On the whole, however, it is a fact to be kept in mind that unlike some other regions of north India, Orissa does not have much caste related conflict over issues relating to access and control over the natural resources including the CPRs (Common Property Resources) at the village level. Also, although there has been an unequal distribution of the land assets on the basis of caste, the traditionally cultivating castes of the state as such have never been deprived of the agricultural land. From the survey of the villages in the different reaches of the command areas of three different categories of irrigation projects, it is revealed that those are mostly resided by the traditional cultivator households in the different reaches of the canal and nothing definitive about the role of social factors on the basis of caste could be said relating to access and distributional norms of canal water for irrigation.

## **5.2 Operational Size and Land Distribution Pattern:**

The operational land holding size and land distribution pattern among the land owning households in the surveyed villages are as follows. Of the total households in the different project areas 2.16 per cent are large farmers owning 10 and more acres of land, 11.24 per cent are medium category farmers, 22.12 per cent are small farmers, 40.10 per cent are marginal farmers, 15.66 per cent are landless tenant cultivators and 8.72 per cent are totally landless. The picture of land distribution in the different reaches of the command areas is as follows. In the head reach villages 1.9 per cent are large farmers, 7.71 per cent are medium farmers, 18.38 per cent are small farmers, 48.36 per cent are marginal farmers, 13.21 are landless tenant

cultivators and 10.55 per cent of the households are completely landless. In the middle reach villages 2.52 per cent are large farmers, 10.69 per cent are medium farmers, 26.59 per cent are small farmers, 33.99 per cent are marginal farmers, 10.04 per cent are landless tenant cultivators and 16.17 per cent are landless households. In the tail end villages 1.97 per cent are large farmers, 13.09 per cent are medium farmers, 20.32 per cent are small farmers, 41.26 per cent are marginal farmers, 20.35 per cent are landless tenant cultivators and only 2.50 per cent are totally landless households.

This shows that head reach villages of the three different categories of command areas have relatively less number of large and medium categories of farmer households as compared to the villages in the middle and tail end reaches of the canal. Tenancy farming is more prevalent in the tail end villages as compared to the villages in the head and middle reach of the canal. More numbers of totally landless category of households are found in the middle and head reach villages. However, when the landownership pattern of the villages in general is looked into, this almost conforms to the state pattern. As mentioned earlier, more than 80 per cent of the landholdings in Orissa are of small and marginal category and in the surveyed villages such category of holdings are found to be around 82 per cent of the total.

The average land holding size of farmers in the surveyed villages of different projects at the aggregate level is found to be 2.97 acres. Of this, 0.68 acre is low land, 0.97 acre is medium category land, 0.54 acre is semi-upland and the rest 0.78 acre is upland, less suitable for paddy cultivation. The average holding size of farmers in the large project area is 2.91 acres. In the medium irrigation project area the average holding size of farmers is 2.31 acres, whereas in the minor irrigation project areas, this is 4.90 acres. When the land quality in the different project areas is looked into, the large irrigation project as well as the minor irrigation projects of the present study shows comparatively an higher average holding of better quality agricultural land namely low and medium category, which is most suitable for paddy cultivation. This is probably due to the selection of the present medium irrigation project, which is located in a hilly terrain of the present Nayagarh district. However, it is needless to mention that the Mal (Semi-upland) and the Berna (medium) categories of land in Orissa are better suitable under the canal irrigation system of cultivation than the Bahal (low land) because of its waterlogging problem.

It is, however, revealed from the focus group discussions held with the villagers of different project areas that although under the present distribution pattern of agricultural land in rural Orissa, the state does not have large scale dominance of large farmers as such and a good chunk of the land is held by the traditional cultivator castes, one or two large and rich farmers in

the village hold considerable influence over the farming community. The other small and marginal farmers as well as the tenant cultivators are found to be dependent on them in various direct and indirect ways relating to supply of agricultural inputs, short term credit, marketing of agricultural produce and so on. These categories of farmers usually belong to the upper castes or the dominant cultivating caste of the village in different project areas. Wherever there is water users' association, it is these people who run the helm of affairs. They often exercise considerable influence upon other farmers of the village relating to the distribution of irrigation water. Even at the village Panchayats these categories of farmers hold considerable influence and needless to say in all types of rural institutions and organizations their presence at the governance and decision making level cannot be ignored altogether.

### **5.3 Agricultural Scenario:**

Notwithstanding the predominance of agriculture in the state, even in the command areas it has more or less retained its subsistence nature of production. After more than 50 years of planned development efforts the state has failed to harness its existing water resources in terms of development of irrigation infrastructure to increase crop yield and minimize production risk of rain fed agriculture. It is estimated that out of a total of 65.59 lakh hectares of cultivable land in the state, as high as 59 lakh (89.95%) hectares of land can be brought under assured irrigation. However, by now less than half of its existing irrigation potential has been exploited and as per the official data nearly 63 per cent of the cultivable land is rain fed and exposed to vagaries of monsoon. There has been very little crop diversification and as agriculture in the state is mostly subsistence oriented and rice being the staple food of the people in Orissa more than 70 per cent of the cultivated land is covered under paddy crop. The yield rate of paddy/rice crop and also the food grains in general is very low. According to CMIE data the yield rate of rice in Orissa during 1996-97 was only 9.9 qtl. per Ha. as against 18.8 qtl. at the national level. Similarly the yield rate of food grains during the same year was 9.0 qtl. per Ha. as against 16.0 qtl. at the all-India level. This clearly reflects the underdevelopment nature of agriculture and less effective performance of its existing irrigation infrastructure to overcome the problems of production obstacles and weather uncertainty.

In such a status of development of agriculture in the state, when agriculture in the study area is looked into, it gives a picture of regional and project level divergence and disparity. While irrigation in the Hirakud command area despite its many shortcomings in the recent years has undoubtedly brought agricultural prosperity to a considerable extent in an agriculturally backward state like Orissa, its impact on the medium irrigation project area and also in the two

minor irrigation project areas is found to be visibly much less. Our analysis of the field data shows that in the command areas there has been very little diversification and switch over of the farmers to the less water consuming commercial crops. Out of a total cropped area of 25,551 acres during both **Kharif** and **Rabi** seasons in the 42 surveyed villages of the different categories of irrigation projects in the year 2001-02, around 90 per cent were placed under paddy. The amount of land put under the paddy crop during **Rabi** (**Dalua chasa**) in the villages of Hirakud Command area is almost half of the **Kharif** intensity, whereas in the cases of the other medium and minor irrigation projects the respective percentages of paddy area during **Rabi** season are found to be only 13.87 and 24.67. The area of land under other cereals is almost negligible. Similarly, area under pulses during **Kharif** is much less and during **Rabi** it is fairly high in the case of medium irrigation project (18.35%) and around 8 per cent of the total cultivated land area for all projects. Growing of cash crops like oilseeds, cotton, sugarcane, etc is found to be less than one per cent of the cultivated land area. Vegetable cultivation by the farmers in the command areas of these four large, medium and minor irrigation project areas has shown some popularity in the recent years particularly in the medium irrigation project area. This, of course, has not been taken up in a larger way due to market constraints and lack of storage as well as food processing facilities to regulate demand and supply positions of vegetables at different points of time of the year in order to assure minimum support price of the produce to the poor farmers.

On the top of this, it is equally distressing to notice that as in the state, the existing canal irrigation system in the command areas of different irrigation projects fail to provide water irrigation coverage to the officially created irrigation potential of the land area at the village level. This also widely varies between the projects. In the case of large project, Hirakud command area while 89.01 per cent of the cultivated land in the surveyed villages is placed under irrigation coverage during **Kharif** season and 45.91 per cent of the land during the **Rabi**, those are respectively found to be 61.93 per cent and 33.23 per cent in the case of medium irrigation project and 80.42 per cent and 23.03 per cent for the villages in the minor project areas

It is found that the yield rate of paddy per acre in the project area of Hirakud command area is 15.12 qtl. per acre during **Kharif** and 19.82 qtl. per acre during **Rabi**. This, of course, shows minor variation across the surveyed villages of different reach areas like head, middle and tail. Interestingly, the yield rate of paddy during **Kharif** in the head reach villages of the canal is lower as compared to middle and tail end villages. In contrast, during **Rabi** season the yield rate is highest in the head reach villages and lowest in the middle reach villages. However,

as compared to the other projects, the yield rate of paddy in the medium irrigation project area is much lower. This is probably due to the hilly terrain and undulating nature of the land in the case of Kuanria medium irrigation project area. Also, it has been observed that application of chemical fertilizer to improve the yield rate of the crops is much lower in the villages of medium irrigation project. In this project area, the yield rate of **Kharif** paddy is highest in the middle reach villages (10.44 qtl) and lowest in the tail end villages ((9.68 qtl) with less variation across the villages of the different reaches of the canal. While no paddy is grown in the middle reach during **Rabi** in the villages of the middle reach, virtually much less area put under the paddy crop in the tail end villages of the canal gives a distorted picture of the yield rate of **Rabi** paddy. In the tail end villages because of around 2-3 acres of **Rabi** paddy crop, the yield rate (11.95 per qtl) shows higher than the head reach villages, where a substantial portion of the cultivated land is placed under **Rabi** paddy crop. In the case of minor irrigation projects, however, the yield rate of paddy in the villages of the two projects taken together is found to be higher than the villages of Hirakud command area during **Rabi** season (23.09 qtl as against 19.82 qtl) and almost a quintal less during **Kharif** season. This is due to better management of irrigation water in the head reach and middle reach villages of the minor irrigation project areas in a scenario of pressing water scarcity.

It is further observed that both during **Kharif** and **Rabi** seasons almost 80 per cent of the paddy cropped area in the villages of different reaches of Hirakud command area is placed under HYV (High Yielding Varieties) paddy. Also, the application of chemical fertilizer per acre of land is reportedly highest in the large irrigation project area (154.49 kg per acre). While the rate of application of fertilizer at the intra project level is highest in the villages of the head reach region (173.55 kg), it is much lower in the villages of the tail end (131.30 kg). As against this, the land areas placed under the HYV paddy in the cases of medium and minor irrigation projects are only 32.52 per cent and 26.10 per cent. The average use of chemical fertilizer by the farmers per acre of cultivated land in the two project areas are only 40.09 kg in Kuanria Medium Irrigation Project and 64.01 kg in the Deras and Ghagara Minor Irrigation Projects. Of course, it is reported by the farmers in the villages of medium irrigation project that they use cow dung as manures more extensively in their field in order to assure regular and steady yield of paddy unlike the chemical fertilizer. As the cultivation practices in this part is yet to take a commercial shape, the farmers do not feel the necessity of intensive use of chemical fertilizer to increase crop yield.

This becomes evidently clearer when the number of farmers having disposable surplus of food grains for sale in the different project areas is looked into from the field data. It is found that while 20.62 per cent of the farmer households in the villages of the Hirakud command area are found to be selling surplus food grains after meeting their self-consumption need, such category of households in the medium and minor irrigation project areas is only around 11 per cent of the total cultivator households. When we look at the picture of farmer households having disposable surplus of food grains across the villages of the head, middle and tail end reaches of the canal, in all types of projects the tail end villages have relatively much lower percentages of households in that category as compared to the head and middle reach villages. Since the pattern of land distribution among the cultivator households of the villages in the project areas almost conforms to the state's distribution pattern of land holdings and the quality of the land at the intra-project level does not show any marked variation across the different reaches, less percentage of farmer households having disposable surplus of food grains in the tail end villages of the project areas may be due to their unequal access to water affecting crop productivity. The picture becomes clearer when we look at the food grains production level of different categories of farmer households in the different reaches of the different project areas and the magnitude of their food consumption needs met from self-production. The field data in this regard show that more number of farmer households in the head and middle reach villages of the canal in the Hirakud command area are better placed in terms of meeting their family food consumption need vis-à-vis the farmers in the tail end villages of the project. This is because cropping intensity is higher in the head and middle reach villages than the tail end, so also the yield rate of food grains in general. This is equally true in the cases of head and middle reach villages of both medium and minor irrigation project areas taken up in the present study.

#### **6.0 Irrigation Scenarios and the Access and Deprivation of Farmers Across the Different Reaches of the Canal:**

Hirakud Dam in Orissa is one of the largest multipurpose river dam projects in India. According to the latest report of the Water Resources Department, Government of Orissa in 2000-01 the total created potential of the Bargarh main canal in which area the present village survey of the study has been done is 86,360 Ha during **Kharif** and 53,260 Ha during **Rabi** seasons in Bargarh district and 42,480 Ha during **Kharif** and 21,650 Ha during **Rabi** in Sonapur district. That means the Bargarh main canal has at present a total CCA potential of 1,25,840 Ha during **Kharif** and 74,910 Ha during **Rabi** seasons. So, naturally in an agriculturally backward state like

Orissa this region is considered agriculturally more prosperous. However, it is observed that the agricultural prosperity of the region has started showing fast deterioration after 1970s, i.e. after around 25 years of the opening of the canals. These days it is not uncommon to notice in the many villages of the region that farmers are unable to do any paddy or other profitable crops during **Rabi** season, which is popularly called **Dalua chasa** in the paddy growing state of Orissa. This scenario is particularly conspicuously visible in the tail end villages of the different distributaries, minors and sub-minors including watercourses at different points of the main Bargarh canal. This further has taken an acute form in the tail end portion of the main Bargarh canal near a village called Bhimtikra in Binka block of Sonepur district. According to the revelations made by the people at the time of focus group discussions in the surveyed villages till the year 1981-82 and also according to land revenue records of the locality **Dalua chasa**, particularly paddy was grown in almost 60 per cent of the command area in the villages of Binka block. However, the percentage of land under **Dalua** paddy crops shall not be more than 30 per cent of the early 1980s irrigated area, at present. These days farmers in the big villages like Kartang, Mahadevpali, Seledi, Tundupali, Ghdadhar, Sasamura, Phulmuthi etc in Binka block of Sonepur district have stopped growing Dalua paddy altogether. Even in Binka NAC area including some of the revenue villages like Uriley, Dabhala, Antarda etc less than 25 per cent of the land in command area of the canal is provided with irrigation water facility for **Dalua** paddy as against more than 60 per cent of the cultivated land area in the past. Thanks to Hirakud canal system many big villages in tail end area of Dunguripali block in Sonepur district such as Sukha, Cherupali, Sahala, Sargul, Ichhapur, Haldi etc were considered agriculturally prosperous villages of the Dunguripali block in early 1980s. However, hardly five per cent of the land in these villages is now provided with irrigation water and in some villages like Sukha, Ichhapur, Haldi etc the double cropping of paddy is now totally stopped. In the past people in the village Sukha had to face caste and family level conflicts leading to court cases and political rivalries. It is found that all these villages in the tail end areas of Binka and Dunguripali blocks of Sonepur district often fight among themselves at the political level to get access to the privilege of canal water in their villages. Even in the middle reach villages of the tail end portion of Bargarh main canal (Bhimtikra main canal) people fight among themselves to get irrigation water for their **Dalua** paddy in the **Rabi** season. Under the scenario of acute water scarcity, people in the villages like Kaudiamunda, Kaintara, Kantapali, Babupali, Mahada, Shankara, etc of Binka block fight among themselves to draw more canal water in their distributaries and sub-distributaries. At the time of village survey it was revealed from the discussions held with the people of

Kaintara and Kantapali that Kaudiamunda farmers do not allow water to pass in their canals during peak level demand for watering of **Dalua** paddy. They raise temporary wall to check the flow of water to other villages of the middle reach area of the canal. It is found that Kaudiamunda is a Brahmin dominated village and they are not only well educated, but also the major landowners. Since other villages of the middle reach region either directly or indirectly depend on them for water and other associated socio-political matters, they easily succumb to their pressures. This evidently becomes clearer when we look at the actual cropped area of villages like Kaintara and Kantapali under the canal irrigation during **Dalua** paddy crop. It is found that while in the tail end villages of Bhimtikra canal hardly 5 per cent of the CCA in the surrounding villages presently do **Dalua** paddy and almost nil in the far tail end villages like Ghodadhar and Sansamura. In the middle reach surveyed villages of the tailend distributary of Bhimtikra canal (the tailend of the Bargarh main canal) the percentages of **Dalua** paddy land during **Rabi** season in the sample villages Kantapali and Kaintara varies between 15 to 20 per cent of the CCA. Even in the head reach villages like Telipali and Samarchipa the percentage of paddy during **Dalua** is around 50 to 60 per cent of the CCA. Not to speak of the **Dalua** paddy, even during **Kharif** quite a few villages in the different reaches of the canal fail to provide irrigation to all of their paddy lands supposed to be covered under the CCA. In the last **Kharif** season (2002) when the entire state was affected with the problem of drought due to inadequate and untimely rainfall the tailend villages of the Hirakud Command area particularly the farmers in the Bhimtikra main canal lost almost 60 per cent of their standing crops due to lack of water at the time of flowering and corn bearing stage of paddy.

The situation in the Barpali canal that is the middle reach canal of the Bargarh main canal is equally grim. In the tail end villages of the distributaries of Barpali canal the percentage of **Dalua** paddy crops varies between 40 to 90 per cent depending upon the location of the village's cultivable land from the passing out of the canal. During **Kharif** also the paddy land provided with irrigation facility varies between 70 to 100 per cent of the CCA. It is reported that especially during **Dalua** paddy the people of village Bhawanipali in the middle reach of Rampur distributary (which is a middle reach distributary of Barpali canal) frequently quarrel with the farmers of Rampur village in the upper reach of the canal as they do not allow smooth flow of the canal water during the time of scarcity, particularly after the transplantation of the paddy when flow of water in the canal reduces during March. Needless to say during this time watering is more required for flowering and ripening of the paddy. However, as Rampur is a big semi-urban village of Dunguripali block with many influential local political leaders including the present MLA

and Bhawanipali is a small village of Binka block having close market linkages as well as agricultural inputs linkages with Rampur, they cannot prevail upon the people of Rampur to get their rightful share of water. On the other hand because of the importance of village Rampur in the region, the farmers succeed in drawing their rightful share of water from the other middle reach villages like Naikenpali and Pandakital situated at the upstream of the canal. It is revealed from the field data that the villages like Naikenpali in the middle reach of the distributary while grows more than 90 per cent of its CCA under **Dalua** paddy crops, this is found to be only 33 per cent of the CCA in the case of village Pandakital, although both the villages are located in the middle reach of the Barpali main canal. Interestingly village Pandakital is located in a strategic point of Barpali main canal and it has enough water in the canal to irrigate all the CCA land for **Dalua** paddy. It is found out from the people that till 1980 the farmers were able to grow **Dalua** paddy in the cent percent of their CCA, when village Rampur and other villages in the downstream of the canal did not have much water problem.

Interestingly the villages in the head reach of Barpali canal, which is the middle reach of Bargarh main canal fails to provide irrigation facility to the cent percent of their CCA land during **Dalua** paddy. It is found from the field data that the canal water now provides irrigation coverage to 90 per cent of the CCA land in the village Dhirpur of the head reach for **Dalua** paddy, whereas this is just around half of the CCA land in the case of another head reach village Babupali during both **Kharif** and **Dalua** paddy.

The picture of irrigation in Attabira canal, the head reach of Bargarh main canal also does not show any optimistic picture of irrigation during **Dalua** paddy, although all the farmers in Orissa resort to mono-cropping of paddy round the year. It is observed at the time of village survey that many villages in the head reach grow paddy in more than the stipulated paddy area of CCA during **Dalua** crops. For the non-CCA land of the village the farmers in the head reach lift the canal water by using diesel pump. As a result, the villages in the middle reach and tail end fail to get their rightful shares. These days many villages in the tail end of the canals of both Attabira and Gudabhaga distributaries situated at the head reach of the Bargarh main canal do not do **Dalua** paddy at all because the water fails to reach in the tail end of the canal. These villages are Turum near river Jira, a tributary of river Mahanadi, Rusuda, Jampali, Desh Bhatli, Tukura etc. In the other tail end villages of Attabira canal such as Garbhana, Mahulpali, etc, irrigation water during **Dalua** paddy is available for around 20 to 50 per cent of the CCA, although the **Kharif** coverage is almost cent percent of the CCA in a normal monsoon year. In the middle reach sample villages of Attabira canal such as Budelpali and Podapali irrigation coverage

during **Rabi** season for crops varies between 40 to 100 per cent of the CCA land, whereas during **Kharif** it is more than 100 per cent of the CCA. Even in the head reach villages like Lachhida and Singhpali coverage of land under **Dalua** paddy varies between 90 to more than 100 per cent of the CCA and during **Kharif** more than 100 per cent of the CCA, that is cent percent of the village's cultivated land is provided with irrigation benefit of the canal water. It was found in one of the sample head reach villages namely Lachhida of the head reach Attabira branch canal of the Bargarh main canal that during **Rabi** season also the farmers grow **Dalua** paddy in more than 100 per cent of their CCA land by illegally lifting canal water to the non-CCA farm land of the village. This often creates conflict situation between the farmers of Lachhida and other neighbouring villages of the locality such as Katabaga, Chabaripali and villages like Degaon, Talsrigida in the downstream of the canal in the middle reach.

It may be mentioned that in the past as both Attabira canal and Gudabhaga distributaries are situated in the head reach of the Bargarh main canal and the Hirakud reservoir, many Telugu farmers from the neighbouring coastal districts of Andhra Pradesh in the beginning of the Hirakud dam had migrated to the region expecting good agricultural prospect after the laying out of the canal. Many are now settled down in the villages of the region by purchasing land from the large and marginal category poor farmers. Also, as many among them could not acquire suitable land from the traditionally farming community like Kulta, Dumal and Chasas predominantly residing in the region and also from the large Brahmin landowners, they preferred to work as tenant cultivators for the small and large farmers, who could not cultivate their land either due to capital or manpower problem. But nowadays, it is observed that a trend of reverse migration has already started among the Telugu tenant cultivators. In the wake of water insufficiency as many villages in the tail end of the canal in the head reach also fail to get canal water for **Dalua** paddy, they no longer find it profitable to operate as tenant farmers. Also due to waterlogging problem in the low land of the villages situated at the head reach of the canal, the productivity has fallen down. Fall in yield rate of paddy is also due to other ecological problems such as excessive use of chemical fertilizer and pesticides to increase the yield rate and mono cropping of paddy during both **Kharif** and **Rabi** seasons. Whatever the case may be, it is an undeniable fact that due to poor management of irrigation water, there has been water scarcity in the tail end and middle reach of the canals of Hirakud command area. This problem has started taking acute form particularly after 1980s due to the following reasons.

First of all, the water retaining capacity of Hirakud reservoir has fallen down in the recent years due to the silting of the dam. Also, due to the diversion of water of river Mahanadi by the present

Chhattisgarh state in the upper reach of the reservoir, its rain-catchments area has fallen down. As a result less water is stored in the reservoir during winter and summer. The poor maintenance of the canal leads to overflowing during rainy season and seepage waste up to 40 per cent according to the view of a canal engineer. It is not uncommon to find that at many points the flow of water in the main, branch, distributaries, minors and sub-minor canals are slowed down due to water hyacinth. Lack of proper repairing work and maintenance of the embankments at regular intervals has caused silting problem affecting thereby the depth of the canal in the downstream and tail end areas. This affects smooth and adequate flow of water in the distributaries, sub-distributaries, watercourses and the drainage channel connecting the water to the crop fields. As there are very few drainage channels people follow flooding techniques to water their fields, where a lot of water is wasted and causes deprivation for the farmers and villages situated at the downstream and tail end areas of the canal. It is observed that on the canal roads of Gudabhaga distributaries and Attabira canal, Bargarh main canal, Barpali canal, Bhimtikra canal, etc. many heavy loaded vehicles including paddy trucks, buses and tractors ply regularly. No care is being taken for the proper maintenance of these roads. Particularly plying of many tractors fitted with the iron wheels during planting seasons of both **Kharif** and **Rabi** crops causes frequent damage of the asphalt and concrete structure of the roads on both the sides of the canal. This affects the embankments of the canal and soil erosion leading to filling of earth in the body of the canal. As a result, at many places the water retention capacity of the canal has fallen down, thereby causing wastage of water in its early stage of release from the reservoir and scarcity problem in the later stage.

It is found that in the Hirakud Command area farmers in the tail end villages of the tail end portion of the Bargarh main canal (Bhimtikra main canal) are more deprived of irrigation water than the tail end villages of middle reach portion and the head reach portion of Bargarh main canal. The deprivation of tail end villages in the tail end portion of the Bargarh main canal is around 10 to 15 per cent of the CCA during **Kharif** and as high as 60 to 75 per cent during **Rabi**. In fact farmers in the tail end only get two watering for their crops during Rabi season and they no longer grow Dalua paddy although it was earlier more conspicuous like the other villages of the Hirakud Command area. In the middle reach villages of the tail end portion of Bargarh main canal deprivation of water in the CCA is around 10 to 15 per cent during **Kharif** and around 70 to 80 per cent during **Rabi**. This is because farmers in the middle reach villages grow **Dalua** paddy by obstructing the flow of water to the tail end area. In the head reach villages of the tail end portion of the main canal deprivation during **Kharif** is less than 5 per cent

and for the **Rabi (Dalua paddy)** it is around 30 to 50 per cent of the CCA. In the middle reach portion of the main canal (Barpali main canal) deprivation of farmers from canal water during **Kharif** and **Rabi** in the tail end villages is respectively around 15 to 20 per cent and 30 to 40 per cent. However, unlike the tail end villages of the tail end main canal farmers here grow **Dalua paddy** during **Rabi**. In the middle reach villages of the middle reach main canal deprivation is less than 10 per cent during **Kharif** and around 20 per cent during **Rabi**. In the head reach villages of the middle reach main canal farmer's deprivation of canal water during **Kharif** is less than 5 per cent, whereas in the **Rabi** this is around 10 to 15 per cent. As compared to the tail end and middle reach portion of the Bargarh main canal, farmers in the tail end villages of the head reach main canal (Attabira main canal) however, get adequate water during **Kharif**, but in the **Rabi** they hardly get any scope to grow **Dalua paddy** in less than 30 per cent of their CCA and that too with much difficulty. In the extreme tail end the farmers do not grow second paddy crop, as the supply of canal water during flowering and crop ripening time is highly uncertain. In contrast to this, it is observed that the farmers in the head reach and middle reach villages of this head reach main canal get scope to draw water for their non-CCA land area both during **Kharif** and **Rabi** for the paddy crop. In the head reach farmers' deprivation of canal water during **Rabi** is less than 5 per cent and for the middle reach villages 10 to 20 per cent. Precisely, for the entire Hirakud Command area farmers' deprivation of canal water now in the entire CCA according to unofficial account of some irrigation officials is 10 to 15 per cent during **Kharif** and 25 to 30 per cent during **Rabi**. According to them, this deprivation can be reduced to less than 10 per cent during both **Kharif** and **Rabi** seasons, if the farmers go for crop diversification and stop raising paddy crop alone.

In the medium and minor irrigation projects farmers' deprivation of the canal water in the tail end villages varies from year to year depending upon the storage of water in the reservoirs. These irrigation projects are mainly designed for protective role, although in Deras Minor Irrigation Project because of urban impact of Bhubaneswar people raise paddy and vegetables, pulses, oilseeds, etc during both **Kharif** and **Rabi** seasons. In these projects farmers' deprivation of canal water in the tail end villages of the CCA varies between 30 to as high as 70 per cent during **Rabi** and that too for the light crops. In the **Kharif** season during good monsoon year, deprivation of canal water in the tail end is around 15 per cent and for the middle and head reach villages, it is almost nil. But, deprivation of water in the head reach and middle reach of the CCA in the **Rabi** season is around 30 to 40 per cent because some of the

farmers in the head reach grow paddy crop although it is officially not permitted for these projects.

## **7.0 Conclusion and Recommendations:**

In a poor state like Orissa, which is agriculturally predominant, but backward and subsistence oriented, the canal irrigation has to play two distinct roles. That is protective as well as the productive roles. Needless to say, the present medium irrigation project, Kuanria and the Ghagara minor irrigation project located in the backward hilly region of Daspalla in the present Nayagarh district can play only a protective role in a traditionally paddy growing state like Orissa. As the dams/reservoirs are designed as such to provide protection to **Kharif** crops during erratic rainfall and drought like situation in the hilly region of Daspalla, nobody bothers about the productive role of these irrigation projects. So whatever little is achieved in the production front, we may call it a success. However, in the case of Hirakud Command area, its role is both productive as well as protective. Since it is a giant irrigation project, it has the potential to transform the backward agricultural economy of poverty stricken Orissa in a much larger way than the other large, medium and minor irrigation projects. But, unfortunately from that point of view, the project has generated only a little of the intended benefits across different segments of people residing in the region. On the other hand, due to poor maintenance of the existing irrigation infrastructure and lacking of an effective irrigation management policy consensually worked out by the people and the government to optimize the use of available water for a productive agricultural economy, its existing irrigation coverage in the CCA area particularly during **Rabi** crops is reducing day by day.

Our planning of the top-down is the real problem and irrigation is no exception. When we open the sluices of the dam we allow the entire canal systems the main, minor and sub-minor – to be opened at the same time leading to wastage of water in the head and scarcity in the tail. While closing the sluices also we do not take any precautionary measure as a result of which people in the tail are not in a position to store water in the (paddy) field. Their crops die and there is wastage of water in the head reach. Within this larger process the inter-plans of the above spell out factors makes irrigation management a complex phenomena. In the wake of sectoral reforms, when the government is trying to hand over the charge of irrigation management and collection of taxes to the people through the Pani Panchayats, WUA and all that feasibility study is a must. In this context our research endeavour needs attention.