The Ozar Water User Societies: Impact of Society Formation and Co-management of Surface Water and Groundwater

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Suhas Paranjape

K. J. Joy

Abstract

This is a study of the three Water User Societies in Ozar – the Banganaga Co-operative Water Distribution Society, the Mahatma Phule Co-operative Water Distribution Society, the Jai Yogeshwar Co-operative Water Distribution Society – on Minors 17, 18, 18A and 19 and Distributary 1of Sub-Minor 3 situated at the tail end of the Right Bank Canal of the Waghad Project in Nashik District, Maharashtra State, India. The Ozar Societies were among the first to be formed in Maharashtra and have served as examples for many societies in Maharashtra and elsewhere. They have also developed techniques for the co-management of groundwater and canal water. The societies have recently completed ten years of operation and the study concentrates on the process of society formation, the impact on society formation, and the issues in co-management that have surfaced through their work.

The study is divided into five sections. The first section provides the background and methodology of the study. The study is based mainly on secondary sources, supplemented with intensive discussion with the activists of the Samaj Parivartan Kendra, who were the initiators of the effort, and the office bearers of the Societies. The extensive records the Societies have maintained is supplemented by a household survey among the members of the three Societies to study the impact of society formation. The second section describes the process of society formation and what they have achieved since their formation. It brings out the novel aspects of the Societies and their formation and also highlights the hitherto not highlighted role of SPK and its nature as an important factor in their success. The building of check dams in the command areas and their judicious use for recharge by letting a portion of the canal water into the check dams, switching over to hourly rates for individual farmers and levying a charge on wells in the command in Mahatma Phule Society are important innovative steps.

The third section evaluates the impact that the societies have made on the lives of the farmers on the basis of the voluminous and meticulously maintained record of the three societies. Incomes have risen many times, more perennial crops like grapes and a larger summer area under crops characterise the change as also a shift from food crops to cash crops. The fourth section studies the impact on the basis of a field survey carried out especially for this study of a sample of the households in the three societies. It extends the evaluation of the impact to inter-household comparisons. What it finds it is that the impact and improvement has been secular across landholding patterns as well as location patterns. Labour income has also grown along with farm incomes. The differential has also grown but the lowest sections have managed to almost meet all livelihood needs. The fifth section discusses issues that emerge out of the experience of co-management and in relation to replicating it. Difficult questions of mensuration had to be faced and solved in an acceptable, non-technical simple manner. The major achievement is that the methods they have evolved are not necessarily accurate, but follow a logic that is amenable to consensus, and though there may be discrepancies they are sufficient approximations. However, the issue of canal recharge has not been truly addressed and remains one of the challenges. More work and study is needed in this direction. Issues remain but their nature has changed. What were problems flowing from from lack of development have now given place to problems that arise from development itself. The Annexure provides miscellaneous findings from the field survey that could not be included in the main text.

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1.

Background and Methodology

The Ozar WUAs

The Ozar Water Users' Associations (WUAs) were among the first few WUAs to be formed in Maharashtra. The WUAs have been a success by any of the conventional norms like irrigation efficiency, increase in the ICA, maintenance of the system, managing the water properly, collection of water charges, etc. This performance itself merits study.

They have also taken another interesting initiative in which, with financial support from the Soil Conservation Department, they have built a number of check dams on the nallahs and streams flowing through their command. These check dams have helped them harvest rain water, store their unused quota of canal water and also helped the recharge of wells. Because of this conjoint use of groundwater and surface water, the water availability has increased manyfold, irrigated area has increased, area under high value crops like vegetables and grapes has increased and has generally led to increased production and incomes.

In one of the WUAs, Mahatma Phule WUA, the farmers also pay certain water charges to the WUA for using water from their wells. They have also developed certain simple methods of monitoring well water levels and estimating how much has been the re-charge. This is a positive step towards bringing well water under social regulation, especially under the control of the WUA. This is an issue that is relevant to almost all WUAs in command areas and has its own implications for bringing ground water under social control and also for equity in water distribution and access.

The need for the study

The Ozar societies have come to be known widely as an example of successful participative management. They have helped form many more societies on the Waghad system of which they form a part. Even then, there have not been too many studies carried out of the Ozar experience. Notable among them are the SPK study of the first few years of their existence and a n IWMI study that has also been later translated into Marathi. Bapu Upadhye, who initiated the effort to form WUAs in Ozar has written a book on the Ozar expereince in Marathi. Some studies related to groundwater have been carried out by the GSDA and a student's monograph. There are also a few SOPPECOM notes available on the ongoing experience. However, most of these studies relate to the first few years of the Ozar WUAs. while the direction had been set during those years, definitive procedures had not been set up, especially in respect of the novel aspects that they had introduced. It is during the latter five years that these procedures have been routinised, the conflicts resolved.

It is now more than years since their command area was turned over to the Ozar WUA in March 2002. Sufficient time has elapsed for trends to work themselves through, for the functioning to stabilise. The Ozar experience can provide valuable clues to issues in the co-management of groundwater and surface water and to some extent, local and exogenous water. For this, we need to explore a number of issues, for example: What was the process through which they approached the new and distinctive direction? What were the factors that facilitated their adoption of these directions? How did the different stakeholders react, the well owners, the non-well owners, the government department (after all breaking the well-canal nexus has so far been a shibboleth with the Irrigation Department) to their ideas of integration and co-management of groundwater and surface water? How were compromises reached? There are difficult issues of mensuration involved. How were they sorted out? How have things been routinised? And what has been the impact of the formation of WUAs? Has concentration of benefits increased or decreased? Have the `last' benefited despite a growing concentration?

There was a need to take up to take up a study that explored these questions. Fortunately, the Ozar societies have also had a history of meticulous record keeping and have generated systematic and voluminous data on their performance. Now was also the right time to take up such a study. Sufficient time had elapsed so that things had stabilised and taken firm shape. The WUA office bearers, the SPK activists who initiated the effort were less burdened with routine tasks than they were earlier and were ready to explore these issues. Indeed, they welcomed this opportunity.

SOPPECOM was also carrying out a dialogue with the IWMI in respect of taking up some issues for study. This study of the Ozar societies was taken up as one of a two part study on co-management of local water and ecosystem rsources. The first one pertained to the case study of the Atpadi Taluka portion of the Tembu Lift Irrigation Society, a major lift scheme on the Krishna river and concerned the co-management of water and energy. This, the other one was a study of the Ozar societies' experience: a study of the processes that took place and the impact that society formation had, including an exploration of the issues involved in the co-management of groundwater and surface water.

Objectives of the present study

The first objective of the study is a systematic process documentation of the experience generated by the three WUAs. It would cover the period from the formation of the WUAs till today. It would cover the different stages, steps, negotiations with the ID, the people, etc., the problems encountered, how solutions were found, etc. It would pay special attention to those aspects not covered by the other studies. For example, one such factor is the crucial role that the Samaj Parivartan Kendra (SPK) and the ideas held by Bapu Upadhye and Bharat Kawle of the SPK. Played in the Ozar societies unique handling of the co-management issue. Another would be the importance of hourly basis of deliveries to the *individual farmer* by the societies, a feature recently introduced and of quite some significance in respect of the efficient management of water resources. We would also try to isolate some of the factors and situations that have contributed to the apparent success of these WUAs. This would be of use in the context of WUAs becoming instruments of sustainable water use, equitable access and participatory management. In Maharashtra the government has already taken a policy decision to hand over the irrigation management to WUAs over a three-year period.

The second objective of the study is to utilise the voluminous data contained in the records of the societies to make a comparative analysis of the pre- and post- WUA formation scenarios on the basis of the WUAs' data. This would be done against certain key variables like availability of water and its dependability, area irrigated and cropping pattern, access to water, timeliness of water delivery, irrigation efficiency, maintenance of the minors and field channels, water charge collection, productivity and income levels, etc. The study would also attempt to study the differential impact of society formation on different sections within the command, for example, on those with different landholdings or those placed at the head, middle or tail reach of a command. This has importance

The third objective of the study is to isolate issues specifically related to the co-management of groundwater and surface water. This includes pretty difficult issues: the basis on which a consensus was reached about co-management, and in one of the societies, on wells attracting a water charge from the society; how to determine the water charge on wells; how far does the water charge correspond to actual water use; what is the nature of the discrepancy, if any, and how it affects different individuals.

The methodology of the study

As mentioned earlier, there is a fair amount of literature available about the Ozar experience, though most of it deals with the early period of the Ozar societies, up to about 1997. This pool of secondary data is the first important instrument of the study. Details are given in the Bibliography section. It includes the personal memoirs of Bapu Upadhye, an SPK study of the Ozar experience of

participation both covering the initial period, an IIM study pamphlet published in 1996, a groundwater study by the GSDA, and a student monograph on groundwater use.

The other important source of data was the records maintained by the three societies. The societies have maintained extensive records of the water received and charged for, the water released into the check dams, the AI/DC ratios, the crop pattern, the charges levied and collected and the economic performance. This record runs right up to the year 2001-2002 and this is especially important for the later years. Since most of the earlier literature covers the data for the period up to about 1997, we decided to concentrate on the data for the last six years. Moreover, the last six years could also be said to reflect the position within these societies after the trends initiated in the early years had time to work themselves out and establish themselves.

Comparison years: 1991-92, and 1996-2002

To study the impact, we needed to determine which years to choose and what the earlier reference year should be. We decided to treat the year 1991-92 as the reference year for comparison. It does not exactly represent a year before the formation of the societies, but represents the earliest year for which data comparable to that later maintained is available. It is a year when the society was being formed, but its impact had not begun to be felt to a great degree and yet sufficiently detailed data are available since the societies began maintaining their records from that year. It also represents the last year before turnover.

We have then chosen to compare the years 1996-97 to 2001-2002 with the reference year. One way was to take alternate years for comparison. However, we thought it would be better to focus on the later years because they would bring out fully the impact of the cumulative developments that have taken place. More importantly, an average of the later five years would also take some account of the different kinds of rainfall regimes.

For the process documentation, especially in respect of the process of formation and initiation, we have relied on intensive interviews with the SPK activists and the WUA office bearers. Some knowledgeable farmers also attended these meetings. Focused group discussions with farmers had earlier been planned. However, in the initial discussions, a need for a household survey in the command areas became apparent and the idea of limited focus group discussions was abandoned in favour of a much more intensive survey effort that is described below.

Objectives and scope of survey

As discussed earlier, the Ozar societies have maintained over the years a meticulous record that yields a wealth of information. The record is comprehensive enough to meet all requirements that may arise in the regular functioning of the Ozar societies and some more. The objective of the field survey is to supplement this information with some more information that the record cannot easily provide.

The first thing it attempts to do is to collect information on a *household* basis. The societies' record is necessarily based on beneficiaries, who after all hold the legal title and entitlement to the land and in the societies. However, in practice, the social unit is not the individual beneficiary, but the household, which may consist of more than one beneficiary.

The broad overall trends are already available from the records maintained by the societies. The survey is meant to throw some more light on further questions. How has the impact been distributed between households? Which households have benefited and how? Are there differences between those households situated in the tail reach and those in the head reach? Have households been able to increase their assets? Which households have done so? Most of these questions are related to the household as a unit and to the inter-household distribution of assets and benefits.

Survey method and sample

The survey was conducted by administering a questionnaire that consisted of both structured and unstructured questions. No systematic proofing or cross checking was attempted since it was not possible to do so within the limitations imposed by time and resources. The findings share the limitations of all such response surveys. They have significance in terms of indicating broad trends but should not be considered to be quantitatively precise. To bring out trends, one has often to develop quantitative indices and make quantitative comparisons and it is important to keep this in mind.

For some of the processing, the additional data were derived from the records and discussions with farmers and SPK and societies' office bearers. Thus, for, example, the crop pattern was based on responses but productivity and price were derived from the data that the societies had maintained and agricultural income was imputed. The survey also attempted to elicit the response and opinion of farmers in respect of some of the new measures.

Since the co-management initiative was the strongest in the Mahatma Phule Society, it was decided that we would conduct a census survey for that society. For the other two societies, it was decided that we would draw a sample of about 10% of households spread over the head, middle and tail reaches and covering different operational holding sizes. This meant a sample comprising households that would cover all the 175 beneficiaries in Mahatma Phule, about 25 out of 250 in Banganga and about 34 out of 340 in Jay Yogeshwar.

Though finally a substantial majority of the Mahatma Phule beneficiaries got covered, in practice things turned out somewhat differently and we had to modify the Mahatma Phule sample. Though the society continues to maintain the original list of 175 beneficiaries that it had received from the department at turnover, there have been many changes in it. Some do not till their land, some have migrated, some were not available even after repeated contact, and one ashram did not wish to divulge information and so on. Finally we could survey and process information for 113 out of the 175 beneficiaries in Mahatma Phule.

Of the 175 beneficiaries the following lists those who were covered and those who were not along with the reasons.

Table 1.1: Mahatma Phule beneficiaries covered

No. of beneficiaries	Remark
113	Surveyed and processed (belonging to 96 households)
8	Surveyed but could not be processed for various reasons
24	Listed, but do not till their land. That land is uncultivable.
7	Listed, but have sold their land
1	Declared she had no use for canal water or for our survey!
8	Listed, but now hold only non-agricultural land
9	Were not available
2	Listed, but have land outside command
1	Declined to make information available

In fact, the society' s membership roster actually lists 138 beneficiaries that practically covers all the farmers who operate land in the command. The 96 households comprising 113 beneficiaries therefore cover 80% of the society' s list. In addition to the 96 households surveyed from Mahatma Phule, 17 households from Banganga and 34 from Jay Yogeshwar were covered making a total of 147 households covered.

Computing incomes

In our pilot testing we soon found that while other sources of income got reported readily and fairly consistently, agricultural incomes was not reported with any great consistency. Also, elements of, at best, caution and at worst, distrust entered the dialogue and could become an obstacle. This was a problem we had faced earlier as well.

One way out was to further detail the questionnaire and build in cross checks. However, this would have lengthened the questionnaire excessively. Moreover, our earlier experience also indicated that even with all that, the information might still lack consistency. At one level, researchers need to treat this reluctance of farmers to part with agricultural income information with a little more respect than they do at the moment. As a rural activist had once remarked wryly to us when we were discussing the problem with him, `Imagine walking into a middle class locality, entering a house and begin asking detailed questions on levels and sources of income!'

The other way out is to have agricultural income as an imputed value calculated on the basis of the agricultural information provided by the respondent. For this purpose we started with the cropping pattern as reported by the respondent. We also prepared a table of productivity before and after the society formation. The average of the last six years as included in the society' s record was used to impute income after the formation. On the basis of these values and the discussions carried out at Ozar and within SOPPECOM, estimated productivity table for crops before the society formation was prepared.

The other thorny issue was that of prices. One way was to use different prices for before and after the Society formation. However, it was not possible to pin down the `before' period with sufficient precision to arrive at a meaningful reference year or period. The fluctuations in the prices of some of the produce, seasonal as well as across years, created another problem. For this reason, we decided to compute both incomes at constant prices, using the average price for the last six years as recorded by the societies in their records. We should be aware that this does not truly compare (with whatever degree of precision it does, which is a separate question) the income then with the income now. Instead the comparison is more close to a `what if' comparison. What if the farmers today had the crop pattern they had earlier, what would their income be? Though we are carrying out the comparison in the sense of a then and now comparison this shift in meaning needs to be kept in mind as well.

Road map for the study report

The study is divided into five sections. This, the first section, provides the background and methodology of the study. The second section describes the process of society formation and what they have achieved since their formation. In effect it comprises what may be broadly called a process documentation of the whole experience. The third section evaluates the impact that the societies have made on the lives of the farmers on the basis of the voluminous and meticulously maintained record of the three societies. The fourth section studies the impact on the basis of a field survey carried out especially for this study of a sample of the households in the three societies. It also extends the evaluation of the impact to inter-household comparisons. The fifth section discusses issues that emerge out of the experience and in relation to replicating it. The Annexure provides miscellaneous findings from the field survey that could not be included in the main text.

2.

The Ozar Water User Societies: The Process

The background

This is a study of three water user societies in Ozar, Maharashtra, namely, the Banganga Water Distribution Co-operative Society, the Mahatma Phule Water Distribution Co-operative Society and the Jay Yogeshwar Water Distribution Co-operative Society (shortened to Banganga, Mahatma Pjule and Jay Yogeshwar societies in what follows) that lie in the extreme tail portion of the Right Bank Canal (RBC) of the Waghad dam command area..

The Waghad system

The Ozar societies are situated at the tail end of the Waghad system. (Fig.s 2.1, 2.2, 2.3 and 2.4 provide information on the location of the Ozar societies.) The Waghad system is part of the four dams that comprise the Upper Godavari Project. The Waghad dam has been built across the Kolwan river, the Karanjwan and Palkhed dams on the Kadwa river and the Ozarkhed dam on the Unanda river. The project has been planned to service an irrigable command area (ICA) of about 59,000 ha spread over 180 villages in six talukas of three districts: Dindori, Chandwad, Niphad and Yevla talukas of Nashik District, Kopargaon taluka of Ahmednagar district and Vaijapur taluka of Aurangabad District. Some of the relevant information about the Upper Godavari Project is summarised below in Table 2.1.

Table 2.1: Some relevant details of the Upper Godavari Project

Upper Godavari Project (comprising Waghad, Ozarkhed, Karanjwan and Palkhed dams)	
Gross Storage	341.14 Million m^3
Live Storage	317.68 Million m^3
Gross Command Area (GCA)	104,100 ha
Culturable Command Area (CCA)	89,400 ha
Irrigable Command Area (ICA)	59,000 ha

SPK 1994, p. 1

Just upstream of the present Waghad dam, there was an old earthen dam that was found to be defective and a new and higher dam was constructed just downstream of the site in 1979. The dam has a gross storage capacity of 76.5 Million m^3 and a live storage capacity of 70 Million m^3. The canals are what is known as *athmahi* canals, that is, eight monthly canals, with no assured provision for summer watering. In the planning stages there was no provision for a right bank canal (RBC), and only later, after considerable pressure from the farmers, was a right bank canal included in the system. The canal network was completed in 1985. The Waghad system now comprises Gross Command Area (GCA) of 13,500 ha, Culturable Command Area (CCA) of 9,640 ha and Irrigable Command Area (ICA) of 6,750 ha served by a 15 km long left bank canal (LBC) and a 45km long RBC. The Ozar societies lie at the tail of the RBC.

The *Samaj Parivartan Kendra*

The major initiative in setting up the Ozar societies was taken by the *Samaj Parivartan Kendra* (SPK) a social organisation in the area, founded and presided over by the Late Bapu Upadhye until his death. Bapu was elected Member of the Legislative Assembly (MLA) when the Waghad dam was being built and his characteristically relentless and vigorous efforts played a major part in the demand for

Fig 2.1 Maharashtra in India

Not to exact scale

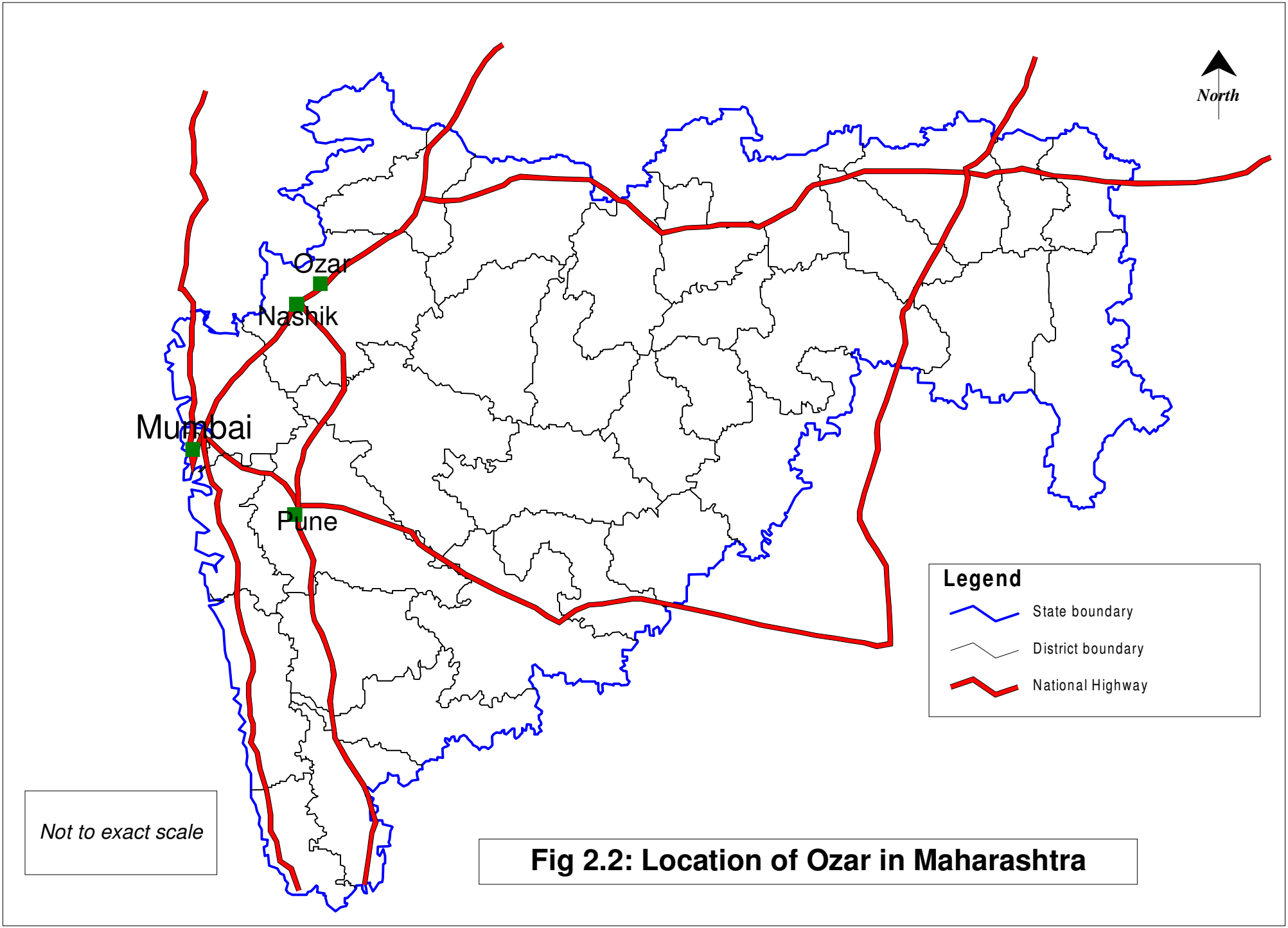


Fig 2.2: Location of Ozar in Maharashtra

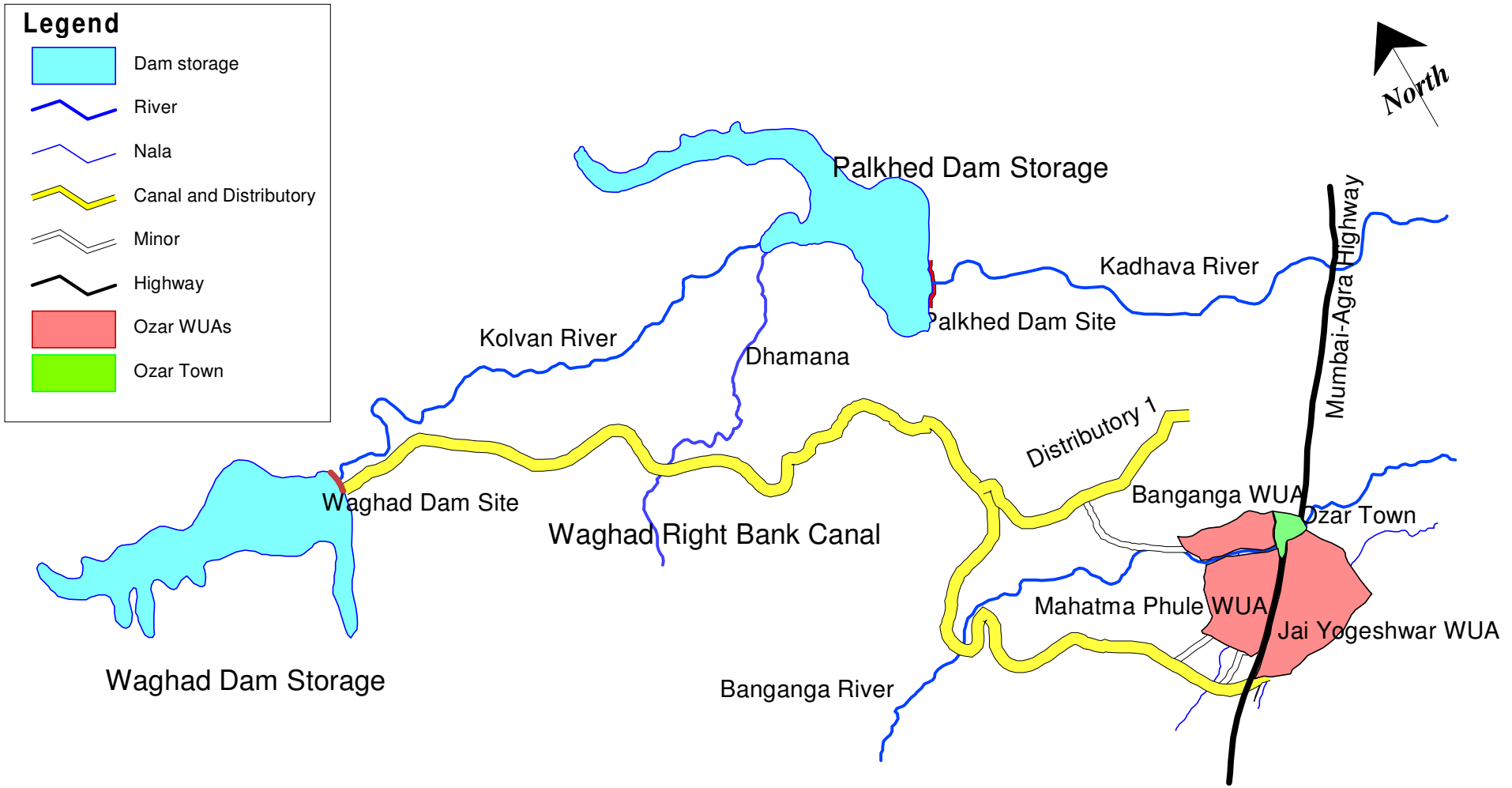
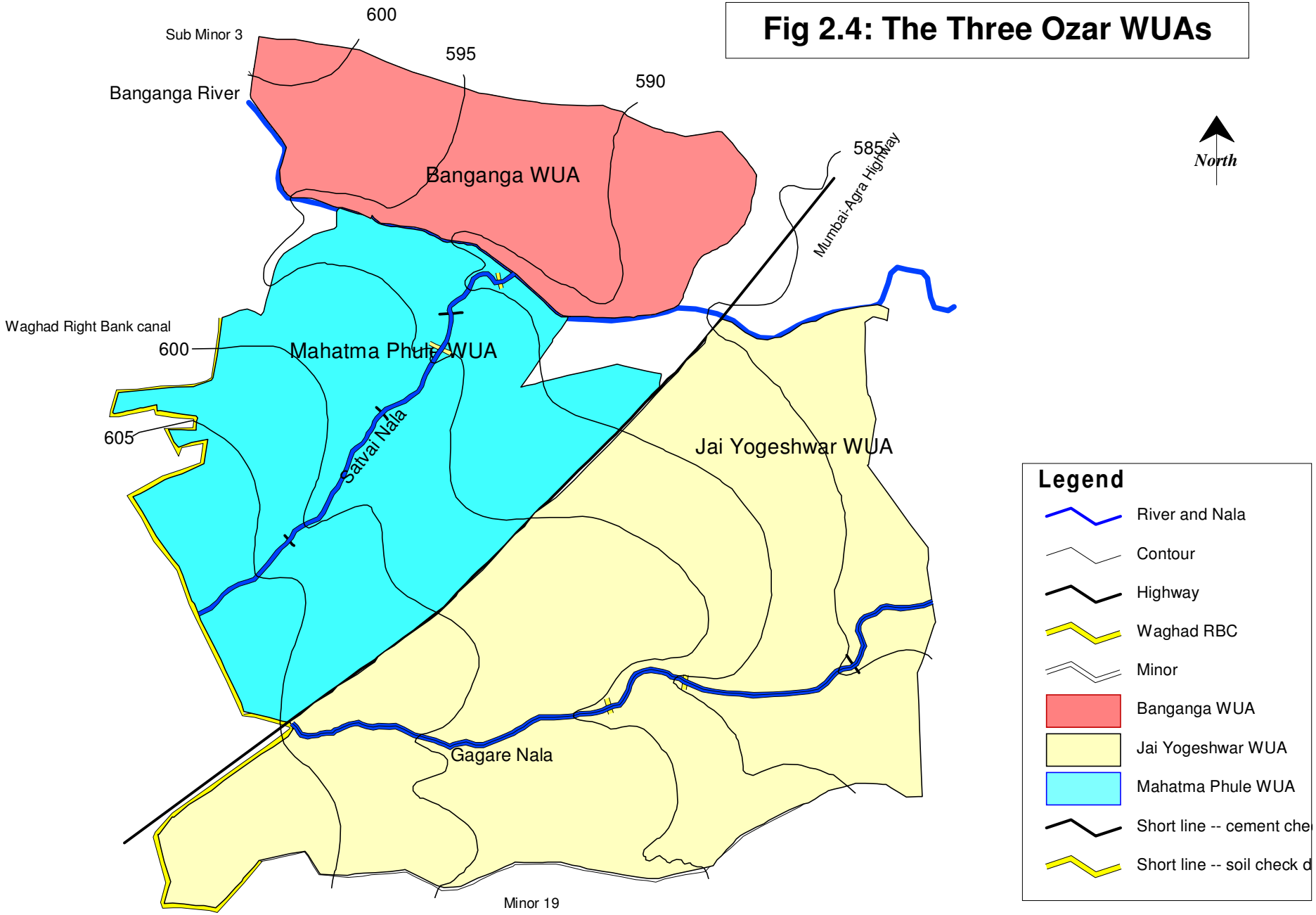


Fig. 2.3: Location of Ozar WUAs in the Waghad System

Fig 2.4: The Three Ozar WUAs



the RBC. He was accompanied in all his efforts by his close colleague and then Vice-President Bharat Kawle. Both are socialists by conviction and have led lives dedicated to serving the interests of the workers, the landless, the women and the downtrodden. Bapu and Bharat had led a struggle of the local farmers and the landless in Ozar for adequate compensation with the Hindustan Areonautics Ltd. (HAL) when it acquired their lands for its MIG Factory. The result is the basti of Lohianagar which houses the common office of the SPK and the Ozar water user societies.

Ozar

Bapu and Bharat are both from Ozar. Ozar was a small town in Niphad taluka of Nashik District about 16 km north of Nashik on the old Bombay-Agra Road and now National Highway No. 3. The entry of the HAL with the MIG factory and the setting up of an Air Force facility nearby was the turning point in the fortunes of this small and sleepy town. It led to a rapid expansion of business and population. Canal water has added to the local prosperity and even the face of the old town is being transformed, not to speak of the new outlying localities in the township that would match any of those in a major city.

The area comprising the three Ozar societies

The operational area of the three Ozar societies – the Banganga Water Users' Society, the Mahatma Phule Water Users' Society and the Jay Yogeshwar Society – comprises a contiguous geographical area of about 1300 ha served by the minors 19,18A, 18 and 17 and Distributary 1 of Sub-minor 3 (SM 3) in the tail portion of the area served by the Waghad RBC. Their respective gross and culturable command areas are shown below in Table 2.2.

Table 2.2: Gross and Culturable Command Areas of the Ozar Societies

Society	Banganga	Mahatma Phule	Jay Yogeshwar
Minor	Distributary 1 of Sub-Minor 3	Minors 17 and 18	Minors 18A and 19
Gross Command Area (GCA)	249 ha	432 ha	615 ha
Culturable Command Area (CCA)	216 ha	340 ha	595 ha

SPK 1994, p. 9

The Banganga command forms the Northmost portion of this contiguous area, the Jay Yogeshwar command forms the Southmost and the Mahatma Phule command falls in between. The Banganga river drains this command. The Banganga soils are virtually all deep black soils. The Jay Yogeshwar command is divided into two broad zones with very shallow and poorly textured soils near the minor and better soils nearer to the Ghagra nala. The Mahatma Phule command is drained by the Satwai nala and almost all the soils are shallow to very shallow. Most of the soils are poorly textured and the proportion of deep or heavy soils is very small.

Before the Formation of the Societies

Before the Waghad dam was built only the land falling now under the Banganga command had some irrigation. There are two old *bandharas* (check dams) of the KT Weir type on the Banganga river that served the Banganga area. This irrigation system, referred to as ` second class'irrigation was entirely farmer managed and the farmers had well-established routines for its operation and maintenance as well as for contributions to its upkeep. The system provided the farmers with water during the late kharif season and also helped in the preparatory phase for the rabi season. It rarely had water in the summer. However, the network of channels also meant that wells were replenished and could provide the necessary supplements till the end of the rabi season. The soils being heavy and rich in texture,

and irrigation being confined to that patch of land, the irrigation was sufficient to stabilise two crops on the land for most of the years in the old days. The rest of the land now falling in the Mahatma Phule and Jay Yogeshwar societies was mostly rainfed and only those who had wells could provide some succour to their crops. Though the Nashik area is famous for grapes, only a very few farmers with wells in a strategic position could maintain grape gardens. Some rabi was possible only during the rare good years when late and sufficient rains were received.

However, by the ' 70s things had begun to change even in the Banganga command. Upstream development of irrigation systems meant that flows into the two weirs on the Banganga river began to be severely curtailed and soon the earlier dependability of the water available from them was lost. The system began to be riddled with the weakness characteristic of a supply constrained system with very little dependability. In their haste to get their hands on whatever scarce water would become available farmers soon began to breach earlier well settled norms and procedures and just before the Waghad dam was built the system had virtually fallen into disrepair.

The Waghad canal system was completed in 1985. However, the Ozar portion of the Waghad system, being placed at the tail end of the system, received very little water from the system. According to the farmers, hardly 50 to at best 100 ha received irrigation in the entire Ozar portion of the command. Having taken part in pressurising the government on having the RBC, the farmers' expectations had grown, and once the Waghad system was operative this led to a further build up. By 1990, the year when Bapu attended the Rahuri meeting, things were delicately poised: if things would not have improved, either there would have been a sharp outburst or the farmers would have lapsed into a stoical acceptance and indifference. The Rahuri seminar probably came at just the right time.

The 1990 Rahuri seminar

Every account of the Ozar initiative marks its beginning from the 1990 Rahuri seminar. Bapu and Bharat both attended the seminar. Bapu had strong opinions on the issue of irrigation and believed that it was greatly possible to extend the irrigated area in the state if only we did away with administrative obstacles, changed the attitude of officialdom, rooted out corruption and relied on the farmers. He had been a member of the Agro-Irrigation Commission of the Government of Maharashtra, had written a book on the issue and had pursued the issue in the Legislative Assembly during his term as MLA. The Rahuri seminar struck a chord in him.

The Rahuri seminar was organised by the Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, one of the four Agricultural Universities in Maharashtra state and the Centre for Applied Systems Analysis in Development (CASAD). R. K. Patil and S. N. Lele, who were then with CASAD, had pioneered Participative Irrigation Management (PIM) in Maharashtra through the Water Users' Society that they helped form on Minor 7 of the Mula project. They had taken an active role in organising the seminar and they presented their experience of Mula Minor 7 arguing strongly for Water Users' Societies taking over irrigation management.

The seminar was well attended and is a landmark in the evolution of PIM in Maharashtra. Those who attended included Shri Agarwal, Chief Engineer, Water Resource Ministry, New Delhi, Anthony Bottrall and Shri Kathapalia of the Ford Foundation, Dr. S. K. Dorge, Vice-Chancellor, MPKV, Rahuri, Dr. S. S. Magar, Head, Water Management Department, MPKV, and Dr. Bharaswadkar, Water and Land Management Institute (WALMI), Aurangabad.

Patil and Lele used their experience of Mula Minor 7 to demonstrate that PIM was a feasible and viable proposition that improved irrigation performance on all counts. The seminar brought out the importance of farmers' participation in irrigation management at all levels. The story of Mula Minor 7 impressed Bapu deeply and he returned with a resolve to attempt something on similar lines in Ozar. It also inaugurated a fruitful interaction and collaboration between SPK and SOPPECOM. R. K. Patil, S. N. Lele and Bapu together were to become founder members of the Society for Promoting Participative Ecosystem Management (SOPPECOM).

Organisational effort

On their return, Bapu and Bharat launched an intensive organisational effort. They first discussed the idea of a Water User Society of the farmers in the SPK. It was decided to first approach the farmers on the SM 3, those now part of the Banganga society, since they were at the extreme tail of the command and faced the greatest deprivation of water. The Banganga farmers, on their part, lent them a ready ear not only because they were deprived of water, but also because their experience and tradition of so-called second class irrigation also meant that they understood the significance of irrigation much better. A formal meeting was organised on 15 June, 1990, less than a month after the seminar. A series of small *baithak*s preceded the formal meeting.

The meeting was very well attended. More than 100 farmers attended. Besides the farmers served by SM 3, Ozar farmers from other minors also attended the meeting. Patil and Lele attended the 15 June meeting. There was intense and prolonged discussion at the meeting. Farmers raised many doubts: the two main ones being, one, the question of discipline and two, the issue of cost. Detailed calculations and examples of how the problems were tackled in Mula Minor 7 convinced most of the farmers that it was a feasible idea and that the somewhat higher cost would be far outweighed by the benefits of assured and equitable access to water.

After the meeting there was a unanimous decision to form a water users' society of the farmers on SM 3. However, the farmers from other minors who had also attended the meeting also wanted that SPK take the initiative in forming water users' societies on their minors too. It was then decided to explore the possibility of bringing all the Ozar farmers in the Waghad command into a single water user society. The meeting ended with these decisions, but ushered in a period of long and intense activity before the societies were formed, consolidated and the actual and final turnover took place. We shall leave the chronological thread at this point and discuss some of the salient issues that came up during the formation of the societies.

Deciding on the number and jurisdiction of the societies

The first issue that had to be settled was how many societies should be formed and what should be their jurisdiction. Initially, the irrigation officials insisted on a hydraulic unit as a whole being treated as a unit for this purpose. They preferred one society for *all* the farmers on SM 3, one for *all* farmers on Minor 17, and so on.

While the SPK agreed with this in principle, they pointed out a number of practical difficulties in doing things this way. One was the question of matching of administrative boundaries with hydraulic boundaries. For example, the head reach of SM 3 lies in Dindori taluka while the tail reach lies in Niphad taluka. The other minors also had similar problems. Moreover, the SPK had worked mainly among the farmers in Ozar and they did not have contact with the other farmers.

This is a not uncommon difficulty and it is also one often faced in watershed development projects as well. The point here is whether priority should be given to social effectivity or to the unit of organisation. Unfortunately, in many cases, the unit is decided on the basis of a rigid hydraulic unit often creating management units that have no cohesiveness and consequently do not perform well.

It is important to note here that SPK was allowed to retain what they saw as the best compromise between social effectivity and hydraulic boundaries. So finally it was decided that three societies would be formed, one, the Banganga society on the Distributary 1 of SM3, that is, the portion of SM3 command that lay in Niphad taluka, and particularly in Ozar, the Mahatma Phule society on Minors 17 and 18 and the Jay Yogeshwar society on Minors 18A and 19. It did not solve the problem fully, but allowed the societies to have contiguous hydraulic sub-units that were at the same time administratively cohesive and were similarly placed in respect of social action.

However minor, there were also some practical difficulties faced by the irrigation administration in respect of these arrangments. If the strict hydraulic unit would have been followed, the already installed measuring devices would have been sufficient to monitor and measure the quantities delivered to the society. The irrigation officials agreed to install new, separate SWFs and automatic gauge recorders for all the societies. With these decision taken the societies were speedily formed. Unlike other areas in which registration itself was often the most time consuming step, the societies applied for registration in December 1990 and were duly registered on 8 March 1991, within three months!

The issue of the seasonal quotas

The other vexed problem was that of determining the seasonal quotas. There was a lot of discussion between the irrigation officials, SPK and SOPPECOM about how the quota should be determined. Normally, the irrigation officials would have had their say without too much discussion. However, this was not the case here since both the SPK and SOPPECOM were well informed in technical matters and SOPPECOM members included many eminent experts who had been part of the irrigation establishment. A number of thorny issues had to be discussed and decided upon.

Carrying over seasonal quotas

The first issue that had come up for discussion was that of the relationship between the kharif quota and the rabi quota and the rabi and the hot weather quota. The farmers wanted that the water saved from the kharif quota should be carried over to the rabi season. The officials expressed their inability to do so as it fell outside the scope of the rules they had. The officials have a point here, since the kharif quota if used, is supposed to be replenished during the kharif season itself. If the kharif quota was not utilised, it did not make any difference to the rabi quota since the unutilised portion would simply flow away; it would not be stored.

The relationship between the rabi and the hot weather quota was simpler to resolve. The Waghad system, technically, was what is called an eight-month system. So the farmers were not entitled to canal water during the summer season. However, there was a provision that though farmers were not assured summer water, they may be given water in the summer if there is sufficient water in the dam. The farmers wanted that a similar saving in the rabi quota be carried over to the summer season. This was agreed to and was included in the MoU.

Irrigation scheduling

Another request the farmers made was in respect of the change in date regarding the start of season. They requested that the season be treated to begin from a later date than was the usual departmental practice. They had some sound reasons for this. They pointed out that the crop calendar prevalent in the area did not match the calendar of deliveries as scheduled by the department. They requested that the irrigation season should start a couple of weeks later than it does now. This has now become part of the MoU and the kharif irrigation season is taken to extend to 31 October and the rabi to 15 March.

We should also note that the farmers' request makes sense from anothepoint of view irrespective of whether the crop calendar and the irrigation schedule actually do match or not. The simple fact here is that wells have water in the immediate post monsoon season and farmers may well be able to water their crops during the immediate post-monsoon period from their wells. If canal irrigation is provided a little later, then the final recharge to wells from canal water seepage takes place that much later and as a consequence the total period during which irrigation can be maintained increases.

CCA or ICA – what should be the basis?

Besides the many other issues which came up for discussion, one important point of divergence that came up, and one on which SPK and the farmers were insistent, was whether the quota should be determined on the basis of the Culturable Command Area (CCA) or on the basis of the Irrigable Command Area (ICA). The department was arguing for a quota based on apportioning the dam storage available for irrigation in proportion to the ICA falling within each society, while SPK wanted the quota to be determined on the basis of the CCA. In fact, the department presented a series of ever diminishing estimates of the quota and it is difficult to make sense of those estimates The SPK however stood its ground firmly and the officials finally relented and accepted the SPK proposal. The quotas granted to these societies are summarised below in Table 2.3.

Table 2.3: Irrigation quotas of the Ozar societies

WUA	CCA	Kharif quota ('000 m^3)	Rabi quota ('000 m^3)
Banganga	216	424	528
Mahatma Phule	340	440	1,016
Jay Yogeshwar	595	1,216	1,410

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Irrigation officials are not usually happy with the concept of CCA proportional quotas. However, we should note that the SPK proposal of CCA based quotas does make sense if we take off our administrative spectacles. The concept of what is irrigable and what is not is much more subjective than the concept of what land is culturable or not. It is quite possible that after water comes to the area, the farmers will put extra effort and sufficient inputs to make culturable but supposedly unirrigable land irrigable. From a long term view, therefore, it makes sense to allocate the quota according to CCA rather than ICA.

Joint inspection, turn over and trial rotation

A similar pragmatic approach and an attempt to reach a balance are evident in the joint inspection and turnover. In August 1990 a joint inspection was carried out and details of the repair and upgradation required prior to turn over were drawn up. This was a task that was taken seriously by SPK and they saw to it that all details were meticulously recorded. The task turned out to be much larger than had been anticipated by the department. If turnover was to wait on completion of the repairs and upgradation and the work would proceed at the usual pace at which departmental work proceeded, turnover would take a couple years. On the other hand, if turnover was carried out without these works being carried out, the farmers would have an inefficient system on their hands and the lack of performance might lead to discouragement and a decrease in the level of participation. It was therefore important that the society should have a reasonably efficient performance in the early years.

A balance was struck through a combination of measures. A list of works which needed to be done on a priority basis was drawn up, and these were to be completed before turnover and the department agreed to complete the rest of the works within a stipulated period. Through meetings of the farmers they were invited to explore what portion of the works could be carried out by the farmers on their own. A considerable amount of work was taken up by farmers' groups, with each group choosing a task commensurate to their ability. Most of the field channels and even a part of the main channel was built this way.

The MoU was signed in November 1991 and after most of the priority works were completed, the system was formally turned over to the societies in March 1992. By this time, though a majority of the

farmers had joined the society, there was a substantial section that was sceptical and those who were keeping their fingers crossed. The sceptical among them thought that a system that could earlier deliver water to at best 50 ha, however improved, would not be capable of supplying water to the tail portions on all the channels in the command.

These issues were tackled through the first test rotation of end of September, beginning of October. Water flowed through most of the command, and even though patches were left out it clearly demonstrated that water could reach all parts of the designated command. It also uncovered a number of problems. First, it pinpointed those locations at which the lack of or improper field channels were leading to the further areas not receiving water. Secondly, it also pinpointed areas where a lot of seepage was taking place and specific locations that needed treatment.

Important as the technical problems highlighted were, what was even more important was the impact that this rotation had on the farmers in the area. It was almost a festival with children joining in as groups of farmers moved around and feasted their eyes on the flowing water. Almost all of the Jay Yogeshwar command and much of the Mahatma Phule command had never seen even a rabi crop. The possibility of receiving water became a live possibility and farmers took on the task of removing the obstacles to the circulation of water within the command with redoubled effort. In that sense, this rotation marks a watershed in the development of the Ozar societies: after this rotation the balance shifted clearly in favour of the societies and silenced the sceptics and the troublemakers.

Organisational matters

SPK's role

In one sense, the organisational details of the societies would comprise a long and dreary list of details. How far, finally, can one depart from the organisational framework provided by the Act itself? What perhaps is more important is to identify the special features which give the Ozar societies their unique brand of success.

The most important factor is the role played by SPK. SPK differs from other NGOs in that it is not an ` outsider' NGO. Generally, NGOs are usually manned by professional persons and activists rarely drawn from the area of their operation. In the case of SPK, the leadership as well as the broad membership and the following were all drawn from the same area. Bapu and Bharat were both from Ozar and had close links with local people and the local farmers through their social activity. Secondly, they were conscious of minimising the role of SPK in the long run and limiting it to special help whenever needed.

We also see this clearly happening in phases. In the first preparatory phase almost all the work was being handled by SPK. With the formation of the societies, responsibility began to slowly devolve on to them, but without any delinking or withdrawal on the part of SPK. Initially three SPK members were part of the managing committees of all the three societies. Today there is no SPK member who is part of the societies' management committee. However, SPK is always there to help if the societies face a problem that they feel is beyond their capacity. SPK plays a role in inter-society matters as well as in larger policy matters, and system-wide co-ordination of the now 19 water user societies that have been formed on the Waghad system.

Technical capability and meticulous record-keeping

The other important aspect of the Ozar societies is the high level of technical ability that they have been able to mobilise with SPK help whenever needed, both in routine matters as well in complicated matters requiring much higher capabilities. One of the important factors contributing to this capability is the continued support and help that SOPPECOM has provided right from the beginning till date.

SOPPECOM and SPK share a general vision and direction and this has often helped arrive at a consensus on the measures to be taken.

However, it is important to emphasise that SPK's own ability in respect of technical matters is crucial in this connection. To use technical support, and to use it rightly and judiciously itself require a high degree of understanding and grasp of technical matters, though it may not amount to expertise. Both Bapu and Bharat show this grasp and facility. They have seen to it that adequate training and technical support are mobilised at both, the macro and the micro or routine levels of expertise that are needed in the functioning of the societies.

They have been able to put together a team of farmers that combines among them experience in farming, social standing, a grasp of the main issues involved, organisational ability as well as technical expertise. This team now comprises the main office bearers of the three societies. They comprise, among others, Vishnupant Pagar, Ramnath Wable and Ramdas Shejwal form Jay Yogeshwar, Rajabhau Kulkarni from Mahatma Phule and Ramdas Manlike and Murlidhar Kasar from Banganga society all of who have been or are Chairpersons of the societies.

Special mention must be made here of Rajabhau Kulkarni who is an Agricultural Engineer and a farmer. He has been instrumental in establishing procedures for, monitoring and carrying through all the technical tasks in relation to the operations of the three societies. With his help the team has often been able to find the right balance between purely technical solutions and the social requirements of the situation. We shall be discussing some of these issues later.

Also, with the help of Rajabhau, the societies have been able to keep meticulous and detailed records of all their activities, the water they have utilised along with estimates of its efficiency and productivity. This itself is an important input in any effort to analyse the impact of the society formation. We shall be discussing the impact on the basis of these records in the next section.

Functioning together

Though they are three separate legal and functional entities, the three societies function in a manner that gives them a larger collective identity. From the very beginning, the societies and SPK share a common office in Lohianagar, the locality that has come up in Ozar as part of SPK's struggle for the rehabilitation of the landless and the homeless displaced by HAL. The societies also share a common secretary, though all other office bearers and the canal operators are separately employed for each society. The common office, the common secretary and the presence of SPK see to it that the earlier common bond is preserved. There is also a co-ordination committee of all the three societies to tackle common or inter-society matters that was established on the request of the farmers. It comprises members drawn from each society as well as SPK activists.

Preserving a close relationship and bond between the three societies has proved to be beneficial in more than one way. First, and most obvious but not unimportant, benefit has been the saving of costs for each of the societies. The other important factor has been the transfer of personnel when needed. For example there are often mutual adjustments when the canal operators are `lent' by one society to another to clear bottlenecks or to help as yet semi-trained persons acquire full capability.

More important perhaps is the greater speed with which learnings, debates and discussions, and procedures are transferred across the societies' boundaries. Even though different societies have adopted different practices in many respects, for example while Mahatma Phule and Jay Yogeshwar have switched to hourly basis for water charges instead of the area-crop basis, Banganga did not do so for a long time. Similarly, while Mahatma Phule levies a charge on wells, the others do not. However, the societies do not get rigidly locked into different practices and there is a broad direction of consensus towards which they move. Even in societies that do not accept a new practice, there is a better understanding and often consensus on the principle behind the new practice.

Extending participation to project level

There are now 18 registered water user societies on the Waghad RBC. They cover almost all the command area of the Waghad RBC. The Ozar societies were the first among them to be set up. Most of the other societies were formed in the wake of the Ozar turn over. This had as much to do with the state policy that gave priority to commands with WUAs as with the visible success of the Ozar WUAs.

With almost the entire command now having been covered by WUAs, the next logical step was to form a federation of WUAs at the canal level, if not at the project or system level. In fact, a pretty strong case may be made out that until such federation at the project level takes place and the federation takes over the system, there cannot really be participatory decision making in the full sense. Till then crucial elements of decision making remain with the state and the WUAs have a role that is akin to participative implementation rather than participative management. Why then has a federation not yet been formed in the Waghad system? Especially when we have three such strong WUAs who can play a very strong role in this respect. This was a question that was asked of the SPK activists and the Ozar WUA office bearers. Their answer was quite important.

Taking action only when a felt need emerges

The first point is that not forming a WUA federation is a conscious decision that they have taken. They believe that the federation has to emerge as a need, a felt need on the part of the WUAs. At present they have a co-ordinating body of all the WUAs on the Waghad RBC and it is this body that takes on the task of negotiating with the state on matters of common interest. The leadership believes that they should stay with the co-ordinating body as the form of co-operation between the different WUAs until the formation of a single body becomes a felt need, a need that arises from below.

This seems to be part of a general philosophy of action, that issues need not be taken up until they become felt needs. However, this seems to contradict their own earlier actions, for it is difficult to believe that concepts of co-management of groundwater and surface water or the idea of charging wells came up as spontaneous felt needs. When this was put to them, Bharat and Rajabhau made a distinction between raising an issue, talking about it, discussing it and taking specific action on the issue. They pointed out that there was a discussion that went on for almost three years before ideas of co-management were accepted and action taken. Similarly, in the case of levying a charge on wells, while the issue has been raised and discussed in all the three societies, action has been taken only in Mahatma Phule, since in the other societies a general consensus has not emerged, though there is strong section that advocates such a step.

The case of the so-called `Karanjvan dam water theft'

Whether there is a formal federation or not, the situation itself is driving the Waghad WUAs towards greater co-ordination and common action. The very fact that the MoUs are in terms of water shares of the storage available for irrigation means that the WUAs have to be informed of the status of storage in the dam, how much of it is being made available for irrigation and whether they are receiving their adequate share of it or not.

This process is seen graphically illustrated in the uncovering of the ` water theft' from the Karanjwan dam in the district. Since 2001-02 was not a very good year, extra reservation for drinking water had been made from the Waghad system, and all the farmers were feeling the pinch. The WUAs went to the collector to ascertain the exact extent of reservation of capacity for drinking water purposes. They also pleaded with him to give due consideration to irrigation needs. The collector sent for the information and since it showed a fair amount of storage, directed the authorities to release about 187 mcft into the Kadva river. However, on his visit to the dam after the release, the Executive Engineer Palkhed division found the storage to be much lower than it should have been.

Accountability is the issue

All these events took place in early May and the WUAs were assured that action would be taken. When even by June 2002, no action was taken, the WUAs approached the newspapers and the scandal broke. The shortfall was estimated to be 202 mcft by the irrigation officials while the newspaper reports claimed it was 318 mcft. Three officials were suspended and an enquiry has been set up. The debate raged about whether it was a case of negligent record keeping as the officials claimed, or whether there was an underhand sale of water as the newspapers claimed.

The point of interest, however, is not whether it was negligence or gross corruption but the role that the WUAs played in this. The point is that the formation of WUAs and MoUs based on volumetric shares had an important role to play in bringing some degree of accountability in the whole episode. It is because of these MoUs that the WUAs could ask for and obtain the necessary records which later exposed the discrepancy.

New directions

Switching to hourly basis – increase in efficiency

Besides being good water users' groups, the Ozar societies have also struck out in new directions and set significant precedents in participative irrigation management. The first of this is the switching over to an hourly basis for calculating the water charge of society members.

So far as the determination of water charges is concerned, in most societies, the formation of water user societies means that the society pays the government on the basis of the metered quantity of water it receives. This means that, so far as the society is concerned, water becomes a cost explicitly related to the quantity of water it receives and not the crop and area. However, in most societies the internal assessment of water charge for members remains based on area and crop. This creates a peculiar problem.

If we treat participative irrigation management as mainly a measure to decrease state presence and to facilitate recovery of water charges and linking them to volumetric supply, this is not a problem. However, if we look upon it also as a measure that creates a push in the direction of water saving and increasing efficiency of water use, then it goes only half the way. For the *individual* farmer in the command, nothing much changes in respect of the relationship between area, crop and water use. It does not, as an individual, create any additional push towards his using more efficient and water saving measures.

The simplest and most obvious measure would be to provide volumetric supply individually to all farmers. However, this is said more easily than done. Setting up a measurement system for every field outlet would involve huge initial investments as well as operational costs. The need is to find a solution that is readily acceptable to farmers and easily implementable with little or no cost.

The solution, first implemented in full in Mahatma Phule and Jay Yogeshwar societies in 1998-99 and also applied in Banganga society last year was simple and has turned out to be acceptable to the farmers so far. The detailed calculations were carried out mainly by Rajabhau. What he did was to estimate the losses and delays from the flow available from the canal. Leaving a small cushion for adjustments he arrived at the total time that would be available for watering. Dividing this time by the total demand for irrigation, he arrived at a figure of the time taken to irrigate one ha. At present the

estimate, in farmers' terms, is that of 1 *bigha* in one hour. A bigha is roughly half an acre, so that the norm here is that of 5 hours/ha.

What Rajabhau proposed was that the water charge could then be converted to the number of hours a farmer received water. The argument was simple enough to understand and though there were some doubts the farmers agreed to give it a try. The system has now been in operation for four years in two of the societies. The issues have not been fully settled but there has definitely been an overall acceptance. That after all is important, because once that is there, later modifications and adjustments will then be much easier to implement.

Shift from rabi to summer

There has been a definite increase in discipline and efficiency with the switchover to an hourly basis for assessment of water charge. Farmers began to try and prepare their fields well in time and manage their affairs in such a way that they would be ready to irrigate their fields when it was their turn to receive water. The canal operators had received instructions to this effect and this meant that the previous practice in which the canal operator would generally have to wait till the farmer was satisfied that he had ` filled' his farm. He could try and persuade but not stop the farmer from taking more water than was customary, and only if it was excessively wasteful could he take the matter to the society. Now the whole problem was simplified at one stroke. All the canal operator had to do was to see that he got so many hours of flow, and it became the responsibility of the farmer to see that his field was irrigated within that time. The result was a greater awareness on part of the farmers and an increase in water application efficiency. However, this concern for efficiency is also related to another shift that has been taking place in the Ozar societies. This is the shift in importance of the rabi and the summer watering.

Normally an eight-month system like the Waghad system would show a relatively higher rabi utilisation than it does (the relevant data will be presented in the next section). However, the rabi utilisation has been relatively quite low, much lower than what one would expect from such a system. And there are important reasons for this. One is the importance of perennials like grape and fruits and to some extent, that of sugarcane. Though sugarcane is there in the Ozar command, it does not dominate the cropping system the way it does elsewhere. These crops require not very large but assured supplements of water in the summer and net a much higher income than corresponding rabi crops.

The general point about the perennials is, in a sense, quite well accepted. The important issue is whether this summer supplement will be available at all. The issue was therefore more of how to make this supplement possible. Earlier, when the department was in control of the system and the water charges were on the basis crop and area, it was easier to take a rabi crop than a summer crop because the department offered a relatively greater assurance of water and did not offer any for the water supplement in summer. With the formation of the water user societies, there was no such constraint on the crop pattern and the water charges: it was for the farmers to assure themselves of this supplement.

As we have already seen, the farmers already had effected an extension of the season by a couple of weeks. There was the provision in the MoU of carrying over savings in the rabi quota to the summer season. The question that naturally came to mind was: what if we save sufficient water in the rabi? Then we will have that vital supplement in summer for our perennials. With the extended season and the rabi saving perhaps we could go a long way towards assuring our summer requirement.

This aspect gave a fresh and qualitatively different impetus to improving efficiency. One of the results was the switchover to hourly rates. The other equally important and simultaneous measure was the rabi ` cut' . By common consent the societies decided to implement a ` cut' in the rabi quota by between 20 and 25% and asked the members to plan accordingly. Moreover, the prevalent norm of 5 hrs/ha is also probably tight and those with field crops like wheat find it a scramble to stick to those norms.

Both of them provide a cushion to deal with exigencies as well; in such situations one would simply forgo the rabi saving. On the whole this has so far proved to be a line of thinking that is acceptable to most farmers.

Co-management of surface water and groundwater

The hourly rate and the rabi ` cut' are two aspects of a package deal that has one, most important aspect that we have reserved for the end. This pertains to the co-management of surface, that is, canal water and groundwater, that is that of wells.

The question of wells in the command has been a vexed one. Though the law allows for a charge to be placed on wells within the command, this is rarely done. Moreover, the initial attitude of the department towards wells was to separate the wells from the canal (to break the *pat-mot sambandh*) rather than to integrate them. As a consequence, for most of the well owners within the influence area of the canals, canal seepage turns out to be a free recharge of their wells. We have also come across instances in which the farmers virtually collude to fill in nominal demand forms dispersed all over the command simply to see that water flows through the command and recharges their wells. They can thus manage to extract a large amount of water at rates that are a small fraction of the rates for canal water, which themselves are quite low.

The situation in the Ozar societies was somewhat different from the usual situation. SPK and SOPPECOM, who provided them support and technical advice and help, were both aware of the problem of wells and the co-management of surface water and groundwater. They had parallel views about the matter. They both believed that a charge should be levied on wells within the command and both believed that there should be an integration of surface water and groundwater. This led to the novel path that the Ozar societies mapped and to the significant advances they made.

Two measures: charging and recharging wells!

This path comprised two measures, both of which are quite important, and the issues related to them will be discussed in greater detail in the concluding section dealing with them. The first relates to the charges being levied on the wells. This consists in getting the idea accepted that the increase in benefit that well owners get is due to the recharge that takes place as the canal water circulates within the command. And since that water is water the society has paid for, they well owners should be paying for it. How much is a question that immediately arises, but is separate from the question of principle that the increased benefit to wells has to be paid for. So far, in the Ozar societies, only the Mahatma Phule society has a system by which wells in the commands pay a charge for the increase in benefit. Mahatma Phule has also devised a system to assess the benefit that has been accepted by the farmers and that too will be considered in greater detail in the last section.

The other measure relates to increasing the benefit from integrating surface and groundwater. It is this aspect that gives additional strength to the first measure, because it demonstrates not only that the society is ready to impose a charge for the well, but also that the society is as interested in seeing the benefit from wells increase. The positive linkage and positive sum approach that emerges from a combination of these is what is the strength of the co-management strategy in Ozar.

Check dams to check losses

No Chinese wall separates: Hydrology tells us that surface water and groundwater are not entirely separate phenomena, there is considerable interaction and interconversion between them. In every command area of canal served projects, substantial portion of the canal seepage and system losses appears in wells or in downstream flows. These are utilised as and where possible by those who can tap them. A large portion of the losses does eventually get used. However, the entire process is an

unmanaged process that leads to free riding. What we need instead is a system that makes it more of a managed system.

This is where the integration of local water resource development and canal systems comes into the picture, a perspective shared by SPK and SOPPECOM. SPK argued that the water flowing away through the drains and out of the system was a net loss. Moreover, since the society had paid for it, it was virtually the farmers' money that was flowing away unchecked! The way to check this loss was to build check dams on the drainage lines in the system so that the water would be detained and the wells in the command would be recharged.

SPK then approached the government for aid in respect of building check dams on the drainage streams in the command. Three major streams drain the command area of the three societies. The Banganga river itself is the drain for the Banganga society's area, the Satwai nala drains the Mahatma Phule command while the Ghagra nala drains the Jay Yogeshwar command. The SPK discussed the possible locations of the check dams and approached the government for help.

Check dams as means of increasing dependability

The SPK immediately came up against another of the government shibboleths. In government practice there is clear line between canal command areas and areas not served by canal irrigation. No local water resource development is carried out in the canal served command areas, and the command area authorities set up do not consider it their task. It took all their resourcefulness for the SPK to finally convince the government that Ozar should at least be treated as a special case to explore the possibilities of building check dams on the streams draining the command.

Today six check dams have been built on the Satwai nala flowing through the Mahatma Phule command, ten on the Ghagra nala flowing through the Jay Yogeshwar command and two check dams (in addition to the earlier two weirs) have been built on the Banganga river flowing through Banganga command. The idea was to create a two-fold supplement and assurance. The check dams would first of all harvest rainwater, secondly it would trap a substantial part of seepage and thirdly, it would also trap extra flows let directly into the stream.

The practice of utilising the check dams is the strongest in Mahatma Phule society and weakest in the Banganga society. We shall take up this question in our discussion of issues in the last section. The practice is to let a part of the quota directly into the check dam. In Mahatma Phule the practice dates back to 1993-94 season and since then it has been a regular feature in the society's operation. The system is not so systematically practised in Jay Yogeshwar and only occasionally and sporadically in Banganga. Initially, in Mahatma Phule, only the calculated difference between the quota and the demand was let into the check dams. It was very soon clear that after every rotation, releasing water into the check dams resulted in a significant rise in the levels in the wells, and that this water often served for watering the crop once or if it was on a drip system even twice and thrice. This has now resulted in a situation where some farmers prefer to let part of their irrigation entitlement into the check dams rather than take it directly through canal.

It is finally this aspect of the co-management of canal and groundwater that has led to the consolidation and enhancement of the Ozar societies' achievements. As we had said earlier, the Ozar societies have a remarkably well kept, all sided and detailed record of their performance. Based on those records, let us first have a look at the impact that the Ozar water user societies have made on the farmers lives in Ozar.

3.

The Ozar Water User Societies: The Impact – From the Records

Comparison years: 1991-92, and 1996-2002

This section presents the impact of the Ozar water societies based on the meticulous and detailed records kept by the societies. As has been discussed earlier, we decided to treat the year 1991-92 as the reference year for comparison. We compare the years 1996-97 to 2001-2002 with the reference year. We also include an average of the later five years for comparison, which would also take some account of the different kinds of rainfall regimes. *All the tables and charts in this section are based on the data provided by the three societies from their records.*

Membership and members availing of irrigation

If we look at the membership of all the three societies, we shall find that the societies have been formed, so to speak, at one go and have made only small increments in their membership in the later years. In Banganga the membership has risen from 65% to 74% between 1991-92 and 2001-02, in Mahatma Phule from 65% to 76% and in Jay Yogeshwar from 71% to 86% during the same period. (See Charts 3.1a, b and c below.) Also the rate of increase is flattening out and, from the current trend, we would expect very little addition to the membership. We shall return to this point a while later, after having a look at the members who avail of irrigation.

If we look at the number of farmers availing of irrigation, we see a clear effect of the nature of rainfall and dam storage. There is no reference year for comparison because in the reference year turnover had not taken place and the records of the society are based on what data was provided by the department and that did not have this item. (See Charts 3.2a, b and c.) However, if we look at the average values, then we shall find that in Banganga, an average of 33% of farmers availed of rabi and 21% of summer irrigation; in Mahatma Phule the corresponding values were 53% and 37%, and in Jay Yogeshwar 53% and 34% respectively.

One thing that we should keep in mind in looking at these figures is the formal nature of these figures. On the ground the unit of organisation and decision-making is more often the household and not the individual listed beneficiary in the membership list. There are also many households who had been listed as beneficiaries but who have sold their land, or migrated or have land that is uncultivable. We shall deal with some of these matters in our next section where we present the findings of a survey that was conducted for this study.

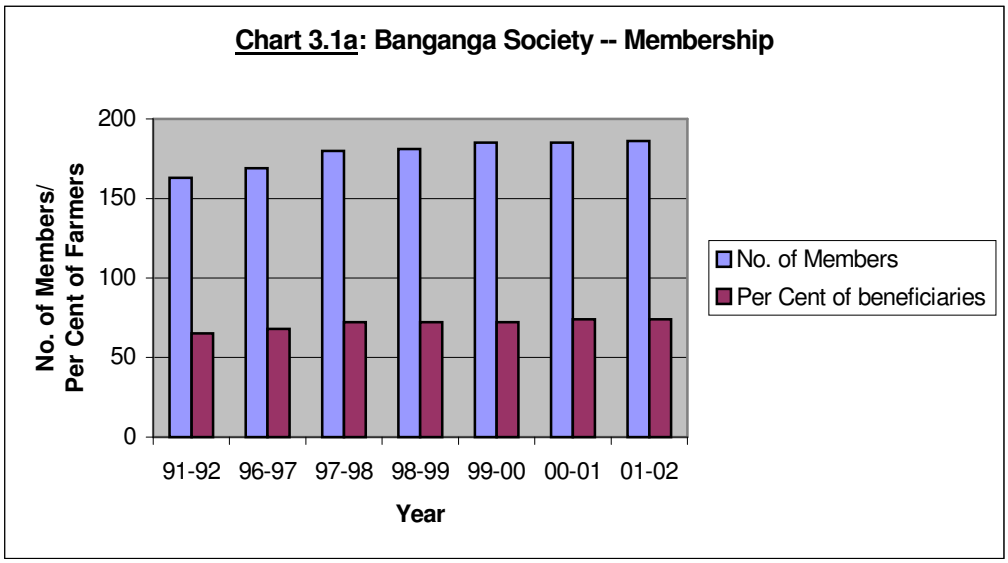
Chart 3.1a: Banganga Society -- Membership
No. of Members/ Per Cent of Farmers
200
150
100
50
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
No. of Members
Per Cent of beneficiaries

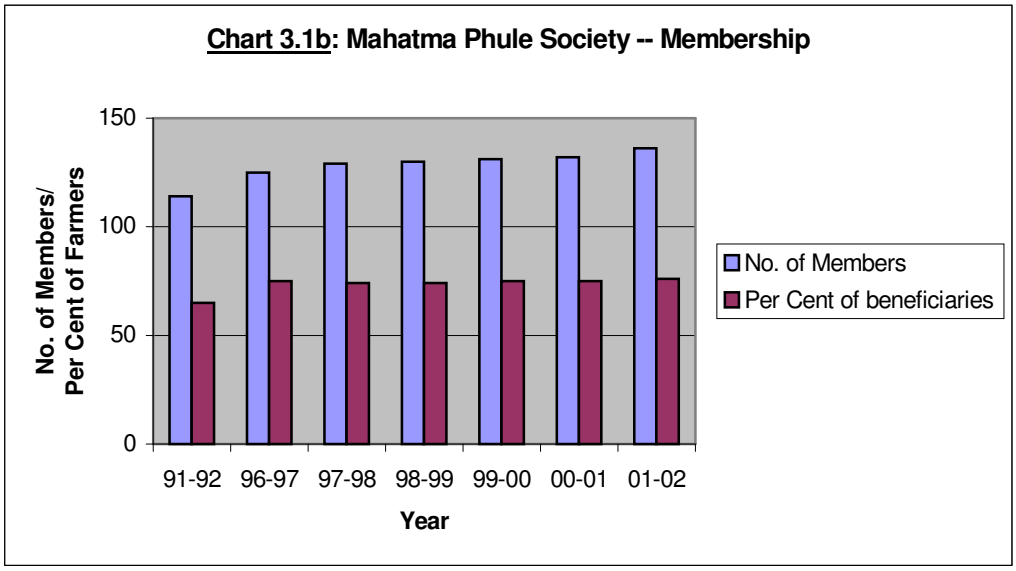
Chart 3.1b: Mahatma Phule Society -- Membership
No. of Members/ Per Cent of Farmers
150
100
50
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
No. of Members
Per Cent of beneficiaries

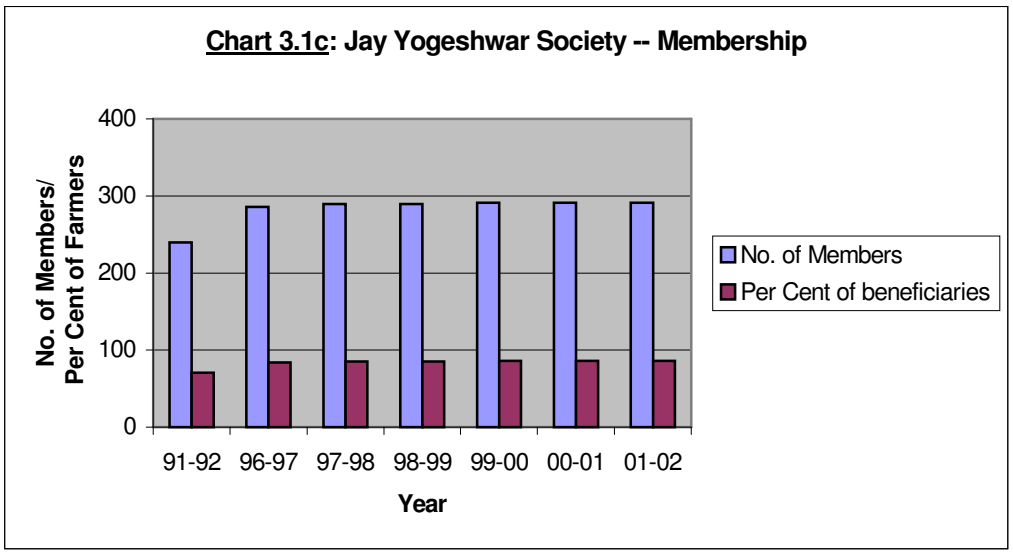
Chart 3.1c: Jay Yogeshwar Society -- Membership
No. of Members/ Per Cent of Farmers
400
300
200
100
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
No. of Members
Per Cent of beneficiaries

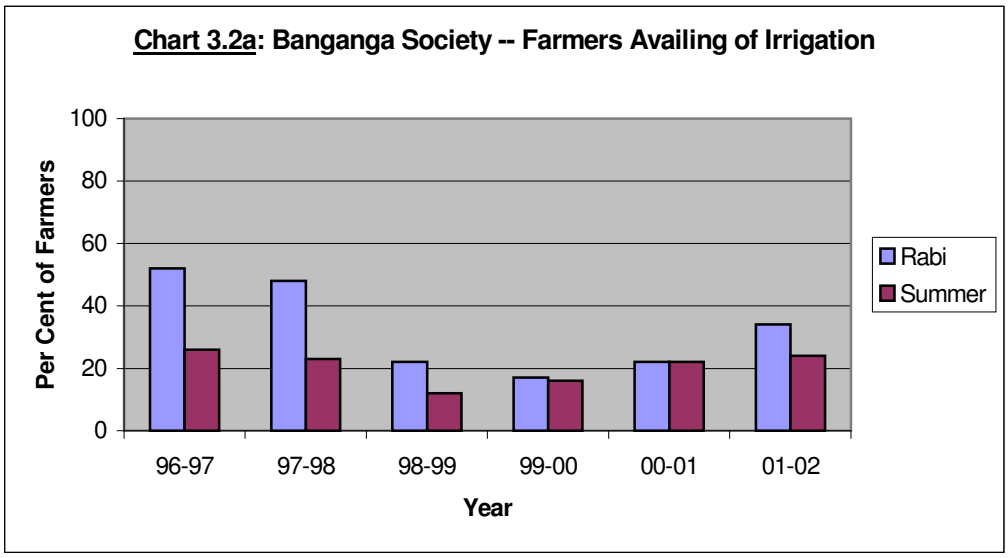
Chart 3.2a: Banganga Society -- Farmers Availing of Irrigation
Per Cent of Farmers
100
80
60
40
20
0
96-97
97-98
98-99
99-00
00-01
01-02
Year
Rabi
Summer

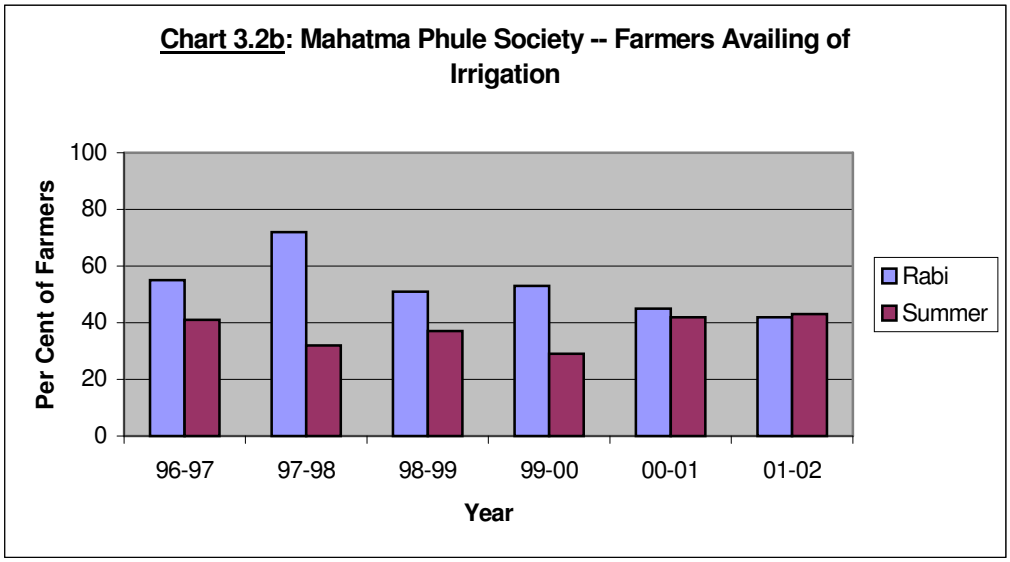
Chart 3.2b: Mahatma Phule Society -- Farmers Availing of Irrigation
Per Cent of Farmers
100
80
60
40
20
0
96-97
97-98
98-99
99-00
00-01
01-02
Year
Rabi
Summer

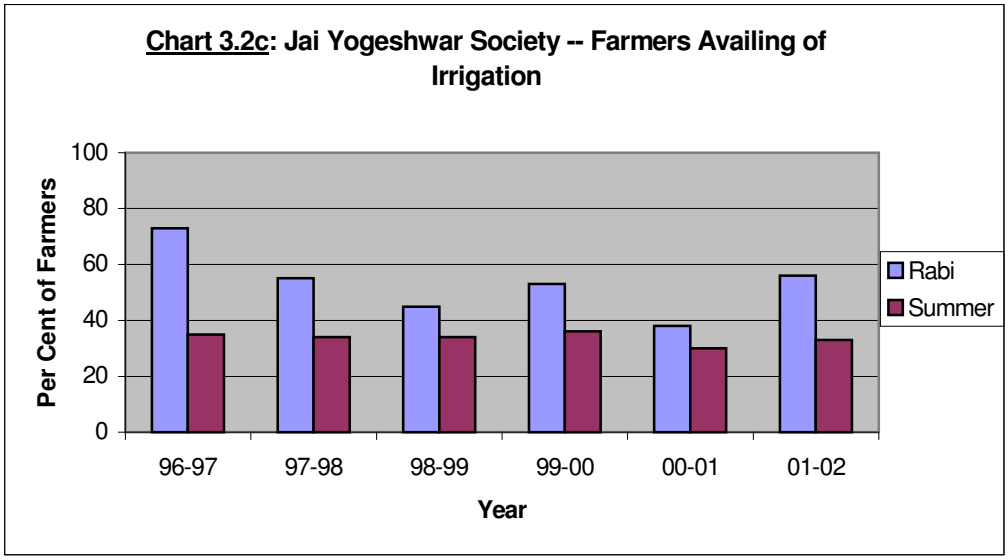
Chart 3.2c: Jai Yogeshwar Society -- Farmers Availing of Irrigation
Per Cent of Farmers
100
80
60
40
20
0
96-97
97-98
98-99
99-00
00-01
01-02
Year
Rabi
Summer

Cropped Area and Cropping Intensity

The impact of society formation begins to be evident from the impact on the cropped area and cropping intensity in the commands of the three societies. Both cropped area and cropping intensity register a secular rise in all seasons for all societies, though each of the societies has its own particular pattern. (See Charts 3.3a, b and c and Charts 3.4a, b and c.)

In Banganga, though both kharif and rabi season cropped area shows an increase, the increase is small. The kharif cropped area increased from 73% to 77% of the CCA and rabi area increased from 69% to 79%. If we remember that Banganga has heavy soils and has some benefit from post monsoon surface and sub-surface flows in the Banganga river in the immediate post monsoon period, we can see why irrigation did not cause much of an expansion in kharif and rabi. The main change here is the greater degree of assurance of irrigation. The summer area, however, shows a significant leap. The summer cropped area increased from a mere 5% to a whopping 39%. This pattern of benefit often explains the particular situation prevailing in Banganga.

In Mahatma Phule, the kharif area increased from 38% of CCA to 49% of CCA and the rabi area from 20% to 44%. The summer area increased from 2% to 19% of CCA. The rabi area doubled to reach a figure just below 50% of the CCA. The greatest impact however is seen in the Jay Yogeshwar society. Here all the increases are large: kharif are increased from 43% to 71% of CCA, rabi area from 29% doubled to 58% and summer cropped area increased from 2% to 17%. this itself is a productive contribution of very significant dimension.

In terms of cropping intensity, we see a significant increase in cropping intensity, expressed as a ratio of the gross cropped area to the CCA in per cent in all three societies. The average for the last six years as compared with that for 1991-92 increased from 100% of CCA to 182% in Banganga, from 60% to 104% in Mahatma Phule and from 74% to 136% in Jay Yogeshwar. This also shows the different starting points that prevailed in the three societies, and interestingly, while the impact has pulled all values above 100%, the distance between the societies has even somewhat increased. However, we also need to take account of the fact that Banganga also has a greater proportion of small holders. The average increases would have been even larger if the last two bad years are not considered.

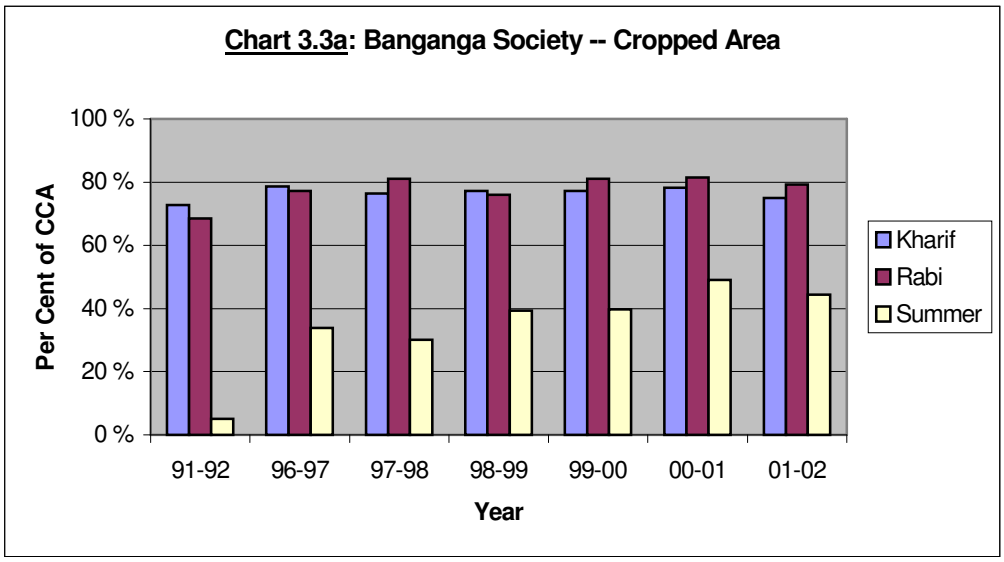
Chart 3.3a: Banganga Society -- Cropped Area
100 %
80 %
60 %
40 %
20 %
0 %
Per Cent of CCA
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
Kharif
Rabi
Summer

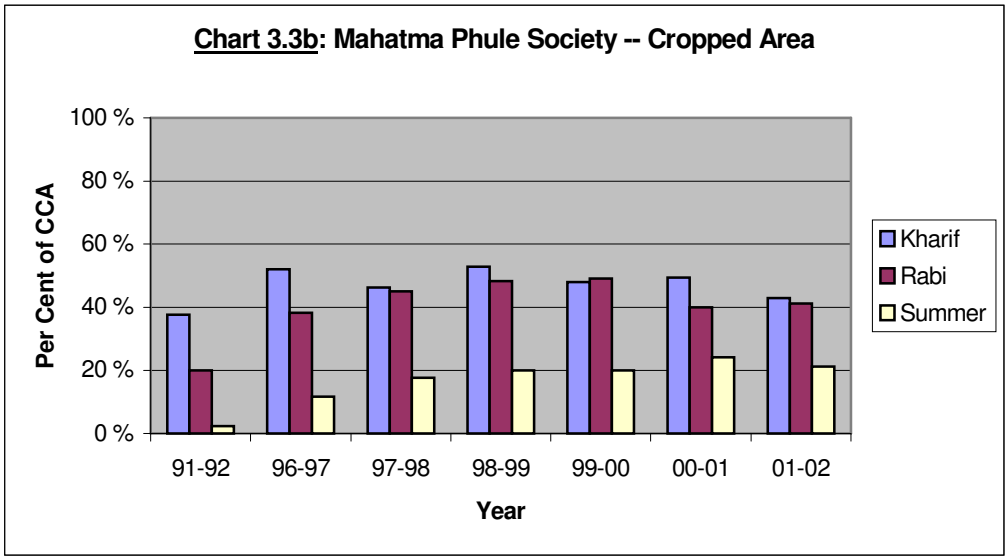
Chart 3.3b: Mahatma Phule Society -- Cropped Area
100 %
80 %
60 %
40 %
20 %
0 %
Per Cent of CCA
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
Kharif
Rabi
Summer

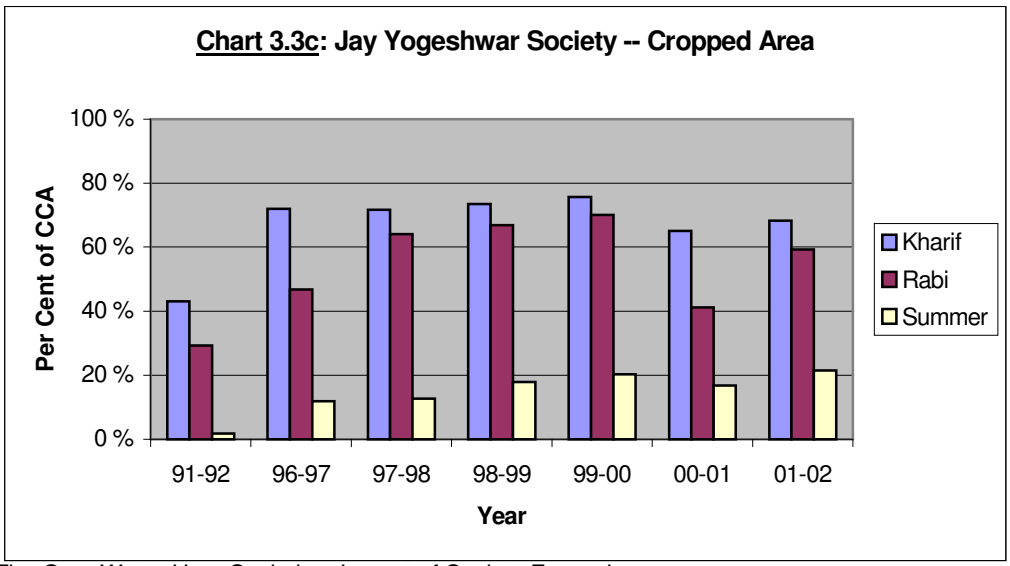
Chart 3.3c: Jay Yogeshwar Society -- Cropped Area
100 %
80 %
60 %
40 %
20 %
0 %
Per Cent of CCA
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Year
Kharif
Rabi
Summer

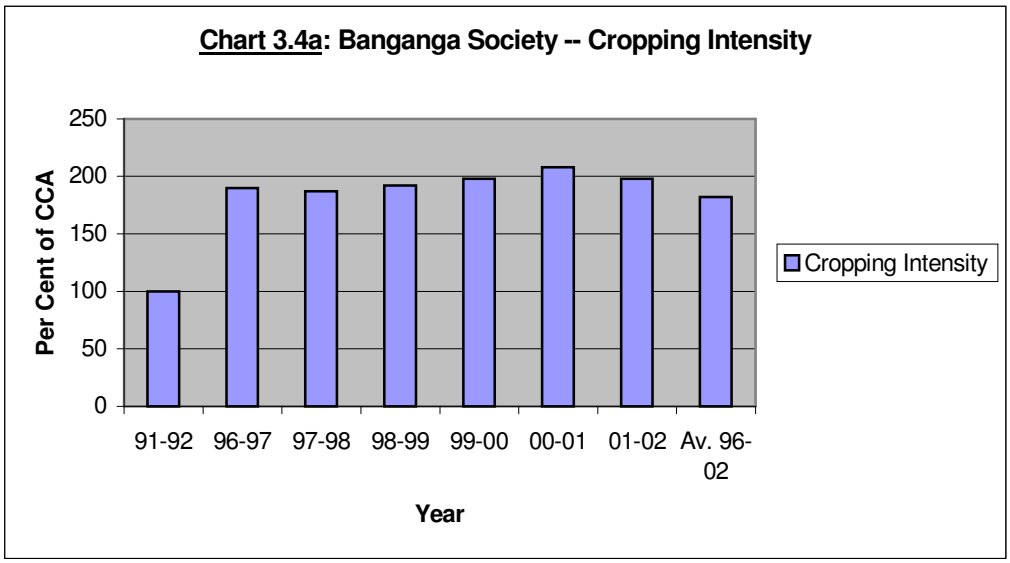
Chart 3.4a: Banganga Society -- Cropping Intensity
Per Cent of CCA
250
200
150
100
50
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Av. 96-02
Year
Cropping Intensity

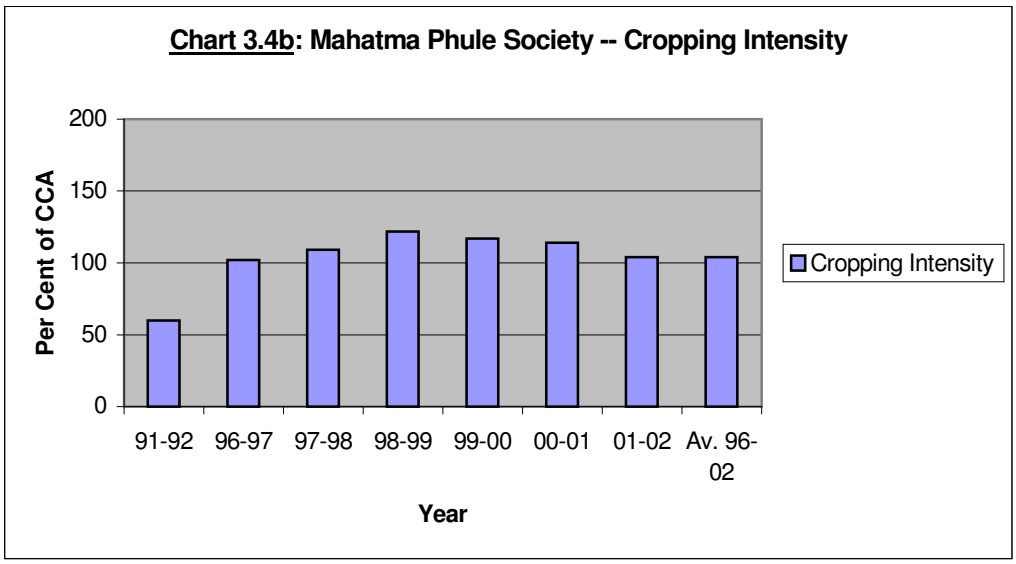
Chart 3.4b: Mahatma Phule Society -- Cropping Intensity
Per Cent of CCA
200
150
100
50
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Av. 96-02
Year
Cropping Intensity

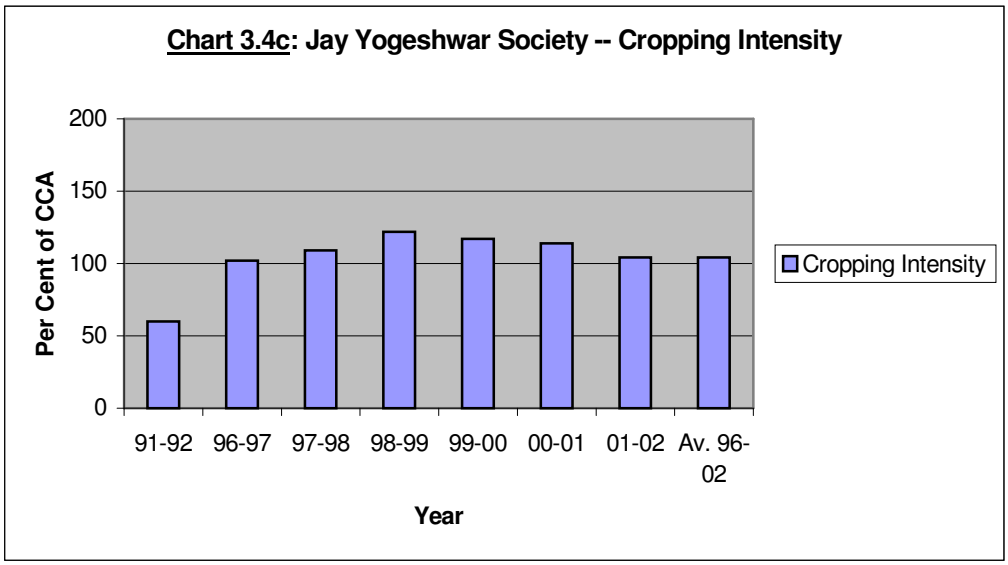
Chart 3.4c: Jay Yogeshwar Society -- Cropping Intensity
Per Cent of CCA
200
150
100
50
0
91-92
96-97
97-98
98-99
99-00
00-01
01-02
Av. 96-02
Year
Cropping Intensity

Crop pattern

The cropping pattern in the Ozar societies over the reference period is presented below in Tables 3.1a, b and c. The overall change is summarised in Table 3.2 and the consequent change of crop priorities in Table 3.3.

In Banganga, the change in crop pattern is not as pronounced as it is in the other two societies. The main losers here are Bajra in kharif and surprisingly, sugarcane. The sugarcane area even earlier was anyway quite small and it makes a difference of only a couple of hectares. The crops that have gained are vegetables – in all the seasons, onion, grapes and pulses. Groundnut has maintained its area.

Table 3.1a: Banganga Society: Crop pattern (ha under crop)

Crop	Area under crop in ha for the year							
	91-92	96-97	97-98	98-99	99-00	00-01	01-02	Av. 96-02
Sugarcane	*3.17*	7.83	1.60	1.00	1.00	2.00	1.00	2.41
Grapes	*49.28*	57.41	57.50	58.00	60.00	61.30	71.40	60.94
Ground nut	*36.26*	45.37	52.63	40.00	35.00	37.50	20.00	38.42
Bajra	*26.37*	11.84	3.50	4.50	3.00	–	–	3.81
Pulses	*0.60*	5.85	2.25	2.00	1.00	1.50	3.00	2.60
Vegetables kharif	*20.22*	25.08	29.25	45.00	50.00	45.30	52.50	41.19
Soybean	–	1.67	1.23	1.00	–	0.50	–	0.73
Wheat	*40.90*	55.54	56.21	45.50	47.00	40.50	51.03	49.30
Chick pea	*1.40*	2.52	2.25	2.00	2.00	1.00	2.35	2.02
Vegetables rabi	*3.00*	15.25	27.50	29.00	18.00	25.00	7.10	20.31
Onion kharif	*0.10*	0.10	0.08	0.50	–	–	–	0.11
Onion rabi	*1.30*	14.64	17.00	17.14	25.00	15.00	11.20	16.66
Onion summer	–	–	–	–	–	10.00	–	1.67
Vegetables summer	*1.76*	–	–	18.80	1.00	–	–	3.30
Total	*184.36*	243.10	251.00	264.44	243.00	239.60	219.58	243.45

In Mahatma Phule society, the change is more pronounced. The major loser here again is Bajra in kharif and a few ha in rabi vegetables and kharif onion. Sugarcane area has increased, but the increase is only a few hectares. The major increase of course is again grapes, where the area has increased threefold. Rabi and summer onions and kharif vegetables have also registered large increases. A degree of experimentation is also evident. Sugar cane, pulses and summer vegetables were tried out, but not continued. Summer vegetables were found to be too sensitive to price and initial expectations of high prices were belied. Grapes were found to be comparatively more stable and profitable as compared to sugarcane and pulses.

Table 3.1b: Mahatma Phule Society: Crop pattern (ha under crop)

Crop	Area under crop in ha for the year							
	91-92	96-97	97-98	98-99	99-00	00-01	01-02	Av. 96-02
Sugarcane	*3.55*	5.64	4.20	11.50	14.90	11.80	8.60	9.44
Grapes	*8.61*	26.32	27.09	33.67	36.47	39.99	44.43	34.66
Ground nut	*32.95*	41.29	45.15	36.40	34.35	41.82	29.95	38.16
Bajra	*41.68*	22.51	15.20	5.00	2.00	0.20	0.40	7.55
Pulses	*4.65*	9.52	3.25	3.00	3.80	1.50	7.10	4.70
Vegetables kharif	*11.16*	38.57	32.84	46.95	32.75	53.63	40.32	40.84
Soybean	–	1.20	2.40	1.10	6.60	0.50	0.00	1.97
Wheat	*41.57*	50.25	59.25	54.40	46.60	37.32	53.10	50.15
Chick pea	*8.50*	13.84	10.00	14.80	10.80	9.10	5.03	10.60
Vegetables rabi	*21.00*	10.04	14.80	15.25	10.60	11.80	3.00	10.92
Onion kharif	*6.00*	–	–	–	–	–	–	–
Onion rabi	*1.00*	3.20	2.20	5.00	15.40	3.00	5.21	5.67
Onion summer	*0.90*	3.00	3.15	7.25	6.10	5.70	3.16	4.73
Vegetables summer	*0.90*	0.80	16.22	4.00	1.60	0.80	1.25	4.11
Total	*182.47*	226.18	235.75	238.32	221.97	217.16	201.55	223.49

In Jay Yogeshwar society, the trend is similar. The major loser here is again kharif Bajra, but in the kharif, Groundnut shows a significant increase, from 50 to over 120 ha. The sugarcane area registers a comparatively larger increase and crosses double figures. The major crops that gain are the same, grapes, kharif and rabi vegetables, and onions. Kharif vegetables register an especially large increase. Summer crop area is relatively much smaller.

Table 3.1c: Jay Yogeshwar Society: Crop pattern (ha under crop)

Crop	Area under crop in ha for the year							
	91-92	96-97	97-98	98-99	99-00	00-01	01-02	Av. 96-02
Sugarcane	*4.63*	21.32	5.40	17.12	17.10	9.40	4.00	12.39
Grapes	*18.72*	45.22	50.50	59.55	59.59	69.09	86.41	61.73
Ground nut	*52.41*	128.43	130.98	116.39	117.91	117.13	121.75	122.10
Bajra	*118.41*	85.72	89.00	62.06	42.98	13.80	24.60	53.03
Pulses	*8.00*	20.78	11.62	9.27	15.15	17.75	10.85	14.24
Vegetables kharif	*24.85*	97.53	106.59	128.01	138.69	128.10	131.10	121.67
Soybean	–	1.31	1.30	2.06	0.20	2.80	0.70	1.40

Table 3.1c: Jay Yogeshwar Society: Crop pattern (ha under crop)

Crop	Area under crop in ha for the year							
	91-92	96-97	97-98	98-99	99-00	00-01	01-02	Av. 96-02
Wheat	*116.29*	112.79	136.12	112.69	140.37	78.88	129.19	118.34
Chick pea	*19.57*	29.17	43.09	36.64	35.91	17.50	37.25	33.26
Vegetables rabi	*8.64*	29.58	64.60	111.35	57.47	33.19	36.04	55.37
Onion kharif	*7.41*	5.50	10.33	10.95	–	–	0.70	4.58
Onion rabi	*16.70*	39.02	65.26	47.51	73.71	26.75	42.60	49.14
Onion summer	–	9.05	4.00	12.00	16.94	5.80	4.90	8.78
Vegetables summer	*0.25*	1.55	3.55	2.40	2.00	1.00	3.80	2.38
Total	395.88	626.97	722.34	728.00	718.02	521.19	633.89	658.40

The major changes can be summed up as follows. First there is a shift from coarser cereals like Bajra to finer staples like wheat. Second, there is a shift from seasonals to perennials. Third, there is a shift from subsistence or low value crops to high value crops. The only exception here is Groundnut in Jay Yogeshwar, though that too can be treated as a somewhat high value crop. And lastly, there is a shift to summer preference over rabi within these changes. This is most evident in Mahatma Phule, where the rabi ` cut' is most established.

Table 3.2: Ozar Societies – Change in Area under Different Crops (91-92 compared with average for 96-97 to 01-02)

Crop	Banganga Society	Mahatma Phule Society	Jay Yogeshwar Society
Sugarcane	-24 %	166 %	168 %
Grapes	24 %	303 %	230 %
Ground nut	6 %	16 %	133 %
Bajra	-86 %	-82 %	-55 %
Pulses	333 %	1 %	78 %
Vegetables kharif	104 %	266 %	390 %
Wheat	21 %	21 %	2 %
Chick pea	44 %	25 %	70 %
Vegetables rabi	577 %	-48 %	541 %
Onion kharif	13 %	-100 %	-38 %
Onion rabi	1,182 %	467 %	194 %
Onion summer	N.A.	425 %	N.A.
Vegetables summer	88 %	357 %	853 %
Total	32 %	22 %	66 %

Table 3.3: Ozar Societies – Change in Crop priorities

Priority	Jay Yogeshwar Society				Mahatma Phule Society				Banganga Society			
	91-92		Av. 96-02		91-92		Av. 96-02		91-92		Av. 96-02	
	Crop	Area (ha)	Crop	Area (ha)	Crop	Area (ha)	Crop	Area (ha)	Crop	Area (ha)	Crop	Area (ha)
1	Bajra	118.41	Ground nut	122.10	Bajra	41.68	Wheat	50.15	Grapes	49.28	Grapes	60.94
2	Wheat	116.29	Vegetables kharif	121.67	Wheat	41.57	Vegetables kharif	40.84	Wheat	40.90	Wheat	49.30
3	Ground nut	52.41	Wheat	118.34	Ground nut	32.95	Ground nut	38.16	Ground nut	36.26	Vegetables kharif	41.19
4	Vegetables kharif	24.85	Grapes	61.73	Vegetables rabi	21.00	Grapes	34.66	Bajra	26.37	Ground nut	38.42
5	Chick pea	19.57	Vegetables rabi	55.37	Vegetables kharif	11.16	Vegetables rabi	10.92	Vegetables kharif	20.22	Vegetables rabi	20.31
6	Grapes	18.72	Bajra	53.03	Grapes	8.61	Chick pea	10.60	Sugarcane	3.17	Onion rabi	16.66
7	Onion rabi	16.70	Onion rabi	49.14	Chick pea	8.50	Sugarcane	9.44	Vegetables rabi	3.00	Bajra	3.81
8	Vegetables rabi	8.64	Chick pea	33.26	Onion kharif	6.00	Bajra	7.55	Vegetables summer	1.76	Vegetables summer	3.30
9	Pulses	8.00	Pulses	14.24	Pulses	4.65	Onion rabi	5.67	Chick pea	1.40	Pulses	2.60
10	Onion kharif	7.41	Sugarcane	12.39	Sugarcane	3.55	Onion summer	4.73	Onion rabi	1.30	Sugarcane	2.41
11	Sugarcane	4.63	Onion summer	8.78	Onion rabi	1.00	Pulses	4.70	Pulses	0.60	Chick pea	2.02
12	Vegetables summer	0.25	Onion kharif	4.58	Onion summer	0.90	Vegetables summer	4.11	Onion kharif	0.10	Onion summer	1.67
13	Soybean	0.00	Vegetables summer	2.38	Vegetables summer	0.90	Soybean	1.97	Soybean	0.00	Soybean	0.73
14	Onion summer	0.00	Soybean	1.40	Soybean	0.00	Onion kharif	0.00	Onion summer	0.00	Onion kharif	0.11

Water Use and Duty

The data on water use and duty are presented in Table 3.4 below. What the data show is that Mahatma Phule has the highest canal use duty followed by Jay Yogeshwar, while Banganga has a significantly lower canal use duty. However, if we consider conjoint use, then Banganga has the highest duty, in fact, a figure that far outstrips the other societies.

This contrast merits some discussion, especially in light of the fact, that co-management initiatives are stronger in the other two societies. A look at the figures will show that while the conjoint use duty in Banganga has been generally higher all through there is a significant rise in conjoint duty since 1998-99. The explanation lies in the particular situation in Banganga. First, Banganga has had a better recharge from the Banganga river itself, so that local harvested water that does not appear in the records is also contributing to irrigation here. Secondly, around 1998-99 after discussion with SPK the society had undertaken a revival of the old channel network and improving the recharge potential by channelising some of the surpluses in the river through these channels. This has led to an increased circulation of water within the area. In fact the poor canal use duty is the other side of the coin, because the same recharge network. Lastly, the better soils in Banganga also allow greater water retention as soil moisture and need relatively fewer waterings.

Table 3.4: Ozar societies – Water Use and Duty

	96-97	**97-98**	**98-99**	**99-00**	**00-01**	**01-02**
Banganga society						
No. of rotations	6	6	6	5	4	3
Direct canal water use '000 m^3	682	541	342	308	220	289
Duty (Canal water use) ha/day-cusec	1.11	0.94	0.83	0.86	1.47	1.08
Water released into check dams '000 m^3	–	–	–	–	20	–
Duty (Conjoint water use) '000 m^3	682	541	342	308	240	289
Conjoint water use duty ha/day-cusec	2.92	3.26	5.34	5.55	5.76	3.71
Rabi water use % of canal water use	74.19	56.11	54.29	62.70	29.59	70.34
Mahatma Phule society						
No. of rotations	6	6	6	5	4	3
Direct canal water use '000 m^3	724	457	563	509	364	352
Duty (Canal water use) ha/day-cusec	1.40	1.51	1.61	1.38	1.95	1.30
Water released into check dams '000 m^3	122	210	120	147	49	59
Duty (Conjoint water use) '000 m^3	846	668	682	656	413	411
Conjoint water use duty ha/day-cusec	1.74	2.35	2.51	2.39	2.54	2.09
Rabi water use % of canal water use	78.32	50.55	41.22	54.10	47.93	69.64
Jay Yogeshwar society						
No. of rotations	6	6	6	5	4	3
Direct canal water use '000 m^3	1,499	1,223	1,010	1,260	680	751
Duty (Canal water use) ha/day-cusec	1.16	1.07	1.34	1.16	1.63	1.30
Water released into check dams '000 m^3	–	–	–	–	–	–
Duty (Conjoint water use) '000 m^3	1,499	1,223	1,010	1,260	680	751
Conjoint water use duty ha/day-cusec	1.82	2.11	3.67	2.90	2.48	2.72
Rabi water use % of canal water use	84.01	58.00	51.09	66.99	62.95	76.22

Changes in production and income

What impact has the change in crop pattern had on the production and income accruing to farmers? The society has also maintained a record of the estimated production and income at the then prevailing average prices. These data are presented in Table 3.5 below.

In Banganga society, we see production increasing steadily but production per ha as well as total gross income have been increasing rather slowly. The latter trend may not be as bad if we leave the last two bad years out of the reckoning. However, in spite of this slow but steady increase, the total gross income per ha shows a *fall*, even if we leave out the last two years. Of course that need not mean a fall in the income per household, since the gross cropped area has also increased without a change in the number of households. Mahatma Phule and Jay Yogeshwar both show firm increases in all the parameters recorded.

The reason for this as perceived by SPK, is that prices for some of the crops have been dropping heavily so that the overall impact of increased production has been offset by this factor. We also need to note that Banganga has started with a very high figure of income per ha. This indicates a much higher proportion of high value cash crops, but consequently also become subject to the fluctuations in prices for such crops.

Table 3.5: Ozar Societies – Change in Production and Income

	Year								
	91-92	**96-97**	**97-98**	**98-99**	**99-00**	**00-01**	**01-02**	**Av. 96-02**	**Av. 96-01**
Banganga Society									
Production (T)	2,793	4,034	3,862	4,483	4,453	4,118	4,087	4,173	4,190
Production (T/ha)	15.1	16.6	15.38	16.95	18.32	17.18	18.61	17.17	16.89
Income (Rs ' 000)	22,930	29,669	28,137	36,470	26,058	28,225	5,208	25,628	29,712
Income (Rs ' 000/ha)	124	122	112	138	107	118	124	104	119
Mahatma Phule Society									
Production (T)	1,846	3,409	3,245	4,636	4,418	4,754	3,793	4,043	4,092
Production (T/ha)	10.11	15.07	13.8	19.45	19.9	21.36	18.57	18.03	17.92
Income (Rs ' 000)	7,500	21,109	18,307	20,265	18,577	23,271	8,254	18,297	20,306
Income (Rs ' 000/ha)	41	93	77	85	83	104	40	80	88
Jay Yogeshwar Society									
Production (T)	2,742	9,319	9,318	12,182	11,650	9,201	9,579	10,208	10,334
Production (T/ha)	6.92	14.86	12.89	16.73	16.22	17.65	15.06	15.57	15.67
Income (Rs ' 000)	21,169	51,026	48,537	69,031	49,477	47,734	9,291	45,849	53,161
Income (Rs ' 000/ha)	53	81	67	94	69	91	14	69	80

Transactions with the Government

The Ozar societies' transactions with the Government are presented in Table 3.6. The societies have stopped receiving the repair and Maintenance subsidy that they used to receive from the government. However, the societies have spent a lot on the repair and maintenance of the system, much more than the subsidies the government has provided. This demonstrates that the societies are capable of taking up this task and seeing it through.

Table 3.6: Ozar Societies – Transactions with the Government

	Transactions in Rs. For the year					
	96-97	**97-98**	**98-99**	**99-00**	**00-01**	**01-02**
Banganga Society						
Subsidy for Repair and Maintenance	3,460	3,460	3,460	3,460	3,460	–
Actual Expense on Repair and Maintenance	15,375	32,612	18,245	13,000	38,000	51,000
Water charges paid	13,604	28,056	23,329	15,421	15,163	18,170
Local fund contribution	2,721	5,611	4,666	3,034	3,032	3,634
Exemption on water charges	3,401	7,014	5,832	3,855	3,791	4,543
Total payment to Government	12,924	26,653	22,163	14,600	14,404	17,262
Mahatma Phule Society						
Subsidy for Repair and Maintenance	5,440	5,440	5,440	5,440	5,440	–
Actual Expense on Repair and Maintenance	11,496	23,479	12,984	16,910	17,000	23,635
Water charges paid	16,480	33,508	29,929	33,870	34,611	29,782
Local fund contribution	3,294	6,701	5,996	6,773	6,922	5,956
Exemption on water charges	4,120	8,377	7,482	8,468	8,653	7,446
Total payment to Government	15,654	31,832	28,443	32,176	32,880	28,293
Jay Yogeshwar Society						
Subsidy for Repair and Maintenance	9,520	9,520	9,520	9,520	9,520	–
Actual Expense on Repair and Maintenance	16,392	14,822	37,031	25,249	37,000	42,000
Water charges paid	35,410	60,241	52,839	48,429	55,633	38,038
Local fund contribution	7,082	12,047	10,568	9,686	11,136	7,608
Exemption on water charges	8,853	15,060	13,210	12,107	13,908	9,510
Total payment to Government	33,640	57,228	50,197	46,008	52,861	36,137

4.

The Ozar Water User Societies: The Impact – From the Survey

As the earlier section shows, the Ozar societies have maintained over the years a meticulous record that yields a wealth of information. The objective of this separate survey was to supplement this information with some more information that the record cannot easily answer, mainly because it maintains its record on the basis of beneficiaries. The survey collected information on a household basis, since in practice the social unit is not the individual beneficiary, but the household, which may consist of more than one beneficiary. It was decided to cover all of Mahatma Phule society and a selected sample from the other two societies. The survey sample finally covered a total of 96 households from Mahatma Phule covering about 80% of the beneficiaries, and 17 households from Banganga and 34 from Jay Yogeshwar covering about 10% of the beneficiaries each.

Before we turn to the findings of the survey, we would like to mention one general feature of the findings. Generally speaking, the information given by farmers confirms the trends the society' s records show. What is also as important, though it may appear somewhat mundane, is that *on the whole, the impact has been positive and of a similar nature for all farmers.* This itself is an important corroboration of the trend. With this prefatory remark we may now turn to the findings of the survey.

All the tables and charts in this section are based on the data gathered from the field survey.

Demographic features

The overall household size is between 7 and 8, but there is a significant number of small households. (See Table 4.1a below.) There are 50 or about one-third households comprising 5 or fewer persons. The number of children in the household goes up with household size.

Some of the incidental information the data yields is on the sex ratio in the population. This more than strikingly corroborates the national disturbing trend of a fall in the sex ratio that the recent census has uncovered. The overall sex ratio is 818, though the median group of 6 to 10 size does show a figure of 926. In children the overall ratio falls to 722. The lowest values are recorded for the lowest household size with an overall sex ratio of 674, a sex ratio of 743 for adults and as low as 429 for children. A small family does not always seem to be good news for women!

The data relating demographic details to operational holding size also show a similar trend. (See Table 4.1b below.) It is the middle groups who show better sex ratios and the extremes show a much lower sex ratio. The lowest ratio is seen in the lowest landholding group (those who do not operate their land) with a sex ratio of 688 overall, 818 for adults and 400 for children.

Table 4.1a: Demographic details of sample (according to HH size)									
HH size class	**No. of House holds**	**Male Adults**	**Female Adults**	**Male Children**	**Female Children**	**Total persons**	**Sex Ratio**		
							Adults	**Children**	**Total**
Up to 5	50	101	75	28	12	216	743	429	674
		(2.02)	(1.50)	(0.56)	(0.24)	(4.32)			
6 to 10	67	174	180	95	69	518	1,034	726	926
		(2.60)	(2.69)	(1.42)	(1.03)	(7.73)			
11 to 15	26	113	95	62	51	321	841	823	834
		(4.35)	(3.65)	(2.38)	(1.96)	(12.35)			
16 and above	4	24	20	20	16	80	833	800	818
		(6.00)	(5.00)	(5.00)	(4.00)	(20.00)			
Total	147	412	370	205	148	1135	898	722	840
		(2.80)	(2.52)	(1.39)	(1.01)	(7.72)			

Figures in parentheses are per HH values

Table 4.1b: Demographic details of sample (according to operational holding size)

LH Class	**No. of House holds**	**Male Adults**	**Female Adults**	**Male Children**	**Female Children**	**Total persons**	**Sex Ratio**		
							Adults	**Children**	**Total**
No land	4	11	9	5	2	27	818	400	688
		(2.75)	(2.25)	(1.25)	(0.50)	(6.75)			
Up to 0.5 ha	9	21	17	8	4	50	810	500	724
		(2.33)	(1.89)	(0.89)	(0.44)	(5.56)			
0.51 to 1 ha	33	83	73	39	30	225	880	769	844
		(2.52)	(2.21)	(1.18)	(0.91)	(6.82)			
1.01 to 2 ha	49	140	122	66	53	381	871	803	850
		(2.86)	(2.49)	(1.35)	(1.08)	(7.78)			
2.01 to 3 ha	30	76	80	48	32	236	1,053	667	903
		(2.53)	(2.67)	(1.60)	(1.07)	(7.87)			
3.01 to 5 ha	14	45	41	21	14	121	911	667	833
		(3.21)	(2.93)	(1.50)	(1.00)	(8.64)			
Over 5 ha	8	36	28	18	13	95	778	722	759
		(4.50)	(3.50)	(2.25)	(1.63)	(11.88)			
Total	147	412	370	205	148	1135	898	722	840
		(2.80)	(2.52)	(1.39)	(1.01)	(7.72)			

Figures in parentheses are per HH values

Landholding

The data on land ownership in the sample is presented in Table 4.2a, b and c below. On the whole, for the sample group land assets within the command have increased for almost all groups. This is true for agricultural land within as well outside the command. The increases are marginal, but turn up in all the groups. This implies that some farmers from outside the sample group have sold their land. In discussion with the SPK and the society office bearers it turned out that those who had migrated and those who were not tilling their land have been selling their land to others in the command.

Non-agricultural land within the command held by the sample group has, in contrast, decreased. The developing township in Ozar and the consequent urban pulls are responsible for this, and many farmers are thinking of converting their land lying near the township to non-agricultural land (NA) land and selling it to builders. However, this trend does not seem to have taken on. Farmers say that some of the expansion of cultivable area, again small but significant, has been on account of land improvement and bringing previously uncultivated land into cultivation.

A consideration of how much land is held by which group (see Table 4.2b below) shows a certain concentration of landholding but does not display the classic pyramid in which the proportion of population steadily rises when correlated with holding size. The structure is more of a middle farmer dominated pattern, thick in the middle with the proportions tapering off towards both extremes. Almost half of the land is owned by half of the households in the middle farmer range (1 to 3 ha). The big farmers (more than 3 ha) own 32% while the small and marginal farmers (less than 1 ha) own 18%. We may characterise this as a middle farmer economy with some concentration of land.

(Note: The appearance of owned land in front of the ` No land' group merits some discussion. Truly speaking, there are no landless in the sample. The classification is based on *operational* holding, that is, land owned less land leased out plus land leased in. Hence the seemingly anomalous entry.)

Table 4.2a: Land ownership of sample (according to operational holding size)

LH Class	No. of HH	Agricultural land				Other land		Total land	
		Within command		Outside command		Within command			
		Before	After	Before	After	Before	After	Before	After
No land	4	4.00	6.12	–	0.02	–	–	4.00	6.14
		(1.00)	(1.53)	–	(0.01)	–	–	(1.00)	(1.54)
Up to 0.5 ha	9	3.48	3.48	–	2.00	–	–	3.48	5.48
		(0.39)	(0.39)	–	(0.22)	–	–	(0.39)	(0.61)
0.51 to 1 ha	33	23.52	25.29	1.80	7.80	0.84	0.54	26.16	33.63
		(0.71)	(0.77)	(0.05)	(0.24)	(0.03)	(0.02)	(0.79)	(1.02)
1.01 to 2 ha	49	74.67	78.96	6.03	12.03	1.44	1.04	82.14	92.03
		(1.52)	(1.61)	(0.12)	(0.25)	(0.03)	(0.02)	(1.68)	(1.88)
2.01 to 3 ha	30	58.34	59.15	11.60	10.80	1.56	0.87	71.50	70.82
		(1.94)	(1.97)	(0.39)	(0.36)	(0.05)	(0.03)	(2.38)	(2.36)
3.01 to 5 ha	14	33.98	32.38	16.60	14.00	3.12	2.32	53.70	48.70
		(2.43)	(2.31)	(1.19)	(1.00)	(0.22)	(0.17)	(3.84)	(3.48)
Over 5 ha	8	45.86	50.86	4.00	4.40	5.89	1.69	55.75	56.95
		(5.73)	(6.36)	(0.50)	(0.55)	(0.74)	(0.21)	(6.97)	(7.12)
Total	147	243.85	256.24	40.03	51.05	12.85	6.46	296.73	313.75
		(1.66)	(1.74)	(0.27)	(0.35)	(0.09)	(0.04)	2.02	2.13

Figures in parentheses are per HH values

Table 4.2b: Proportion of landholding according to operational holding size

Size of landholding	No land	Up to 0.5 ha	0.51 to 1 ha	1.01 to 2 ha	2.01 to 3 ha	3.01 to 5 ha	Over 5 ha	Total
Per cent of households	2.72	6.12	22.45	33.33	20.41	9.52	5.44	100.00
Per cent of land	2.39	1.36	9.87	30.81	23.08	12.64	19.85	100.00

A look at the table correlating land ownership to society shows that average holding sizes lie in a small range with Banganga showing the smallest values per household, followed closely by Mahatma Phule and followed at some distance by Jay Yogeshwar. It also shows that the net increase in agricultural land within the command is higher for Banganga and Jay Yogeshwar while it is practically zero for Mahatma Phule. Too much should not however be read into this since the Jay Yogeshwar samples are smaller and if the sample size were to be sufficiently enlarged the sellers would also become part op the sample. For that very reason, it is more interesting that the Mahatma Phule figures show an *average* increase in agricultural land *outside* the command of almost half an acre per household.

Table 4.2c: Land ownership of sample (according to society)

WUA	No. of HH	Agricultural land				Other land		Total land	
		Within command		Outside command		Within command			
		Before	After	Before	After	Before	After	Before	After
Banganga	17	23.37	24.57	4.80	4.80	0.75	0.55	28.92	29.92
		(1.37)	(1.45)	(0.28)	(0.28)	(0.04)	(0.03)	(1.70)	(1.76)
Mahatma Phule	96	152.00	152.86	28.23	44.25	3.70	3.81	183.93	200.92
		(1.58)	(1.59)	(0.29)	(0.46)	(0.04)	(0.04)	(1.92)	(2.09)
Jay Yogeshwar	34	68.48	78.81	7.00	2.00	8.40	2.10	83.88	82.91
		(2.01)	(2.32)	(0.21)	(0.06)	(0.25)	(0.06)	(2.47)	(2.44)
Total	147	243.85	256.24	40.03	51.05	12.85	6.46	296.73	313.75
		(1.66)	(1.74)	(0.27)	(0.35)	(0.09)	(0.04)	(2.02)	(2.13)

Figures in parentheses are per HH values

Livestock

The information on livestock shows somewhat of an unexpected result, that livestock population has fallen greatly after the formation of the societies. (Table 4.3a and 4.3b.) From 4.5 animal units per household, it has fallen to a little more than half its previous value at 2.6 animal units per household. This trend is a secular trend that cuts across landholding size, with the sole exception of the lowest group who seem to have managed to buy two additional milch animals.

Table 4.3a: Livestock owned by sample (according to operational holding size)

LH Class	No. of house holds	Bullocks		Milch animals		Small animals		Barren cattle		Calves		Total animals	
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
No land	4	2	2	1	3	–	–	–	–	–	–	3.25	5.75
		(0.5)	(0.5)	(0.3)	(0.8)	–	–	–	–	–	–	(0.8)	(1.4)
Up to 0.5 ha	9	10	7	3	6	50	–	–	1	–	–	38.75	15.30
		(1.1)	(0.8)	(0.3)	(0.7)	(5.6)	–	–	(0.1)	–	–	(4.3)	(1.7)
0.51 to 1 ha	33	48	33	47	23	16	4	1	4	–	–	115.55	66.95
		(1.5)	(1.0)	(1.4)	(0.7)	(0.5)	(0.1)	(0.0)	(0.1)	–	–	(3.5)	(2.0)
1.01 to 2 ha	49	84	65	114	38	7	7	31	5	4	7	256.80	123.50
		(1.7)	(1.3)	(2.3)	(0.8)	(0.1)	(0.1)	(0.6)	(0.1)	(0.1)	(0.1)	(5.2)	(2.5)
2.01 to 3 ha	30	56	42	37	28	7	2	8	14	–	1	112.15	89.70
		(1.9)	(1.4)	(1.2)	(0.9)	(0.2)	(0.1)	(0.3)	(0.5)	–	(0.0)	(3.7)	(3.0)
3.01 to 5 ha	14	30	17	31	18	–	1	–	–	–	–	68.75	40.00
		(2.1)	(1.2)	(2.2)	(1.3)	–	(0.1)	–	–	–	–	(4.9)	(2.9)
Over 5 ha	8	21	21	18	13	6	–	17	6	–	3	60.10	43.55
		(2.6)	(2.6)	(2.3)	(1.6)	(0.8)	–	(2.1)	(0.8)	–	(0.4)	(7.5)	(5.4)
Total	147	251	187	251	129	86	14	57	30	4	11	655.35	384.75
		(1.7)	(1.3)	(1.7)	(0.9)	(0.6)	(0.1)	(0.4)	(0.2)	(0.0)	(0.1)	(4.5)	(2.6)

Figures in parentheses are per HH values

Table 4.3b: Livestock owned by sample (according to society)

WUA	No. of house holds	Bullocks		Milch animals		Small animals		Barren cattle		Calves		Total animals	
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
Banganga	17	26	17	70	9	–	–	30	9	–	–	137.50	35.45
		(1.5)	(1.0)	(4.1)	(0.5)	–	–	(1.8)	(0.5)	–	–	(8.1)	(2.1)
Mahatma Phule	96	146	105	115	88	59	4	1	3	–	2	320.05	220.40
		(1.5)	(1.1)	(1.2)	(0.9)	(0.6)	(0.0)	(0.0)	(0.0)	–	(0.0)	(3.3)	(2.3)
Jay Yogeshwar	34	79	65	66	32	27	10	26	18	4	9	197.80	128.90
		(2.3)	(1.9)	(1.9)	(0.9)	(0.8)	(0.3)	(0.8)	(0.5)	(0.1)	(0.3)	(5.8)	(3.8)
Total	147	251	187	251	129	86	14	57	30	4	11	655.35	384.75
		(1.7)	(1.3)	(1.7)	(0.9)	(0.6)	(0.1)	(0.4)	(0.2)	(0.0)	(0.1)	(4.5)	(2.6)

Figures in parentheses are per HH values

Most of this reduction is in the number of milch animals, which has fallen to almost half its previous value, followed by a reduction in the number of bullocks, which has fallen to about 70% of its

previous value. The trend is the most pronounced in Banganga. It earlier had the highest number 8 animal units per household and has now the lowest, only 2. In the case of milch animals, the 17 households earlier had 70 milch animals and now have only 9.

What may have been the reasons for this seemingly anomalous trend? From our discussions at Ozar it would seem that there are two main factors responsible for this. First, with a greater assurance of irrigation, other higher value options to dairying like grapes, floriculture, vegetables, etc., become more attractive for reasons of income and being relatively simpler to manage. Similarly, increasing incomes have allowed farmers to purchase tractors and a number of operations for which bullocks were needed can now be carried out by hiring in the necessary equipment.

Devices and vehicles owned

One of the indicators of how one' s way of life has changed is the change in devices, machinery and equipment that one uses. We collected information on some devices that would reflect the changes taking place in the farmers' lives. The information is presented for devices and vehicles in Tables 4.4a and b and for pumps and tractors, etc., in Tables 4.5a and b.

Table 4.4a: Devices and vehicles owned by sample (according to operational holding size)

LH Class	No. of House holds	LPG stove		Biogas		Mobikes		Motor vehicles		Bullock carts	
		Before	After	Before	After	Before	After	Before	After	Before	After
No land	4	2	4	–	–	1	6	–	1	1	1
		(0.50)	(1.00)	–	–	(0.25)	(1.50)	–	(0.25)	(0.25)	(0.25)
Up to 0.5 ha	9	0	8	–	–	–	4	–	–	5	3
		–	(0.89)	–	–	–	(0.44)	–	–	(0.56)	(0.33)
0.51 to 1 ha	33	10	33	1	2	10	23	–	4	21	16
		(0.30)	(1.00)	(0.03)	(0.06)	(0.30)	(0.70)	–	(0.12)	(0.64)	(0.48)
1.01 to 2 ha	49	11	52	–	1	6	44	2	8	31	28
		(0.22)	(1.06)	–	(0.02)	(0.12)	(0.90)	(0.04)	(0.16)	(0.63)	(0.57)
2.01 to 3 ha	30	14	32	2	1	10	28	1	5	23	24
		(0.47)	(1.07)	(0.07)	(0.03)	(0.33)	(0.93)	(0.03)	(0.17)	(0.77)	(0.80)
3.01 to 5 ha	14	6	17	3	2	4	14	1	3	12	10
		(0.43)	(1.21)	(0.21)	(0.14)	(0.29)	(1.00)	(0.07)	(0.21)	(0.86)	(0.71)
Over 5 ha	8	5	11	–	–	3	12	–	5	8	8
		(0.63)	(1.38)	–	–	(0.38)	(1.50)	–	(0.63)	(1.00)	(1.00)
Total	147	48	157	6	6	34	131	4	26	101	90
		(0.33)	(1.07)	(0.04)	(0.04)	(0.23)	(0.89)	(0.03)	(0.18)	(0.69)	(0.61)

Figures in parentheses are per HH values

The information shows a very significant improvement in the overall standard of living. Whereas earlier, on an average, one out of three households had an LPG stove, now all households except one have at least one. This implies that though firewood fuel may not been eliminated, its importance has certainly decreased. This again has its implications for policy making. For environmental regeneration, better availability and greater assurance of LPG supply may be as important a measure as social forestry!

Biogas expectedly has increased only among the middle and large farmers. The number of mobikes has gone up for all groups from an average of one in four to nine in ten households. The number of bullock carts has fallen marginally. What is striking is the increase in the number of motorised four-wheel vehicles. It should be remembered that these do not include tractors and the like; they are dealt with separately below. From about three in a hundred households their number has now increased to almost one in every five households. That is a big leap indeed, though the increase is expectedly confined to the middle and big farmers. We had the occasion to discuss this change at Ozar and from the discussion one may conclude that the vehicles are mainly the sturdy jeep-like varieties that serve as transport vehicles as well. (Had we realised the significance of this trend earlier, we may have included information on type of four-wheeler as well.) The switch from bulk crops to crops like grapes or vegetables where low volumes have to transported often, a jeep is a wise investment that takes care of many functions including family outings, transport of produce, to hiring it out in its idle time. A good investment all round.

So far as the division between societies is concerned the phenomenon is shared by all the societies and seems to be a general one. There are slight differences between the societies, for example, Mahatma Phule has the highest number of mobikes per household, while Jay Yogeshwar has the highest number of four-wheelers, etc., but the differences are small and could very be ironed out by larger sampling. What is interesting and valid is the broad trend the information reveals.

Table 4.4b: Devices and vehicles owned by sample (according to society)

WUA	No. of House holds	LPG stove		Biogas		Mobikes		Motor vehicles		Bullock carts	
		Before	After	Before	After	Before	After	Before	After	Before	After
Banganga	17	10	18	–	–	10	14	1	3	10	11
		(0.59)	(1.06)	–	–	(0.59)	(0.82)	(0.06)	(0.18)	(0.59)	(0.65)
Mahatma Phule	96	34	109	5	5	21	94	3	19	61	50
		(0.35)	(1.14)	(0.05)	(0.05)	(0.22)	(0.98)	(0.03)	(0.20)	(0.64)	(0.52)
Jay Yogeshwar	34	4	30	1	1	3	23	–	4	30	29
		(0.12)	(0.88)	(0.03)	(0.03)	(0.09)	(0.68)	–	(0.12)	(0.88)	(0.85)
Total	147	48	157	6	6	34	131	4	26	101	90
		(0.33)	(1.07)	(0.04)	(0.04)	(0.23)	(0.89)	(0.03)	(0.18)	(0.69)	(0.61)

Figures in parentheses are per HH values

Pumps and equipment owned

The information on pumps and equipment is presented in Tables 4.5a and 4.5b. The pumps tell a familiar and expected story. Diesel pumps are out, electric pump-motors are in. The number of electric pumps has almost doubled, from two per every three households it has increased to six per five households and this increase too is secular, cutting across holding size, though the average number of pumps per household also secularly rises with holding size. The co-management strategy has a lot to do with this, since, with it, the pump becomes a necessary instrument of production and has to be acquired by the small as well as the large farmers.

The number of tractors, power tillers, sprayers have been lumped into one group. This relates to the use of sophisticated and mechanised equipment in agriculture. Here too we see a large increase, from one every eight households to one every alternate household. Moreover, this is not confined to the larger group alone, though the values secularly increase from one in every four households in the lowest household group to three for every two households in the highest holding group. Here too a shift is evident from draft animal power and human labour to mechanised operations.

Unlike other items, mechanical equipment shows up a contrast between the three societies. So far as pumps are concerned, the trend is very similar and the values are not too different. However, in respect of mechanical equipment there is a distinct difference. While Banganga has more than one mechanical equipment per household, Jay Yogeshwar has about four every five households and Mahatma Phule has only one every three households. The differences are large enough, though even here, the sample sizes in Banganga and Jay Yogeshwar being small, this needs to be taken as indicating a possible line of exploration.

Table 4.5a: Pumps and Equipment owned by sample (according to operational holding size)

LH Class	No. of HH	Electric pump motors		Diesel pumps		Tractors, Power tillers, etc.	
		Before	After	Before	After	Before	After
No land	4	2	5	–	–	–	1
		(0.50)	(1.25)	–	–	–	(0.25)
Up to 0.5 ha	9	5	8	–	–	–	2
		(0.56)	(0.89)	–	–	–	(0.22)
0.51 to 1 ha	33	17	31	2	2	3	12
		(0.52)	(0.94)	(0.06)	(0.06)	(0.09)	(0.36)
1.01 to 2 ha	49	30	55	4	–	4	18
		(0.61)	(1.12)	(0.08)	–	(0.08)	(0.37)
2.01 to 3 ha	30	24	37	3	1	7	22
		(0.80)	(1.23)	(0.10)	(0.03)	(0.23)	(0.73)
3.01 to 5 ha	14	11	21	1	–	3	10
		(0.79)	(1.50)	(0.07)	–	(0.21)	(0.71)
Over 5 ha	8	9	20	2	1	1	11
		(1.13)	(2.50)	(0.25)	(0.13)	(0.13)	(1.38)
Total	147	98	177	12	4	18	76
		(0.67)	(1.20)	(0.08)	(0.03)	(0.12)	(0.52)

Figures in parentheses are per HH values

Table 4.5b: Pumps and Equipment owned by sample (according to society)

WUA	No. of HH	Electric pump motors		Diesel pumps		Tractors, Power tillers, etc.	
		Before	After	Before	After	Before	After
Banganga	17	15	20	1	–	6	19
		(0.88)	(1.18)	(0.06)	–	(0.35)	(1.12)
Mahatma Phule	96	51	109	7	–	7	30
		(0.53)	(1.14)	(0.07)	–	(0.07)	(0.31)
Jay Yogeshwar	34	32	48	4	4	5	27
		(0.94)	(1.41)	(0.12)	(0.12)	(0.15)	(0.79)
Total	147	98	177	12	4	18	76
		(0.67)	(1.20)	(0.08)	(0.03)	(0.12)	(0.52)

Figures in parentheses are per HH values

Fodder sources

How have the fodder sources changed with the impact of irrigation development after the formation of the society? What we see is a shift away from crop residue to fodder crops and purchases. (See Tables 4.6a and 4.6b.) This too is a secular trend across holding size though the larger groups show it more strongly. In respect of the societies, there is a distinct difference between Banganga and the rest. There is a significant *reduction* in the households reporting fodder crops as one of their sources. This ties in with the drastic fall in livestock in Banganga which was part of their earlier dairy activity.

Table 4.6a: Fodder sources reported by sample (according to operational holding size)

LH Class	No. of House holds	Fodder crops		Crop residues		Purchased		Own land		Other land	
		Before	After	Before	After	Before	After	Before	After	Before	After
No land	4	–	–	–	–	–	–	–	–	–	–
		–	–	–	–	–	–	–	–	–	–
Up to 0.5 ha	9	–	1	5	4	1	4	–	1	–	–
		–	(11)	(56)	(44)	(11)	(44)	–	(11)	–	–
0.51 to 1 ha	33	7	11	25	19	16	22	1	4	3	1
		(21)	(33)	(76)	(58)	(48)	(67)	(3)	(12)	(9)	(3)
1.01 to 2 ha	49	10	18	38	29	19	27	1	3	1	1
		(20)	(37)	(78)	(59)	(39)	(55)	(2)	(6)	(2)	(2)
2.01 to 3 ha	30	12	12	25	21	17	18	2	10	1	1
		(40)	(40)	(83)	(70)	(57)	(60)	(7)	(33)	(3)	(3)
3.01 to 5 ha	14	4	3	13	10	5	7	–	1	1	–
		(29)	(21)	(93)	(71)	(36)	(50)	–	(7)	(7)	–
Over 5 ha	8	2	5	7	6	3	5	–	2	–	–
		(25)	(63)	(88)	(75)	(38)	(63)	–	(25)	–	–
Total	147	35	50	113	89	61	83	4	21	6	3
		(24)	(34)	(77)	(61)	(41)	(56)	(3)	(14)	(4)	(2)

Figures in parentheses are % HHs reporting those sources

Table 4.6b: Fodder sources reported by sample(according to society)

WUA	No. of House holds	Fodder crops		Crop residues		Purchased		Own land		Other land	
		Before	After	Before	After	Before	After	Before	After	Before	After
Banganga	17	11	5	13	9	7	11	1	8	3	2
		(65)	(29)	(76)	(53)	(41)	(65)	(6)	(47)	(18)	(12)
Mahatma Phule	96	7	20	69	56	38	50	–	1	2	–
		(7)	(21)	(72)	(58)	(40)	(52)	–	(1)	(2)	–
Jay Yogeshwar	34	17	25	31	24	16	22	3	12	1	1
		(50)	(74)	(91)	(71)	(47)	(65)	(9)	(35)	(3)	(3)
Total	147	35	50	113	89	61	83	4	21	6	3
		(24)	(34)	(77)	(61)	(41)	(56)	(3)	(14)	(4)	(2)

Figures in parentheses are % HHs reporting those sources

Crops and cropping pattern

The information on the area under different crops is presented in Tables 4.7a, b and c according to holding size, society and reach, respectively. For the agriculture related items we have used reach as one of the factors that may make a difference. Crop pattern in terms of percentage of area under different crops is presented in Tables 4.8a, b and c.

In the overall cropping pattern there is a shift away from coarse cereals, chick pea, other legumes and oilseeds to wheat, vegetables, grapes, sugarcane to some extent and floriculture and other fruits. The trend is fairly secular across holding size for wheat, vegetables and grapes, but not so for sugarcane, other fruits and floriculture which is confined to the middle and large farmers. The most dramatic increase is in grapes, from 6 ha earlier to 73 ha now. Between societies, there are some differences indicated, but the broad trend is followed in every society. For example, cereals like bajra and jowar, once staple and main crops, are practically extinct in Banganga dropping from about 35 gunthas per household to a mere 1.5 guntha per household in the sample. Banganga also has a whopping 43% of the sample household land under grapes.

Table 4.7a: Area under different crops reported by sample (according to operational holding size)

LH Class	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
No land	Before	1.00	0.58	0.09	1.17	–	0.50	–	–	–	–	–	–	3.34
	After	0.05	3.50	–	–	–	0.30	–	2.90	2.40	–	–	–	9.15
Up to 0.5 ha	Before	1.99	0.99	–	0.80	–	0.60	–	0.60	–	–	–	–	4.98
	After	–	1.59	–	–	–	1.19	–	0.85	1.29	–	–	–	4.92
0.51 to 1 ha	Before	13.21	5.78	0.30	4.29	0.42	6.03	–	1.18	1.15	–	–	–	32.36
	After	2.41	9.61	0.05	1.50	0.20	6.46	0.40	8.95	10.30	–	–	0.50	40.38
1.01 to 2 ha	Before	32.78	20.57	0.26	7.45	0.20	19.74	0.28	3.92	1.40	0.48	–	0.30	87.38
	After	2.20	26.55	–	2.10	0.30	15.40	2.05	25.65	22.13	1.50	0.50	2.45	100.83
2.01 to 3 ha	Before	23.90	16.30	0.22	8.10	1.17	15.56	0.45	2.30	3.40	0.45	–	–	71.85
	After	5.23	14.38	–	1.25	0.20	9.20	0.90	13.88	21.00	–	4.35	0.05	70.44
3.01 to 5 ha	Before	14.00	8.33	1.00	1.52	–	5.40	0.10	1.10	0.75	1.00	1.00	–	34.20
	After	1.70	8.90	–	1.00	0.40	6.00	–	6.30	6.45	2.00	3.80	1.00	37.55
Over 5 ha	Before	20.23	5.30	0.88	2.40	2.59	5.50	0.20	2.70	–	–	–	–	39.80
	After	5.25	12.00	8.60	3.10	0.50	5.10	1.05	21.30	9.50	–	–	0.10	66.50
Total	Before	107.1	57.85	2.75	25.73	4.38	53.33	1.03	11.80	6.70	1.93	1.00	0.30	273.91
	After	16.84	76.53	8.65	8.95	1.60	43.65	4.40	79.83	73.07	3.50	8.65	4.10	329.77

Figures are in ha

Table 4.7b: Area under different crops reported by sample (according to society)

Society	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
Banganga	Before	6.14	5.49	–	2.30	0.10	5.70	0.25	3.15	4.50	0.75	–	–	28.38
	After	0.25	5.77	–	–	–	2.69	0.10	7.58	12.70	0.30	–	–	29.39
Mahatma Phule	Before	70.37	39.61	0.19	14.94	0.60	31.71	0.40	2.99	2.20	1.18	1.00	0.30	165.49
	After	9.34	47.26	8.45	3.65	0.50	26.36	2.90	36.55	38.82	3.20	7.75	4.10	188.88
Jay Yogeshwar	Before	30.60	12.75	2.56	8.49	3.68	15.92	0.38	5.66	–	–	–	–	80.04
	After	7.25	23.50	0.20	5.30	1.10	14.6	1.40	35.70	21.55	–	0.90	–	111.50
Total	Before	107.1	57.85	2.75	25.73	4.38	53.33	1.03	11.80	6.70	1.93	1.00	0.30	273.91
	After	16.84	76.53	8.65	8.95	1.60	43.65	4.40	79.83	73.07	3.50	8.65	4.10	329.77

Figures are in ha

Table 4.7c: Area under different crops reported by sample (according to reach)

Reach	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
Head	Before	21.48	12.72	0.70	5.40	1.21	13.14	0.30	4.25	0.35	0.48	–	–	60.03
	After	3.15	19.43	–	1.00	–	9.90	0.55	19.08	14.59	1.30	0.90	1.75	71.65
Middle	Before	51.65	24.80	1.75	12.47	2.21	22.67	0.35	4.38	5.03	1.45	1.00	–	127.76
	After	10.19	35.84	0.25	7.25	1.40	23.79	2.40	40.45	33.36	2.20	7.55	1.55	166.23
Tail	Before	33.98	20.33	0.30	7.86	0.96	17.52	0.38	3.17	1.32	–	–	0.30	86.12
	After	3.50	21.26	8.40	0.70	0.20	9.96	1.45	20.30	25.12	–	0.20	0.80	91.89
Total	Before	107.1	57.85	2.75	25.73	4.38	53.33	1.03	11.80	6.70	1.93	1.00	0.30	273.91
	After	16.84	76.53	8.65	8.95	1.60	43.65	4.40	79.83	73.07	3.50	8.65	4.10	329.77

Figures are in ha

Table 4.8a: Per cent of gross cropped area under different crops reported by sample (according to operational holding size)

LH Class	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
No land	Before	30	17	3	35	–	15	–	–	–	–	–	–	100
	After	1	38	–	–	–	3	–	32	26	–	–	–	100
Up to 0.5 ha	Before	40	20	–	16	–	12	–	12	–	–	–	–	100
	After	–	32	–	–	–	24	–	17	26	–	–	–	100
0.51 to 1 ha	Before	41	18	1	13	1	19	–	4	4	–	–	–	100
	After	6	24	0	4	0	16	1	22	26	–	–	1	100
1.01 to 2 ha	Before	38	24	0	9	0	23	0	4	2	1	–	0	100
	After	2	26	–	2	0	15	2	25	22	1	0	2	100
2.01 to 3 ha	Before	33	23	0	11	2	22	1	3	5	1	–	–	100
	After	7	20	–	2	0	13	1	20	30	–	6	0	100
3.01 to 5 ha	Before	41	24	3	4	–	16	0	3	2	3	3	–	100
	After	5	24	–	3	1	16	–	17	17	5	10	3	100
Over 5 ha	Before	51	13	2	6	7	14	1	7	–	–	–	–	100
	After	8	18	13	5	1	8	2	32	14	–	–	0	100
Total	Before	39	21	1	9	2	19	0	4	2	1	0	0	100
	After	5	23	3	3	0	13	1	24	22	1	3	1	100

Figures are in % of gross cropped area

Table 4.8b: Per cent of gross cropped area under different crops reported by sample (according to society)

LH Class	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
Banganga	Before	22	19	–	8	0	20	1	11	16	3	–	–	100
	After	1	20	–	–	–	9	0	26	43	1	–	–	100
Mahatma Phule	Before	38	16	3	11	5	20	0	7	–	–	–	–	100
	After	7	21	0	5	1	13	1	32	19	–	1	–	100
Jay Yogeshwar	Before	43	24	0	9	0	19	0	2	1	1	1	0	100
	After	5	25	4	2	0	14	2	19	21	2	4	2	100
Total	Before	39	21	1	9	2	19	0	4	2	1	0	0	100
	After	5	23	3	3	0	13	1	24	22	1	3	1	100

Figures are in % of gross cropped area

Table 4.8c: Per cent of gross cropped area under different crops reported by sample (according to reach)

Reach	When	Cereals	Wheat	Pigeon pea	Chick pea	Other Legumes	Oilseeds	Fodder	Vegetables	Grapes	Other fruits	Sugarcane	Floriculture	Gross cropped area
Head	Before	36	21	1	9	2	22	0	7	1	1	–	–	100
	After	4	27	–	1	–	14	1	27	20	2	1	2	100
Middle	Before	40	19	1	10	2	18	0	3	4	1	1	–	100
	After	6	22	0	4	1	14	1	24	20	1	5	1	100
Tail	Before	39	24	0	9	1	20	0	4	2	–	–	0	100
	After	4	23	9	1	0	11	2	22	27	–	0	1	100
Total	Before	39	21	1	9	2	19	0	4	2	1	0	0	100
	After	5	23	3	3	0	13	1	24	22	1	3	1	100

Figures are in % of gross cropped area

Income: the aggregate impact

Finally, any impact has to translate itself into income as well, but how to calculate that income has always been a problem. As pointed out earlier, in our pilot testing we soon found that agricultural incomes was not reported with any great consistency. Also, elements of, at best, caution and at worst, distrust entered the dialogue and could become an obstacle. '

It was decided to compute agricultural income as an imputed value calculated on the basis of the agricultural information provided by the respondent. This was done on the basis of the cropping patterns as reported by the respondent, the table of productivity before and after the society formation, and constant prices, using the average price for the last six years as recorded by the societies in their records. (The information is presented in Table 4.10.)

As pointed out earlier, we should be aware that this does not truly compare (with whatever degree of precision it does, which is a separate question) the income then with the income now. Instead the comparison is more close to a ` what if' comparison. What if the farmers today had the crop pattern they had earlier, what would their income be? Though we are carrying out the comparison in the sense of a then and now comparison this shift in meaning needs to be kept in mind as well.

Impact on incomes

The information on impact on incomes is presented in Tables 4.9a, b and c below. The first general trend is that the income from *all* sources has increased: agricultural income has increased 6-fold from about 25,000 Rs per household to 1,50,000; income from livestock from about 350 to 900; income from employment from 5,500 to 13,000; income from business from 2,250 to 7,500; wage and allied income from about 70 to 1,150; and total income from about 33,000 to 1,89,000.

How is this increase divided between different holding sizes? It is obvious that the larger holdings would get a larger rise in incomes, but how does this compare in terms of ratios? What we find is that the proportionate rise in income over earlier income is greater for many of the households in the smaller holding sizes. What one can say is that if we take the spread (the ratio of the highest to the lowest value among the groups), then the spread for agricultural income has fallen a little from about

5.2 to about 5. The other concern is whether or not the income is sufficient to provide basic subsistence needs. If we assume 50 Rs per person day as subsistence wage, 250 days of work for two persons as the employment need, and a net income at half of the gross income, then the lowest income reported for a group, that is, Rs. 45,000, provides for a wage of about Rs. 45 per person-day. On its own, that is still not sufficient. It needs the other income in order to pull it above the 50 Rs mark. In general, for many households access to other avenues of employment is still important for them to cross the subsistence mark. Its proportion has gone down, but it still retains significance. The per household income in Jay Yogeshwar and Banganga is fairly high as compared to Mahatma Phule, with all the earlier provisos of such comparison. Income variation according to reach appears to be even more neutral suggesting that if common and equitable access in the command is established, the natural factors of landholding take precedence over position within the reach.

The other information related to the functioning of the society is presented separately in self-explanatory tables in Annexure A. Finally, we should note that the seemingly mundane finding that the beneficial impact cuts across holding sizes is of quite some significance. It means that all have participated and participated visibly in the benefits accruing from the formation of the society. That after all is the first mandate the society has to fulfil its minimum mandate. Inequality does remain and will take new forms and create new problems. For example, though the ratio between the low and the high may remain the same, the sheer size of income the higher group enjoys may admit them to a different style and standard of living that may be so far out of the reach of the lower groups as to be problematic. But these are new problems, problems of development, not the lack of it.

Table 4.9a: Income from different sources reported by sample (according to operational holding size)

LH Class	No. of House holds	Agricultural Income		Income from Livestock		Income from Employment		Income from Business		Income from Wage, Artisanship and Household industry		Total Income	
		Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
No land	4	34,375	717,526	–	–	60,000	99,000	–	–	–	–	94,375	816,526
		(8,594)	(179,381)	(–)	(–)	(15,000)	(24,750)	(–)	(–)	(–)	(–)	(23,594)	(204,131)
Up to 0.5 ha	9	47,098	405,163	–	–	–	24,000	22,000	40,000	–	30,000	69,098	499,163
		(5,233)	(45,018)	(–)	(–)	(–)	(2,667)	(2,444)	(4,444)	(–)	(3,333)	(7,678)	(55,463)
0.51 to 1 ha	33	453,560	3,268,884	–	–	273,000	536,000	20,000	108,000	10,000	91,000	756,560	4,003,884
		(13,744)	(99,057)	(–)	(–)	(8,273)	(16,242)	(606)	(3,273)	(303)	(2,758)	(22,926)	(121,330)
1.01 to 2 ha	49	1,058,327	7,340,090	–	20,000	278,000	679,000	100,000	264,000	–	–	1,436,327	8,303,090
		(21,599)	(149,798)	(–)	(408)	(5,673)	(13,857)	(2,041)	(5,388)	(–)	(–)	(29,313)	(169,451)
2.01 to 3 ha	30	1,170,869	6,691,805	30,000	32,000	150,000	356,000	79,000	108,000	–	49,000	1,429,869	7,236,805
		(39,029)	(223,060)	(1,000)	(1,067)	(5,000)	(11,867)	(2,633)	(3,600)	(–)	(1,633)	(47,662)	(241,227)
3.01 to 5 ha	14	491,122	2,602,069	–	–	–	80,400	–	30,000	–	–	491,122	2,712,469
		(35,080)	(185,862)	(–)	(–)	(–)	(5,743)	(–)	(2,143)	(–)	(–)	(35,080)	(193,748)
Over 5 ha	8	358,603	3,545,236	24,000	84,000	82,800	136,000	120,000	560,000	–	–	585,403	4,325,236
		(44,825)	(443,155)	(3,000)	(10,500)	(10,350)	(17,000)	(15,000)	(70,000)	(–)	(–)	(73,175)	(540,655)
Total	147	3,613,955	24,570,772	54,000	136,000	843,800	1,910,400	341,000	1,110,000	10,000	170,000	4,862,755	27,897,172
		(24,585)	(167,148)	(367)	(925)	(5,740)	(12,996)	(2,320)	(7,551)	(68)	(1,156)	(33,080)	(189,777)

Main figures are in Rs/yr: Figures in parentheses are per household values

Table 4.9b: Income from different sources reported by sample (according to society)

WUA	No. of House holds	Agricultural Income		Income from Livestock		Income from Employment		Income from Business		Income from Wage, Artisanship and Household industry		Total Income	
		Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
Banganga	17	850,426	3,674,693	30,000	32,000	171,000	324,000	20,000	115,000	–	–	1,071,426	4,145,693
		(50,025)	(216,158)	(1,765)	(1,882)	(10,059)	(19,059)	(1,176)	(6,765)	(–)	(–)	(63,025)	(243,864)
Mahatma Phule	96	1,977,762	13,424,826		20,000	506,000	1,398,000	201,000	548,000	5,000	15,000	2,689,762	15,405,826
		(20,602)	(139,842)	(–)	(208)	(5,271)	(14,563)	(2,094)	(5,708)	(52)	(156)	(28,018)	(160,477)
Jay Yogeshwar	34	785,768	7,471,253	24,000	84,000	166,800	188,400	120,000	447,000	5,000	155,000	1,101,568	8,345,653
		(23,111)	(219,743)	(706)	(2,471)	(4,906)	(5,541)	(3,529)	(13,147)	(147)	(4,559)	(32,399)	(245,460)
Total	147	3,613,955	24,570,772	54,000	136,000	843,800	1,910,400	341,000	1,110,000	10,000	170,000	4,862,755	27,897,172
		(24,585)	(167,148)	(367)	(925)	(5,740)	(12,996)	(2,320)	(7,551)	(68)	(1,156)	(33,080)	(189,777)

Main figures are in Rs/yr: Figures in parentheses are per household values

Table 4.9c: Income from different sources reported by sample (according to reach)

Reach	No. of House holds	Agricultural Income		Income from Livestock		Income from Employment		Income from Business		Income from Wage, Artisanship and Household industry		Total Income	
		Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
Head	30	663,633	5,060,288	–	20,000	256,800	664,000	72,000	229,000	–	72,000	992,433	6,045,288
		(22,121)	(168,676)	(–)	(667)	(8,560)	(22,133)	(2,400)	(7,633)	(–)	(2,400)	(33,081)	(201,510)
Middle	71	1,928,497	11,779,601	54,000	104,000	355,000	807,400	249,000	581,000	5,000	25,000	2,591,497	13,297,001
		(27,162)	(165,910)	(761)	(1,465)	(5,000)	(11,372)	(3,507)	(8,183)	(70)	(352)	(36,500)	(187,282)
Reach	46	1,021,825	7,730,884	–	12,000	232,000	439,000	20,000	300,000	5,000	73,000	1,278,825	8,554,884
		(22,214)	(168,063)	(–)	(261)	(5,043)	(9,543)	(435)	(6,522)	(109)	(1,587)	(27,801)	(185,976)
Total	147	3,613,955	24,570,772	54,000	136,000	843,800	1,910,400	341,000	1,110,000	10,000	170,000	4,862,755	27,897,172
		(24,585)	(167,148)	(367)	(925)	(5,740)	(12,996)	(2,320)	(7,551)	(68)	(1,156)	(33,080)	(189,777)

Main figures are in Rs/yr: Figures in parentheses are per household values

Table 4.10: Productivity and prices assumed for imputed income

Crop	Productivity (T/ha)		Price (Rs/T
	Before	After	
Wheat	1.8	2.5	6,000
Chick pea	1	1.2	11,429
Onions	5	7.5	7,700
Grapes	10	20	12,857
Maize	1.25	2	5,714
Jowar	2	3	5,714
Tomato	2.5	4	3,214
Bajra	1	1.5	5,714
Groundnut	2.5	5	6,500
Vegetables	2	4	3,214
Floriculture	1	1	10,000
Guava	5	15	5,000
Pomegranate	5	15	5,000
Tur	1	1.5	10,000
Udid	0.75	1	10,000
Sugarcane	100	100	786
Peas	1	1.2	10,000
Rice	1.5	2.5	6,000
Kulith	0.75	1	6,000
Matki	0.75	1	10,000
Mung	0.75	1	10,000
Soybean	1.5	3	7,071

5.

The Ozar Water User Societies: Issues in Co-management

The importance of volumetric supply

There cannot be co-management management of surface water and groundwater (henceforth simply co-management) without bringing wells into the participative management net. It is important that the Mahatma Phule society has been able to do that. It would be instructive to look into the way in which they have been able to do so. There was intense discussion and debate around this point for almost three years in all the three societies before the decision was taken in Mahatma Phule to apply water charge to the wells based on water released into the check dams. There are two levels at which the argument proceeded, one in respect of the general problem of wells and one in the case of the argument about the water released into the check dams. Both have been somewhat conflated and it is better to treat them separately.

The argument that the SPK and the activists gave essentially said, here is water that we have paid for. Now someone else would be using it without paying for it. Is it not fair that they should pay for it? This finally is the core of the argument. Before going into its details, we would like to point out that the change in water charge assessment from area and crop basis to a volumetric basis is more than a surface change. Without this change, it is almost impossible o formulate the argument in an effective manner.

The point is that when the charge is on the basis of area and crop, implicitly one is not buying the water, but a service. The extra water that drains away either through seepage or the portion that flows out of the command is not part of the deal, in effect, it is not part of the stake the farmer holds. The changeover in basis of assessment now implies that it is the volume of water being delivered by the department that is the commodity under transaction and turning it into a service is an *internal matter* for the society. It makes the farmers stakeholders in the water, and farmers become their own service providers.

What about well owners' investment in wells?

So, on the basis of the change in method of assessment, it becomes possible to put forward the argument: if someone is using water we have paid for, it is only fair that they should pay for it. There still is a long way to go. Our discussions with SPK show that there were two main hurdles that had to be crossed. The first is the question of the investment that well owners have made in their wells.

This is an important issue and has come up everywhere whenever there has been a suggestion that well owners too should pay a water charge. The argument is that the water has become utilisable only because the well owners have invested in the well, in the lifting device and equipment and in the distribution system. The water use that they are enjoying is therefore the rightful fruit of and return on that investment and it is unjust to charge them for the water use.

The SPK and the farmer activists agreed that the argument could apply to the water that the wells intercepted in normal course whenever the canal was not flowing. But could the well owners deny that the additional water that came into their wells was solely due to canal operation and that without canal operation, any amount of investment that they made, however huge, would not raise the water level in their wells one bit? Moreover, they also pointed out, the additional water that canal operation provided helped them use their investment better and reduced the idle time of their investment, so they were even getting additional benefit and should not mind paying a water charge. This is the argument that finally prevailed in Mahatma Phule.

The idea of building check dams and letting all the excess flow into the check dams is also connected with the change of basis. The water flowing away is now water the society had paid for and it was simply money going down the drain. Earlier, it was not. Then the problem of saving water and increasing efficiency was the concern of department not the farmers since it did not directly affect their stake. Now the farmers had acquired a stake in that portion as well. So, the idea of building check dams within the command can be seen as being influenced by the coming together of two concerns, concerns arising out of the ideas and convictions of the SPK as well as farmers' interest in increasing water use efficiency and lowering cost.

The problem of mensuration

So, in principle, now we have an agreement that well owners should pay for the increase in the water in their wells, the next problem is to determine how much of the water they should pay for, and how much. In Mahatma Phule, the decision by consensus was that the well owners would pay for the water released into the check dams. We shall return to this decision later. That still leaves us with the problem of how to determine which well owner pays how much.

This is an important problem to resolve if we have to being into practice what we decide in principle. We have already seen one instance of this in the change over to a time-based assessment of water charge for the individual farmers. In that case, the problem was resolved by a commonly accepted, simple and transparent procedure of assessment. The complicating factor here was that all well owners were not equal. In the case of time based assessment, there were problems of difference, but on the whole there was broad agreement that the outlets delivered one cusec and the command on each outlet was not too far spread out. In the case of wells they were placed at different distances and differed greatly in the amount of water that appeared in them after a rotation.

The solution that was accepted

First let us have a look at the final solution that was accepted by the society. What is done is to measure the depth of water in the well immediately after a rotation. The depth of water in the immediate pre-monsoon period in summer is also noted. The difference between the two is the characteristic of the well that determines the charge for the well. This charge is related to the amount of canal water that is released into the check dams. The amount of water that is released into the check dams is divided by the sum of the differences arrived at and measure of water use equal to volume per depth is derived. The difference in level for each well multiplied by this parameter gives the corresponding water for which the well owner should be charged.

To take a simple example let us say that there are only two wells. The first well has a depth of water of 20 m after a rotation and a pre-monsoon level of 10 m. The second well has a depth of water of 10 m after a rotation and a pre-monsoon level of 5 m, Let us assume that 1500 m^3 of water was released into the check dams that recharged these wells. In this case the differences in depth are 10 m and 5 m respectively for the two wells, so the sum of differences is 15 m. Dividing the total volume of water 1500 m^3 by the sum of differences gives us a parameter of 100 m^3 per m. So the first well would be charged for 10 x 100 = 1000 m^3 and the second well for 5 x 100 = 500 m^3 of the water.

What does it measure?

The technological purists would certainly pick many points of disagreement with this method. The wells receive not only the water released into the check dams, but also that of seepage. Secondly, it does not necessarily receive all of the water that is released into the wells. Thirdly, the water received in each well is not necessarily proportional to the difference in depth so calculated.

That was the argument from a technologist' s perspective. Let us approach the problem from the stakeholders perspective. The main problem to be settled is to determine who pays how much. That is

the essential problem, not precisely how much water each well has. They do have a relation, but are distinct problems. From the point of view of the stakeholders, they need an agreed upon principle, and a sufficiently transparent procedure that ties cost to benefit received in an agreed manner. And this is precisely what the procedure captures.

The procedure is based on a prior agreement in principle that the water that is let into dams has to be paid for by the well owners since it appears in their wells. Once this is granted, then those who receive more water should pay more and those who receive less should pay less. And then an agreed upon, simple and transparent measure that is a reasonable approximation of who pays how much. Reasonable here again should not be seen in the technological sense in the sense of an acceptable per cent accuracy, but rather as that which appeals to reason or common sense. And it certainly appeals to common sense that the amount to which the depth of water increases is a fair measure of the increase in amount of water in the wells.

Deciding how much water to release and when

Procedures have also be established about how to decide how much water to release into the check dams and when. How are these things decided upon in Mahatma Phule? The decision is arrived at generally at the beginning of the rotation, before the rotation begins. The demand during that rotation is assessed and generally the difference between the amount of water to be supplied during the rotation and the demand worked out is released into the check dams. Normally the water is released into the check dams at the end of the rotation after everyone has watered their fields. Water is let into the upstream check dam from which it flows down into the downstream check dams as the upstream ones fill up.

An assessment is also carried out on how much water has been stored that year behind the dam. If it is a good year and there is a somewhat greater amount of water in the dam, that is taken into account and a larger portion may be released into the check dams.

Evolving practices

Recently a new practice has also come up. Some farmers request the society that part or whole of their quota should be released into the check dams instead of being delivered to their fields directly. In that case they are directly charged for that portion of their quota even if it is not delivered to their fields directly. They get to choose which check dams the water should be released into, and it is their responsibility to provide for adequate channels to carry the water to those check dams. It goes without saying that no one is allowed to lift water directly from the check dam storage.

There has been change in some practices and their regularity as well. Initially, in the few years following 93-94, the monitoring of wells for purposes of assessment was frequent and detailed. Now some sort of a convention about the relative contribution of each well has been established and the fequency and detail of monitoring has gone down. The practice of some farmers having their quota released into check dams has also served to strengthen the conventional nature of the relative contribution. For example, releasing water into any specified check dam does not necessarily mean that only those farmers will get the benefit; the water is added in different degrees to all check dams downstream and the wells recharged from them. However, since the farmers in the direct influence zone of that particular check dam benefit the most, they do not mind paying for the entire quota.

In itself, there is nothing wrong in there being some difference between the precise share of water each well receives and the charge that is assessed by convention and consensus, so long as the latter are reasonably grounded in the latter in the sense earlier pointed out. This is, in fact, the strong point of the Ozar experience. The ability to evolve simple, transparent procedures sufficiently and reasonable close to actual water shares to determine who is to pay how much.

What about Banganga and Jay Yogeshwar?

Given Mahatma Phule's successful co-management, a question naturally arises – why have Banganga and Jay Yogeshwar not followed Mahatma Phule in this respect? We had an interesting discussion with SPK and the farmer activists in this respect.

One strand of thinking was that, yes it hasn't happened yet, but it is happening, but at a slower pace. For example, as our earlier data also show, Jay Yogeshwar tried releasing some water into their check dams a couple of years. Last year, in Banganga, farmers on their own de-silted some of the check dams and asked that water be let into them. Also, the Banganga check dams leak and, unless something is done about retaining water in hem for a longer period, it is difficult for them to decide on releasing water into them.

Particular conditions in both societies also need to be taken into account. In Jay Yogeshwar, the demand is higher than in Mahatma Phule and it is more difficult to generate surpluses to be released into the check dams. The Ghagra nala that drains the Jay Yogeshwar command originates almost within the command so that its catchment area is not very large. In contrast, the Satwai nala that drains the Mahatma Phule command originates quite some distance away and has a much larger catchment. As a consequence, the Mahatma Phule check dams have sizeable benefit of the water from the local catchment added to the water released into the dams. The Jay Yogeshwar check dams do not enjoy this benefit. Many Jay Yogeshwar soils are very poor and need more frequent watering as well.

In Banganga, opposite conditions create the a similar effect. Here the wells are already better charged. The two main Banganga weirs are much larger than the check dams on the Ghagra nala or the Satwai nala. In those nalas, once water is released into an upstream dam, it fills up fairly quickly and the released water flows down into the next check dam, so that releasing a portion of the quota during the rotation is enough to fill them all. In contrast, the water released into the Banganga weirs may not fill even one of them and special outlets may be needed to achieve some degree of fair distribution of water between the check dams. Also, they are much favourably placed in respect of well recharge and well irrigation has been strong since the second class irrigation days. The soils are richer in texture and do not need as frequent watering as the others do. Moreover, recently there has been a drive to clear the old second class channels and divert some monsoon flows directly through them rather than let them into the weirs. This has reportedly resulted in better availability of water in the wells.

However, it should be noted that in both societies the Mahatma Phule experience has not gone unnoticed. There are signs that farmers have been thinking about that experience and reflecting on it. That is why we have had attempts in both societies to release water into the check dams in their command. The Banganga initiative in clearing the channels that served the old second class irrigation system is also a related and parallel stream of co-management thinking. What is important is that Mahatma Phule experience has got them thinking and trying to find their own way of combining canal water and local groundwater sources.

Towards replicating co-management strategies

The Ozar experience is an important step towards co-management. But in learning from it, it is also important that we do not turn it into a rigid model. And the SPK would be the first to advocate that caution. The fact that they did not try to apply the Mahatma Phule procedures and understanding directly in the other societies speaks for this caution. While they did not refrain from talking about them, they did not act on any of the problems unless they became problems and the farmers demanded a solution.

In one sense, it could even be argued, co-management has always been there in that farmers have always used the wells in the command areas as instruments of managing canal water and canal induced recharge. The problem there is that it has always been individual management and there has been no systematic collective effort at co-management. Participative irrigation management offers us

a chance of shifting from unregulated individual management practices to systematic collective co-management. This is the importance of the Ozar experience.

Between consensus and precision

As we have earlier pointed out, so far as forming a consensus on how to share costs in a manner that is reasonably related to groundwater use, the Mahatma Phule experience is exceedingly successful. However, the question of precision cannot be entirely brushed aside. There a couple of outstanding issues that need to be clarified if lessons are to be drawn from it for replication.

Recharge from field deliveries, from releases into check dams and from rainfall

Just as there is recharge of wells from water released into check dams, there is also recharge from field deliveries. The consensus today is that the well owners should pay for the water released into the check dams. This is not necessarily a satisfactory solution. What about the recharge of wells that takes place *without* water being released into the check dams? Should we not treat it similarly?

There are a few possible reasons why this may not have been done. In a situation in which all farmers are also well owners and everyone's wells are being recharged by field deliveries, we may take it for granted that in paying for the field deliveries the payment for the water in the wells is also being covered. However, this may not always be so. We may have a situation in which the net result is not all that equitable.

Let us take an illustrative example. Let us assume that there are three farmers and the hourly assessment is in place. Let us assume that that all three farmers receive 10 hours of water each. Assume further that farmer A does not own a well and the other two farmers B and C own the two wells described in the earlier illustrative example, that is, the wells that show a depth difference of 10 and 5 m respectively. There is no water being released into the wells. Instead the wells are receiving recharge from the field deliveries. Assume further that of the 10 hours of water, the field crop uses 5 hours and 2.5 appear as recharge in the wells. So 7.5 hours appear in the wells, of which 5 hours appear in B's well and 2.5 hours in C's well. The actual water use (as a first approximation) of the three farmers A, B and C is 5, 10 and 7.5 hours out of the 30 hours received by them, while the rest of the water is lost. If they pay for water in the proportion of their water use they should then pay in the proportion of 5:10:7.5, that is, for 6.67, 13.33 and 10 hours respectively.

In a similar manner we may also need to take into consideration the benefit from local rainfall being intercepted by the check dams. Just as the investment in the wells by individual farmers is not related to the water that appears in them by recharge from canal water, it could be argued that the extra water that appears in them does not do so because of the investment in the wells but because of the public investment that has gone into the check dams. Moreover how large that benefit is may well be crucial in determining how much difference check dams would make as a co-management measure.

The need for an in-depth study

In effect, we have in Ozar, not one, but three different situations in the three societies and three different degrees and kinds of co-management. The three situations differ significantly in the catchment areas of the streams that drain the commands, in the soils that are dominant in the area and in co-management practices. Also we need a clearer assessment of the relative contributions of rainwater harvested by the check dams, recharge from field deliveries, recharge from water released into the check dams and canal water use itself.

In particular, we need to be able to work out a broad water balance for the three societies. Unfortunately, there has been no systematic attempt at taking up this task. The earlier study by the groundwater department does not throw much light on the water balance. A student project on the

societies goes somewhat further but falls far short of working out a water balance. This cannot be done in a short time. It requires an in-depth study of the water balance in these three societies.

Ozar should not become a `special case'

There are many features of the Ozar experience that have been treated as ` special cases' and permitted by the government. It goes to the SPK's credi that they could get them through because they combined a completely reasonable case with considerable social backing and standing. However, it does not do much credit to the government agencies who had often permitted these special cases on a pilot basis. It would have been better if they had considered the reasons for allowing these special cases and on the basis of the experience taken up a study of whether these special cases should be made general or not. In the absence of such a study and policy recommendation, permitting some things in Ozar also ensures that they remain exceptions.

By far the most important such measure is that of permitting check dams in the canal command areas. It is doubtful whether such measures can be taken by the water user societies on their own. The investments needed are often of an order that cannot be raised by the farmers. If permitting the Ozar societies to construct check dams as a special case does not result in a study of what building those check dams has achieved, then Ozar does remain confined to becoming a special case. That is another reason for carrying the in-depth study we have suggested above.

Methodology of the study: the SOPPECOM approach to Ntural Resource Database Management Systems (NRDMS)

Carrying out the study we have suggested is a challenging task. and the choosing an appropriate methodology for the study is the first such component. Working out a fully scientific and precise water balance for this large an area may turn out to be prohibitively costly. It would also adopt a methodology that would go against the grain of participative methods. On the hand, it has been demonstrated that while PRA-type of methods do give us important qualitative insights the quantitative information they generate is unreliable and at worst, worthless.

What is needed is methodology that combines scientific and participative approaches in a way that combines their strengths and eliminates their weaknesses by complementary advantages. It is as important not to let the scientific component excessively escalating costs and extending time frames. It is also important to retain farmers' participation in the exercise because their present and future practices are going to be important factors in determining the water balance.

This is a different topic that would require a separate and fuller discussion. SOPPECOM has developed the outline of such a methodology that would combine participative and scientific approaches optimally described in its note on the SOPPECOM approach to NRDMS. Crucial to this task is the development of robust models that would provide a sufficiently approximate first estimate that could be successively refined as further data is collected and monitored. It then functions as a tool for participative planning. The process of setting up an NRDMS system and evaluating water balance and water use options is expected to take about two years.

At the cross roads

The Ozar water user societies are entering a crucial phase of their existence. Up till now they have maintained a rising curve in system improvement and efficiency and in productivity enhancement. Co-management has carried them this distance. But now other matters and issues are also coming to a head. In the coming years these will prove crucial in shaping their future path of development.

For example, the very benefits have brought about a change in the crop pattern. Within the span of ten years, it has shifted from an earlier subsistence based mode of farming with a predominance of coarse

cereals like bajra to an almost exclusively cash crop based pattern. While this has meant a very significant rise in incomes, it has also meant two more things. First, it has meant that subsistence needs are not directly met by agriculture the way they were earlier. So even the small holder has to buy food. Secondly, because it is exclusively cash crop oriented, it has also meant a much greater risk, as farmers have found out over the last two or three years. This trend is likely to be accentuated further by globalisation. Also the other change in the crop pattern, the relatively greater shift to and emphasis on summer crops or perennials also has reached a point where not very large changes in summer area or summer availability may be forthcoming.

So far co-management strategies have been oriented towards the availability of water, that is, as instruments of harnessing more water. It is possible that the strategy may have to be reoriented towards water use, that is co-management as an instrument of optimal water use and towards minimising risk. This may involve moving towards combining agriculture and industry, looking at agricultural production as part of biomass and energy production and planning copping ystems in that manner. But that is a different story, and as we have said earlier, those are different problems, not the old ones; they are problems arising from development, not the lack of it.

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Annexure A

Miscellaneous Survey Tables

Table A1: Land within command sold before society formation in sample

Society	HH size class	LH Class	Reach	To whom sold	Area (ha)	Reason
Mahatma Phule	6 to 10	1.01 to 2 ha	Head	HAL	6.00	Acquired by Govt.
Mahatma Phule	6 to 10	2.01 to 3 ha	Middle	Farmers	0.45	Economic difficulty
Jay Yogeshwar	11 to 15	3.01 to 5 ha	Middle	Farmers	1.60	Economic difficulty
					8.05	

Table A2: Land within command sold after society formation in sample

Society	HH size class	LH Class	Reach	To whom sold	Area (ha)	Reason
Jay Yogeshwar	Up to 5	0.51 to 1 ha	Middle	Farmers	0.20	Economic difficulty
Mahatma Phule	6 to 10	0.51 to 1 ha	Middle	Farmers	0.53	Economic difficulty
Jay Yogeshwar	6 to 10	1.01 to 2 ha	Tail	Farmers	0.37	Economic difficulty
Mahatma Phule	11 to 15	1.01 to 2 ha	Tail	Builders	0.60	Shortage of water
Mahatma Phule	6 to 10	1.01 to 2 ha	Tail	Builders	0.60	Shortage of water
Mahatma Phule	6 to 10	2.01 to 3 ha	Middle	Builders	2.69	Economic difficulty
Mahatma Phule	6 to 10	3.01 to 5 ha	Tail	Farmers	0.90	Shortage of water
Mahatma Phule	6 to 10	3.01 to 5 ha	Middle	Farmers	0.50	Shortage of water
Mahatma Phule	11 to 15	3.01 to 5 ha	Head	Farmers	4.32	Shortage of water
Mahatma Phule	11 to 15	3.01 to 5 ha	Tail	Builders	1.00	Shortage of water
					11.71	

Table A3: Land converted to NA in sample

Society	HH size class	LH Class	Reach	Area (ha)
Mahatma Phule	11 to 15	1.01 to 2 ha	Tail	1.00
Mahatma Phule	6 to 10	2.01 to 3 ha	Middle	2.69
Mahatma Phule	6 to 10	3.01 to 5 ha	Tail	0.30
Mahatma Phule	6 to 10	3.01 to 5 ha	Middle	0.50
Mahatma Phule	6 to 10	3.01 to 5 ha	Middle	1.00
Jay Yogeshwar	11 to 15	Over 5 ha	Head	0.30
				5.79

Table A4a: No. of households in sample reporting difficulty in watering crops (according to size of operational holding)					
LH Class	**No. of households**	**Kharif crops**	**Rabi crops**	**Summer crops**	**Perennial crops**
No land	4	2	2	3	
Up to 0.5 ha	9	4	4	8	6
0.51 to 1 ha	33	10	10	30	15
1.01 to 2 ha	49	5	7	40	15
2.01 to 3 ha	30	7	8	28	6
3.01 to 5 ha	14	5	5	11	5
Over 5 ha	8	–	–	4	1
Total	147	33	36	124	48

Table A4b: No. of households in sample reporting difficulty in watering crops (according to society)					
Society	**No. of households reporting**	**Kharif crops**	**Rabi crops**	**Summer crops**	**Perennial crops**
Banganga	17	5	6	17	3
Jay Yogeshwar	34	3	3	26	9
Mahatma Phule	96	25	27	81	36
Grand Total	147	33	36	124	48

Table A5a: Reasons for difficulty in taking crops reported by sample (according to size of operational holding)				
LH Class	**No. of Households**	**Insufficient water**	**No year round water assurance for perennials**	**Other reasons**
No land	4	–	3	1
Up to 0.5 ha	9	5	3	1
0.51 to 1 ha	33	18	11	3
1.01 to 2 ha	49	28	14	1
2.01 to 3 ha	30	11	14	2
3.01 to 5 ha	14	4	4	3
Over 5 ha	8	3	1	–
Total	147	69	50	11

Table A5b: Reasons for difficulty in taking crops reported by sample (according to size of operational holding)				
LH Class	**No. of Households**	**Insufficient water**	**No year round water assurance for perennials**	**Other reasons**
Banganga	17	9	7	2
Jay Yogeshwar	34	20	4	2
Mahatma Phule	96	40	39	6
Grand Total	147	69	50	10

Table A6: Drinking water source reported by sample (according to society)												
Society	**Drinking Water Source**											
	Well		**Canal**		**Borewell**		**Common well**		**Piped water supply**		**Tanker**	
	Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
Banganga	16	10	–	–	–	4	–	–	1	4	–	–
Jay Yogeshwar	31	26	–	–	–	–	4	–	2	7	2	5
Mahatma Phule	82	87	–	3	1	1	1	1	6	17	–	5
Grand Total	129	123	–	3	1	5	5	1	9	33	2	10

Table A7: Irrigation water source reported by sample (according to society)												
WUA	**Drinking Water Source**											
	Well		**Canal**		**Borewell**		**Common well**		**Piped water supply**		**Tanker**	
	Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
Banganga	13	16	4	17	–	8	1	–	1	–	–	–
Jay Yogeshwar	24	31	1	33	–	11	–	–	–	–	1	1
Mahatma Phule	78	87	4	78	1	2	–	–	1	1	–	–
Grand Total	115	134	9	128	1	21	1	–	2	1	1	1

Table A8: Water source for animals reported by sample (according to society)												
WUA	**Drinking Water Source**											
	Well		**Canal**		**Borewell**		**Common well**		**Piped water supply**		**Tanker**	
	Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
Banganga	14	10	–	–	–	3	2	–	–	–	–	–
Jay Yogeshwar	31	33	–	–	–	–	3	1	1	–	1	1
Mahatma Phule	65	61	–	–	1	2	1	1	1	1	–	–
Grand Total	110	104	–	–	1	5	6	2	2	1	1	1

Table A9a: Area irrigated by wells and canals in sample (according to operational holding size)

LH Class	No. of Households	Area irrigated by well alone	Area irrigated by well and canal	Area irrigated by canal alone	Total Area Irrigated
No land	4	–	5.30	–	5.30
		(–)	(100 %)	(–)	(100 %)
Up to 0.5 ha	9	–	2.89	0.19	3.08
		(–)	(94 %)	(6 %)	(100 %)
0.51 to 1 ha	33	0.43	22.04	3.28	25.75
		(2 %)	(86 %)	(13 %)	(100 %)
1.01 to 2 ha	49	4.25	66.65	1.00	71.90
		(6 %)	(93 %)	(1 %)	(100 %)
2.01 to 3 ha	30	2.75	50.50	2.90	56.15
		(5 %)	(90 %)	(5 %)	(100 %)
3.01 to 5 ha	14	3.80	20.70	1.36	25.86
		(15 %)	(80 %)	(5 %)	(100 %)
Over 5 ha	8	–	46.00	–	46.00
		(–)	(100 %)	(–)	(100 %)
Total	147	11.23	214.08	8.73	234.04
		(5 %)	(91 %)	(4 %)	(100 %)

Table A9b: Area irrigated by wells and canals in sample (according to society)

WUA	No. of Households	Area irrigated by well alone	Area irrigated by well and canal	Area irrigated by canal alone	Total Area Irrigated
Banganga	17	0.4	23.98	0.19	24.57
		(2 %)	(98 %)	(1 %)	(100 %)
Jay Yogeshwar	34	1	66.63	4.88	72.51
		(1 %)	(92 %)	(7 %)	(100 %)
Mahatma Phule	96	9.83	123.47	3.66	136.96
		(7 %)	(90 %)	(3 %)	(100 %)
Grand Total	147	11.23	214.08	8.73	234.04
		(5 %)	(91 %)	(4 %)	(100 %)

Table A9c: Area irrigated by wells and canals in sample (according to reach)

Reach	No. of Households	Area irrigated by well alone	Area irrigated by well and canal	Area irrigated by canal alone	Total Area Irrigated
Head	30	0.4	46.56	0	46.96
		(1 %)	(99 %)	(–)	(100 %)
Middle	71	8.15	102.37	7.95	118.47
		(7 %)	(86 %)	(7 %)	(100 %)
Tail	46	2.68	65.15	0.78	68.61
		(4 %)	(95 %)	(1 %)	(100 %)
Grand Total	147	11.23	214.08	8.73	234.04
		(5 %)	(91 %)	(4 %)	(100 %)

Table A10a: Period of water shortage reported by sample (according to size of operational holding)

LH Class	No. of Households reporting	Before WUA			After WUA		
		From month	To month	Average period (months)	From month	To month	Average period (months)
No land	4	December	June	7.00	April	June	2.5
Up to 0.5 ha	9	November	June	7.43	Feb	June	4.7
0.51 to 1 ha	33	December	June	6.97	March	June	3.7
1.01 to 2 ha	49	November	June	7.57	Feb	June	4.1
2.01 to 3 ha	30	December	June	6.39	March	June	3.9
3.01 to 5 ha	14	December	May	6.64	March	May	3.4
Over 5 ha	8	December	May	6.75	March	June	5.5
Total	147	December	June	7.04	March	June	4.0

Table A10b: Period of water shortage reported by sample (according to society)

WUA	No. of Households reporting	Before WUA			After WUA		
		From month	To month	Average period (months)	From month	To month	Aver peri (mon
Banganga	17	February	Jun	5.00	March	June	
Jay Yogeshwar	34	February	May	4.58	March	May	
Mahatma Phule	96	October	Jun	8.37	February	June	
Grand Total	147	December	Jun	7.04	March	June	

Table A10c: Period of water shortage reported by sample (according to reach)							
WUA	**No. of Households reporting**	**Before WUA**			**After WUA**		
		From month	**To month**	**Average period (months)**	**From month**	**To month**	**Aver peri (mon**
Head	30	December	June	6.81	February	June	
Middle	71	November	June	7.05	March	June	
Tail	46	December	June	7.15	March	June	
Grand Total	147	December	Jun	7.04	March	June	

Table A11a: No. of households and water demand			
WUA	**Water demand not placed**	**Water demand placed**	**Grand Total**
Banganga	–	17	17
Jay Yogeshwar	1	33	34
Mahatma Phule	11	85	96
Grand Total	12	135	147

Table A11b: No. of households and water demand (according to reach			
WUA	**Water demand not placed**	**Water demand placed**	**Grand Total**
Head	1	29	30
Middle	9	62	71
Tail	2	44	46
Grand Total	12	135	147

Table A12a: Reasons for not placing water demand (according to society)						
WUA	**Land was made NA**	**Other water source available**	**Land not level**	**No field channels**	**Absentee**	**Total**
Banganga	–	–	–	–	–	–
Jay Yogeshwar	–	1	–	–	–	1
Mahatma Phule	4	4	1	1	1	11
Grand Total	4	5	1	1	1	12

Table A12b: Reasons for not placing water demand (according to reach)						
Reach	**Land was made NA**	**Other water source available**	**Land not level**	**No field channels**	**Absentee**	**Total**
Head	1	–	–	–	–	1
Middle	3	4	1	1	–	9
Tail		1	–	–	1	2
Grand Total	4	5	1	1	1	12

Table A13a: Households reporting opinions about hourly rate (according to society)				
Opinion	**Banganga**	**Jay Yogeshwar**	**Mahatma Phule**	**Grand Total**
It is good and desirable	8	17	32	57
Desirable but insufficient for full irrigation	4	3	17	24
Adequate for grapes but not other crops	–	–	2	2
Hourly charges are too high	3	1	11	15
Good but flow should be adequate	–	5	11	16
Time limit needs to be increased	–	1	2	3
Inappropriate, water is wasted	–	1	–	1
Water is saved since farmers closely monitor delivery	2	5	18	25
Charge should be area based	1		1	2
Inadequate method	1	2	4	7

Table 13b: Households reporting opinions about hourly rate (according to reach)				
Opinion	**Head**	**Middle**	**Tail**	**Grand Total**
It is good and desirable	12	29	16	57
Desirable but insufficient for full irrigation	3	13	8	24
Adequate for grapes but not other crops	–	–	2	2
Hourly charges are too high	5	7	3	15
Good but flow should be adequate	1	8	7	16
Time limit needs to be increased	–	1	2	3
Inappropriate, water is wasted	–	–	1	1
Water is saved since farmers closely monitor delivery	8	9	8	25
Charge should be area based	2	–	–	2
Inadequate method	2	3	2	7