TANKS IN EASTERN INDIA : A STUDY IN EXPLORATION

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HYDERABAD
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About the authors

Niranjan Pant is Director, Centre for Development Studies, Lucknow since 1988. He has been doing research in the field of irrigation management since 1975. Initially he was associated with two research institutes, A. N.Sinha, Patna and Giri Institute, Lucknow. In addition, he has worked as a consultant/advisor to National and International organizations such as Ford Foundation, USAID, Planning Commission of India and TAHAL Consultants and the World Bank, *Danish*, *Dutch*, SIDA, and NORAD missions. In the course of research work he has availed visiting fellowships/research collaboration with Harvard University, U.S.A., JSPS and IDE, Japan and WAU, the Netherlands. He has had several associations with IWMI since 1980.

Ravindra Kumar Verma (b. 1956), Ph D. has been engaged in teaching and research for over two and half decades. At present he is teaching at P G Department of Political Science, R N College, Hajipur (Vaishali). He has participated in various national and international refresher courses including one conducted in association with ISS, The Hague, Netherlands. Verma has also been on the expert panel of government bodies. He has contributed a great deal to the fields of Indian politics, rural development and irrigation management in shape of five books and nearly 75 research papers in journals like EPW, IJPS, IJPA, JJDMS, JSES, Mainstream etc. One of his books has been awarded by the Government of India. He has long association with Niranjan Pant, including in the research institutions at Patna and Lucknow.

About the Book

Despite the pivotal role played by tanks in the eastern region of India over centuries, it is an under-researched area barring studies of *ahar pyne* systems of Bihar. The problem arises mainly because of lack of appreciation of the role of tanks in east India on the part of researchers, particularly the foreign scholars, who pioneered research on tank irrigation in the late 1970s in India and held the view that tanks were concentrated in south and central India and ignored the tanks in the eastern region. This dominance of south Indian studies in tanks found an echo in the pattern of funding for further research and rehabilitation of the tank based systems in that region. Part of the neglect of the tanks in the eastern region is on account of absence of any documentation of the status of tanks in that region. The authors feel that while lot of publications and publicity have been going on for decades for in depth studies and investments in the tanks of south India, lack of studies and therefore lack of publicity of tanks in eastern India has resulted in them going unnoticed by donor agencies.

The present study therefore, attempts to explore this neglected terrain in terms of status of tanks in the eastern region of India. Further, fishery aspect has also been studied as it happens to be an inseparable part of tanks. Although fishery is an integral part of tank activities, it escapes the attention of researchers dealing with irrigation and gets neglected in research. Therefore, irrigation and fishery aspects of tanks have been studied not only through historical records but a survey of the two aspects has also been carried out in the states of Bihar, Jharkhand, West Bengal and Orissa.

CONTENTS

FOREWORD

Water is indispensable to agricultural production and livelihoods of many people. India is foremost among the countries in the world practicing various irrigation methods mostly through canals, tanks and wells. In the post independence period, the country has invested huge amount of capital in the major and the medium irrigation projects. However, the gap between the potential created and utilized has been increasing over the years. Given the high cost of developing the major irrigation projects, it is proved that minor irrigation sources like tanks and wells can play a key role in stabilizing the irrigated area in the country.

Among the minor irrigation sources, wells and tube wells constitute the major share (58.7 per cent) followed by canals (25.7 per cent). Growth of well irrigation has been at the expense of irrigation from tanks and other sources. Looking at the tanks, during the period from 1950-2005, the area under tanks had been decreased from 3.6 million hectares to 2 million hectares. Tanks are mostly concentrated in areas where other sources of irrigation are less or completely absent. Marginal and small farmers are worst affected due to the continuous decline of tank irrigation for whom an alternative source of irrigation is either costly or not available.

Efforts are underway to identify and implement programs that help stabilize the tank irrigation potential in the country. Several studies have highlighted the importance of tank rehabilitation programs. Most of the studies have focused on tanks in south India where in the intensity of tanks is primarily a function of rainfall pattern, terrain (slope) and soil types.

This book is the outcome of an interesting and very important study on tanks in eastern India done by Dr. Niranjan Pant and Dr. Ravindra Verma under ITP during 2004-06. I am sure the findings of the study will re-emphasis the importance of tank irrigation in eastern India and will attract the government and other agencies to focus their future irrigation investment on tanks in this region.

ITP has much benefited from this study and the resulting publication. I congratulate the authors for this very important contribution.

K. Palanisami

Director, ITP

PREFACE

I (Niranjan) had the privilege of participating in almost all of IWMI-Tata annual partners meetings and its planning workshops till April 2008. During all such meets one common topic of discussion used to be tank irrigation in India. However the proposed/ conducted studies used to be generally confined to south Indian tanks. On some occasions some speakers would argue for taking research on tank irrigation in the eastern region of India. Having done a study of tank irrigation in *ahar-pyne* systems of Bihar in 1997-98, I knew how important these systems were both in the historical and temporal context and used to get provoked on such occasions. The culminating flash point came in the workshop meeting in March 2004 at IRMA, where it was proposed to study south Indian tanks involving a sum of Rs. 2.2 million funds from IWMI-Tata programme. I stoutly objected this proposal and later proposed a study of tanks in the eastern region of the country and after initial problems, was ultimately awarded a research grant of 3.89 lakh rupees. Since the coverage of the study was quite vast and the completion of the study had time constraints, I decided to share the task with Ravindra and the two of us carried out this study. Our working together was facilitated by the fact that we had worked together as a perfect research team in the early 1980s. After the study was completed sometime in January 2007, Tushar Shah wrote to me, "The historical picture you provide of irrigation in general and tank irrigation in particular is priceless. I enjoyed reading those sections on Bihar, Jharkhand as well as West Bengal." This encouraged us to go for the publication of the study in to a book and it was thats how this book originated.

The book explores the history and status of tanks in the four east Indian states. The book contents have been built around eight chapters. The contents in these chapters are often explained with the help of tables and whenever necessary material is provided in the annexure. Chapter one introduces tanks in general and those in eastern India in particular and highlights the paucity of available tank data. An important component of the chapter is the highlight of the utter neglect of tanks in the east Indian states and high preoccupation with south Indian tanks both in research and renovation/modernization. The chapter also covers research methodology and the process of selection of tanks for the study. The scenario in the East Indian states vis-à-vis south Indian states is examined in the second chapter with the help of available secondary data. The chapter also deals with the procedure adopted for the survey of four East Indian states and the reasons for exclusion of Uttar Pradesh. Chapter three to six cover the states of Bihar, Jharkhand, West Bengal and Orissa. A common feature of these chapters is that the historical accounts of tank irrigation, including those of the selected districts from each state is followed by

the survey findings in respect of each state. A number of case studies were conducted in Bihar and Jharkhand and the findings of such studies have also been included in the respective chapters. The details of case studies however are included as annexure. Chapter seven covers the fishery aspect of tanks, including its historical perspective. Chapter eight sums up salient points emerging from the study and hopes for the revival of indigenous tanks by their integration with the on going and new surface schemes.

Tables are arranged in two ways. One set of tables have been provided that go side by side of the description in each chapter. All such tables are based on secondary sources. Another set of tables have been generated from authors' survey. Such tables are common to four states of Bihar, Jharkhand, West Bengal and Orissa. These tables have uniform titles for all four states and have been arranged in the same order for all states. The only distinguishing feature of the state tables is the use of the first letter of the name of the state to which the tables refer. All survey tables of Bihar for instance would have numbering from B-1 to B-18. Similarly the consolidated tables of all four states have been numbered from E-1 to E-18, denoting eastern India. Although tables have been numbered 1-18, table 9 is split in three tables as a, b, and c. This means there are 20 tables for each state and a total of 100 tables based on the survey.

At times words with different spellings have been interchangeably used such as *bundh, bundha, bandh, bund, and band*. Similarly, *santal, santhal, pyne, pain, ryot, royot, raiyat* etc. In all such cases usage of the word is either location specific or author specific. While the location may refer to a district, region or state, authors generally refer to modern writers or old British gazetteer writers. It would be found that while British gazetteer writers have been using the word *santal*, the modern writers use the word *santhal*.

Many individuals and institutions have assisted us in preparing the book. The names of the institutions have been mentioned while discussing data collection in the methodology section. First and foremost this study was made possible by a research grant under IWMI-Tata Programme and we are grateful to the then head of the programme, Tushar Shah for providing funds for the study. We are gratified to our friends P.P.Ghosh and Indradeo Sharma who helped us intellectually and logistically in Bihar. We are also grateful to Deep Joshi for being instrumental for every possible assistance in PRADAN's offices in West Bengal and Jharkhand. In Bhubaneswar, Bismaya Mahapatra of Harsha Trust was a pillar of strength for us in providing guidance and logistic support for Orissa and we sincerely thank him for the same. Two others helped us in Orissa and for that we wish to thank, R.K.Panda of MASS, Sambalpur and Tapan Padhi of RCDS, Bhubaneshwar.

A number of research assistants helped us in the completion of research leading to the book but the one deserving special mention is Sidheswar Singh, who was very helpful in tirelessly collecting both secondary and the primary data for Bihar, Jharkhand and West Bengal and for this he deserves our sincere thanks. Above all a number of unnamed individuals who guided us to the tank sites and provided intimate information about tanks deserve our whole hearted thanks.

The publication of the book has been most torturous and agonizingly slow process and has been going on for over three years. The initial encouragement and support was provided by Dinesh Kumar, the then head of IWMI-Tata programme and we express our big thanks to him for the same. The publication of the book however would not have been possible without the timely interventions of Madar Samad, head of the IWMI office in India and he deserves our thanks for the same. Finally, we wish to express our thanks IWMI- Tata team, particularly to Padmaja Karanam and Vidya Ramesh for the editing of the manuscript.

Niranjan Pant

and

Ravindra Kumar Verma

LIST OF TABLES

ABBREVIATIONS

BC	-	Backward Caste
CCA	-	Cultural Command Area
CSE	-	Centre for Science and Environment
DTW	-	Diesel Tubewell
EEC	-	European Economic Community
EUC	-	European Union Currency
FD	-	Fisheries Department
GIA	-	Gross Irrigated Area
GOB	-	Government of Bihar
GOJ	-	Government of Jharkhand
GOI	-	Government of India
GOO	-	Government of Orissa
GOWB	-	Government of West Bengal
GOUP	-	Government of Uttar Pradesh
HC	-	High Caste
ID	-	Information Department
IFPRI	-	International Food Policy Research Institute
IWMI	-	International Water Management Institute
JRY	-	Jawahar Rozgar Yojana
MFP	-	Marginal Forest Products
MI	-	Minor Irrigation
MID	-	Minor Irrigation Department
MIP	-	Minor Irrigation Project
MPLAD	-	Member of Parliament Local Area Development
MOWR	-	Ministry of Water Resources
NIA	-	Net Irrigated Area
NGO	-	Non Governmental Organization
OBC	-	Other Backward Castes
O & M	-	Operation and Maintenance
PRADAN	-	Professional Assistance for Development Action
SC	-	Scheduled Caste
ST	-	Scheduled Tribe
STW	-	Shallow Tubewell
TID	-	Tank Improvement Department
UT	-	Union Territory

Glossary (Some Important Terms)

***Ahar*:** It is a reservoir consisting of a major embankment across the line of the drainage with two side embankments running backwards up to the line of the drainage gradually losing their heights because of the gradient of the surface. An ahar is an U-shaped or rectangular tank, which is supplied with water by a *pyne*, or by an artificial catchments basin placed across the line of drainage. Embankments are built on three sides of rectangle, the highest bank being at the end where the water would ordinarily emerge, while one side is left open to allow the water to enter. This structure is prevalent in Bihar and Jharkhand.

***Bhuinhari*:** The original clearers of the forests are recorded as *Bhuinhars*. Land given to them is known as *Bhuinhari* lands. These lands are privileged for which they pay only fixed quit rent.

Bandh: In Orissa it is a four sided tank excavated below the *kata* from which it derives its water by percolation. They are almost invariably used for drinking purposes.

Chanr/Sair: It is a traditional tool used when the level of the water in a stream or tank is very little below the level of the land to be irrigated. Two men standing one on each side of the pool of water, dip the *chanr* into pool, swing it up to the bank, and tip the water into the channel by sharply raising the ropes.

***Chhath Puja*:** *Surya* (Sun God) considered the god of energy and of the life-force is worshiped during the *chhath* fesival to promote well-being, prosperity and progress. The sacred worship of *Surya* is observed mainly in Bihar and eastern Uttar Pradesh. It is held according to Hindu calendar, on the sixth day *shukla paksha* of the month of *Kartik* (around November). It is performed in order to thank *Surya* for sustaining life on earth and to request the granting of certain wishes.

***Chik Baraik*:** A tribe found mainly in Ranchi, Gumla and Lohardagga. They are artisan tribes as their main occupation has been making cotton threads and clothes.

***Dabaris*:** It is a special case of the large number of traditional water harvesting and storage tanks that can be seen even today in the Budelkhand areas of Uttar Pradesh and Madhya Pradesh. Natural depressions in these landscapes were used for making these tanks.

Don: It is wetland in which paddy is grown. It is usually terraced and boundary made to store rainwater for paddy crops.

Dung: The most commonly used traditional lifting device in West Bengal, which is a longitudinal vessel about 10-15 feet long, mounted on a pivot. A person who stands on any one side (either in the pond or outside) operates it manually and pushes it up and down to lift water.

***Gilandazi*:** It refers to the amount spent by the estate for improvement of irrigation works. It was later realised from the farmers under the *Gilandazi.*

Genrabandi: It refers the series of embankments, which prevented the water from escaping from the fields. The *gherwa* or outer embankment used to be about four feet high, within which were a series of smaller embankments (*genera*) and last of all were the ordinary *ails* round individual fields.

Gotia**:** In olden days, the village land used to be collectively managed by the village community among the tribes of Ranchi district and the village officials used to distribute annually village lands to the different families within the village. In token of this annual arrangement each family used to receive a clod i.e. *goti* of earth from the *gotia* (village headman).

Gountias: They played a very important role in the construction and maintenance of the tanks in Orissa. *Gountia* or the village headman who held a hereditary position continued till the beginning of the Maratha rule.

Hathia nakshatra: It refers to the period between Septemeber 26 and October 7. It is based on Hindu calendar, which is divided into 24 *nakshatra*, representing a certain portion of moon's path in the zodiac.

Jalkar: In Bihar, it includes tank, *pokhar, ahar*, river watercourse, channels, *chaur, dhav,* reservoir lake, ox-bow lake etc., in which *makhana*, *singhara* and fish is reared. In general terms it refers to right of private ownership of the bodies of water or *jalkar* (from the Sanskrit *jal* meaning 'water' and *kara* meaning 'tax') attached to the estates of *zamindars*. Such *jalkar* rights covered non-navigable rivers, *beels*, ponds, *haors* and tanks.

Karin: It is a water scoop shaped like "dug-out" canoe cut in half. It is usually made of single piece of wood, but iron *karins* is not uncommon. The water is raised by a lever overhead with a weight at the end of it. The *karin* is used for raising water from *ahars* or from a lower channel to a higher, where water is plentiful, and has not to be shifted to a considerable height.

Kata: Prevalent in Orissa, it is an ordinary irrigation tank that is constructed by throwing a strong earthen embankment, slightly curved at either end across a drainage line, so as to hold up an irregularly shaped sheet or water. The undulations of the country usually determine its shape as that of a long isosceles triangle of which the dam is the base.

Khudi murrammat**:** This system of use of community labour for maintenance of irrigation work was also very much in vogue in the erstwhile Madras state, where it was legitimised through legislative action and is called *khudi murrammat* (self repair).

Khunt-katti: Among the tribes, the original clearers of the forests used to get recognition of usufruct right over the areas they cleared and also the right to admit new members in the same category. This system is still found in the areas of Ranchi district among the *Mundas* (Singh Muda in Purulia, West Bengal).

Laterite Soil**:** This soil is mainly found in the highlands of western part of Ranchi plateau and *pat* region. This soil is dark red or brown in colour because of iron content.

Latha: This is a long beam working on an upright forked post, which serves as a fulcrum. The beam is weighted at one end with a log or stone, and a cone-shaped bucket (*Kunru)*

is attached by a rope to the other end. The cultivator pulls down the rope till the bucket is immersed, the weight attached to the lever then lifts it, and the bucket is emptied in to the water channel.

***Mahli*:** They are mainly found in the districts of Ranchi, Lohardagga, and Gumla etc. Their economy is based on basket weaving, collection of forest refuse, agriculture, carrying palanquin etc. Each *mahli* family owns some land for cultivation but generally they have *tanr* land.

***Munda*:** In Orissa it is an embankment of smaller size across a drainage channel. In Bihar there is tribe by the same name.

***Oraon*:** The second most populous tribe in Jharkhand. They originally hailed from west coast of India. Their economy presents a mixture of agriculture, labour, collection of marginal forest products and services. Each family owns some agricultural land. Now a days some well to do oraon families have their own wells and diesel machines. The agriculture provides engagement to the oraon for six to eight months in a year and for the remaining period they collect forest refuse. They utilize the services of tribes like lohara, mahli, chik barik, and karmali in agriculture.

Pahan: Is the priest of oraon, munda and such other tribes. In some areas he is known as *Baiga*.

***Paraha (Padaha)*:** Comprises a number of villages, which ranges from about five to thirty. Each *paraha* has a particular territory.

***Parha Raja*:** The head of each *paraha* is known as *paraha* raja.

Pats: The *Pat* is the highest portion, lying west of Ranchi plateau and south of Garhwa and Palamau district and having elevation ranging between 1000m and 1200m. These isolated *pats* are outliers of the Deccan lavas and have maintained flat tops.

***Pyne*:** Is the local name for the diversion channels. These channels may be of various sizes. The small ones are those found originating in *ahars* and carrying the water of the *ahars* to cultivable plots. The large ones have their origins in rivers from which water is diverted through these artificial channels by erecting embankment in the riverbeds.

***Sagar*:** The tank structures, which are the largest ones called *sagar* were most visible feature of all feudatory states including Kalahandi in Orissa.

***Simli*:** The simplest lifting device, a relatively inexpensive one, which is a triangular metal tray tied with ropes on both the sides. The ropes are held by two persons, one on either side, and pulled and released successively to throw water. A *simli* throws small amounts of water each time.

Tanr: It is cultivated dry upland and is also known as *gora* or *bari* in the district of Singhbhum.

Zamindar: The indigenous estate holder and the local ruler was known as *zamindar* (from the Arabic *zamin* or 'earth/land' and the Hindi *dar* meaning 'one who holds').

CHAPTER-I

INTRODUCTION

Tanks are basically small reservoirs built of earthen walls across the rivers, streams and drainage channels to impound and store water to irrigate fields through channels. Unlike the diversion channels, tanks retain the water for future use. Where not supplied by perennial rivers, which is mostly the case, their storage depends on precipitation in the catchment. Tanks are often linked with one another, and such tanks are known as cascade tanks. The outflows from one might flow into another one further down the slopes. Historically tanks have been important in the states of Tamil Nadu, Andhra Pradesh, Karnataka and Kerala in the south India; Uttar Pradesh, Bihar (includes Jharkhand), West Bengal and Orissa in the eastern India; Madhya Pradesh, Rajasthan, Maharashtra and Gujarat in central and western India.

The word *tank* is often used in common parlance to describe small irrigation reservoirs and a large number of small man-made lakes are also designated as tanks. There is no standard definition for tank. In the eastern states of Orissa and West Bengal, pond and tank are interchangeable expressions, while in Andhra Pradesh, Karnataka and Tamil Nadu, tanks refer to a section of irrigation reservoirs, including small and medium sized water bodies. In fact, some of the tanks in Tamil Nadu and Karnataka are quite large.[1]

Construction of small and big tanks have been taken up in India from time immemorial for domestic purposes, fisheries and irrigation. The irrigation tanks with elevated embankments have some similarity with tanks built for domestic purpose and fisheries. Also, it is not uncommon to find tanks that combine irrigation with fisheries. Since the tanks can store catchments runoff during rains for future use, the necessity and utility of tanks is great in areas ravaged by frequent occurrence of droughts more particularly in areas where rainfall is scanty and ground water is not easily available. But it is important for uses like “fisheries” in areas with shallow groundwater table and heavy rains. Tanks also play an important role in preserving the environment and the ecology of the region. Tanks are vast in number and varied in size and are spread all

[1] Fish Seed Committee of the Government of India (1966) termed all water bodies of more than 200 ha in area as reservoirs

over the country. In different areas, they carry different nomenclature like tank/pond *malguzari, ery, kanmai, talab, tanka, kunta, baories, pokhur/pukar, sagar, kata, munda, bandha, khadim, haveli* system, *ahar* etc.

Some evidence of advanced water harvesting systems can be traced back to the pre-historic times in Puranas, Mahabharat, Ramayan and various Vedic, Buddhist and Jain texts. However, the most vivid and detailed description of such systems are found in the *Arthasastra* – a politico administrative treatise of Chanakya (also known as Kautilya) who was a mentor to and minister of Chandragupta Maurya (321-297 BC), the first emperor of India (Agarwal and Narain 1997, 11).

In *Arthasastra*, Kautilya clearly observed that kings dug tanks at locations where water for irrigation was plentiful. Semi-circular bunds were raised adjacent to small hillocks and water reservoirs. He further observed, "The king should arrange for permanent sources of irrigation for agriculture such as tanks and *bandhas*/dams. In case other people are themselves eager for construction of such permanent sources, the king should provide them with necessary land, watering and wood. In such collective construction if some person is not able to participate himself, he should contribute the money as compensation for his labour or provide a labour to represent him. It is further clarified that ownership of these sources would remain with the king" (Yogi 1973, 93-94). Kautilya not only provided detailed description of the mechanism for construction of irrigation sources, but also mentions about their ownership and administration. He asserts, "According to *Shastras* the king is the owner of all lands and water resources, therefore, he is eligible to collect water tax apart from land tax" (Yogi 1973, 215).

He also provided the details of the manner in which water tax should be levied. According to him, "those irrigating from the wells constructed by them are required to pay one fifth of the crop. Those irrigating their lands through pitchers/earthen pots, carried over their shoulders, are required to pay one fourth of the crop and those irrigating their lands from canals etc. should pay one third of the crop share to the king. Those irrigating their lands from the waters of rivers, lakes, tanks, ponds or wells, should pay one fourth share of the crop" (Yogi 1973, 215-216).

Kautilya mentions two types of embankments – the *sahodaka* where there is a natural flow of water, and *aharyodka*, which is a sort of storage tank with water brought in through channels specially dug for this purpose. Some important points emerging from the treaties of Kautalya, which have a relevance in the understanding of tank irrigation status today, are: (i) the land on which a tank was built was the property of the state; (ii) settlers pooled their resources to build a tank for common use; (iii) punishment was prescribed for a person who failed to co-operate in the building of an irrigation work; (iv) fines were imposed for damage to embankments or flooding of the lower tank by a tank constructed at a higher level. In addition, detailed instructions about exemptions from taxes, fines for failure to repair or maintain the tanks were given by Kautilya (Agarwal and Narain 1997, 14).

The technology of tank irrigation was known for several centuries. References to tanks occur from the time of the Sangam literature, i.e., 1st to 4th centuries AD (Meinzen-Dick 1984). Many of the existing/functioning tanks of today are several centuries old, as borne out by a large number of inscriptions dating from the 8th century. Historical evidence suggests that tank construction was sponsored by kings, chiefs, dominant farmer castes and even merchants and priests for purposes of revenue enhancement, tax concession and religious merit (Subbhalakshmi 1988).

Tank as a source of irrigation was most predominant in the southern and eastern parts of India. In the south, right from Chola era (985-1205 AD) to the Vijayanagar kingdom (1336-1546 AD), cascade tanks were constructed in Andhra Pradesh and Karnataka. Anantarajsagar or Pourma milla tank in Cuddapah district in Andhra Pradesh is a magnificent monument of Vijayanagar kingdom[2]. Similarly, Pal kings, who ruled over the present day Bengal from 760 to 1100 AD, constructed many large tanks in their kingdom (Bagchi 1995, xviii-xix). Further east, in the present day Orissa, *gonds*, the principal tribe of dravidian origin had established their rule by 9th century AD so much so that the whole section of eastern and central provinces assumed the name "*Gondwana*". It was the citadel of the most magnificent tanks. If there was one thing that chracterised *gond* kings most, it was the construction of various types of tanks such as *katas, mundas, bandhas and sagars* during their reign.

The predominance of tanks in Deccan plateau and eastern India, including Chhota Nagpur plateau is on account of the unique topography of the regions. In case of Deccan plateau, the tracts with undulating topography and rocky substrata are eminently suitable for tank irrigation. There are a number of reasons for the overwhelming presence of tanks in Deccan plateau. The rivers of Deccan are solely dependent on monsoon rains. There are many streams that become torrential during rainy season but dry up in the remaining part of the year. Besides, poor infiltration capacity of soils and substrata becomes ideal for storage of water for the lean season. Over and above, the undulating terrain and rocky substrata makes cost of construction of wells prohibitive. Tanks could also be formed across the slope of a catchments area for storage of rainwater. Consequently, two types of tanks, namely cascade tanks and reservoir tanks are found in this region. Cascade tanks are constructed in a series by bunding the running stretch of the same valley at several points. The surplus water, which spills over the waste-weir of one-tank, feeds the tank lower down and so on. The reservoir tanks are bigger tanks constructed across a single point in a valley. The cascade tanks are mostly concentrated in the Telangana region of Andhra Pradesh and many parts of erstwhile Madras district (Bhattacharjee 1961, 4-5).

The need for irrigation arises from the fact that the temporal and spatial distribution of rainfall and natural moisture regime is not in accordance with the water requirements

[2] This tank was constructed with a 1,372 m long earthen embankment on the Maldevi river with a water-spread area of 41.4 sq. kilometers

of the crops cultivated. Though the whole of eastern India, except some parts, lie in a humid zone with an annual rainfall of about 1200 mm, which is sufficient for *kharif* crops like paddy and maize, the occurrence and distribution of rains is highly erratic and distinctly seasonal in character. The monsoon often starts late and recedes early. Then, there are significant time gaps between wet spells. Such patterns of monsoon have severe consequences for crop cultivation in eastern India, where paddy is the most important crop covering about 70 per cent of the net cropped area. This crop is highly sensitive to droughts. The entire crop may fail for want of one or two critical watering. The most pertinent case in point is the severe drought of 1966-67 in which the production of food grains in the eastern region went down by over 50 per cent. Herein lies the significance of irrigation. It bridges the gap between rains, protects the crops from failure for want of moisture and stabilises agricultural production and activity. Again, most of the annual rainfall (over 85 per cent) in the region takes place during the four months from June to September, with very little precipitation during the remaining months of the year. In the absence of irrigation, cultivation is largely confined to these monsoon months. Irrigation facility extends the period of cultivation beyond the monsoon months. As a matter of fact, consequent to the drought of 1966-67, paddy production of many districts of eastern India decreased considerably. In Gaya district of Bihar, it decreased by 84.2 per cent (Prasad and Sharma 1991, 232).

Tank Irrigation in Eastern India

In the eastern region, over centuries, tanks and ponds constituted an important source of supplemental irrigation for crops during periods of water stress. Thus, tanks and ponds have been checkmating the hydrological characteristics of the monsoon by holding and conserving monsoon rains for utilization at critical stage of crop growth. Tank irrigation has a rich heritage on account of long historical antecedents in eastern India, comprising eastern Uttar Pradesh, south Bihar plains, Jharkhand, West Bengal and Orissa.

In case of south Bihar plains and Chhota Nagpur plateau, the indigenous system of the *ahar-pyne* has been evolved to overcome the obstacles, which the physiography of the area poses to crop cultivation.

Ahar-pyne is historically the most important source of irrigation in south Bihar plains and Chhota Nagpur plateau. Three factors contribute to the wide spread presence of this system of irrigation in the region. These are (i) scanty rainfall, (ii) a steep slope in farm land, which causes extensive runoff and (iii) soil, which is either heavy clay or loose sand, in both cases equally non-retentive of moisture. The ingenuity of the inhabitants has helped devise a system by which the natural drainage is blocked and the water is impounded (Pant 1998, 3133). Even today *ahar-pyne* provides a shining example of participatory irrigation management.

The eastern highlands (plateau) extends over Bihar, West Bengal, Madhya Pradesh and Orissa. The uplands of Chhota Nagpur plateau cover the districts of Palamau, Ranchi,

Dhanbad, Hazaribagh, Giridih, Santhal Pargana and Singhbhum. The same extend into the Purulia, Bankura and Midnapore districts of West Bengal. The northern Orissa highlands comprise Dhenkanal, Kendujhar, Mayurbhanj, Sambhalpur and Sundergarh. Little is known about the water harvesting system of this region. However, there is lot of evidence of rich tank irrigation system in Chhota Nagpur plateau. Although no major irrigation project could be undertaken in the region due to its hilly terrain, the system of damming valleys by a series of bunds 8 to 10 feet high, exist everywhere. It forms small tanks or *ahars*. These were not generally provided with masonry sluices, and the water seeping through them could be used to irrigate rice fields down-stream. Once the water was drawn, wheat or gram was sown in the tank bed. This practice ensured a good *rabi* crop.

Similarly, the somewhat steeper gradients of West Bengal offer greater scope for flow irrigation from small-scale reservoirs/tanks (Boyce 1987, 12). *Pukurs, talaos, bils, jhils and sayars* are most widely found water structures dotting the rural Bengal. These are mostly used for irrigation purposes (Bagchi 1995, 122). Official statistics report that prior to partition, the area irrigated by tanks grew substantially in Birbhum, Bankura and Midnapore districts, from 260,000 acres in 1910 to 700,000 acres in 1947. At the same time, tank irrigation shrunk in Burdwan, Malda and Murshidabad districts, from 470,000 to 225,000 acres. The reasons for these opposite phenomena however, need to be examined (Boyce 1987, 165-166).

The upland continues in Orissa, that at one time was called Gondawana, comprising parts of present day Madhya Pradesh, Maharashtra, Andhra Pradesh and Orissa. In Orissa it consisted of feudatory state of Kalahandi and the areas of pre-colonial states of Patna and Sambhalpur.

In Orissa, tanks of different kinds irrigated large areas. Some are upland tanks, which irrigate the nearby fields by gravity and are locally named as *kata.* Some are dug out tanks (like *pukhurs* in West Bengal) and are locally called *bandha.* These again require different types of lifts, while *mundas* are single impounded streams, and do not require any lift (Bagchi 1995, 122).

Database on Tanks

Construction of tanks that form part of the minor irrigation works dates back to ancient times as enunciated in the preceding part of this chapter. However integration of such works with large irrigation works was a matter of deliberate policy on the part of British colonial rulers. In 1854, they devised a definite irrigation policy laying a criterion for investments on irrigation works, which also provided the policy framework for fixation of water rates. The Public Works Department was set up and separate funds for two categories of irrigation works –major and minor, was instituted. However, some think that the initiation of the term minor irrigation did a lot of disservice to the water resource development programmes in this country. Though the British introduced the word 'minor irrigation' purely for financial management and accounting convenience, the classification marked the beginning of shift of emphasis from minor to major (Barah

1996, 6). Later in 1903, Irrigation Commission recognized the importance of small irrigation works and assessed that such works were responsible for more than half the irrigation area in the country. The drive for minor irrigation works actually started under the "grow more food" campaign launched in 1943 when financial assistance began to be extended by the government for these works (Anon 1991, 1-2)

Minor irrigation schemes fall in two categories, i.e., minor surface irrigation and ground water. Surface minor scheme comprise of storage schemes, diversion schemes and surface water lift schemes. The storage system includes tanks and reservoirs, which impound water of streams and rivers. Tanks occupy a very important place under minor irrigation schemes. Small irrigation tanks are generally called *bundhies* owned by individuals or groups of farmers. These have commands upto 20 ha. The state government constructs only large tanks with command area ranging from 20 to 2000 ha. In fact of late, tanks below 100 ha are being transferred by the state governments to the Panchayats.

The essential components of tanks are (i) *bund* or dam which is generally earthen but at times it is partially or fully masonry, (ii) *anicuts* and feeder channels to divert water from adjoining catchments, (iii) a waste weir to dispose off surplus flood water, (iv) sluice to let tank water flow out of the reservoir, and v) conveyance and distribution systems. The size of the storage is determined by the dependable run-off from the catchments, the rainfall pattern and the cropping system, that would decide on the inflows and outflows possible. The best and the direct method to estimate the dependable run-off would be to gauge the annual stream flow at the tank site for a number of years. As this is not a feasible proposition for small streams that often provide inflows into tanks, the run-off is computed on the basis of empirical formulae, estimated for the basin within which the tank catchment fall and found valid for the region from past experience.

Tanks fail mainly due to two reasons - silting of bed and breaches due to inadequate or bad maintenance of the bund/embankment. The restoration work generally consists of strengthening of the *bund* by raising its height, improvement of the spillway capacity, and occasional desilting of bed (Anon 1991, 3).

Since tanks come under various agencies, departments and tiers of government bodies within a state, there is no proper coordination to compile the data on the status of tanks. The non-availability of reliable data was felt in various forums including the Planning Commission meetings, academic seminars and workshops. Ministry of Agriculture sanctioned a centrally sponsored scheme named as Improvement of Irrigation Statistics during VI Plan (1980-85), which was fully funded by the central government. Since no fruitful result could be achieved, the scheme was abandoned in year 1986-87 and in the same years two separate centrally funded schemes were initiated.

Under one of the schemes, a complete census of MI works was conducted in the country to provide database of MI schemes with 1986-87 as the reference year. The second scheme provided for the rationalization of MI statistics in each state / UT. Under this each state/UT identified the nodal department for compilation of MI statistics. Each

such department was required to establish a statistical cell for which funds were to be provided by GOI. The statistical cell was required to compile a quarterly progress report in a prescribed format. The statistical units were also to take up special studies for assessment of the schemes going out of use. Among the four south Indian states, in Tamil Nadu and Andhra Pradesh, the nodal departments were State Statistical Bureaus, while in Karnataka and Kerala, MI departments were the nodal agencies. Among the east Indian states, in Uttar Pradesh, Bihar and West Bengal, MI departments were the nodal agencies; in case of Orissa, Planning and Coordination department had the responsibility of coordination.

Ministry of Water Resources at the centre collects data on minor irrigation development in each state in the form of quarterly progress reports. The statistical cell created in the nodal department of each state /UT are instrumental in collecting the required information from all departments/agencies contributing towards the development of MI within the state/UT. The fact of the matter is that some states/UTs have not created the statistical cells. Hence, country level data is highly fuzzy. Further, even in states where such cells exist, the present status and update worked out is based on the estimates using data obtained from 1986-87 MI Census. In fact, 1987 Census remained, for a long time, the only country-level database that gave a detailed account of the number of tanks in the country. Even here the state of Rajasthan did not conduct the Census. Bihar, which conducted the Census, did not submit the report until March 1991. This exercise was repeated once again in the third MI Census with the base at 2001 and the report published in October 2005.

Rationale of the Study

In the early 1980s, Pant (1982) argued that during the Plan period untill 1980-81, 76 per cent of the total financial outlays in irrigation had been spent in major and medium irrigation works and only 24 per cent was spent on “minor irrigation” works. As against this, “major and medium” projects[3] developed 49 per cent of the irrigation potential, while minor irrigation works developed 51 per cent. According to the author, during the Plan periods till 1980-81, it was only during the fifth Plan period (1974-78) when major and medium irrigation projects created more irrigation potential (52 per cent) than the minor. Based on this analysis, Pant had argued in favour of minor works as against large projects and concluded, “small is beautiful” (Pant 1982). This view of Pant, had created a great deal of debate. While one group favoured the argument the other group opposed the protagonists of the idea, which held that the very idea of large irrigation projects was altogether ill conceived and unwarranted. Those who did not agree with the idea enumerated a number of shortcomings associated with minor irrigation (Dhawan 1996). While some others did not subscribe to the idea of 'small is beautiful', but chose to

[3] All projects having a CCA of more than 10,000 ha are major projects. Those having CCA between 2000-10000 ha are medium projects. All projects having CCA up to 2000 ha come under MI projects. Projects less than 100 ha are local sector projects, maintained by Panchayati Raj bodies.

criticize the large irrigation projects[4]. While a number of problems are associated with large irrigation projects, the one that deserves special mention is the ecological and environmental degradation on account of water logging (Vaidyanathan 1999). It was further argued that while budgetary allocation for irrigation projects had increased, allocation towards maintenance of existing tanks and construction of new ones remained a small fraction of the sector outlays (Vaidyanathan 2001).

Ignorance and Apathy of Tanks in Eastern India

Since tank irrigation constitutes the most important segment of minor surface irrigation schemes and had been the most important source of irrigation in the southern and eastern India, it is necessary to undertake a study of tank irrigation in eastern India. Such a study is urgently needed because, despite the pivotal role played by tanks in the eastern region over centuries, this remains a virgin territory as far as research is concerned. Another reason is that there is hardly any database on the status of tanks, for the country as a whole and this region in particular. In the absence of a robust database, wild guestimates are being made[5]. As per Working Group on Minor Irrigation for the formulation of the Tenth Plan (2002-2007), the total number of surface flow schemes is 4.19 lakh. The data based on updated MI census of 1993-94 however, provides no separate figures for tanks. The first MI census (1986-87), which did a more detailed analysis in respect of tanks, concluded that silting and poor maintenance reduced the gross irrigated area by tanks to 3.07 million ha in 1985-86 from 4.78 million ha in 1962-63. This was despite the fact that many new tanks were constructed during these periods and several others were renovated. Vaidyanathan calculates a colossal loss of Rs. 500 crore due to this (Vaidyanathan 2001). Given this fuzzy scenario in respect of tanks in India and near ignorance of tank in eastern India except those of south Bihar, it was absolutely necessary to conduct a study.

There is scarcity of information available on tanks and the reference period for what is available is 5-7 years old. This is because there is delay of about 5 years in publishing land use statistics and the delay in respect of MI Census is about 7 years. In addition there is lot of discrepancy between irrigation statistics compiled under land use statistics and those compiled under MI Census. This is on account of different methods of estimation and difference between these two sets of figures at the conceptual level (GOI 2001, 84-82). Further, several gaps exist in the information that is available on tanks and their management and usage. Most assumptions are not backed by data. Again, little is known about the scale of deterioration of tanks and the extent of impact on the

[4] They held the view that the Indian Plans accorded high priority to irrigation sector and made massive investments in this sector. It was mentioned that in comparative nominal terms, the public sector outlay had risen from an average of Rs. 90 crores per annum during the first Plan to over Rs. 65,000 crores in the Eighth Plan. Yet performance of irrigation sector had not matched the expectation; both in terms of pace of development, use of facilities and their impact on productivity of land.

[5] While one study mentions the number of tanks in India as 15.13 lakh (Vaidyanathan 2001), another study mentions existence of more than 10,000 tanks in one district of Tamil Nadu (Mosse 2003, 29). The ADB tank study reports that the number varies between 200,000 and 350,000 (ADB 2006).

communities (Vaidyanathan 2001). In this respect the latest report (3rd MI Census) estimates that there are 2,32,619 tanks in the country (GOI, October 2005, 50-51)

Over and above the reasons cited above, eastern region has the largest number of tanks in India. This factual position sounds unbelievable in the light of the myth that has been perpetuated for a long time that makes tank irrigation synonymous with Peninsular India. Therefore, it is not uncommon to find such claims that in the subcontinent as a whole, systems of tank irrigation are concentrated in coastal districts of southern and central India and northern Srilanka (Mosse 2003, 05). However, the fact remains that as per the first and the only comprehensive MI Census done in a long time period, the four east Indian states chosen for the study contained the largest number of tanks.[6] As per this MI Census, there were a total of 4,74,427 tanks and ponds in India. Further, the four south Indian states of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala were having 35.6 per cent ponds/tanks, while the four states of east namely, Uttar Pradesh, Bihar (Jharkhand included), West Bengal and Orissa were having 56 per cent of the total ponds/tanks. Thus, these two regions together accounted for about 92 per cent of the tanks of India. However, in terms of net irrigated area, the four states of south India accounted for 55.5 per cent of India's net tank irrigated area, while the four states of east accounted for 25 per cent net tank irrigated area. But what is significant is that the 8 states together contained 80.6 per cent of the net tank irrigated area (GOI, March 1991, 43-44).

Preoccupation and Publicity of Tanks in South India

In the context of south India, despite the centrality of tanks in the region's economy, the research on tanks started from sometime in the early 1980s (Mosse 2003, 31). However, what is significant is that the research that was carried out on south Indian tanks, more particularly with the funds of the Ford Foundation, was highly publicized which attracted further funding for research and also for tank rehabilitation in the region from the World Bank and other big funders. Until late 1990s, when "Dying wisdom" from the Center for Science and Environment was published, there was complete ignorance about tanks of eastern India, except the "*ahar- pyne*" system of Bihar. The pre-occupation of researchers with south Indian tanks can be observed if one goes to some good academic libraries[7]. This is also observed in the study of tanks sponsored under IWMI-Tata Water Policy Programs during 2003-2004[8].

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[6] The MI Census, 1987 did not contain any tank data in respect of the states of Rajasthan and Bihar. In case of Rajasthan no such Census was conducted, while in case of Bihar the data was not consolidated until March 1991.

[7] Pant in April 2004 randomly checked these facts in some good academic libraries of New Delhi and found that over 90% of the books on tanks irrigation dealt with south Indian tanks, while the rest of the books dealt with tanks in general, and very few books were found to deal exclusively with tank irrigation in eastern India.

[8] The study involved case studies of tanks and 73% of tanks were from south India (Tamil Nadu alone had 45% of studied tanks). About 25% of tanks were from central and western Maharashtra. There was only one study (2%) from eastern India.

The problem arises because all those who pioneered tank research in India since the late 1970s held the view that tanks were concentrated in south and central India, i.e., the coastal districts of Tamil Nadu and Andhra Pradesh, south-central Karnataka, Telengana in Andhra Pradesh and east Vidarbha in Maharashtra. In north India, tank irrigation, according to them, was found in north-east Uttar Pradesh, in the area of the former kingdoms of Oudh and Rajasthan, east of the Aravalli mountain range (Von Oppen and Subba Rao 1980) and no mention of tanks in the eastern India was made.

Unfortunately, for the past several decades, tank research has been equated to study of south India tanks by researchers both from outside as well as within India. They succeeded in publicizing the need for tank rehabilitation in south India and generating huge funds for the same. A recent example sighted on the negligence of east India tanks research is the study of tanks by Saktivadivel undertaken for ADB. In the 102 pages report, which covered a few selected states of India, only Orissa was covered from east India, accounting for just 5 pages, mostly summary of an earlier ADB study. A section in the report "Tank Irrigation in Different Regions of India" confines to talks of tank functions and history in south India alone (ADB 2006). In this context, two more studies dealing with tank research (Von Oppen & Subba Rao, 1980 and Mosse, 2003) need to be mentioned.

Disproportionate research and resulting publications on tanks in south India has also led to greater availability of funds, particularly from the foreign donors for the rehabilitation/rejuvenation of tanks in this region. During the Seventh Plan several externally aided tanks related projects were implemented in south India[9]. One was World Bank Assisted Karnataka Irrigation Project. The project that continued for a long time, involved an aid of Rs. 6,706 million. In case of Karnataka, some NGOs were also providing financial aid. For instance, during 1995-2003 DHAN foundation had provided an aid of Rs. 121 million. Similarly, another NGO by the name PALMYRA provided an aid of 1,476 million during the same period. Then there was EEC assisted MI project in Andhra Pradesh involving Rs.249 million (GOI 1991, 12) grant. During the Plan period (1985-90), there were other tank modernization / rehabilitation projects undertaken in south India, and the most important one was Tamil Nadu's Tank Rehabilitation and Water Management Project funded by the EEC. The project was implemented in two phases. The first phase was during 1987-89, while the second phase including extension (from 1989) continued up to 1999. It involved a total aid of Rs. 1794 million. Apart from it, Tamil Nadu also received an assistance of Rs. 1,028 million for tank modernization during 2001-2002 from the World Bank. In Kerala Community Irrigation

[9] Report of the Working Group on Minor Irrigation for formulation Eight Plan 1990-95 (GOI 1989) does provide the details of externally aided MI projects. But the report of the working group on Minor Irrigation for formulation of the Tenth Plan 2002-2007 (GOI 2001) has not included any information on externally aided projects. All the financial figures given in terms of rupees are based on those provided to us by Gomathynayagam, who along with Saktivadivel conducted the IWMI- Tata tank study in 2003-2004.

project, apart from lift irrigation schemes, tank irrigation systems were also involved. This externally aided project received grants-in-aid from the Netherlands Government and the estimated cost of the project was Rs. 1,500 million. In addition, since 1999 there is an ongoing EEC funded project in Pondicherry involving Rs. 36 million.

As against this, the only externally aided proposed project, which is mentioned in the Working Group report, is the one on modernization of tank irrigation systems in Orissa. It was estimated to cost Rs. 170 million (GOI 1991, 14).

Comparison of Tanks in the Two Regions and the Desirability of the Study

The hard empirical data provided in Table 1.1 further rationalizes the study of tanks in eastern India. The table consists of two parts. The first part gives an all India position in respect of tank irrigation vis-a-vis other sources of irrigation. Part two of the table covers tank irrigation in the southern and eastern states of India. Looking at part one it becomes obvious that the importance of tank as a source of irrigation has been diminishing both in percentage and absolute terms. While in 1956-57, net tank irrigated area was about 4.5 million ha., in 2002-2003 it dwindled to about 1.9 million ha.

Table- 1.1: Net Irrigated Area and Tank Irrigation during 1950-2003

Part-I : Percentage of Net Irrigated Area – By Source and Total Net Irrigated Area ('000 ha)

Year	Govt. Canals	Private Canals	Tanks	Tube Wells (TWs + Other wells)	Other Sources	Total (Ha)
1950-1951	34.3	5.5	17.3	28.7	14.2	20853
1960-1961	37.2	4.9	18.5	29.6	9.8	26661
1970-1971	38.5	2.8	13.2	38.2	7.3	31013
1980-1981	36.8	1.2	7.8	48.0	6.2	41779
1990-1991	34.6	1.1	6.8	51.0	6.5	47434
1999-2000	28.3	0.3	4.5	60.9	5.4	56761
2002-2003	27.8	0.4	3.6	63.3	4.9	53131

Part-II : Tank Irrigation in Southern and Eastern Indian States ('000 ha)

Year	Southern States					Eastern States						Total (India)
	A .P.	Tamil Nadu	Karn-ataka	Kerala	Sub Total	Bihar	Orissa	West Bengal	U.P.	Sub Total	Southern & Eastern States	
1956-57	1180	888	327	31	2426	241	495	390	423	1549	3975	4492
%	26.3	19.8	7.3	0.7	54	5.3	11	8.7	9.4	34.5	88.4	100
1961-63	1246.5	938.5	356.5	45.3	2586.8	278.8	418.5	368.3	417.6	1483.2	4070	4580.7
%	27.2	20.5	7.8	0.99	56.5	6.1	9.1	8	9.1	32.4	88.9	100
1965-66	1189	503	325	60	2077	175	495	328	391	1389	3466	4441
%	26.8	11.3	7.3	1.3	46.8	3.9	11.1	7.4	8.8	31.3	78.1	100
1971-72	813	924	374	74	2185	144	583	303	334	1364	3549	4123
%	19.7	22.4	9.7	1.8	53.0	3.5	14.1	7.3	8.1	33.1	86.1	100
1976-77	1089	800	256	51	1296	126	271	303	295	995	2291	3898
%	27.9	20.5	6.6	1.3	56.3	3.2	6.9	7.8	7.6	25.5	81.8	100
1984-85	775	715	327	38	1855	131	257	277	148	813	2668	3330
%	23.2	21.5	9.8	1.1	55.7	3.9	7.7	8.3	4.4	24.4	80.1	100
1990-91	968	769	240	49	2026	115	289	263	104	771	2797	3245
%	29.8	23.7	7.4	1.5	62.4	3.5	8.9	8.1	3.2	23.8	86.2	100
1992-93	729	629	257	48	1663	120	298	263	84	765	1428	3243
%	22.5	19.4	7.9	1.5	51.3	3.7	9.2	8.1	2.6	23.6	74.9	100
1995-96	747	512	230	49	1538	140	305	263	58	766	2304	3106
%	24.1	16.5	7.4	1.6	49.5	4.5	9.8	8.5	1.9	24.7	74.2	100
1999-00	651	633	245	53	1582	155	293	324	90	862	2444	2750
%	23.7	23	8.9	1.9	57.5	5.6	10.7	11.8	3.3	31.3	88.9	100
2002-03	426	422	239	49	1136	111	100	313	58	608	1718	1897
%	22.1	21.9	12.4	2.5	59.9	5.8	5.2	16.3	3	30.7	90.6	100

Source: (i) 1956-57, "Study of the Problems of Minor Irrigation, PEO, Planning Commission, GOI, 1961, (ii) 1961-63, All India Review of MI Committee on Plan Projects, Planning Commission, GOI, June 1966, (iii) 1995-96, World Irrigation and Water Statistics 2002, IWMI, Colombo, (iv) 1999-2000 and 2002-03 data is drawn from Land Use Statistics, MOA, GOI, March 2004 and February 2006 and, (v) the rest of the data is taken from Indian Agriculture in Brief: 9th, 14th, 18th and 25th editions.

Indian Agriculture in Brief: 9th, 14th, 18th and 25th editions, New Delhi.

Examination of part two of the table clearly brings out two things. First, while the four states of south India accounted for 47 per cent to 60 per cent of the net tank irrigated area, the four states of east accounted for 24 per cent to 36 per cent. The two regions together constitute 74 per cent to 94 per cent of net tank irrigated area. This is indicative of the very high importance of the two regions in India's tank irrigation landscape.

The other important point emerging from the data is that while in case of south India the decline in tank irrigated area has been inconsistent during the last four decades (showing increase in certain years), in case of eastern India, the decline remained consistent. The main reason for this trend is that while good amount of financial resources, more particularly from international donor agencies have been spent on rehabilitation of tanks in south India, tanks in the eastern India suffer from a complete neglect.

The comparative position of tanks in south India and eastern India has also been shown in Table 1.2. Here data were obtained from the two MI Census, one carried out in 1987 and the other in 2001. Two parameters have been examined using these data. The first one is the change in number of tanks and the second is the extent of utilisation. It is found that the overall decline in the number of tanks at the all India level is to the tune of 51 per cent. However, there are wide variations across states both in the south and the east. In case of south, Karnataka experiences the least decline of 18 per cent, while Kerala experiences a devastating decline of over 95 per cent from the 1987 figures. Similarly in case of eastern India, highest decline (92 per cent) is found in West Bengal. This is closely followed by Uttar Pradesh, where about 76 per cent of the tanks disappeared. In case of Orissa about 50 per cent of the tanks have disappeared during the 14 years period. In respect of the extent of utilization of created potential, the utilization in the four south Indian states is about 69 per cent, while it is about 64 per cent at the all India level and about 61 per cent in eastern India. Looking across states, it is found that the highest utilization of created potential is in Kerala (90.2 per cent) followed by Uttar Pradesh (85 per cent) and then Jharkhand (73 per cent). The lowest utilization is found in West Bengal (55.6 per cent), preceded by Orissa (59.3 per cent).

Table- 1.2: Comparative Status of Tanks in the South and the East Indian States

(Land in ha)

States	No. of Tanks		% of Decline	Potential Created 2001	Potential Utilized 2001	% of Utilisation
	1987	2001				
Southern States						
Andhra Pradesh	61,177	43,148	29.4	11,70,448	8,22,306	70.3
Tamil Nadu	36,862	18,469	49.9	5,40,535	3,48,888	64.5
Kanataka	21,245	17,466	17.8	2,85,195	1,92,469	67.5
Kerala	49,736	2,413	95.1	34,747	31,337	90.2
Sub Total	**1,69,020**	**81,496**	**51.8**	**20,30,925**	**13,95,000**	**68.7**
Eastern States						
Bihar	NA	1,639	-	41,417	35,151	84.9
Jharkhand	NA	3,763	-	15,430	11,294	73.2
Orissa	7,989	11,977	49.9	12,86,604	1,69,970	59.3
Uttar Pradesh (Incl. Uttara Khand)	27,149	6,588	75.7	61,244	52,058	85.0
West Bengal	2,30,592	19,344	91.6	12,322	69,164	55.6
Sub Total	**2,65,730**	**4,672**	**-**	**4,67,773**	**2,85,579**	**61.1**
Total of India including UTs.	**4,72,908**	**2,32,619**	**50.8**	**36,06,159**	**22,90,526**	**63.5**

Source: 1987 data from Surface Minor Irrigation Development in India, GOI, MOWR, MI Division, March 1991, pp 43-44

2001 data from Report on 3rd Census of Minor Irrigation Schemes, GOI, MOWR, MI Division, October 2005, pp 50-51.

The overall data in Table 1.2 points out that the extent of utilization of created tank potential of south Indian states is better than that of east Indian states.

Lack of studies[10] and therefore lack of publicity of tanks in eastern India resulted in lack of donor interests in funding tank rehabilitation projects. The present study attempts to explore the status of tanks in eastern India comprising of eastern Uttar Pradesh, south Bihar, West Bengal and Orissa. This study was primarily taken with this point of view so that enough interest is created among researchers about tank systems of this region.

Objectives of the Study

The main objective of the study was to prepare a status document on tank irrigation in eastern Uttar Pradesh, south Bihar, West Bengal and Orissa. Attempts were also made to capture the regional diversity. Following were the complementary objectives:

- Examine the historical antecedents of tank irrigation in each of the selected states and in different regions within each state
- Examine the reasons of decline in tank irrigation in all states and in regions thereof
- Examine the evolution of relationship between the society and the tank system, both in terms of the roles assigned and the sustainability of the system.
- Examine the multiple uses of tanks, particularly aquaculture
- Identify the present day major beneficiaries of tanks in different states and to shortlist the common denominators of such beneficiaries across the states and the regions
- Identify the conditions of success for environment-friendly and sustainable development of tanks across states and regions
- Examine the prospects of rehabilitation of tanks and its potential linkage with other ongoing systems of irrigation. Tank utilization for developing aquaculture

Hypothesis

Since the study was of exploratory nature, no hypothesis was proposed. However, a large part of the high lands in the region are the abode of the tribal. Sometimes these high lands have indigenous systems of tank irrigation; hence we might examine this relationship.

Methodology

Data were collected from secondary and primary sources. In respect of primary sources, reconnaissance surveys of different states were carried out and data collected through group discussions; transit walks (in & around tank commands); and detailed

[10] While the authors have come across a large number of studies on south Indian tanks, there is not a single study (except south Bihar), which covers eastern India.

semi structured interviews with knowledgeable individuals, (farmers, tank functionaries, politicians, bureaucrats, journalists, scholars). Secondary data sources included historical and other official records collected at state capitals and regional headquarters.

There were three field visits planned initially to be carried out during the period 2004-05, each for about a fortnight. The first visit was to be before the monsoon; the second during the monsoon, and the third during the critical *hathia nakshatra* period (second week of October) when artificial irrigation becomes a necessity for the paddy crop in the whole of the eastern region.

While the field visit was planned to start by mid May 2004, there was delay and the field visit started in August 2004 during the *kharif*. The second visit was undertaken during the *rabi* season in January 2005 and the third visit was carried out in summer month of May 2005.

Also, after the initial field visits of Bihar, West Bengal and Orissa, it was decided to incorporate tank fisheries into the survey. With respect of Bihar, tank survey was carried out both in Bihar and Jharkhand. But for secondary data, Jharkhand was merged with Bihar.

Field Reconnaissance and the Survey

The first field visit was conducted during September 4 – 25, 2004, covering Patna and Nalanda districts of Bihar; Birbhumi and Purulia in West Bengal and Sambhalpur, Bolangir and Kalahandi in Orissa.

In October 2004, tanks in Patna, Nalanda and Jamui districts of Bihar were surveyed and during November 2004, Birbhum, Bankura nad Purulia districts of West Bengal were surveyed.

The second field visit carried out during *rabi* season between January 18 – February 5, 2005 covered Ranchi and Gumla districts of Jharkhand as well as Bankura and Purulia in West Bengal. During this period, new and old official documents were also collected from Calcutta, Bankura and Purulia.

The third field visit was carried out during May 6 – 21, 2005 and reconnaissance and tank survey was carried out in Sambhalpur and Kalahandi districts in Orissa as well as collecting official documents and data for the state; and visit to Bihar to consolidate primary and secondary data for the state.

In July 2005, Palamau district of Jharkhand was surveyed. The data of Gumla district was found to have discrepancies and to correct that, a re-survey was carried out in August 2006.

Data Collection Techniques

Review of secondary data was useful to get a quick picture of the current situation of the tanks, their historical antecedents as well as its ecological and geographical coverage.

In September 2004, a semi structured interview schedule was prepared with a view to carry out discussions with tank stakeholders and other knowledgeable persons.

During the course of the field work, apart from visiting tank sites; data was collected of data was done through transit walk, direct observations, group interviews etc,. In addition, state archives, libraries, government departments, reputed NGO offices were visited for collecting both historical documents and secondary data. In this respect the A. N. Sinha Institute, Sinha Library and the Secretariat library in Patna, Asiatic Society, IIM, and Center for Studies in Social Sciences in Kolkata; Tribal Institute in Ranchi, State Archives and Nabakrushna Choudhary Centre for Development studies in Bhubaneshwar were found to be very resourceful. PRADAN in Purulia and Ranchi districts were helpful in field research as were Harsha Trust and Regional Centre for Development Cooperation (RCDC) in Bhubuneshwar, Manav Adhikar Sewa Samiti (MASS) in Sambhalpur and Karrtabya at Chhoriagarh in Kalahandi.

Some major changes incorporated in the methodology include:

- Study planned to begin in mid-May or early June 2004 (with the intention to undertake first leg of field visits before onset of monsoon). Total time envisaged for data collection and analysis was 6 months (spread over 9 months). Field work for 45 days was spread over 140-150 days (each field visit, 15-day duration). The study was to be complete by February 2005.

Against the envisaged plan, the first leg of field visit was undertaken in *kharif* (August 2004). Second during peak *rabi* (January 2005) and third in summer (May 2005).Though actual schedule was reversed, it did not effect the study as it was possible to visit the study states in all three seasons.

The main intention of starting the study in May 2004 was to undertake the first leg of field visits in the 4 east Indian states before the onset of monsoon. However, due to delay in approval of study proposal, it could be started only in August 2004.

- Initially, Pant planned to conduct the study by himself but later decided to collaborate with R.K. Verma of Bihar University, a research collaborator, who shared the responsibility of investigations in Bihar, Jharkhand and West Bengal.
- Initially field work was planned in Uttar Pradesh. But literature survey and initial discussions with competent authorities, brought to light that in the last 25 years, tank irrigation in the eastern Uttar Pradesh had waned and presently tank irrigation is confined to the Bundelkhand region. It was therefore decided to exclude Uttar Pradesh (in particular eastern Uttar Pradesh) from the tank survey and coverage of Uttar Pradesh was confined, to data from secondary sources for the comparative purposes.
- After the first phase of field visit, in the state of Bihar, West Bengal and Orissa, it was decided to incorporate tank fisheries into the survey.

- As Jharkhand was carved out of Bihar in November 2000, tank survey was carried out both in Bihar and Jharkhand separately. However, in terms of secondary data, Jharkhand data is merged with that of Bihar.

Tank Site Reconnaissance

It consisted of the following: (i) walking / driving around the tanks and utilizing direct observation technique; (ii) use of interview guide/semi-structured interview; (iii) focus interviews with groups of stakeholders; (iv) interviews with individuals / informants; and (v) pre-testing of interview schedules.

I. Walking and direct observation: To observe the tank dynamism in terms of activities of various tank water users, different types of activities performed by male and female users of tanks, direct observations were recorded. This was very useful in understanding the importance of tanks for bathing, cleaning of clothes, ceremonial purposes, fishing and irrigation "Seeing was believing," when it come to the real dependence of certain social groups on these tanks. Gender based segregation of users was clearly visible in tanks in case of bathing and washing of clothes. Observations noted in brief during the field visits were elaborated and recorded in detail at the end of the day.

II. Use of interview guide: An interview guide was a list of topics to be discussed with tank stakeholders, and they were grouped in such a way that the sequence of discussions was easy to manage for the respondent. Side by side, questions were prepared so that the respondent could think and respond in a meaningful way. In cases where the responses were not satisfactory, probing questions such as "who gets what, why, when, how, how do you mean, anything else, but why" etc., were asked. This process helped get further information on who gets what and why, particularly in respect of irrigation water and fisheries.

Generally questioning began by referring to scenes at the tanks site. Questions were asked in an open-ended yet probing manner, asking respondents to provide concrete information/examples. New questions were generated from the answers given. At the same time, respondents were also encouraged to raise questions keeping in mind the group dynamics at work.

III. Focus interviews with groups: All the above-mentioned techniques were used in group interviews. The process of group formation started along with walking and seeing around the tanks. Once a walk around the tank/tanks in the village was over, people were requested to gather at a central place. Efforts were made that the group constituted a mix of men and women, various social groups such as caste and various factions representing the tank village. The group size varied between 8 and 20.

IV. Interviews with key informants / individuals: During the course of the visits to tank sites and more particularly during the course of group interviews, person's knowledge and his/her willingness to divulge information were noted. All such knowledgeable persons, who were thought to be , were later contacted individually and their detailed interviews conducted.

Apart from selecting this, other knowledgeable persons specially selected for their better understanding of either the tank systems or other matters linked to development of the tanks, be it social, ecological, historical, etc., were selected for indepth interviews.

V. Pre-testing of interview schedules: Two sets of interview schedules were formulated after the initial part of the first phase of field trip was over. The schedules ultimately used for the tank survey are incorporated as **Annexue-1.** During the rest of reconnaissance, including the first phase, the same were exercised during the group interviews. Both the interview schedules were pre-tested, improved, refined and finalized in the subsequent phases. It should however be clearly understood that both - village and tank schedules were exercised on groups of farmers and not on individual farmer and the data so collected were used for analysis. At the same time, the PRA conventional technique was not used which is highly time consuming and at the same time superfluous. This means the survey methodology was a mix of conventional survey and PRA methods.

Selection of Districts / Regions, Tanks and villages

The selection of states had already been done before we embarked on the field visit. However as explained in the preceding pages, Uttar Pradesh was dropped from the survey when found that tank irrigation in eastern Uttar Pradesh was more a matter of history and that in present times rarely used by anybody.

In respect of other states, the regions and/or districts were selected based on our study of historical records and discussions with knowledgeable persons. Once the region/ district was selected, the researchers looked around for large tanks, with historical important and still contributing to irrigation and fishery. In some other cases, researchers contacted local knowledgeable persons to know about villages or places where tank irrigation was popular. Once such villages were identified, the tanks were selected.

In the states of Bihar, Jharkhand and West Bengal, tanks survey was carried out under the supervision of Verma. Survey of tanks in Bihar and West Bengal was during October– December 2004 and in Jharkhand during February, July 2005 and August 2006. In case of Orissa Pant survyed the tanks September 2004 and May 2005. The list of tanks surveyed along with other locational details is incorporated as **Annexure-2.**

CHAPTER-II

The Scenario of tanks in Eastern India

The overall scenario in India

At the commencement of the first five-year Plan, the number of tanks in the country was assessed to be nearly 5 lakh, spread across different states (GOI 1966, 9). However, this data do not include the figures for West Bengal, which contains the largest number of tanks as per the MI Census of 1986-87. Further, this data classified tanks into two categories, those irrigating below 100 acres and those irrigating 100 acres and above. According to this data, about 94 per cent of tanks belong to the first category, while only 6 per cent belong to the second category. The data on tanks as per 1951 Census are provided in Table-2.1. However, the reliability of this data is questionable[11]

The second important sources of data on tank irrigation are MI Census of 1987 and 2001. The Census of Minor Irrigation works with reference to 1986-87 was initiated in the same year with a view to complete it by 1987-88. However there was omission of two important states in this Census. Rajasthan did not conduct the Census and in case of Bihar, the primary enumeration work had been completed, but the consolidation of the data at state level was not done, hence no data was provided (GOI 1991, 8). As per this Census, there were 4.73 lakh ponds/tanks in India (including 1519 tanks in UTs).

The state wise data emerging from the MI Census 1987 are provided in Table-2.2. A comparison of the data emanating from the two tables reveals that there is a marginal decrease in the number of tanks in 1987 in comparison to 1951. However, before we proceed, a few points need to be mentioned. First, Rajasthan data is missing in both the tables. Second, West Bengal data is missing in 1951 data (Table-2.1), while Bihar data is missing for 1987 (Table 2.2). So no comparison of these two states is possible. Third, wide variations are found in some of the state-level figures of number of tanks. In addition, in case of Table-2.1 it is found that the summation of state wise figures of number of tanks does not add up to the total of 4995 provided in Table-2.1. As regards the four south Indian states, a marginal increase in the number of tanks was observed from 1951 to 1987 in case of Andhra Pradesh and Tamil Nadu. In case of Karnataka a substantial decrease in the number of tanks by 42 per cent is witnessed

[11] For instance, Orissa was reported to have only 1700 tanks (1200 below 100 acre and 500 above 100 acres). But, at the same time, the area irrigated from these tanks was reported to be 40% of the total area irrigated from all sources (GOI 1966, 9-11).

during the time period between the two Census. However, the greatest variation is found in case of Kerala where the total number of tanks rose from 1500 in 1951 to 49736 in 1987 showing a phenomenal increase of 33 times. In case of Uttar Pradesh, the decrease is quite substantial (81 per cent). Orissa on the other hand, witnessed a phenomenal increase of 370 per cent during the time period.

Table 2.1: State wise Number of Tanks in Different Categories

(In hundreds)

Sl. No.	Name of State / Territory	Below 100 acres	100 acres and above	Total
1.	Andhra Pradesh	483	84	567
2.	Assam	Nil	Nil	Nil
3.	Bihar	269	9	278
4.	Gujarat	192	12	204
5.	Jammu & Kashmir	-	-	-
6.	Kerala	14	1	15
7.	Madhya Pradesh	383	19	402
8.	Madras	247	67	314
9.	Maharashtra	440	41	481
10.	Orissa	12	5	17
11.	Mysore	338	27	365
12.	Punjab	2	-	2
13.	Rajasthan	N.A.	N.A.	N.A.
14.	Uttar Pradesh	1352	48	1400
15.	West Bengal	N.A.	N.A.	N.A.
	Total States			**4995**
1.	Andaman & Nicobars	-	-	-
2.	Delhi	-	-	-
3.	Goa	-	-	-
4.	Himanchal Pradesh	-	-	-
5.	Manipur	-	-	-
6.	NEFA	-	-	-
7.	Pondicherry	1	1	2
8.	Tripura	3	-	3
	Total Territories	**4**	**1**	**5**
	Grand Total			**5000**

Source: All India review of MI works committee on Plan projects, Planning Commission. New Delhi, June 1966 p.9

A decrease of 42 per cent in case of Karnataka and an increase of 33 times in case of Kerala do not seem to be in conformity with any kind of logic. The only possibility could be that the norms for classifying the water bodies as "ponds" and "tanks" or the size-related norm might have changed.

In the same manner, the increase of 370 per cent in number of tanks in Orissa and decrease of 81 per cent in case of Uttar Pradesh is inexplicable. All these reinforce our argument about the non-reliability of tank statistics.

Table 2.2: Minor Irrigation Census of Minor Irrigation Ponds/Tanks in use

Sl. No.	Name of State/UT	Minor Irrigation S. Flow Schemes	Ponds/Tanks in use S. Lift Schemes	Total
1.	Andhra Pradesh	60,745	432	61,177
2.	Arunachal Pradesh	15	0	15
3.	Assam	33	455	488
4.	Bihar	N.A.	N.A.	N.A.
5.	Goa	1,303	82	1,385
6.	Gujarat	133	47	180
7.	Haryana	7	0	7
8.	Himanchal Pradesh	840	14	854
9.	Jammu & Kashmir	73	44	117
10.	Karnataka	20,152	1,093	21,245
11.	Kerala	4,396	45,340	49,736
12.	Madhya Pradesh	15,507	3,234	18,741
13.	Maharashtra	12,539	2,302	14,841
14.	Manipur	0	0	0
15.	Meghalaya	155	0	155
16.	Mizoram	150	0	150
17.	Nagaland	0	0	0
18.	Orissa	6,879	1,110	7,989
19.	Punjab	3	2	5
20.	Rajasthan	N.A.	N.A.	N.A.
21.	Sikkim	0	0	0
22.	Tamil Nadu	36,523	339	36,862
23.	Tripura	645	575	1,220
24.	Uttar Pradesh	10,810	16,339	27,149
25.	West Bengal	62,379	1,68,213	2,30,592
	State Total	**2,33,287**	**2,39,621**	**4,72,908**

Source: Surface Minor Irrigation Development in India, GOI, MOWR, MI Division, March 1991, p.43.

In such a scenario, the only available data in respect of tanks at the all India level is from the MI census of 1987. Whatever updating done in latter years was based on this basic Census (this includes 2001 MI Census). In all other subsequent documents, whether those brought out by the Planning Commission or by the MOWR, there is no separate data on tanks either relating to irrigated area or financial investments. All such data has been bundled under a category referred to as "Minor Irrigation" to deal with irrigation development and financial investments. In fact, the Working Group Report (GOI 2001) does not even mention about the externally aided tank projects while the earlier one (GOI 1989) did provide the details. Given the constraints, we have relied greatly on land use statistics provided by Ministry of Agriculture for secondary data and the old District Gazetteers for obtaining information about history of tanks. The only exception in this respect is the 3rd MI Census, and the data emanating from the same are provided in Table 1.2.

In Table-2.3, figures of area irrigated by tanks in the four east Indian states are provided. If we look at the overall column, it is found that there is a general decline in the net area irrigated by tanks, so much so that during the last 50 years the tank irrigated area declined by almost half. The only exception being the years 1999-2000 when the tank irrigated area went up by about 1 lakh ha in comparison to 1995-96. This enhancement is noticeable in all the eastern India states except Orissa and this is inexplicable. It is also possible that this kind of picture has emerged in the absence of firm data.

Table - 2.3 Net Tank Irrigated Area in eastern India

(000 ha.)

	Uttar Pradesh	Bihar	West Bengal	Orissa	Total
Tank Irrigated Area (1956-57)	423	241	390	495	1,549
	(N.A)	(N.A)	(N.A)	(N.A)	-
Tank Irrigated Area (1961-63)	417.6	278.8	368.3	418.5	1,483
	(8.2)	(14.9)	(27.3)	(40)	-
Tank Irrigated Area (1965-66)	391	175	328	495	1,389
	(6.7)	(8.8)	(22.9)	(50.7)	-
Tank Irrigated Area (1971-72)	334	144	303	583	1,364
	(4.8)	(6)	(20.3)	(50.7)	-
Tank Irrigated Area (1976-77)	295	126	303	271	995
	(3.6)	(4.4)	(20.3)	(25.8)	-
Tank Irrigated Area (1984-85)	148	131	277	257	813
	(1.5)	(4.7)	(14)	(17.5)	-
Tank Irrigated Area (1990-91)	104	115	263	289	771
	(1)	(3.4)	(13.8)	(17.7)	-
Tank Irrigated Area (1995-96)	58	140	263	305	766
	(0.5)	(4.3)	(15.5)	(11.3)	-
Tank Irrigated Area (1999-2000(P))	90	155	324	293	862
	(0.7)	(4.3)	(13.8)	(14.6)	-

Values in paranthesis indicate "Tank Irrigated area as per cent of total irrigated area in the state"

P = Provisional

Source: as in table 1.1 (+ the following)

1961-63 data is drawn from a India Review of MI work, GOI 1966, p 11

Another interesting point to be noted is that between 1971 and 1977, there was a drastic reduction in the area irrigated by tanks across states. During this period, tank irrigated area decreased from 1.364 mha to 0.995 mha. However, West Bengal is an exception to this trend, where it remained the same at around 3 lakh ha. The main reason for this is the expansion of canal networks in the state during this period. There is no denial of the fact that in many cases tanks are filled with imported canal water, more particularly when rains in the tank locality are scarce or untimely. The investigators observed this during the fieldwork as well. Boyce has rightly observed that the most important use of tank water in West Bengal was during the rainy season itself as an insurance against monsoon failure, particularly in the critical month of September. However, some water is retained for winter crops (Boyce 1987, 165). For instance, tanks in some parts of Kangaswati canal project command in Bankura district received water from canals, which provided free water to farmers on account of lack of the institutional mechanism for water distribution (Rawal 1999, 62).

In case of Orissa, the tank irrigated area has increased during 1991, 1996 and 2000 while in case of Bihar an increase is noticeable during 1996 and 2000. Uttar Pradesh and West Bengal witnessed an increase in tank-irrigated area during 2000. One of the main reasons of the slump in case of Orissa during this period was the severe drought of 1997, which affected severely the districts such as Kalahandi, Sambhalpur, Bolangir and Baragarh. It is no coincidence that historically all these districts are most famous for tank irrigation.

Table 2.3 also includes data relating to percentage area irrigated by tanks in the states. A mere glance over the data makes it obvious that importance of tank as a source of irrigation has been diminishing over the years. However, in spite of the diminishing importance over time, tanks have higher relative importance in Orissa and West Bengal when compared to Uttar Pradesh and Bihar.

Uttar Pradesh

Even forty-five years ago, tank irrigation was not of great significance in Uttar Pradesh. But by mid 1980s, tank as a source of irrigation became almost insignificant in the state. The main reason for disappearance of tank irrigation from Uttar Pradesh was the flurry of free boring scheme[12] and groundwater markets (Pant 2005), earlier preceded by the rapid progress in groundwater development. Even canals, which were the most important source of irrigation for a long time, were overtaken by wells as a source of irrigation (Pant 2004). Though assumed low significance at the state level, tanks were one of the most important sources of irrigation in the

[12] Rapid expansion of groundwater irrigation in Uttar Pradesh was largely due to the GOUP subsidy programme started in mid 1980s. In January 1986 GOI issued revised guidelines for assistance to small and marginal farmers for increasing agriculture production. Importantly in Uttar Pradesh 70% of the scheme amount was to be spent as subsidy on MI works. GOUP enhanced rate of subsidy from 25% to 33.3% for small farmers, from 33.3% to 50% for marginal farmers and 50% for SCs and STs. While the subsidy was for purchase of the pump the boreing of wells was free for the target groups.

eastern region of Uttar Pradesh.[13] A number of factors facilitated sustainability of tank irrigation in this region for a long time. The eastern tract is flood prone with periodic occurrence of droughts. It is characterized by an impeded drainage, which was accentuated on account of laying of railway line during the British period. Unlike the western region where British started Ganga canal system in the late 19th century, there was no major canal system in this region prior to Independence. The eastern region represents highest concentration of poor people in the country where small and marginal farmers with their very small and scattered holdings are abound.

Tank irrigation in the plains of eastern Uttar Pradesh is varied in size and historicity. In this region, tanks and ponds were an important source of irrigation for the poor farmers for a long time, until free boring spurt provided them with access to purchased water from well owners. The existence of an early Indian hydraulic engineering work was recently confirmed at Sringaverapura near Allahabad with the discovery of a tank, dating back to first century BC through archeological excavations. It was not only long (more than 250 m long) but was fed perennially by Ganga water. Incidentally, Sringaverapura is the same place where, according to Hindu epic Ramayan, Rama crossed river Ganga during his exile from Ayodhya, which dates back to 12th century BC (Agarwal and Narain, 1997, 12). In Sultanpur district, tank irrigation was a cooperative effort – villagers worked in a collective way till all the lands were watered. In Azamgarh district, *lat* (a type of tank structure) was extensively used for irrigation. The area irrigated from a *lat* in seasons of scanty rainfall was not large but in normal years, *lats* helped to equalize the water of the entire area within their ambit.

Writings from early 20th century show that tanks, as a source of irrigation, were common in Gorakhpur district and other parts of eastern districts in Uttar Pradesh. "They are the usual square or rectangular excavations dug down to water level, the spoil earth forming high banks on which trees are planted in many cases. These tanks are often of considerable size, and they serve a very large area, averaging some 273,000 acres, though this figure must be acceptable with some qualification owning to the confusion that often arises between artificial tanks and natural pools." The manner in which tank irrigation was practiced was further elaborated as "by taking water along narrow channels, and from these raised to the level of the fields by *beris* or swing-baskets of wicker-work in the style which was well known throughout the then United Provinces. (Nevill 1909, 57).

Jaunpur is mentioned as one of the few districts where irrigation was practiced most extensively and in as early as 1867, nearly 95 per cent of 5,61,407 acres of land was irrigated. But tanks were not popular in the district because they were costlier than wells, but less cost efficient. Nonetheless, they were said to be in large numbers, possibly because of the greater fame and merit attached to their construction. They were however

[13] The eastern Uttar Pradesh forms part of Gangetic plains, which subsumes 64 of the total 71 districts in Uttar Pradesh. The eastern region comprising of 27 districts is bounded by Nepal in the north and by Bihar in the east.

seldom kept under good maintenance after the death of the original owner and the district was said to be full of ruined tanks (Nevill 1908, 41-44). Opposite was the case of the district of Allahabad where in 1884-85, the average area irrigated was 2,19,096 acres, which was a mere 19.75 per cent of the net cultivated area. Of this, 1,20,518 acres (55 per cent) were watered from wells and the rest from tanks, *jhils* and streams or other sources (Nevill 1911, 40).

The old Gazetteers, not only provide details of the sources of irrigation but also the extent of irrigation. Since irrigation from tanks in the olden days was mostly done manually, it would be interesting to know the practice details. In Basti district of eastern Uttar Pradesh, the old Gazetteers mentioned that there were no canals in the district but an ample stock of water could be procured from the numerous streams, lagoons, reservoirs (tanks), and wells. From the tanks or its equivalents, water was lifted by the sling baskets[14]. In his reports on eastern India, Buchanan calculated that a group of ten men, working with two pairs of baskets could irrigate some 4,727 square yards, or just below one acre daily. Although this was the most expensive method, this was the most common and popular method of irrigation because farmers believed that the water thus lifted contained sediments, which could be nutrients for plants (Atkinson 1881, 594). As explained in the preceding section, in the Gangetic plain areas of Uttar Pradesh, well irrigation was being practiced from time immemorial on account of favourable conditions. However, the eastern parts provided ideal conditions for tank irrigation till the recent past. Another region of Uttar Pradesh, which found favour with tank irrigation, was Bundelkhand[15], which had borders with Madhya Pradesh.

To the south and south west of Uttar Pradesh lie the districts of Lalitpur, Jhansi, Jalaun, Hamirpur, Mahoba and Banda, which form part of the central Indian plateau. These districts are situated on or below the slopes of the plateau. The tract is broken up especially in the south, by low rocky hills – the spurs of the Vindhyan ranges. The soil cover is thin, underlain by hardrocks and is infertile. The whole of this area forms part of Bundelkhand region. The area suffers from the uncertainty of deficient or excess rainfall averaging around 900 mm.

Irrigation is not a new concept in Bundelkhand; as early as the fifteenth century AD, tanks and reservoirs were already in use for water harnessing and irrigation. Although many of these structures have fallen into disrepair or have been destroyed, some are still

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[14] Such baskets, when shaped like a boat, were called *godala* or *beri*, and when shaped like round shield, were called *don* or *donri*. The ropes or strings by which the basket was swung were termed *dori*, and the small wooden instrument used in opening and shutting the apertures of the water channels was called *hatha*.

[15] Bundelkhand derives its name because Bundelas ruled this part of Uttar Pradesh and Madhya Pradesh. It stretches over six districts of southern Uttar Pradesh and twelve districts of northern Madhya Pradesh occupying almost 70,000 square kilometers of the central plains in India. It is bounded in the north by Yamuna river and in the south by the hills of the Vindhyan Plateau. The region presents a unique set of geologic and geographic characteristics, which have had profound effects on human development in the region as well as on the country as a whole.

in use today. The reservoirs take many forms. In areas of very scanty rainfall, a number of ingenious methods of storing water for irrigation have been evolved by local people. They include sub-surface tanks, roof water harvesting systems, step wells, tanks, ponds and lakes. Some of these lakes were large enough to store water for 18 months to 2 years, an extremely important feature, given the rainfall regime of the region, characterized by frequent droughts.

The case of *dabaris* is a special case among the large number of traditional water harvesting and storage tanks that can be seen even today in the Budelkhand region. These tanks fall in the category of minor irrigation tanks and have various names. One can see such tanks called *chandel* tanks in Bundelkhand; called *malguzari* tanks in Bhandara, Chandrapur and Gadchiroli districts of Vidarbha; and called *dabaris* in Chattisgarh. These came up as a consequence of traditional wisdom. Feudal land tenure systems placed centralized powers in the hands of the local landlord over sizeable contiguous pockets of lands extending over hundreds of hectares. Natural depressions in these landscapes were used as *dabaris* or *chandel* tanks. Embankments were made usually on the downstream side. Water would be released from the tanks by using a traditional system of a water chamber in which water is let through holes in the embankment kept plugged with wooden poles. To start with, the top most plug is removed to let the water out and as the level of water goes down, the plugs at lower levels are released. Usually such structures were used to grow long duration paddy varieties (Marothia, 2004).

Tank Survey in four East Indian States

The first chapter deals in considerable detail with the methodology adopted for the study. The survey was conducted to document some basic information so that some key trends could be gauged. To that extent the survey was found to be very useful. Also, as four states were covered, broad representative features were kept in mind and he survey conducted within this broad frame work and the survey has been very informative.

A point that needs to be explained is that in respect of analyzing the socio-economic base of the tank beneficiaries, the social status in terms of caste and the economic status in terms of land holdings were examined. Muslims were categorised under high, backward and depressed castes depending on their social status rather than treating them as an exclusive religious category. For instance *sheikh*, *sayyed*, *mughal* and *pathan* were grouped with high castes; *ansaris* with backward and *quureshi* and *chikwa* with scheduled castes. In case of one village in Palamau district, most of the Muslims were migrants and there was no clarity about their social status, therefore, the entire Muslim population, who were beneficiaries of the tanks, was taken out of the analysis. The selection of this village also highlights the shortcoming of the sample selection. Another point that needs to be highlighted here concerns the strategy of research. Initially we had not planned for a systematic survey and wanted to do case studies. This strategy was in fact adopted in

case of Bihar, but later on it was decided to go for a quick survey. The same approach was adopted in case of Gumla district in Jharkhand. As a result, for Bihar and partly for Jharkhand, both the survey and detailed village cases were available, while for other states; it was based on survey, informal discussions, observations and historical documents.[16]

Before the survey data is analyzed, it would be useful to clarify some more points, which are associated with the content and extent of data in various tables. As regards ownership of tanks, they are categorized into government, panchayat or private ownership. In case of government tanks, the ownership is either with the MI department or with fisheries department. However, they have been put under one category, i.e., government tanks. Similarly tanks owned by panchayats include all tanks previously owned by individuals/*zamindars* and presently entrusted with the panchayats. This category also includes tanks, particularly in Orissa, where once private tanks were rehabilitated under a European Union donor project and then handed over to panchayats for maintenance. The private category includes all such tanks which were under government / panchayat ownership but are captured by individuals and litigation is pending for title. This category also includes tanks in private land. This explanation is necessary because of variations in data in the two state survey tables, i.e., Table 2 and 11, which seem to deal with similar categories but actually present different data. While Table 2 presents a legalistic and formal position in respect of tanks, Table 11 provides a more realistic situation on the ground presented by the respondents during the group interview.

Although a total of 119 tanks were surveyed across the four states, not all the information required was always forthcoming for all the tanks. Therefore, in some of the tables, the information is on lesser number of tanks. A case to refer is Table 16 which has been prepared on the basis of data for 37 tanks (instead of 47) in Jharkhand, 16 tanks (instead of 20) in Bihar, 12 (instead of 31) in West Bengal and 8 (instead of 21) in Orissa. Thus, the requisite data were available only for 73 tanks. In the examination of survey data, each one of the four states, starting with Bihar, followed by Jharkhand, West Bengal and Orissa were taken up and at the end inter-state comparisons have been made.

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[16]All data collected from field survey are tabulated in a uniform manner in 20 tables for each of the four states plus one more set providing inter-state data. Although the tables are numbered 1 to 18, table 9 consists of three tables as a, b and c, thus making the total number of tables 20 for each states and a total of 100 tables (four states plus one inter state) for the study. In case of all such tables, the first alphabet of the state is added before the table number. So Bihar tables are mentioned as B-1, B-2, B-3 etc. Similarly J- is added for Jharkhand, W- for West Bengal, O- for Orissa and E- for Eastern India (all four states).

CHAPTER III

BIHAR

On the basis of its physical features, the state of Bihar can be divided into three regions, viz., north Bihar plains, south Bihar plains (the area north and south of Ganges respectively) and Bihar plateau also known as Chhota Nagpur plateau. The total area covered under south Bihar is about 40,000 sq.kms, which is slightly less than one fourth of the total area of 174,000 sq.kms of the state. Historically, *ahar-pyne* system of indigenous irrigation has been the most important source of irrigation in south Bihar. Even today, it provides a shining example of participatory irrigation management. "This indigenous system is the outcome of the natural conditions and physical configuration of the country, and has been evolved to meet the obstacles which they place in the way of cultivation." (O'Malley 1919, 144)

Most of the places in the south Bihar region receive an average annual rainfall of about 1000 mm, which may be just sufficient for some of the low water-consuming crops grown during *kharif*, but not paddy. In addition, the rainfall is conditioned by two constraints. First, there is a deficit in the rains almost every third year. Second, paddy experiences moisture stress during the crucial period of *hathia* in case of rain failure. The southern part of this dry zone comprising erstwhile districts of Patna, Gaya, Shahabad, south of Munger and south of Bhagalpur is usually referred as south Bihar.

Bounded by Bihar plateau in the south and Gangetic valley in the north, south Bihar has a marked slope from south to north towards the Gangetic valley and is comparatively rapid, the average fall northwards being about 1.13 to 0.76 metre per km. A number of rivers debouch from the southern hills and intersect the region as they flow across from south to north. Since these rivers are rainfed, as soon as rainfall occurs in their catchments, they swell up into rushing torrents and discharge the runoff very quickly (within hours) through their sloping beds. As a result, the water is either rapidly drained from the area where the soil is stiff clay or percolates down swiftly if the soil is sandy.

Ahar-Pyne System[17]

On casual examination, the area would seem utterly unsuited for rice cultivation, both from the physiographic and the rainfall regimes. But both difficulties have been overcome by the ingenuity and industriousness of its inhabitants, who have devised a system by which the natural drainage is blocked and the water impounded for use and have also brought rivers into their services by diverting the water they bring down.

Therefore, in order to prevent the water being wasted, long narrow artificial channels called *pynes* are led off from the rivers by means of which the water is conveyed to the fields. The water is impounded in extensive reservoirs called *ahars*, which are formed by constructing a series of retaining embankments across the lines of drainage.

Ahars consist of a major embankment across the drainage lines with two side embankments running backwards upto along the drainage line, gradually losing their heights due to the surface gradient. An *ahar* is either U-shaped or rectangular. Embankments are built on three sides of the rectangle, the highest bank being at the end where the water would ordinarily emerge, while one side is left open to allow the water to emerge and enter (O'Malley 1926, 94). The drainage water enters from the catchment following the natural gradient of the country. Water supply for an *ahar* comes either from natural drainage after rainfall (rainfed *ahars*) or through *pynes* where necessary diversion works are carried out. Opening outlets made at different heights in the embankment draw out water for irrigation. *Ahars* with sides that are more than a kilometre long, irrigating more than 400 ha are not rare, though smaller ones are more common (Sengupta 1996). However, the average area irrigated per *ahar* during the early twentieth century was said to be 57.12 ha (Tanner 1919, 145).

Pyne[18] is the local name for the diversion channels. These channels maybe of various sizes. The small ones are those found originating in *ahars* and carrying the water of the *ahars* to cultivable plots. The large ones have their origins in rivers from which water is diverted through these artificial channels using the *ahars*. They are led some way upstream, above the level of the land intended to be irrigated. It is often 3 to 5 km before the water of the *pynes* reaches the level of cultivation. Some of the biggest *pynes* are 16 to 32 km in length, and some of them known as *dasian pynes* (*pynes* with 10 branches) irrigate many thousand acres of land of hundreds of villages (O' Malley 1919, 145).

Apart from irrigation, another useful purpose served by *ahar-pyne* system is flood mitigation. Writing about the then Gaya district, the collector (1947-49) observed that as long as these minor irrigation works were kept in a reasonable state of repair, floods in lower regions were well under control (Roychoudhry, 1957).

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[17] This section has drawn heavily from Pant's paper, "Indigenous Irrigation in South Bihar: A case of Congruence of Boundaries", *Economic and Political Weekly*,33,49, December 5, 1998.

[18] A *pyne* can be used for (I) transporting the river water to an *ahar*, (II) to irrigate the field (rarely directly) through branches taking off from it and (III) taking out *ahar* water for irrigation

Extent of Irrigation

The *ahar-pyne* system of irrigation was overwhelmingly more important in south Bihar, where it used to irrigate about 35 per cent of 2.5 mha of cropped land during the first two decades of the 20th century. Compared to this, the irrigation in north Bihar was a mere 3 per cent of 3 mha cropped area. During this period, of the 0.98 mha area irrigated by *ahar-pyne*, 0.88 mha area was from south Bihar, while only 0.1 mha was from north Bihar (Tanner 1919, 136). The area irrigated by this indigenous system has since then witnessed a constant decline—from 0.94 mha in 1930s to 0.64 mha in 1971 and to 0.55 mha by 1975-76**.** Today the area irrigated by *ahar-pyne* system in whole of Bihar has come down to about 0.53 mha constituting about 12 per cent of irrigation from all sources (GOB 1997), compared to about 18 per cent from south and north Bihar alone during the first two decades of 20th century[19].

As per records, the average area irrigated by tanks in British India was about 8 million acres but the supply to many of the works was very precarious and was bound to fail in years of extreme drought. This figure does not include large areas over which some water is held up for sometime after every rainfall by means of field embankments such as to be found under different names in Bengal, Bundelkhand, the Central Provinces, Gujarat and Bombay Deccan. The agricultural value of these temporary storage works was considerable, but the areas protected by them were not usually recorded or regarded as tank-irrigated areas (Higham 1908, 325).

The Irrigation Commission of 1901-03 estimated the total area ordinarily irrigated in British India from all sources, (Table 3.1) were the total cultivated area is being taken as 226,000,000 acres (Higham 1908, 345).

Table 3.1: Irrigation area by source and ownership in 1901-03

In acres

Source of Irrigation	State works	Pvt. Works	Total
Wells	-	12,895,000	12,895,000
Canals	15,644,000	1,235,000	16,879,000
Tanks	2,944,000	5,194,000	8,138,000
Other sources	-	6,186,000	6,186,000
	18,588,000	25,510,000*	44,098,000

Note: This does not include irrigation data in Native States (land of local kings/*zamindars*)

* The area shown under other sources includes a large area (5,000,000 acres) irrigated in Bengal from private canals and from water held in natural depressions and in shallow artificial tanks.

[19] The extent of decline has been worked out on the basis of following data sources: (I) Census records from 1921 to 1961, (II) Season and Crop Report, Bihar 1971, and (III) District wise data available with the Directorate of Statistics, Government of Bihar, 1975-76.

Reasons of Decline

There are three important reasons for the decline of *ahar-pyne* system: First, until the abolition of *zamindari* system,[20] the za*mindars* used to maintain these systems as they had the capital resources and vested interest in doing so. Tenants were required to pay *gilandazi* (for improvement of irrigation works) charges. "*Gilandazi* is an excellent form of investment as the capital spent on it attracts a dividend of 40 to 50 per cent in the first year itself, and in some cases 100 per cent. Even if the landlord received only half of the produce from the land irrigated by these works, they would get a very good return on their capital outlay" (O'Malley 1919, 158). After the *zamindari* abolition there are no regular budgetary outlays for the repair of these systems. The only possible avenues of repair were hard manual labour during drought period, JRY, some relief schemes, food for work programme and also MI department which can spend some plan funds for the renovation of these systems.

Second, a large number of alternatives have come before the farmers during the post Independence period in the form of new canal schemes and tubewells. The growth of tubewells, particularly during the post green revolution period is phenomenal. This has been aided by high doses of government subsidies for private tubewells. Back in 1970-71, the area irrigated by tubewells in Bihar was about 17 per cent of the net irrigated area, and this reached above 48 per cent in 1994-95 (GOB 1972 and 1997).

Further, wells in alluvial are a much more reliable source for irrigation than tanks and *ahar-pynes*. Even at the start of 20th century (Table 3.1), while wells were irrigating 29 per cent of area, tank irrigation was limited to 18 per cent. With population increase, irrigation demands had also increased and to meet such demands alternative sources had to be tapped. So much so, that by 2001, while *ahar-pynes* were irrigating 1.6 per cent area the area irrigated by tubewells had increased to 26.6 per cent.

The third reason for the declining performance of *ahar-pyne* system in south Bihar's irrigation is non-integration of these systems in the new diversion schemes undertaken by the state's Irrigation department after Independence. The problem got accentuated on account of not taking over these systems formally and legally.

Need for Integration between New and Old Schemes

In 1950's, particularly during the first and the second five-year Plans, a number of diversion based irrigation schemes were undertaken in south Bihar. In most of the cases, the area brought under the command had very elaborate indigenous irrigation network through *ahars* and *pynes*, particularly in the upper reaches. The planners realising the valuable contribution of this indigenous system in subsidiary storage and water distribution, dovetailed it in their plan, thereby increasing the capability of

[20] During the British period all the cultivated land belonged to *zamindars* (feudal landlords) who paid a fixed share of the revenue to the British Government. After Independence in 1952 this system was abolished and the land was distributed among the erstwhile tenants.

the run-of-the-river scheme on a rain-fed river, whose performance was subject to occurrence of monsoon flows. They relied on the contribution of the existing *ahars* so much that they planned for about two-thirds of the command to be irrigated during the critical *hathia* period through the *ahars*, which were to be filled up from canal networks by drawing maximum possible water during favourable period of river flow.

The envisaged integration of *ahar-pynes* with the new irrigation schemes, however, could not be achieved in a large number of cases and this indigenous system was made to languish over time. A study by a Bihar based consultancy firm shows that the number of *ahars* in the command of Upper Mohar Irrigation Project covering the districts of Gaya and Aurangabad had dwindled from 109 in the pre-project period to 44 in post project period (Metaplanner 1990) consequently affecting irrigation in an adverse manner. If due attention had been paid to proper maintenance of these indigenous systems and their integration with new canal networks, all these new diversion schemes would have been grand success stories.

Management of Ahar-Pyne System

Three functionaries looked after the operation and maintenance of *ahar-pynes*, particularly the ones relating to maintenance and overseeing of water distribution. These were headman, *barahill* (supervisor) and *gudait* (watchman). A unique feature of *ahar-pyne* management system in some parts of south Bihar was that some functions were associated with particular castes. For instance only *dusadhs* (schedule caste) were hired for the job of watch and ward. Similarly, the drumbeaters used to be from the Muslim caste of *dafalis. Dusadhs* were selected for the job of watchmen because they used to be physically sturdy, and their muscle power used to come handy in matters of inter-village and intra-village disputes. Similarly call for *goam (*collective physical action) used to be made by beating of drums, and drum beatings was the traditional occupation of *dafalis*.

Acquisition and Transport of Water

Since some of the *pynes* ran over 30 kms, covering hundreds of villages and irrigating thousands of acres of land and the construction of such irrigation works required huge capital investment, only big landlords could build it. In fact, sometimes it required the collaboration of two or more landlords. In such occasions, each participating landlord used to appoint his team of officers to look after his interest on the negotiating table during the construction phase. It should however be understood that usually the cost involved in the construction of *pynes* was much higher than that of *ahars*. The construction of *pynes*, particularly the large ones, involved excavation of channels running into several kilometers. In case of *ahars*, even when they were large, the work involved construction of embankment from three sides, the highest being on the northern side to check the flow of water from south to north. Writing even in the early part of the present century, O'Malley noted that no new *pynes* of considerable size were being constructed in his

times. According to him, large *pynes* were constructed several years back when larger areas were under the control of single *zamindars* (landlords) and their authority to enforce their orders and wishes was more absolute than during O'Malley's times (O'Malley 1919, 155).

Repair and Maintenance

The repair and upkeep of *ahar-pynes* is generally of two types. The first one involves major repairs and the other deals with the minor routine upkeep to make the system work. In case of major repairs, as farmers did not have the capital required, the responsibility of these matters was entrusted with the landlords. This point has been highlighted by both Buchanan (1939) and O'Malley (1919, 147). No doubt, the amount spent by the landlord was later realised from the farmers under the *gilandazi* (improvement of irrigation works) (mentioned earlier while discussing the reasons of decline in tank irrigation). Today also, farmers do not undertake major repairs and the same are done by the MI department. The only difference is, in the past, farmers had to pay for the repairs as well as irrigation, while today they do not pay for any of these. The routine upkeep work involves cleaning and desilting of *ahar* and *pyne* and maintaining the water conveyance network, while the system is in operation. Ordinary maintenance such as the clearance of silt, the repair of small branches of the ahars and field channels is done by the cultivators themselves under *goam* system and it starts before the onset of monsoon. In the past, under this system, "at the order of the landlord or his local agent or servant, the cultivators have to supply one man per plough to turn out on these occasion and carry out the work; the peasants come out in a body and this is called *goam*" (O'Malley 1919, 146). In case of wealthier peasants, they were allowed to send paid labourers but had to be present to supervise the ongoing work. This system of use of community labour for maintenance of irrigation work was also very much in vogue in the then Madras state, where it was legitimised through legislative action (Reddy 1996) and is called *khudi murrammat* (self repair). *Goam* was and still is very effective in meeting the emergencies. The call for *goam* is made by beating of drums. The drumbeater goes from place to place announcing the nature and location of the emergency. The most common emergencies relate to breaches in embankments and big *pynes*, breaking, cutting and blocking of *pynes* in upper reaches. Even blocking or diversion of river water in the upstream is not uncommon during the water scarcity times of drought years. *Goam* occurs even today in hundreds of villages of south Bihar.

Thus collective action finds place in operation as well as maintenance works. The maintenance work includes desilting of *ahar* and *pyne* beds, and regular repair of embankments. Apart from these routine activities, an important task is to keep constant vigil, particularly during monsoon against sudden damage of protective works which may occur due to natural or man-made reasons. The operational works include cutting and closing embankments for diversion, erection of bunds or *garandis* across the *pynes*, opening and closing of outlets and manual water lifts at times to irrigate uplands.

Allocation and Distribution of Water

Allocation of water, which was managed by the cultivators, was a major source of conflict. Buchanan (1939) wrote that the landlords would "appoint proper persons to divide the water among the tenantry". According to O'Malley (1919, 146-147), the *parabandi* system was used to distribute water among the villages from a common source (usually a *pyne*). *Parabandi*, derived from the term *para* (turn) and *bandi* (fixation) means fixation of turn. Each village had its fixed turns in terms of number of days and hours to avail the irrigation service. These turns were assigned through mutual agreements or on the basis of ancient customs. In case of principal *pynes* under different estates, the rulers of such estates used to maintain a detailed register called *lal bahi* (red register). The register specified the irrigation rights of each village. Usually *parabandi* arrangements began in the month of *aswin* (mid-September to mid-October), when the demand was high and supply limited. At other times, all branches of *pynes* are left open (Agarwal and Narain 1997, 87).

Selected Districts for the Survey

The three districts selected for the survey of tanks were Patna, Nalanda and Jamuai.[21] Although in the beginning it was planned to conduct the survey in the districts of Patna, Gaya and Jamui, from a reconnaissance carried out around old Nalanda area, some of the largest and oldest of tanks in Bihar were seen here with fishing and irrigation together. Subsequently, Gaya was dropped from the study.

Leaving out district Gaya from the study was really distressing considering the fact that this district is historically most important for the *ahar-pyne* irrigation. In the old district Gazetteers of 1906, O'Malley wrote that the agricultural prosperity of Gaya depended on an extensive system of irrigation. While in the north east part of the district, Sone canal provided the boon, elsewhere people were dependent on methods of irrigation which had been practiced from time immemorial and was known as *ahar-pyne* system (Roychoudhry 1957, 204). However, consolation can be derived from the fact that a great deal has been written on the *ahar-pyne* system of irrigation in Gaya district.

Another reason for doing the survey in Nalanda was to explore the possibility of establishing possible role for the large tanks that exist within a few kilometers radius of the old Nalanda ruins in the supply of food for the students, teaching community and their families in the ancient Nalanda university. Unfortunately the detailed history of these large tanks could not be found.

Patna and Nalanda

Nalanda, which consists of the then Biharsharif sub division, did not exist in those days and was part of the Patna district. Thus, old records are not available separately for Nalanda and Patna data is applicable to Nalanda as well.

Writing detailed account of big and small reservoirs/*ahars* that existed in Bihar and Patna in the early 19th century, Buchanan observed that the cost of maintaining such

[21] While Nalanda was a part of Patna district in the past, Jamui was carved out of Monghyr district.

reservoirs varied between rupees 25–500, depending on the size. He further informs that the expense both of making and repairing the canals and reservoirs was entirely defrayed by the *zamindars*, who appointed proper persons to allocate the water among tenantry. Towards the end of the season, the water was lifted from both reservoirs and canals using lifting devices. The basket suspended by rope, called here *changr,* was sometimes used, when the quantity of water remaining was small; but, when the quantity of water was considerable, an equipment like a canoe was used if the height to which it was to be raised was small, while the pot raised by level was preferred, when the height was considerable (Buchanan 1934, 533-34).

In the early part of 20th century, O'Malley wrote that the agricultural prosperity of Patna depended largely on extensive system of irrigation. To the west of the district cultivators benefited from a portion of Sone canal. But elsewhere, they were dependent on indigenous methods of irrigation of which the most prominent was *ahar/ karhas*. This indigenous system was so devised as to utilize not only the rainwater and the water brought down by the rivers debouching from the Gaya district, but also as much of the floodwater as possible. This was done chiefly by masonry reservoirs called *ahar*. The water impounded in these reservoirs was distributed among the fields through narrow channels called *karhas.* Whenever the level of the fields to be irrigated was lower than of the *ahar,* water was led into the *karha*s through pipes known as *bhoklas*. But, if the fields requiring irrigation was at higher elevation, water was lifted to the requisite heights by means of water lifting devices. The water, after being taken to the fields was retained in them by means of a network of low banks (ails) collectively called *genrabandi*[22].

In Patna, *ahars* were the most important works of irrigation owing to their sheer number and the large area they irrigated. Cultivators did minor repairs of *ahars* and *pynes*, while those requiring considerable expenditure were usually carried out by landlords along with rest of the arrangements for irrigation (O'Malley 1907 a).

While writing about irrigation and agriculture in the early part of 20th century, O' Malley also makes descriptions about social groupings. In this respect, his observations on two most prominent backward castes are most interesting. According to him, "The *goalas* or *ahirs* are the most dominant caste in the district in terms of the size of its population. They are thrifty race, selling grams and husks, themselves thriving on coarse food; and cutting grass for their cattle, while their women go about selling milk, butter and *ghi.* They are generally cultivators and cattle breeders. While many of the poorer are labourers, a few rich *zamindars* also belong to the caste. They are notoriously the most quarrelsome caste in the district, consequently concerned in riots and very fond of *lathi*; cattle trespass forms a frequent subject of dispute among them. They have the reputation of being audacious cattle stealers, and many at the bottom of the social

[22] *Genrabandi* was the name for the series of embankments built to prevent water from running off the fields. The *gherwa* or outer embankment used to be about four feet high, within was a series of smaller embankments (*genra*) and last of all were the ordinary *ails* round individual fields (O' Malley and James 1924, 100).

hierarchy are professional thieves." On *kurmis* also his observations are no less interesting as he observes, "They are almost entirely employed in cultivation but many of the poorer are labourers. Some take service as *khidmatgars* – a few are *zamindars* and *thikadars* and many in towns are moneylenders. As cultivators, they confine themselves to stable crops as a rule and do not breed cattle. They are fond of petty litigation, and are apt to engage in disputes about the possession or crops and lands" (O' Malley and James 1924, 51-52).

In 1922, James observed that the clay soil which was found in large part of Patna district did not retain moisture well; and the slope from south to north was such that rain water would runaway if no measures were taken to store it. Cultivation therefore, depended largely on embankments, which prevented water from being wasted away and as a result 60 per cent of the cultivated area was irrigated which was higher than in any other district in Bihar (O' Malley and James 1924, 95).

The extent of irrigation from different sources in different periods of 20th century can be gauged from Table 3.2 and Table 3.3.

Table 3.2: Area Irrigated by Source over years

(Area in thousand acres)

Source of Irrigation	Year and Area		
	(1907-12)	**(1921-22)**	**(1964-65)**
1. Government Canals	24.0 (3.7)	153.2 (19.8)	122.3 (18.3)
2. Private Canals/Pains	232.2 (36.1)	232.2 (30.0)	Negligible
3. Tanks and ahar	261.4 (40.6)	261.4 (33.8)	59.4 (8.9)
4. Wells	73.1 (11.4)	73.1 (9.5)	182.5 (27.3)
5. Other source	52.9 (8.2)	52.9 (6.9)	304.9 (45.5)
	643.6 (100)	772.8 (100)	669.1 (100)

Values in paranthesis indicates percentage.

Source: District Gazetteers, Patna, 1924 and 1970

Note: Other sources in 1907-12 and 1921-22 refer to water directly taken from river. *Private* canals and *pynes* in old Gazetteers are treated as synonymous. *Pynes*, however, are intrinsically linked with *ahars* because *pynes* provide an important function of filling tanks with water apart from providing irrigation to the fields directly.

Table 3.3: Irrigation by Tanks in Patna (including present Nalanda District) over the Years

Year	Irrigation from all sources (acres)	Irrigation from Tanks (acres)	Percentage of land irrigated by tanks
1911	507744	157437	31.01
1921	677633	261085	38.52
1931	683164	261363	38.25
1941	657230	240160	36.54
1951	626155	50689	8.11
1961	652285	25279	3.87

Source: Census 1961: Bihar: District Patna, District Census Handbook

Note: The reason for the sharp decline of the irrigation from tanks is not mentioned in the document of the Census 1961

Table 3.2 deals with source wise irrigation in the district during the first 65 years of 20th century, while Table 3.3 presents data in respect of tank irrigation at decadal intervals starting from 1911. Tank irrigation in Patna (including Nalanda) district marks a big jump between 1911 to 1921 from 31 per cent to about 39 per cent. For the next two decades, percentage area under tank irrigation remained more or less in the range of 37 per cent and 38 per cent. However, it marked steep decline during 1941 and 1951, to about 8 per cent of the irrigated area. These slumps must be on account of decreasing influence of *zamindars* on the management of tanks, which is evident from further decline in tank irrigated area to nearly 4 per cent. Another possibility is that increasing well irrigation, and drawing down of water table was affecting the tank yield or storage. The Table 3.2 also shows remarkable increase in irrigated area by wells from 1921-22 to 1964-65. In many situations, tank inflow is nothing but outflows from shallow aquifers

The most important finding emerging from Table 3.2 is that tanks and *ahars* constituted the most important source of irrigation at least till the end of the first quarter of 20th century. Further, if the area irrigated by private canal or *pynes* is also included, the extent goes over from two third to three quarters of the total irrigated area. Another noticeable feature is that “other sources” in the later period became the most important source, so much so that this category accounts for about 46 per cent of the irrigation. A number of knowledgeable people in Bihar regard that a large chunk of this is from *ahar* and *pyne.*

Jamui

Jamui district has been carved out of Monghyr and forms the southern part of old Monghyr district, which was most famous for its *ahar-pyne* irrigation in whole of south

Bihar. In fact, the southern part of the present Jamui district forms border with Jharkhand and has the same kind of topography and social group as that of Palamau.

Towards the end of the first quarter of 20th century, while writing about the area constituting the present Jamui district, O'Malley (1926) had observed the area consisted of undulating country stretching from Kharagpur hills southwards to the border of the then district. In the Jamui *thana* and the present district, in the north of this tract, there are extensive areas under rice, and in the extreme south (referring to the area bordering Jharkhand), the cultivators carve out paddy fields by leveling the beds of streamlets, and terracing the sides of the wider and shallower valleys. In the same way he goes on to say, in south Monghyr (refers to present Jamui district), irrigation is practiced far more elaborately, affecting 42 per cent of the net cropped area. The irrigation is of three main kinds, viz., from artificial water channels called *pynes,* from artificial reservoirs called *ahars,* and from wells. According to him *ahars* formed the principal source of irrigation in the then Jamui subdivision and that irrigation from this source in Jamui *thana* was 63 per cent and that in Chakai *thana* was 54 per cent. He further mentions that both small and large *ahars* operated in this area. If a small *ahar* was built across a drainage channel, a narrow cut was made at the deepest end to let out surplus water. On the other hand, if the *ahar* was a large one, a weir was made for this purpose, so that water would escape and fill other *ahars* lower down the tract. The water flowed through a weir from *ahar* to the channels and to the fields. However, when supply level drops in the *ahar*, water is taken by means of *latha-kunri, karin* and *chanr*[23] (O'Malley 1926, 91-95).

Describing the tribal belt of the district, O'Malley observes that little irrigation is possible in the hilly region of the Chakai *thana.* But rice is grown in reasonably large areas in the beds of hill streamlets, which the *santhals* turn into fertile lands using their

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[23] The *latha* is a long beam working on an upright forked post, which serves as a fulcrum. The beam is weighted at one end with a stone, and a cone-shaped bucket (*kunru)* is attached by a rope to the other end. The cultivator pulls down the rope till the bucket is immersed, the weight attached to the lever then lifts it, and the bucket is emptied in to the water channel.

The *karin* is a water scoop shaped like "dug-out" canoe cut in half. It is usually made of single piece of wood, but iron *karins* are not uncommon. The broad open end rests on the water channel which is to irrigate the fields, and the pointed end is dipped in to the reservoir. The water is raised by a lever overhead with a weight at the end of it. The *karin* is used for raising water from *ahars* or from a lower channel where water is plentiful, to a higher channel and has not to be shifted to a considerable height.

The *Chanr Sair* is used where the level of the water in a stream or tank is slightly below the level of the land to be irrigated. Here water is often raised by means of *chanr* or *sair*. This consists of a piece of closely woven bamboo matting, about 18 inches to 2 feet square with two of its corners brought together and sewn up. Two ropes are attached to the wedge-shaped end so formed, and one to each of the pieces of wood fastened across the mouth to keep it open. Two men standing one on each side of the pool of water, dip the *chanr* into pool, swing it up to the bank, and tip the water in to the channel by sharply raising the ropes. Water is sometimes lifted to a high level by means of a series of these *chanrs,* when fields to be irrigated form a succession of terraces on a slope.

skills. An embankment is built across the stream near its source, and the stream-bed beneath the embankment is leveled into fields, which continue one below the other, like the steps of a stairway, down the whole length of the stream, till it reaches the main stream or strikes soil, which can not be cultivated. Each field also acts as a small reservoir for the field below it and all the fields are thus assured of a continuous supply of moisture and, except in extremely dry years, produce good crop.

According to O'Malley, some of the reservoirs thus formed were very large and supplied an extensive area with water, but a good deal of cutting was required in order to construct channels from the bed of the stream in which the water was originally collected (O'Malley 1926, 95-96).

Survey Findings

In terms of origin of tanks (Table B-1), it is found that while an over-whelming proportion of tanks (73 per cent) in Nalanda are of ancient origin, 88 per cent of tanks in Patna were built during the British period. Overall, just 5 per cent of the tanks were built during the post-Independent period. But there were 40 per cent of tanks from ancient / medieval period[24] and 55 per cent were from British period.

As regards the ownership of these tanks (Table B-2), it is found that in Patna 50 per cent of tanks were owned by government while the rest 50 per cent were privately owned. The privately owned tanks include those captured by individuals where legal petition is pending with the court for title claim. In case of Nalanda, each panchayat and individual households own about 30 per cent tanks and the government owns 27 per cent.

In terms of people's access to the tanks (Table B-3), it is found that in Bihar, in 80 per cent of the cases, the tanks are open to all. Looking at the fact that 40 per cent tanks are private, this implies that a number of tanks allow access to outsiders.

In terms of size of tanks (Table B-4), it is found that tanks of all sizes are found in Bihar. However, the largest proportion of tanks are found in the size category of 2.5 to 10 acres which covers 45 per cent of the tanks, followed by 20 per cent of tanks with a size category of 11 to 20 acres and then 15 per cent tanks falling the size category of below 2.5 acres. The average size of the tanks is 16.2 acres. District wise analysis showed that the average size of tanks in Patna is 20.1 acres, followed by 14.5 acres in Nalanda and three acres in Jamui.

The average irrigated area per tank (Table B-5) shows much greater evenness. Although area irrigated per tank was highest (60 acre) in Jamui, the average for the state

[24] It refers to tanks constructed before the advent of British in India. This categorization was used for the survey of tanks (see interview schedule at p.146, question 2). Since our research was not an archeology study, the categorization ultimately depended on what our responded said (p.121, para 2) and/or what we observed during the site visit. However as per historians, the ancient period is taken up to 6th century AD and medieval period from 7th century to 16th century

as a whole comes to about 48 acres per tank. The ratio of irrigated area and the tank area was also found to be highest in Jamui where it stands at 20:1, followed by Nalanda where one acre of tank area irrigates 3.1 acres of land and the lowest ratio is at 2.6:1 in Patna; the average for the state, however, comes to 2.9:1.

Table B-6 examines the data on tank-irrigated area from two angles. The first one looks at area irrigated by tanks during the three cropping seasons and the second one looks at the mode of irrigation, i.e., whether manual, energized, lift or flow irrigation. In case of manual irrigators, they use such traditional modes as *karing, latha -kudi*, while in case of mechanical all kinds of pumps such as diesel and kerosene are used. In case where water level is high such as in case of village Salalpur in Patna district, Chinese diesel pump set (called by farmers as CD, which stands for - Chinese Diesel Engine) were found to be very popular among the farmers.

Data on season wise irrigation shows that the largest proportion of the area is irrigated during *kharif* season, which accounts for 60.7 per cent of the total tank irrigated area, followed by 38 per cent during *rabi* and a meager 1 per cent of irrigation during the summer season.

As regards different modes of irrigation, flow irrigation is possible only during the *kharif* season, while in *rabi* and summer seasons, no flow irrigation is practiced in any of the districts. Even during *kharif*, lift irrigation seems to be more in vogue as about 58 per cent tank irrigation is done through pumps, compared to 33 per cent by flow and about 9 per cent manually. The only exception in this respect is Patna district where about 49 per cent of irrigation is done through flow method compared to about 43 per cent through pumps. Another notable point is that although tank irrigation is meager during the summer, about 27 per cent of it is done manually, compared to about 73 per cent through energized lifting. This is in sharp contrast to the proportion of area irrigated through manual means in *kharif* (8.8 per cent) and *rabi* (1.6 per cent).

In Table B-7 the gross area irrigated through various modes in the three districts is examined. It is found that overall about 73 per cent of gross irrigation is through energized lifting, followed by about 21 per cent from flow irrigation and 6 per cent done manually. In case of Jamui mechanical mode is most popular accounting for 93 per cent of the gross irrigated area. In the case of Patna, 54 per cent of the tank irrigation is through pumps and 39 per cent by flow method. In case of Nalanda, about 77 per cent of the area is irrigated by pumps and about 16 per cent of the area is irrigated by flow method.

As regard average number of irrigators per tank (Table B-8), it is 66 in Patna and 62 in Nalanda. However, Nalanda seems to have larger number of farmers (4) per acre of tank irrigated area, as compared to 3 farmers per acre for Patna.

In Tables B-9a, 9b and 9c the depth of tanks during monsoon, winter and summer seasons respectively, was examined. One thing which comes out very vividly from the

three tables is that in all districts the depth of water goes on consistently dropping from monsoon months to winter and then to summer. This is quite natural as these water bodies do not receive inflows during the non-monsoon period. During rainy season the largest proportion of tanks (45 per cent) have a storage depth of 5-7 feet and another 35 per cent have a storage depth of above 10 feet. During winter, the largest proportion of tanks (40 per cent) have storage depth in the range of 3-5 feet, and only 10 per cent have storage depth above 10 feet. There is further reduction of depth during summer months and it is found that 55 per cent tanks dry during summer months and storage in another 40 per cent tank remain below 5 feet, and a mere 5 per cent tanks maintain a storage depth of 7-10 feet.

As regard the source of tank water (Table B-10), it is found that 45 per cent tanks derive their stock from rain (run off from the local catchment), while another 35 per cent of tanks derive their stock from a combination of rain, rivulet, bigger tanks and from flood water. The rest of 20 per cent derive their stock from canals, artesian sources and from village drains.

In respect of maintenance (Table B-11), it is to be noted that responsibility of maintenance does not necessarily imply that maintenance was actually carried out by the organizations, who own the responsibility. This is particularly true in the case of government and panchayat tanks. In this respect, it is revealing that as high as 40 per cent of Bihar tanks are maintained by others who include tanks occupants, fish contractors etc. For another 35 per cent of the tanks, maintenance responsibility lies with the MI or FD of the state government. Individuals who have inherited them own another 20 per cent of the tanks. Only for the rest 5 per cent tanks in Bihar, panchayat takes the responsibility of maintenance.

Table B-12 consists of two parts. While the first part deals with the repair of embankments, the second part deals with the frequency of desilting. The table shows the pathetic state of affairs with regard to the two major maintenance requirements. It is found that while in 35 per cent of cases the embankment was never repaired; in 50 per cent cases, desilting was never done. In 25 per cent of cases, repair of embankment was done once in 2-10 years and in another 25 per cent cases, it was once in 11-30 years. Desilting, on the other hand, was resorted to less frequently. Only in 5 per cent cases it was done once in 2-10 years and in 30 per cent cases, it was once in 11-30 years. However in 15 per cent cases, maintenance (embankment and desilting) was done annually and these were the tanks which were either owned by individual or by unauthorized occupants or are run by some form of collectivity. In all these cases, pisciculture is the main function of the tank.

Table B-13 provides data on the agencies/individuals spending money for the maintenance and here a contrast is visible in relation to Table B-11 which covers agencies/ individuals accountable for the maintenance of tanks. What is very striking is that there are 35 per cent of tanks where no maintenance is done. Another important point is that there is considerable extent of community contributions; in about 25 per cent of cases

community action and panchayat contribution is forthcoming in comparison to 5 per cent cases where panchayat has the responsibility (Table B-11).

Tables B-14 and Table B-15 need to be examined together. While Table B-14 furnishes data for the tank studied in detail in each district, Table B-15 furnishes data on all the tanks in the villages/hamlets where survey/study was conducted. While Table B-14 contains data for about 20 tanks, the latter is based on data for about 78 tanks. The first thing that strikes is that none of the tanks in the three districts are exclusively for domestic purposes nor any of the tanks in the study villages were abandoned. The main difference between the data furnished in the two tables is that the larger proportion of the surveyed tanks has pisciculture related activities. While 20 per cent of the surveyed tanks are concerned with pisciculture, only 6 per cent of the village tanks have pisciculture. This becomes obvious if the data in the two tables is examined in terms of multipurpose tanks. While 65 per cent of the studied tanks are multi-purpose tanks (Table B-14), the percentage is as high as 80 in respect of all village tanks (Table B-15).

Table B-16 deals with pisciculture aspect of tanks. It is found that there are 16 tanks, which are either exclusively engaged in pisciculture or has pisciculture as one of the activities or which have data on fisheries activities. It was found that these 16 tanks generate a total of more than Rs. 18 lakhs rupees. The economic value of the output generated per tank varies to a large extent between Patna and Nalanda. The returns from fish production are not significant when it is assessed in per unit area terms. While fisheries in Nalanda tanks generate an economic value of Rs. 8,800 per acre of tank area, Patna tank generates a lesser value of Rs. 5,800 per acre.

Table B-17 and B-18 contain data of the villages / hamlets where the tanks were located. Looking at the overall position in three districts, it found that higher castes own a much higher proportion of the land compared to lower castes. The difference is so much so that while about 17 per cent households belonging to high castes own about 35 per cent of the land, 29 per cent SCs own only about 7 per cent of the land in the villages. Although OBCs (this category is expressed for both the categories of BC-I and BC-II) also own much less land, it is slightly higher than their share in the population. This is evident from the fact that while there are about 54 per cent of OBCs in the sample, the land owned by them is about 58 per cent of the total village land.

The same is reflected in Table 18 where average land holding of different castes is shown. The average size of land holding of high castes is 2.75 acre, followed by 1.44 acre for the backward castes and 0.34 acre for the scheduled castes. There are a lot of inter-district differences in this respect as can be seen from the table.

Findings of Bihar Village Cases

As mentioned in chapter-2 in case of Bihar, case studies were prepared from 7 villages/hamlets. All the case studies are presented in the book as **Annexure-4**. The case studies present different pictures in terms of origin, nature and extent of benefits

and beneficiaries of tanks. Side by side, socio-economic power play, which determines, who gets what and why, has also been discussed.

In terms of variety, while in one village we find deep dug tanks known as *khata*, in other villages we see various types of tanks owned by individual farmers to several tanks owned by fisheries department, panchayats and village committees. Even in this early 21st century, it is not uncommon to see traditional water lifting devices such as *karing* and *latha kudi* in villages which are not far from the state capital Patna.

An interesting feature of several of these tanks is the seasonal nature of water availability in the tanks. A case in point is Salarpur village of Patna district. During September 2004, when we visited the village, the *khatas* (deep tanks) were full of water, and all kinds of traditional lift devices were visible. However, when the tank was visited again during December 2004, all *khatas* were dry and there was no sign of any traditional manual water-lifting devices. Followings are some of the other important features/ findings emerging from these case studies.

- Although high castes like *bhumihars* still dominate the power structure, the concept of dominant caste has taken a change for the better, particularly in the democratic framework. The scheduled caste members, holding panchayat offices, were found to be counted as influential persons in the village. Similarly in some other villages, *kurmis* and other OBCs on account of larger share of land holding seem to dominate the village politics.

- In several cases it was noticed that private parties had captured tanks located in government and panchayat lands and made large profits by using them for pisciculture. It was also found that a lot of land in the water spread area of the tanks was illegally occupied and used by influential farmers.

- Although fisheries department and panchayats made huge profits from the fishery contracts, they never ploughed back any portion of this income in desilting or other repairs or even routine maintenance works of these tanks. Another feature more pronounced in case of FD was the rampant corruption in issuing contracts. This resulted in huge revenue losses to the department.

- In many situations, particularly when rains were scanty, there was visible conflicts between the fish contractors and irrigators. This was most visible where rains were not occurring and irrigators desperately needed water to save the crops. On his/her part a fish contractor will not allow water to be taken out of tank when it has reached a critical level below which the survival of fishes is threatened.

- The location of the tanks is ideal for the local topography and agricultural and other uses, particularly those tanks that exist since ancient and British times. But the tanks are not properly maintained, and therefore are not in good condition, even after public investments.

- The power dynamics at the society level, specially the caste and class dominance and vested interests, have adverse impact on the profitability distribution of irrigated crop production and fisheries activities from the tanks and the benefits are confined to the dominant communities.
- Wherever the tank management has been the responsibility of individual owners, the maintenance of the structures has been good, and hence management of water has resulted in profitable uses.
- There has been a huge waste of public investments as private interests in connivance with the socially dominant groups and government officials (in case of fishing contracts) work against the public interests.
- Community actions have been encouraged in exigencies and social causes in recent past but prior to 1980s for agricultural purposes.
- Progressive leadership and necessity have prompted community action for management of tanks for agricultural purposes.

CHAPTER-IV

JHARKHAND

The state of Jharkhand was carved out of Bihar and came into being on 15th November 2000. The topographical features of the state are different from that of Bihar. The state is composed of Chhota Nagpur plateau of Vindhya mountain range similar to the districts of Bankura, Purulia and Birbhum of West Bengal. The state can be divided into three parts, viz., north eastern part containing districts of Godda, Dumka and Deoghar, (earlier known as *Santhal Pargana*); the north west part consisting of districts Palamau, Hazaribagh and Dhanbad; and the southern part consisting of Ranchi, Gumla Lohardagga, Shinghbhum and others. The state has nearly 27 per cent tribal population, who are the original inhabitants, living in settlements in deep jungles. The major traditional source of their livelihood was the forest and they were introduced to settled agriculture in the latter part of 19th and early 20th century. The immigrant, non-tribal population made them to shift to permanent cultivation. The concentration of *santhal* tribes is greater in northeast part of the state, and they perhaps started practicing agriculture earlier than the rest of the state.

The *santals* first settled in this region during 1790-1810. Later on in 1855 *santal* Rebellion known as *hul* broke out. This triggered migration of *santals* to these areas that brought a change in their lifestyle and mode of sustenance. In O'Malley's words, "'*Santal rebellion*' caused *santals* from different parts of Bengal to concentrate in these areas by migration. But later they had to migrate out due to insufficient reclamation of forest land for agriculture, as it did not match with the needs of fast growing population" (O'Malley 1910, 54-65).

The surface of these areas is to a large extent composed of long undulating ridges between which the drainage runs off to join the larger streams. The crests of ridges are very poor for cultivation. However, the slopes of these ridges have been used for cultivation. The slope thus presents the appearance of a series of steps, which are converted into terraces for rice cultivation. The rice terraces are flooded as soon as the rain sets in, and water is retained until the crop matures in late autumn. Thus irrigation was absolutely not necessary. The natural topography facilitated irrigation to a large extent. O'Malley (1910, 190-91) writes, "Fortunately the undulating nature of the country affords great facilities for protective works. These facilities have been so fully utilized so that one third of rice land is now protected and only two third remain unprotected".

The irrigation works generally took the form of embankments constructed across ravines, hollows or the natural depression or at the head of the numerous valleys that impounded the drainage water. These formed reservoirs from which the rice fields stretching away, were irrigated. The such small sized tanks are called *'hires'* and the large sized ones are called *bands.* These embankments were in very large numbers, judged by the fact that each village had at least one or two. The smaller ones dried up in a month or two after the rains ceased, whereas the larger ones having large catchments ensured continuous stream flows during the dry spells.

Their sites were usually well chosen and the beds of the bunds were often impregnated with natural springs. The *gouda* area, which was another tract of 259 square kms., was irrigated by channels called *daubs* leading from embankments thrown across the bed of streams to fields at lower level (similar as *pynes* in Gaya district). These channels frequently traversed through several villages, all of which assisted in their construction and shared the benefits accruing from them. In the opinion of McPherson, the existing land system (with farmers holding fragmented land in the head, middle and tail end) benefited due to the peculiar advantage of cooperation it created amongst the cultivators. He further termed "the faculty of association and cooperation has been fostered and developed to a degree that is impossible in the ordinary district.... works (irrigation works) that were beyond the means and enterprise of the individual cultivators were successfully carried through by united efforts of the community.... and cooperation has told not only on the work of construction but also on the work of maintenance and repair (of bandhs, tanks and other works of irrigation)" (O'Malley 1910, 192-93).

Even *ryot* (tenant) cultivators were free to construct embankments. The landlords were self-restrained from interfering in the work of improvement of irrigation works, and left individual *ryots* free to think out and execute their own ideas in agriculture and irrigation.

North western part of the Jharkhand, where the tank survey was conducted has been significant for irrigation since the 19th century. The hilly and undulating terrain in the western part of this region (Palamau) witnessed settled agriculture very late. This history of irrigated agriculture in this region is not very old; as the tribal people (original inhabitants) practiced slash and burn cultivation[25] in which irrigation had practically no role to play. Substantial influx of caste peasantry during 19th century from the plains of Bihar to this region brought the agricultural practices, including the art of irrigation with them. The contact of caste peasantry, such as *mahto* and *kurmi* with tribals stimulated the growth of agriculture and extension of irrigation through *'ahars', pynes'* and tanks (Sharma, 1985, 118-120)

[25] Slash and burn agriculture is the process of cutting down the vegetation in a particular plot of land, setting fire to the remaining foliage, and using the ashes to provide nutrients to the soil for use of planting food crops. Slash and burn is a method of agriculture primarily used by tribal communities for subsistence farming (farming to survive). Humans have practiced this method for about 12,000 years, ever since the transition known as the Neolithic Revolution, the time when humans stopped hunting and gathering and started to stay put and grow crops. Today, between 200 and 500 million people, or up to 7% of the world's population, uses slash and burn agriculture.

In the beginning of the 20th century, the region throughout had a system of, damming up valleys by 8-10 feet high *bunds* constructed in series, forming small tanks or *ahars*, having no masonry sluices. These *ahars* gave agriculturists a good harvest of paddy whether rainfall was sufficient or not. In this undulating tract, with erratic rainfall, there must be enumerable small streams, the water of which could be dammed and diverted into tanks and utilized in saving the crops at critical seasons. On the bed of the tank, as the water was drawn off, wheat or gram were sown on the moist soil and good rabi crop was obtained (O'Malley 1910 a, 193).

As discussed above, the tribal population gave up slash and burns cultivation and started settled agriculture in 1930s. Famines had made them construct *ahars* during the 19th century but the pace of construction of *ahars* and tanks was accelerated during the first quarter of the 20th century. The first survey and settlement operations in the district of Palamau recorded existence of 148 *ahars* that went up to 1095 at the time of second survey (1894-95 and 1896-97). The survey and settlement operations in mid 1930s recorded the existence of 11, 282 tanks (Sharma 1985, 120). With the passage of time the significance of tank irrigation grew considerably. The 'grow more food campaign' covered rehabilitation and construction of tanks, *ahars, pynes, karhas* under the minor irrigation scheme.

The southern part of Jharkhand consists of Ranchi, Gumla, Lohardagga and Singhbhum districts. The districts of Gumla and Lohardagga were hitherto part of Ranchi district. Ranchi, situated at plateau of Vindhya range of mountains, has a major part of these ranges stretch through north to south like natural wall with rocky spurs and deep valleys. The central tract of mountain separated by Damodar Valley is undulating, intersected by numerous streams and rivers and studded with low rocky hills as well as isolated peaks. The region receives rain almost throughout the year, though concentration is during the monsoon months from June to September.

The hill streams remain almost dry except in rainy season and do not offer as much scope for irrigation as the perennial rivers. The process of soil erosion is active throughout the district due to the undulating land. The rainwater washes away the top soil in the uplands and deposits it in the low land. As compared to other districts of the Chhota Nagpur plateau, the tradition of water harvesting was relatively weak in Ranchi district. Hence, cultivation was traditionally rain-fed. Some of the landlords did construct *bandhs* for irrigating their lands but at the turn of the century, many of them were too poor to keep these in a state of repair. They were also on such bad terms with the cultivators that they were reluctant to work with them to carry out any larger works. The peasants too were extremely improvident, though they had shown themselves capable of united action in their struggle against landlords. British officials noted that they had not joined together to carry out any large irrigation works. In the more heavily forested parts of the district, the local tribal people cleared forest lands to make new fields and embanked and terraced the land in streambeds. This was the normal way in which they extended their cultivation (Kumar 1976, 1-6 & 196-200).

Table 4.1 Changes in Population Distribution of Major Tribes in Jharkhand

Tribes	Population of Tribes over the decades				
	1941	**1961**	**1971**	**1981**	**1991**
Munda*	527116	628931	723116	845887	899162
	(14.76)	(15.02)	(14.77)	(14.57)	(14.88)
Asur*	4388	5819	7026	7783	9122
	(0.12)	(0.14)	(0.14)	(0.13)	(0.15)
Oraon*	637296	735025	876218	1048064	1137656
	(17.85)	(17.55)	(17.89)	(18.06)	(18.82)
Mahli*	56309	67979	74452	91868	105361
	(1.58)	(1.62)	(1.52)	(1.58)	(1.74)
Chick Baraik*	-	30770	33476	40339	45645
	-	(0.73)	(0.68)	(0.69)	(0.76)
Lohra*	47137	92609	116828	169090	173968
	(1.32)	(2.21)	(2.39)	(2.91)	(2.88)
Santhal	1392744	1541345	1801304	2060732	2067039
	(39.01)	(36.81)	(36.79)	(35.50)	(34.20)
Kharwar	77589	190357	139272	222758	173308
	(2.17)	(4.55)	(2.84)	(3.84)	(2.87)
Kharia	86777	108983	127002	154158	147235
	(2.43)	(2.60)	(2.59)	(2.66)	(2.44)
Ho	383737	454746	505172	536524	630378
	(10.75)	(10.86)	(10.32)	(9.24)	(10.43)
Chero	19337	30845	38741	52210	60116
	(0.54)	(0.74)	(0.79)	(0.90)	(0.99)
Bedia	31813	38241	48021	60445	71719
	(0.89)	(0.91)	(0.98)	(1.04)	(1.19)
Bhumij	109230	101057	124918	136110	155961
	(3.06)	(2.41)	(2.55)	(2.35)	(2.58)
Others**	196775	161133	280936	378239	367340
	(5.51)	(3.85)	(5.74)	(6.52)	(6.08)
All Tribes	**3570248**	**4187840**	**4896482**	**5804207**	**6044010**

Values in paranthesis are in percentage.

Source: P.C. Oraon, 2003

Notes: * These are the tribes found in survey areas

** In this category those tribes are included whose population is below 50,000

In Table 4.1 the changing pattern of tribal population in Jharkhand has been presented[26]. Among the tribes which inhabit Jharkhand, the most important ones in terms of population size are *santhals, oraons, mundas* and *hos*. Except for *santhals* and *hos,* all important tribes were covered in the tank survey. A striking point that emerges from the data is that while the population of all tribes had increased over the years, the proportion of certain tribes in relation to the total tribal population has decreased. Among such tribes, *santhals* are the most prominent ones. In 1941 their population was 39 per cent, which decreased to 34 per cent in 1991. As regard *oraons*, they were about 18 per cent in 1941 and remained same in (19 per cent) 1991. In respect of *mundas*, their proportion has more or less remained the same. In 1941 they constituted 14.8 per cent and five decades later also they constituted 14.9 per cent. Another important inference that can be derived from the data is that those tribes that remain low in social hierarchy such as, *mahli, lohra, chick barik* etc., constitute a very low proportion of the total tribal population.

Relationship between Tribes, Agriculture and Tank Irrigation

The population of tribes in Jharkhand is 27 per cent and the profile of these tribes vary in terms of occupation, environment, natural resource and land. The concentration of tribal population is highest in the districts of Ranchi, Gumla and Lohardagga. As mentioned earlier, the tribes covered were *munda, oraon, asurs* and other tribes having lower position in the social hierarchy such as, *mahli, lohra* and *chick baraik*.

Mundas and Asurs

The first settlers in the district of Ranchi (including Gumla) are the *asurs* and the *mundas* who established themselves in the region under the system of village communes in the form of self-governing villages with a strong sense of community feeling, communal ownership of land and great cohesiveness and purposefulness in the village agencies. Each village was under the leadership of a village chief called *munda*. A confederacy of about 20 villages was known as *parha*, whose head used to be the *paraha raja* or the *manki* (Verma 2002, 8). Those who cleared jungles for cultivation were in possession of the reclaimed land and were known as *bhuinhars* and such land was known as *bhuinhari* land. The Chhota Nagpur king appointed his relatives to rule over these *mankis* and they used force over the markis for collecting revenue. This phase witnessed the eviction of the tribal population by brute force. The newcomers took possession of the tribal's *bhuinhari* land, which was originally reclaimed by them and converted these into *majhias* (landlord's privilege) land. Chhota Nagpur tribes lived in relative isolation and lack security until the 16th century. In 1585, Akbar made the king of Chhota Nagpur a *malguzar* or tributary, and as a result, tribal chief became tributary to the great empire. The headman from each village collected subscription and paid it to his *parha* chief and the *parha* chief paid the money to the raja (Verma 2002, 8). The beginning of the transformation of the tribal agrarian system however, could be traced to the rise of the

[26] The tribes, which formed part of our tank survey, have been marked with an asterisk.

feudal state system in the medieval period, which led to the alienation of the land held by the tribals. Towards the beginning of the 19th century, a class of Muslim, Sikh and Hindu traders, moneylenders and adventurers began to find their way to Chhota Nangpur. As a result the *bhuinhars* gradually diminished their possession of the land. This is evident from the fact that merely 249 sq. kms. of 18264 sq. kms. of land was in possession of the *bhuinhars* by the end of the 19th century. The introduction of the so-called *zamindari* police by the British administrators in 1809 amounted to nothing less than the appointment of the wolf as shepherd (Hofmann et al 1950, 513). The illegal deprivation of the tribesmen of their right over the land led to insurgencies. With a view to woo the tribals, the Chhota Nagpur Tenure Act of 1869 was passed and a special commissioner was appointed to survey and demarcate the privileged land of the tenants (*bhuinhars*). Again a tenancy Act was passed in 1908, which safeguarded the rights of the tribals over the land. The Deputy Commissioner was empowered to restore their *khuntkatti* rights over land. The economy of *munda* was based on agriculture, fishing, collection of MFP (marginal forest products) and services or labour. The *munda*, basically being a warrior tribe, is generally not oriented to agriculture and historically do their cultivation by dry and wet methods. They practiced cultivation of coarse variety of paddy, vegetables, maize, *marua, kurthi, kodo, arhar, til* and mustard. The fine varieties of paddy or *agahani* paddy were cultivated by wet method (Oraon 2003, 305-6).

Oraons and Others

Unlike *mundas*, *oraons* are an agricultural community. The *oraon* economy is primitive, subsistent and self-sustaining; whose basic features are food gathering, hunting and agriculture. P. C. Oraon the eminent anthropologist and Director, Jharkhand Tribal Welfare Research Institute, Ranchi observes that although *oraons* are settled agriculturists, the forests also play an important role in their economy. Over 96 per cent of *oraon* population directly and indirectly depends on agriculture (Oraon 1993, 1-11).

Table 4.2 Oraon Tribes by Categories

Sl. No.	Agricultural Classes	Percentage of Oraon Population
1.	Cultivators of un-owned land and dependents	93.84
2.	Cultivators of owned land and dependents	0.73
3.	Cultivation labourers and dependents	1.49
4.	Non cultivating owners and their dependents	0.32
	Total	**96.38**

Source: Oraon, 1993

It is needless to discuss the agricultural practices of *oraon*, which are no way different from those of other local tribes in the region. However, it is relevant to throw

light on irrigation practices, including acquisition and regulation of water by the *oraon* tribe. Well to do *oraons* who grow potatoes, onions etc., on their *bari* or *chira* lands dig wells to irrigate them. In the past, water was drawn manually with the help of *latha kundi* but no such practice was found when we visited the area. The villagers informed us that the government had given them a number of pump sets, which were used to extract water from wells. Presently in a few villages, reservoirs in which rainwater is stored are also used by some well to do *oraon* cultivators by raising bunds at some cost and labour. The regulation of water is an important issue. To quote Oraon again, "Between the first ploughing and the sowing, the *oraon* cultivator has to repair breaches, if any, in the ridges that separate one terrace from another. Adding earth to the sides and top also strengthens the ridges. The objective of this is to prevent rainwater from running over the ridges or passing through the breaches in the ridges to the lower terraces. From the time paddy is sown till the end of the rainy season, the amount of the water in the fields has to be regulated constantly. If too much rainwater is accumulated in the field the farmers make a narrow opening on the lower side of the field and allow the surplus water to run off. But if no rain occurs for a day or two, opening is sealed using earth, and the field is allowed to get partially submerged with water. Towards the end of the season (the middle of September), the embankments are made watertight to keep sufficient water in the fields" (Oraon 1993, 3). This reveals that *oraons* are conscious of using water wisely. It implies that they do also regulate the tank water according to the need and environment.

A success story of a person from *oraon* community tells the community's aptitude towards agriculture in tough conditions. In Jamtoli, Simon Oraon managed to conceptualize, plan and organize the finance for the construction of five check dams, which irrigated over hundreds of acres of land. He experimented with flow irrigation techniques and built his first check dam when he was just fourteen years old, which enabled part of his father's land to be irrigated when the monsoon was poor or late: a system that greatly improved his household's food security. His success with these crops encouraged him to expand Jamtoli's irrigable potential. "Although, it cannot be denied that Simon Oraon's irrigation schemes have been very important in terms of increasing food security and profits from rabi season crops, his emphasis on modern farming is, to some extent, resulting in replacement of more traditional farming methods." (Jewitt 1996, 118-20).[27]

Other tribes in the locality of Ranchi and Gumla districts are *mahli, chik baraik*, and *lohra*. The concentration of *mahli* tribe is in Ranchi, Gumla, Lohardagga and Singhbhum districts of Jharkhand. They have always maintained sustenance in association with *mundas* and *oraons*. The material culture of the *mahli* tribe reveals their existence-oriented economy, which is based on basketry, collection of MFP, agriculture, carrying palanquins and labour. Previously basketry was the main occupation for this tribe. Each

[27] This has been described as detailed village case and the same is provided in Annexure V. A summary of the case is also provided at the end of Chapter IV.

family owns some land for cultivation, but they are generally *tanr* land and hence do not give good yields. As they do not have sufficient land, many of them do not have plough and bullocks to till the land. Although they were said to be professional drumbeaters, in the survey villages, they were found to be associated with *oraons* for sustenance.

Chik Baraik tribe is concentrated in the districts of Ranchi, Gumla and Lohardagga districts of Jharkhand. They are traditionally weavers and thread makers. But they also do collection of MFP, trapping of birds, agriculture work and wage labour. In the present times, they face problems in collection of MFP, as this job is contracted out under the MFP collection and Forest Regulation Act by the forest department. At times they give their agricultural land to *munda* and *oraon* for sharecropping and keep themselves engaged in weaving.

The concentration of *lohra* tribe is in Ranchi, Singhbhum, Palamau, Hajaribagh and Santhal Pargana. *Lohra* youths are the work force of the community. Their main means of livelihood has been iron tool making. They used to purchase iron from the *asur* and *agaria* (migrant from Madhya Pradesh) tribes and prepare tools in their workshops. Each *lohra* family owns some cultivable land, but of poor quality. They do not have sufficient land on which they can depend on for sustenance. They also collect food and MFP from the forests.

Table 4.3 Survey Area Profile (Census 1991)

Sl. No.	Name of block and District	Geographical Area (Sq. Kms)	% of ST Population	% of SC Population
1	Ranchi Total	7573	43.56	5.57
a	Bero	387.84	58.35	1.91
b	Sonahatu	376.58	24.37	8
c	Bundu	264.19	47.95	6.56
2	Gumla Total	5320.94	69.76	3.62
a	Sisai	425.44	65.03	1.34
b	Bharno	299.77	72.44	1.56
3	Palamau total	4315.16	8.98	27.41
a	Chainpur	639.43	18.85	22.71

Source: P. C. Oraon, 2003

Palamau

The word Palamau is made up of two Hindi words "*Pala*" which means frost and "*mu*" which means dead. The whole word meaning "dead from the frost" is indicative of parts of the district experiencing severe frost during winter months (Roychoudhury 1961, 1). The district is bounded on the north by the river Sone that separates it from erstwhile district of Shahabad and by the district of Gaya. In the west, the district is bounded by Garhwa.The districts of Chatra in the east and Latehar in the south respectively, surround Palamau.

The district is characterized by a series of hill ranges running parallel, through which the river Koel passes. The most valuable arable lands in the district are found in the valleys and on the banks of Koel and Sone rivers. The rest of the district consists of hilly, broken country covered with low growth jungle and dissected by deep gullies caused by numerous streams and torrents which come in spate during the monsoon, but dry up in summer.

The rainfall in the district is either insufficient or unfavourably distributed for the paddy crop, hence the fate of the crop depends a great deal on the good rainfall in the months of September and October for the crop to reach maturity. Yet there is every likelihood of failure of monsoon during this period. At the same time flow in the large streams diminishes rapidly while that in the smaller stream the flow altogether disappears soon after the rains stop. Further, much of the area under cultivation in the district is highly fissured, undulating and unsuitable for irrigation, except in small patches. But the ingenuity of the inhabitants had helped overcome these difficulties posed by hydrology and topography. Embankments were constructed across the natural slope of the land, and small streams were dammed and diverted. Rice fields were laboriously prepared by terracing the land or in some cases, the stream bed was made into one long, narrow rice field.

As far back in the early part of 20th century, O'Malley wrote about the use of small *bunds* called *ahars*, for rice cultivation in Palamau district. A large number of *ahars* were constructed in almost every depression all over the area. These *bunds* which acted as reservoirs, varied in size. The area irrigated also varied significantly, from less than one ha to 40 ha. In some cases, damming of *nullah* and small streams formed reservoirs and water was diverted from streams through channels called *pynes* (O'Malley 1907, 72-76).

The *bandh* ran along the contours. As it progressed on length, the catchment area went on increasing and at places it required *pucca* flood escapes, to let out floodwater, locally known as *chahakas.* Here and there throughout the embankment and irrigation channels, *bhaos* (wooden or earthen or cement pipes) were fitted to let out water in the district (Roychoudhury 1961, 180).

Besides *ahars*, *pynes* (narrow water channels) have also been an important means of irrigation in Palamau. *Pynes* are diversion channels taking off from the streams of

catchments ranging from 2.6 to 7.3 square kilometres. They divert the water into the fields for irrigation. Generally an earthen bund is built across a valley. The *pyne* takes off from upstream of the bund and water is diverted through it. The surplus water escapes through a suitably located waste-weir (Sinha 1956, 10).

On account of its hilly terrain, no big irrigation project could be taken up in Palamau during the pre-Independence era (Sharma 1985, 118). Nevertheless, everywhere a system of damming up valleys by a series of bunds of 8 to 10 feet height forming small tanks or *ahars* existed. These were generally not supplied with masonry sluices, but the water seeping through them served the purpose of watering the rice patches located downstream. Villages where *ahars* were in order, never failed to give the agriculturalist a good harvest of paddy whether rainfall was sufficient or not; while in villages where *ahars* were in disrepair or were not there, yields were little or nil (Sunder 1898, 7).

In the district, like in other tribal areas, the history of irrigation is neither of any great significance nor very old. However, as in other districts of Jharkhand, Palamau also witnessed substantial influx of peasant communities from plains that brought with them the well-established agricultural practices of plains, including the art and craft of irrigation. Consequently peasant castes such as *mahtos, kurmis* etc., came in contact with tribal people, particularly *oraons.* This led to the growth of irrigated agriculture through a complex of *ahars* and *pynes* (Singh 1975, 6). This process appears to have accelerated during the first quarter of 20th century. While in 1911, the area irrigated by tanks was a mere 200 acres, it rose to 80378 acres by 1921 (Sharma 1985, 120).

The *santhal* region of Jharkhand had a very rich tradition of building and maintaining of *bandhs* and tanks. The O'Malley's account does not provide exact area of irrigation by tanks. The maintenance and repair of these structures in this region was by nicely inducing the tenants. The *ryots* were encouraged to improve the land they cultivated through irrigation by a rental law that provided that the land is leased for a fixed term of 15 years. Thus *ryots* were assured that they could utilize the irrigation structure for which they made investments towards construction and maintenance, for such long periods. This had resulted in a considerable rise in cultivation of rice in this region. But the migrant non-tribals such as Bengali, Bihari and up-country immigrants pushed the *santal* tribes off their land by force, 'cajolery' and trickery. By the application of large capital or steadier labour, they developed the *bandhs* and tanks into works of considerable size. In many villages, magnificent reservoirs retained water through some of the driest years. Their construction had often been started by *santals* and completed by others. Not only that irrigational expansion took place, but the quality of agricultural land was also improved (O'Malley 1910, 198).

Upper caste immigrants who resorted to irrigation from *bandhs* and tanks have largely inhabited the district of Palamau. The amount of tank irrigation in the district rose from 200 acres in 1911 to 81,176 acres in 1941. This exorbitant rise was a result of influx of peasant castes from the plain into this region during 1930s. The settlement surveys reveal that *ahars,* tanks and *pynes* alone irrigated 69,829 acres in mid 1930s

(Sharma 1985, 120). The figures in Table 4.4 show the rise and fall of tank irrigation from pre-Independence period to post Independence period. Besides, the figures also show a sharp decline in tank irrigation in the district from 1961 onwards.

Table 4.4: Extent of Tank Irrigation in Palamau District, Jharkhand

Period of Irrigation	Area Irrigated		Total area irrigated
Pre-Independence	**Area (acres)**	**Percentage**	
1921	80,378	89.2	90,041
1931	81,176	89.7	90,536
1941	81,176	89.7	90,536
Post-Independence			
1951	40,426	65.5	61,757
1961	1,46,150	83.4	1,75,070
1971	48,820	27.1	1,78,690
1978	22,720	11.8	1,92,900

Source: 1, ID Sharma 1985. 2. Bihar Through Figures, Directorate of Statistics and Evaluation, Planning Department, GOB.

Ranchi

The present Gumla district was carved out of the erstwhile Ranchi district. Therefore what is mentioned here for Ranchi in terms of historical position is also applicable to Gumla district. Although Ranchi had never been very important for tank irrigation, the selection of Ranchi was done with a view to study the contrast between highly developed and least developed tank irrigation practices in close proximity. This was possible by comparing situations in Gumla and Ranchi. As a matter of fact, Gumla district formed the western portion of erstwhile Ranchi district. In the erstwhile district of Ranchi, tank irrigation was very much in vogue in certain pockets in the east and the west. These were the pockets where the indigenous tribal caste of *oraons* and the migrant *mahto* caste were living together, particularly since the last quarter of the 19th century. The *mahatos* are the equivalent of *kurmi* castes in Uttar Pradesh, who are very good cultivators. The *mahtos* migrated to Jharkhand from their original abode in Bihar and brought with them the culture of irrigated agriculture and the art and craft of tank building. Among the tribals, while *mundas* (Warrior class) were not oriented to irrigated agriculture, the *santhals* and *oraons* did practice some kind of primitive agriculture. When they came in contact with *mahatos*, they learnt the tricks of the trade quickly. Therefore by visiting the villages of Ranchi and Gumla one can very well see this contrast in juxtaposition.

As O'Malley observes, the process was well described by McPherson, who regarded the "*Santhal* as a born reclaimer". According to McPherson, a *santhal* knows

where to throw his cross *bandhs* and where to make his terraces. He loves to clear jungle, and level the rough slopy land, more than the civilized Bengali, Bihari, and up-country immigrant.

Ranchi district is bounded on the north by the districts of Palamau and Hazaribagh; on the south by districts of Singhbhum (Jharkhand) and Sundergarh (Orissa), on the east by Singhbhum and Purulia (West Bengal) and on the west by districts of Raigarh and Surguja (Madhya Pradesh).

The plateau that covers the districts of Gumla and Ranchi consists of rocky spurs of various heights with deep valleys radiating from the central mass. The highest portion of the central plateau is a ridge eight to ten miles south west of Ranchi from where the main rivers of the district, Subarnarekha and South Koel originate. The plateau was formerly covered intensively with forests, which have gradually disappeared on account of heavy increase of the inhabitants and also due to commercial exploitation. Reclamation of land for cultivating cereals has further reduced the area under forests.

The districts of Ranchi and Gumla have the highest concentration of scheduled tribes in Bihar (including Jharkhand) where about 31 per cent of tribal population of the whole Bihar live in these two districts. Of the number of tribes that inhabit the two districts, *oraons* account for about 43 per cent and *mundas* 35 per cent and together accounting for 78 per cent of the tribal population. The remaining 22 per cent of the tribal population is distributed among 27 other tribes (Kumar 1970 a, 99-100).

Gumla

Gumla is located in the south western part of the state and southwest from Ranchi. It falls south of the districts of Palamau and Garhawa. The total geographical area of the district is 5320.94 sq kms and the total population of the district according to Census 2001 is 9,20,597. As per Census of 1991, the scheduled tribe (ST) population in the district was 69.76 per cent of the total population. Within the ST population, the *oraons* population was 3,87,940, *lohras* constituted 11 per cent and *mahlis* were less than 3 per cent.

The topography of the district is undulating and hilly, technically known as 'pats'. It falls in the altitude between 600 to 900 meters, that means at an altitude higher than that of Palamau and Ranchi. The land of the district can be divided in two categories – the *don* land and *tanr* land. *Don* land is wetland in which paddy is grown. It is usually terraced and field bunds are constructed to store rainwater for paddy. It is known as *bahal* and *kanali* in Dalbhum distirict. *Tanr* land is upland and dry land. It is known as *gora* and *bari* in the districts of Singhbhum. The surface has weathered into laterite soil. The soil texture is red loamy, red sandy and alluvial. This alluvial mixture is of recent alluvium. The entire Gumla region falls in the area of high density of cultivators say 20 per cent and above in the state. The annual rainfall is recorded at 1600 mm. Terraced fields can be found in abundance and major crops are paddy, maize, *jwar*, *bajara*, potato and vegetables in the district. The agriculture in this region seems to be introduced by

migrants. In areas with greater concentration of native population, there has been comparatively lesser development in irrigation. The tribal ecology is not prone to agriculture. Therefore, large patches of fields can be found barren, as they do not intend reclamation of land for agriculture.

Survey Findings

The survey in the state was carried out in the districts of Ranchi, Gumla and Palamau. While Palamau has a long tradition of tank irrigation, Ranchi (including Gumla) had good tank irrigation in those parts of the districts where migrants from Bihar had settled down or *oraon* tribes inhabited. During reconnaissance, a village Khukhra near Chatti, Bero block, Ranchi district was visited. Here, over 90 per cent inhabitants were migrants from Bihar who invariably worked as non-skilled labourers in a nearby factory and depended exclusively on tank irrigation. The village was 15 km from Bero block office in the same road.

In all, as is evident from annexure 2, tanks spread over 22 villages and 3 towns of 3 districts were surveyed. While 16 tanks from Ranchi and one from Gumla district were surveyed in February 2005, 16 tanks from Palamau district were surveyed during July 2005. Verma surveyed another 15 tanks in August 2006 in Gumla district to bring about even distribution of surveyed tanks in three districts and also to remove some of the inconsistencies that were found in the earlier analysis.

Based on the inclusion of the 15 new tanks surveyed in Jharkhand and from Table J-1, the overall position shows that 17 per cent of tanks, all from Ranchi, have an ancient/medieval origin This means that while none of the sampled tanks in Palamau and Gumla had an ancient origin, 50 per cent of the tanks in Ranchi have ancient origin and only 12 per cent each have come into being during the British period and post Independence period. In case of Palamau, 67 per cent of tanks are said to be from the British period, followed by one third during the post Independence period. The overall position also shows that more than half (53.2 per cent) of the tanks were constructed during the British period. The proportion of such tanks is 67 per cent in Palamau, 63 per cent in Gumla and 31 per cent in Ranchi. Similarly, while about one third of tanks in Palamau and Gumla were constructed after Independence, in Ranchi such tanks constituted about 13 per cent. Another notable finding is that only 4 per cent of the tanks were constructed after 1990, clearly indicating meager progress in recent years.

In terms of ownership, it is found (Table J-2) that an overwhelming proportion of tanks (64 per cent) are owned by government, while about 30 per cent of tanks are private and only 6 per cent are owned by panchayats. The largest proportion of private tanks (50 per cent) was found to be in Ranchi, whereas the largest proportion of panchayat tanks (13 per cent) were in Palamau. In the state as a whole, although about 30 per cent of tanks are private, in 94 per cent of the cases, tanks had open access (Table J-3). Here the trend is very much similar to what was found in Bihar.

It is pertinent to note that unlike the neighbouring states of Bihar and West Bengal, there are restricted water rights in Jharkhand. The old government tanks have been virtually under the control of the local people. In case of private tanks, the water rights

are restricted to owners only. In some cases it was found that even the owners do not use water for irrigation at the cost of pisciculture. In Tunja village of Bundu block, Gorai *talab* (tank) contains large amount of water, but has been leased out to one Ram Prashad Das by MI department of GOJ on contract of Rs. 1 lakh. He does not allow anyone to take water from the tank and sells it to nearby brick kiln owner at the rate of Rs. 5,000 per lakh of bricks. Similarly in Sonahatu village, the tank owners do not allow water to non-owners. As a result, Bundu bara *talab* (big tank) is virtually under the control of two localities of Bundu town. The fishermen of these two localities (who live close to the tank) use the tank for fishing for their sustenance. They do not even invest on *ponha* (fish seeds) as enough fish grows in the tank naturally. Similarly in Sisai also, the tank owning family does not allow water to non-family members. This means that unauthorized persons who have captured these tanks for their personal use reserve the water/fish rights to themselves even in cases of government/panchayat tanks.

In Jharkhand, ownership over the tanks has been of two kinds: (i) previously under the ownership of local kings but now turned over to the fisheries department, MI department or Revenue department of Government of Bihar/Jharkhand; and (ii) privately owned/occupied tanks. In nutshell, the water rights are reserved with tank owners in case of private tanks, and in case of government tanks, the unauthorized occupants restrict the rights to themselves.

In terms of size of tanks (Table J-4), it is found that an overwhelming proportion of the tanks are of small size in Jharkhand. In fact, about 43 per cent of tanks are of size below 2.5 acres and another 49 per cent are in the size range of 2.5 to 10 acres. This is quite understandable considering the fact that the whole state consists of a hilly terrain. On an average, the size of a tank in the state comes to 6.7 acres (Table J-5). However, there is a great deal of variation in the size across districts. While in Gumla the average size comes to 4.3 acres, it is 5.2 acres in Palamau and goes up to 10.5 acres in Ranchi. Naturally, same pattern is found in respect of per tank-irrigated area also. The average tank irrigated area is 8.8 acres in Gumla, 9.4 acre in Palamau and 12.6 acre in Ranchi. As regards irrigation done per acre of tank area, Gumla has a ratio of 2.1:1, followed by Palamau with 1.8:1 and then followed by Ranchi with a ratio of 1.2:1.

As mentioned in the preceding section, 15 new tanks in Gumla district were surveyed in August 2006. This was done mainly to make the distribution of sample tanks across districts even. Further, it appeared to us that the information in respect of Gumla collected by our research assistant during the survey February 2005 was not consistent with the data earlier collected by Pant. Over and above, only one tank was surveyed in Gumla and this was a private tank known as *Kali Babu ka talab* (tank of Kali Babu). This tank was visited by Pant during January 2005 reconnaissance and lot of information on the tanks both from the direct and indirect sources was collected.[28]

[28] The tank is very close to Sisai market and is said to be about 300 – 400 years old. According to present owners, Kalika Prashad's forefathers were the priests of Ratu Raja who gave this tank to them as a gift. The present owners are the descendents of Kalika Prashad consisting of 9 owners. Presently two brothers live close to the tank and one of them, Sushil Sharma (44 years) High School educated, is the active farmer of the land.

Looking at the area irrigated during different cropping seasons, methods of irrigation used and gross area irrigated by different methods (Table J-6 and J-7), following are the findings. The largest proportion of area is irrigated during *kharif* season (51 per cent), followed by 43 per cent during *rabi* and 6 per cent during summer. Further, while in Palamau and Ranchi, about two third of gross irrigated area consists of flow irrigation, in case of Gumla over 98 per cent of gross irrigated area is derived by energized pumps and less than 2 per cent of area is irrigated through flow method. Nevertheless, it should be clearly understood that an overwhelming proportion of flow irrigation takes place during *kharif* when tanks are full, about 86 per cent of area is irrigated by gravity method, and 14 per cent by pumps. The picture however takes a reverse turn during *rabi* when 91 per cent of area is irrigated by energized irrigation devices (pump sets), 7 per cent by flow method and 2 per cent manually. One striking feature emerging from Table J-6 is that although tanks irrigate very little area during summer, about 24 per cent is irrigated by surface flow and about 4 per cent by manual modes. This is mainly because most of the tanks surveyed are located in undulating land, which enables such irrigation modes to work. Looking at the overall picture (Table J-7) it is found that in Jharkhand the largest proportion of GIA is obtained through pumps which cover about 51 per cent of the GIA closely followed by gravity method that covers 48 per cent of GIA. Manual irrigation covers just about 1 per cent of GIA. Taking each district separately (Table J-7), it is found that in case of Palamau, gravity method is the most important mode of irrigation covering about 66 per cent of GIA followed by pumps that irrigate about 34 per cent of GIA. Almost similar pattern was seen in Ranchi, where 64 per cent of area is irrigated by gravity method, followed by 32 per cent by pumps and then about 3 per cent by manual means. As mentioned in the preceding pages, this is in sharp contrast to position in Gumla.

The average number of irrigators per tank is about 15 and the average size of the tank comes to 6.6 acre (Table J-8). Further analysis shows that on an average, there are two irrigators per acre of tank area. There are however wide variations across the three districts. The highest pressure is found in case of Palamau, where about 4 irrigators depend on an acre of tank area. This goes down to 2 irrigators per acre in Gumla and the least pressure was noticed in Ranchi where less than 2 irrigators depend on one acre of tank irrigated area.

Tables J-9a, J-9b and J-9c contain the data concerning the depth of storage of water during rainy season (*kharif*), winter season (*rabi*) and summer season (*zaid*). The data clearly shows that during rainy season, the largest proportion of tanks (47 per cent) have 7.5 to 10 feet deep water storage. During the winter season the largest proportions of tanks (40 per cent) have a storage depth of 3 to 5 feet. During summer also, the largest proportion of tank (49 per cent) have the same depth of 3 to 5 feet, but 30 per cent tanks go dry and 9 per cent record below 3 feet depth.

The sources of water (Table J-10) in the tanks in Jharkhand are predominantly rains in the catchments, which fill 66 per cent of the tanks surveyed, followed by another 17 per cent which apart from rains depend on rivulets, other tanks and floodwater. There

are another 17 per cent of tanks which depend on other sources such as springs and drainage from villages. Although rains appear to be the main source of tank inflows, in the case of Ranchi over 31 per cent of tanks are filled with artesian sources and drainage from villages.

Tables J-11 to J-13 provide data on maintenance, repairs and the agencies concerned with the same. As mentioned while dealing with Bihar data, there are some variations in the data presented in Table J-2 and J-11, although both the tables seem to deal with same type of categories. The difference lies in the fact that while Table J-2 deals with legalistic and formal kind of answers, Table J-11 provides more practical answers. The major difference between data in the two tables is that they help make the distinction between panchayat-owned and panchayats-maintained tanks. It is found that while 6 per cent of tanks are owned by panchayats in Jharkhand, only 2 per cent own responsibility of maintenance. In respect to frequency of repairs of embankment and desilting, it is found that in largest proportion of cases, neither of the things was ever done. In 62 per cent cases no repair of embankments was ever done, while in 57 per cent cases desilting was never done.

It was found that only in 26 per cent cases repair of embankments and in 23 per cent of cases desilting was done once in 2-10 years in the state as a whole. What is however intriguing is that even in case of privately-owned tanks, no attention was paid to repairs of tanks. Consequently, whatever repair is done (Table J-13) is met by fund provided by the government. The only exception in this regard is district Gumla, where the owners of tanks maintain about 13 per cent of tanks. Nonetheless, what appears obvious is that in the state as a whole, in 51 per cent of cases funds come from the government and in 4 per cent of the cases funds come from the owners of the tanks and in remaining 45 per cent cases no repair is done. As far as the maintenance and repair of tank structures is concerned, whatever repairs/desilting takes place; only the state government provides the funds. Two trends were generally found. First, the maintenance and repairs of tanks are not integrated with ongoing government irrigation schemes. Second, government money is invested without any custodian and community involvement.

Table J-14 provides results of the analysis of data on various uses of the tanks surveyed. It is found that about 83 per cent of tanks are multipurpose, 9 per cent of tanks are exclusively meant for irrigation, 6 per cent of the tanks cater to mainly domestic purpose, and only 2 per cent are exclusively for pisciculture. The picture is slightly different if we look at all the tanks of the villages where surveyed tanks were located (Table J-15). Here, greater diversity is found and a slightly lesser proportion of the tanks (77 per cent) fall under multipurpose category. As per this data, there are about 12 per cent of tanks, which are abandoned, about 5 per cent deal with only irrigation and 4 per cent each exclusively deal with fishery and domestic purposes.

Table J-16 presents data on income accrued from tanks through pisciculture. On the basis of data on 37 tanks (out of 47 surveyed) for which information is available, the

annual income was estimated to be Rs.19.14 lakhs. The average value of economic output generated from tank use for the state as whole comes to about Rs. 517.2 lakhs thousand per tank. The highest value per tank is in Ranchi which it is Rs. 689.28 lakhs followed by Rs. 54.8 lakhs in case of Palamau and Rs. 158.12 lakhs per tank in case of Gumla. Since the tank sizes vary not only across districts but also within districts, the best mechanism to measure the relative performance of the tanks would be to assess the economic value of the fish catch per acre of tank area as this provides a standard yardstick to compare the performance. Our analysis shows that tanks in Palamau have the highest economic value of Rs. 10,538 generated from fish production per acre of tank area, followed by Rs. 5,866 in case of Ranchi and Rs.2,600 in case of Gumla.

Tables J-17 and J-18 provide results of the analysis of data relating to caste-wise households and the land owned by these caste groups. The data presented in these tables are about all the beneficiary households in the villages/hamlets where the surveyed tanks are located. In terms of land ownership, our analysis shows that 5 per cent of the high castes own 17 per cent of the land. The OBCs constitute 47 per cent of the households, but own only 25 per cent of the land. SCs constitute 5 per cent of the households and own about 5 per cent of the land. Finally, about 43 per cent tribal households own about 53 per cent of the land.

Among the districts, only in Ranchi, HCs condition is somewhat adverse as 9 per cent of them own only 6 per cent of land. Compared to the SCs, OBCs land holding is less in all the three districts but is least in Ranchi where 69 per cent of the OBCs households own only 18 per cent of the land. The land ownership position of SCs in Palamau is least where they constitute 18 per cent of the households, but own only about 11 per cent of the land. As compared to SCs, STs seem to be quite better off in terms of owning land in Ranchi where they constitute 18 per cent of the households and own 60 per cent of the land. Almost similar trend emerges when we look at the average land holding of various caste groups (Table J-18).

Across the districts, HCs have the highest average landholding per household of 3.87 acres, followed by 1.33 acres for STs. The holding size of SCs (1.11 acre) is better than that of the OBCs whose average land holding per household is only 0.58 acres. In terms of relative advantage of each caste in each district, our analysis shows that in Palamau, HCs are better off as their average land holding is as large as 13.06 acre. In Ranchi district, STs have highest land holding (3.64 acres) in the district. In Gumla district, HCs are better than other castes as their land holding size averages is 6 acres.

Findings of Jharkhand Village Cases

As mentioned in Chapter II in case of Jharkhand, eight case studies were prepared from tank villages/hamlets in Gumla district, where 15 new tanks were surveyed in August 2006. In addition, one case study was done from Ranchi district. Although this village was not from the surveyed tank villages, this was included in the case studies mainly because it provided an excellent example of innovations in

collective efforts. Also, the village was part of the Bero block, where tank survey was carried out in Ranchi district. All the case studies have been attached in the book as **Annexure-5**. However, the key features emanating from the case studies have been subsumed under heads of location and topography, socio-economic structure and agriculture and irrigation.

Location and Topography

The case studies drawn from the surveyed villages were located on Ranchi–Gumla highway. While some villages viz., Sisai and, Kudhra and Pilkhi were close to the highway, some others viz., Turiamba, Gurgaon and Digdon were interior villages. In terms of villages as physical entities, while some of the villages were single villages and with one village site of dwellings, the others were scattered into 2 to 5 hamlets. Again while villages such as Turiamba, Domba and Sisai were large, Gurgaon, Chhoti Sainda, Digdon and Pilkhi were small.

The villages had hilly and undulating topography and they form part of Chhota Nagpur plateau. However in some cases such as Gurgaon, the topography of the village was relatively less undulating and the soil texture was good. On the other hand, in case of Chhoti Sainda, the entire region had a high altitude plateau. The dome shaped outcrops of rocky formations could be seen around the locality. The highly undulating land had a greater slope from east to west, in contrast to the south to north slope that was more common. In most of the cases the agricultural fields were terraced.

Socio-economic and Power Structure

Although all the studied villages in Gumla district were tribal, invariably migrants were an important ingredient of the demographic composition of these villages. The villages were inhabited by a number of tribes namely, *oraon, mahli, lohra* and *cheek baraik*. *Oraon* are placed at the top in the social hierarchy. Traditionally they were cultivators and own large holdings. As against them, the average holding of other scheduled tribes in the villages was found to be considerably less. The tribes with meager land holdings were *mahlis, lohras* and *cheek baraiks. Mahlis* are backward tribe in terms of social hierarchy and have basketry and drum beating as their traditional occupation. The drum beating was earlier used to disseminate information also. Again, *lohra* is another socially backward tribe and has blacksmith craft as traditional occupation. Similarly *cheek baraiks*, another lower tribe is traditionally from the weaver clan.

Besides tribes, there are Hindus in the villages, who had migrated from the other places and their castes are *yadava, mahatogope koiri/mahato, vaishyas* and *brahmins.* They had migrated from Bihar plains several generations back.

In the studied villages, power and influence seemed to go with *oraons, vaishyas* and *brahmins*, who held panchayati and other offices in the villages. One brahmin migrant was found to be an influential person in the village because he worked in the Jharkhand

Electricity Board as a meter reader. He was helpful to the villagers in approaching the local bureaucracy. Similarly, Late Hira Sao (*Vaishya*) was a rich man who invested money in agriculture in the village and his son Dwarika Sao developed agricultural practice in the village. The Saos were influential persons till recently, but now have left agriculture for running business in Gumla and Ranchi.

Among tribes, the institution of *pahan* was also found to be a source of power and influence. The *pahan* is a religious leader who enjoys influence over the villagers. A case in point was Fagua Oraon, who was the *pahan* of the village Gurgaon, and was treated with respect and regard. He possessed good knowledge of land and social relations in the village.

In some villages like Domba, the tribal people dominated the village in terms of population size, but migrated Hindu castes, who were also in sizeable number, dominated in village affairs. Most of them had migrated to this village four generations ago from Rohtas district of Bihar. Generally *oraons* own considerably large land holdings, but their land holding ratio in this village is much lower than that in other Oraon villages (average 0.75 acres). Here a *vaishya*, Jagdish Choudhary, ruled the roost. He commanded respect among *oraons* also. He owned 20 acres of land. His forefathers had migrated to this area from the then Shahabad district (presently Rohtas district) of Bihar, and he was in the fourth generation of the migrant family. His forefathers introduced agriculture in this area. With changes in socio-economic dynamics in the village, he expanded his activities by taking up business along with agriculture. He had been *pramukh* of Bharno block under the previous panchayati system. He prevailed upon the social-political domain through his off springs. His sons dominated the fish committees in taking fishing contract from the fisheries department.

The tribal population also dominates Sisai village in terms of their strength. The migrant *brahmin* family, which is presently divided into three families, were most powerful and had economic resources, power and influence. In Digdon village, although *oraon* and a few other tribes numerically dominated the village, the *rajput* migrants were socio-economically powerful and were the dominant group. *Rajputs* constituting merely 12 per cent of the households,owned approximately 22 per cent of the village land. The average landholding of the *rajputs* was nearly 6 acres, whereas that of *oraons* was nearly 3 acres. On the other hand in Chhoti Sainda village, all the influential persons belonged to *oraon* tribe.

Agriculture and Irrigation

The studied villages generally have the same pattern of agriculture. Paddy, maize, peas and potato were the major crops grown in the village. In some villages such as Turiumba and Sisai, cultivation of ginger and vegetables was gaining popularity. The main sources of irrigation in the villages were tanks, wells, ditches and rivulets. The agriculture mainly depended on rains. For the *rabi* crops, especially vegetables including potatoes, depended on tanks. Cultivation of wheat was very rare. In these villages, there

was no renting in or renting out of pumps, unlike in other areas. Farmers borrowed pumps free of charge in an informal manner on the principle of give and take.

A common feature of tanks was their reducing use for irrigation and increasing use for pisiculture. It was also found that most of the tanks were owned by fisheries department and such tanks were invariably not provided with any maintenance. It was also found that though fisheries produced very good dividends, the tanks were contracted on paltry sums and corruption was rampant. In the case of private tanks, owners did maintain the tanks and reaped rich dividends. In case of *Kali Babu ka tank*, the value of annual fish catch was Rs. 40,000. The three owner brothers shared the cost of fish seeds and fingerlings and they shared the income in proportion to their share of investment.

The *Darhi Doin* tank in Digdon village used for irrigation purpose is worth a mention. It is an old tank constructed during British time. It was a private tank owned by two Rajput families. The water-spread area of the tank was only 0.5 acres. Although it is a small tank, it served agricultural purposes more than its capacity. The tank had a peculiar feature and its major source of water was a spring, where in water came out from the aquifer automatically through its discharge area. Another peculiarity of this tank concerns the system of conveyance of water. The owners had constructed an underground water channel of nearly 2000 feet long along the divider (*merdha*, constructed between two fields) leading to a gallery. The water from the gallery was later lifted mechanically to the fields of upper reach. The owners were very conscious of their agriculture and the tank, whereas none of the *oraon* tribal landholders were found to have dug a tank. The small tank irrigated 10 acres during *rabi* and 4 acres of vegetables during summer.

In some of the villages like Gurugaon and Domba, the tribal people were less interested in agriculture. The people of this area were reluctant in reclamation of land for farming. They preferred to go for daily wage in the nearby town (Sisai) for their livelihood instead of developing their agriculture. As a consequence, tanks in the area were getting abandoned as nobody cared for them. They had not renovated these tanks since they were constructed. In such villages, traditional crops such as maize and millet were most prevalent. On the other hand, there were villages such as Sisai, which seemed to be agriculturally prosperous. Although the cropping pattern and agricultural practices were same as in the other villages and the major crops were paddy and potato, cultivation of wheat was practiced, which was unusual for the area.

Special Case Study

Village: Hariharpur; **Panchayat:** Jamtoli; **Block:** Bero; **District:** Ranchi

Hariharpur village was a unique example for the development of agriculture and reclamation of land powered by community efforts and use of local knowledge with quality leadership of a traditional institution of leadership named *padaha raja* (chairman of the tribal social institution). In this whole experiment a septuagenarian tribal leader took the initiative and using his native wisdom stepped up reclamation of forest land,

improved the ditches and *chanwra* (inundated land patch). Initially he is said to have invested his own money to construct *Deshbali bandh*. Later, having been impressed by his efforts, others provided funds for improvement of tanks and *bandhs* in the village. For meeting the financial needs of the community work, including agricultural development in the village and the needy, he created a *jamin* (land) bank in which certain amount of paddy was stored. There were four major water bodies in the village. Funds were obtained from the *jamin* bank and external sources such as district commissioner, soil conservation department and rural development department as well as Christian mission for the construction of water bodies. The Christian mission had provided 30 quintals of paddy for construction of channels. The tribal leader claimed that these structures and water bodies irrigated 1,000 acres of land during each *kharif* and *rabi* seasons but only 20 acres during summer season. Irrigation is done through gravity flow structures and pumps. Hiring in and hiring out of pumps is practiced in the village and the rental charge was between Rs. 100 and Rs. 150 per hour with fuel.

The villagers at some point in time do the maintenance of these structures individually and at other time in an organized and collective way. Pisciculture is also practiced in the village tanks. All those farmers, whose lands have been used for construction of these structures, get a share of the fish produce in proportion to the land they had donated. Nearly 25 to 30 acres of land is *pahan khet* (tax free land, locally called *pujar* or *girahi*). The *padaha raja* is the supreme court of tribes. The tribal leader claimed to have settled not only their social disputes but also serious cases of murder and assaults through this institution.

CHAPTER V

WEST BENGAL

The somewhat steep gradients of West Bengal offer greater scope for flow irrigation including that from small scale reservoirs/tanks. In the first half of the 20th century, in a large part of West Bengal, tanks were the primary source of irrigation. These small earthen reservoirs stored runoff from the catchments and water diverted from rivers during rainy season. The most important use of water was probably during the *aman* season (June-October) itself as insurance against monsoon failure, particularly in the critical month of September for use on secondary crops in the winter (Boyce 1987, 12-13, 165).

The tank-irrigated area in West Bengal was about 27 per cent during 1961-63. It registered a marginal decline by 1965-66 and then remained stagnant at about 20 per cent upto 1976-77 (Table 2.3). However, during the past three decades it remained stationery at around 14-15 per cent. This clearly demonstrates that while in the states like Uttar Pradesh and Bihar, tank irrigated area had diminished to a large extent, in West Bengal it still retains its primacy as it still accounts for about 14 per cent of the total irrigated area.

The three districts selected for the tank survey are Birbhum, Bankura and Purulia. All the three districts form part of the undulating uplands in western part of the state and have been historically the most important regions for tank irrigation. As shown in Table 5.1, even today the three districts have higher proportion of tanks used for irrigation as compared to the situation in West Bengal as a whole.

Table 5.1: Irrigation and Non-Irrigation Tanks

Sl. No.	Districts	No of Tanks		Total
		Irrigation purpose	Non-irrigation purpose	
1.	Bankura	14057 (39.8)	21295 (60.2)	35352 (100)
2.	Birbhum	14681 (33.8)	28812 (66.2)	43493 (100)
3.	Purulia	18426 (69.6)	8065 (30.4)	26491 (100)
4.	West Bengal overall	161757 (17.6)	756422 (82.4)	918179 (100)

Values in paranthesis are in percentage.

Source: Third Minor Irrigation Census (2000-2001) in West Bengal, Water Investigation and Development Department, GOWB, December 2003, p.172.

While in the state as a whole about 18 per cent tanks are for irrigation purpose, in the three districts selected for the survey a substantial proportion of the tanks are for irrigation purposes. Nearly 70 per cent of the tanks in Purulia are meant for irrigation. In terms of number also, Purulia has the largest number of irrigation tanks in comparison to the other two districts. Bankura follows Purulia where about 40 per cent of the tanks are used for irrigation. In case of Birbhum nearly 34 per cent of tanks are for irrigation purposes.

Purulia

Purulia district owe its name to an ordinary village which had gradually gained influence and become the headquarters of the erstwhile Manbhum district in 1838. The name was retained when Purulia was separated from Bihar and joined with West Bengal in 1956 (Sen 1985, 1). The district has numerous small storage pools called *bandhs* of considerable antiquity though some modern ones were constructed during the famine relief operations recent years. In an undulating terrain it is easy and economical to manage water conservation by building embankments across drainage lines. These *bandhs* are built at higher level than the fields to be irrigated. Their main function was to prevent the monsoon rain from draining off too quickly. The most noticeable example of such is *Sahib bandha* at Purulia. It has a water spread area of 24 ha when the reservoir is full of water and even when the water level is at its lowest, it has a water spread area of 12 to 14 ha. It was constructed in about 1848 mainly by convict labour. This tank/lake is the chief source of water for the western half of the town. The two *Rani bandha* at Pandra and Jaipur and similar large *bandhs* at Adra, Kashipur, Manbazar, Barabhum and Balrampur also supply drinking water (Sen 1985, 22).

Purulia district falls in the south western part of West Bengal and is part of Chhota Nagpur plateau. The entire district is undulating or hilly with a succession of rolling uplands with intervening hollows through which the drainage runs off to join larger streams. The arid uplands and the depression between them, like the western part of Bankura, are practically the only land on which agricultural practice was possible. Cultivation in the district was traditionally difficult due to soil erosion and limited irrigation facilities. Farmers depend mainly on rainfall, which is approximately 1276 mm annually. But the rainwater rapidly flows down to join the streams rendering the fields susceptible to soil erosion and non-conservation of sufficient moisture by soil. The amount of rainfall and the climate in the district are favourable for paddy cultivation.

The topography and land forms of the district make irrigation essential but render irrigation from river diversions, canals and wells impossible. All large rivers and streams in the district run a turbulent course, with their beds lying much below the level of crop land. The principal rivers originating in the region are Dwarkeshwar, Kangsabati and Silabati. Besides, there are a large number of rivulets in the region. The Damodar river also flows along the district's northern boundary (Sen 1985, 156). The topography of the district offers little irrigation potential, as diversion canals from the rivers are not long, due to the high cost and intensive labour required (Agarwal and Narain 1997, 181).

Besides, there is hardly any scope of deep or shallow tube well and river valley irrigation projects. Hence, *bandhs*, tanks, reservoirs and *jorbandhs* were the only dependable sources of irrigation in the district for centuries. The topography and agricultural conditions render the conservation of rainwater using embankments, built across the drainage lines or streams at elevations higher than the fields to be irrigated, with a purpose to prevent the monsoon rain draining away rapidly and to supply water to the crops in the land below by slow percolation (Sen, 1985).

The historical accounts show that the embankments, tanks and reservoirs were constructed both by the rulers and local *zamindars*. Almost every cultivated village in the district has *bandhs*. In some cases, these embankments were constructed high across deep valleys but usually raising low *bandhs* on one or more sides embanked any existing natural depression; these *bandhs* were constructed wherever it was possible to catch a certain amount of surface drainage and at the same time to terrace a few rice fields below them. The early gazetteers noted that the local villagers regularly multiplied the number of embankments (bunds) and enlarged and deepened the existing ones. However, financial constraints marginalized the irrigable command area. In a few cases, as much as 100 acres of land had been possibly irrigated from such a *bandh* (Sen 1985, 158).

A large number of tanks in the district were constructed during medieval and British periods. These tanks were in the form of reservoirs to provide irrigational facilities to the largest area of cultivable lands. Prior to the establishment of the TID in December 1960, a large number of tanks in Purulia district were rendered derelict for want of timely repairs or through neglect of their owners over long years (Sen 1985, 159). There can be four reasons behind this neglect: (i) increase in number of owners owing to family divisions, (ii) change in agricultural practices like use of the improved implements besides seeds, fertilizers and energized irrigation devices that require dependable supply of water, (iii) growing disinterest of the owners in cultivation and (iv) the tenants had no sense of responsibility over the husbandry of the land. Traditionally *zamindars*, rajas and high caste landlords owned the tanks and *bandhs*. But with the passage of time they lost control over them or lost their ownership gradually, first due to abolition of *zamindari* and later on due to land reforms in West Bengal. The multiplicity of ownership due to division in families has also adversely affected the tank irrigation in the districts. The sharp decline in tank irrigation is owing to various reasons such as, disappearance of the labour intensive traditional modes of fetching water from the tank, growing disinterest of traditional tank owners in agriculture owing to land reforms, increasing control of the tanks by non-owners, new power relations in society and increasing use of tanks for pisciculture at the cost of irrigation.

Spread over an area of 6259 sq. kms with a population of 25.35 lakh persons (Census 2001), Purulia district is at a low in almost all parameters of development in West Bengal. One third of its population belongs to SC/ST category. The main source of sustenance of people of Purulia is agriculture that faces all topographical odds adding to poor level of assured irrigation. On top of this, the average operational holding is very

low. As per the agricultural Census of 1995-96, the district's average land holding is merely 0.85 acres and nearly 92 per cent of land holdings are either small or marginal, covering 72.67 per cent of the area. The medium and large holdings are negligible in number (GOWB 2002, 94-95). A number of rivers and rivulets in the district have been ill-fed by streams and naturally they remain dry through a greater part of the year. As such for improvement in irrigation facilities, reservoir and *jorebund* schemes were found suitable for the district during post Independence era because of its topography.

Rice is the principal crop of the district and three varieties *aman*, *aus* and *boro*[29] are grown. Other cereals include wheat and maize. *Rabi* and *kharif* pulses are grown in a limited area. Nearly 93 per cent of total agricultural area was covered by paddy cultivation (91 per cent *aman*, 2.29 per cent *aus* and 0.08 per cent *boro*) in the district in 1968-69 (Sen 1985) and the recent data also shows that paddy was the only cereal cultivated in the district during 1997-98 and 2001-02 (GOWB 2002, 960). The cultivation of paddy depends on adequate water availability and conducive climatic conditions. The temperature of Purulia district (46ºC) is suitable for the paddy cultivation but due to undulating terrain, rain water runs off the fields very fast leaving them eroded and dry. Besides, shallow and deep tubewell irrigation is not feasible in the district due to non-availability of adequate groundwater resources. The other minor irrigation projects are also not feasible as the rivers and rivulets remain dry for most parts of the year. Thus the embankments are the most suitable devices to contain water for irrigation during erratic rains.

Declining Trend in Tank Irrigation

Tanks have been most crucial for irrigation in Purulia as compared to other districts of West Bengal. The data reveals that tanks and *bandhs* account for majority of the irrigation in the district. Such *bandhs* are constructed practically in whichever place possible to capture surface drainage and at the same time to terrace a few rice fields below them. The irrigation is normally affected by percolation. Only in exceptional cases, a cut is made in the *bandh* or the water drawn off by a pipe or through some outlets as is done when it is required to protect the seedlings or water paddy towards the end of the season. When land is first brought under cultivation, the cultivator naturally tackles first the land in lowest part of a slope. The *bandh* constructed is usually somewhere down the slope and consequently gets a large amount of surface runoff.

As cultivation extends, the lower *bandhs* are themselves converted into rice fields, except where they have been excavated deep, and the new *bandhs* constructed upstream get proportionally less water and at the same time have to serve a large area. In the years of scanty rainfall or when the storage is poor in the tank, *debuka* or *deuka* is used to lift the water for irrigation. Even the *debuka* is used to lift water to the surface structure and

[29] In West Bengal, the three cropping seasons approximately coincide with the three meteorological seasons. The cropping seasons are *kharif* 1 (pre-monsoon), *kharif* II (monsoon) and *rabi* (dry and winter). Three rice varieties are grown in these different seasons—*aus*, *aman*, and *boro* respectively. *Aman* is the leading rice crop, accounting for > 50% of the cropped area, followed by *boro* (25%) and *aus* (15%).

not to the field directly as in case of Bihar. However, the pump sets are used for lifting water directly to the field and in case of surface flow structures, a swing basket like device is used. This involves the labour of two persons for the whole day to irrigate one *bigha* i.e., one-third of an acre of land.

The historical account suggests that the district has been mainly under tank irrigation, as this was the only possible source. It is estimated that earlier merely 13 per cent agricultural land was under assured irrigation, tanks and *bandhs* being the only source. In the later part of 1960s, the area covered under tank irrigation constituted 96.3 per cent of the total area irrigated compared to merely 2.56 per cent under canal irrigation. This clearly shows that tanks and *bandhs* were the major sources of irrigation in the district. But the percentage area under tank irrigation has been declining consistently, i.e., 96.26 per cent in 1965-66 to 95.49 per cent in 1967-68 and 91.8 per cent in 1970-71 and 38.6 per cent (compared to 40.8 per cent by canal) in the year 2001-2002 (Table 5.2). What is more important is that there has been sharp decline in tank irrigation in terms of actually area irrigated as well (Table 5.2). However, when the TID of the GOWB initiated rejuvenation of tanks as a part of utilization of PL- 480 funds in the district in 1961, there was a rise in area irrigated by tanks by nearly 8000 acres. However, this cannot be called a substantial improvement, when we consider the fact that from 1970-71 to 1973-74 a total of 699 tanks were taken up for rejuvenation under the scheme that benefited a total of 15,754 acres.

The data in Table 5.2 shows the extent of decline in percentage and actual area under tank irrigation over the decades.

Table 5.2: Extent of Tank Irrigation in Purulia

Year/Period	Average area under tank irrigation (acres)		Average of total area irrigated (acres)
	Magnitude	Percentage	
1965-68*	1,70,833.33	95.9	1,78,066.6
1971-72*	1,78,341.18	90.7	1,96,719.1
1997-2000	70,258.33	36.62	1,91,825.0
2000-2002	62,812.50	39.12	1,60,562.5

Source: Calculated on the basis of District statistical hand Book 2002 and * marked calculation is based on the figures mentioned in District Gazetteer, 1985

Bankura

Since the beginning, the district has had a purely agrarian economy. This is evident from the fact that over 81 per cent of its total population depended on agriculture in the last quarter of 19th century (Hunter 1877). Bankura like Purulia is one district of West Bengal that has unfavourable conditions for agriculture due to its undulating topography, which was hitherto inaccessible to irrigation based on canals and wells. However, eastern and north eastern parts of the district are an extension of the extensive alluvial flats of Burdawan and Hoogly districts. The rest of the district is composed of undulating and

hilly terrain through which several natural streams originate and carry the drainage to larger streams. Arid uplands and the depression between them were the only lands on which wet rice crop could be grown, if sufficient rains are available. The distribution of rainfall in the district is favourable for agriculture when pre monsoon showers occur in May or early June and heavy monsoon showers in June–July and again in September – October. If the rain failed in any of the above periods, people's lives would be adversely hit. The region had witnessed great famines as a fall-out of monsoon failure. O' Malley (1908, 107) writes, "The district is liable to famine owing to… absence of complete irrigation works to counteract the effect of a failure of rains". The most terrible famine occurred in 1866 followed by that of 1874, 1885 and 1897, all due to failure of rains in respective years in the district. Actually what compounded the problem in those times was absence of mechanisms for large-scale transport of food grains.

Western and southern parts of the district suffered severely from monsoon failure, whereas, the extent to which its effects were felt in its north eastern portion was not serious (O'Malley 1908). The severity of the famines is reflected in following lines. "Thirty five poor wretches were dying daily of hunger and multitudes of deserted orphans were roaming the streets and subsisting on worms and snails" (Ibid :). The tracts most liable to suffer from the famines were the western and north western parts (Gangajalighati, Sonamukhi, Chhatna, Raipur, Simalpal thanas and outpost) in the district.

It can be infered from the above illustration that the preservation of rainwater for agricultural use had been very crucial for survival of the people of Bankura for ages. Thus Bankura required irrigation everywhere except the east. On the other hand, Bankura's natural configuration of undulating surface intersected by numerous rivers and streams, makes holding of water easy enough by simply constructing embankment across the drainage lines or across small *nallas*. These embankments were made at levels higher than the fields to be irrigated and their main use was to prevent the monsoon rain draining away rapidly and to supply water to the crops in the land below by slow percolation. Digging tanks was regarded as sacred work for the kings (Hunter 1877, 236) and canals were unknown to this part (O'Malley 1908).

So far as *bandhs* or tanks or any such structures for building reservoirs are concerned, it has been stated that no village could be found without tanks in the district. It was common practice in Bankura to build embankments at suitable places to confine the surface runoff and impound it in reservoirs known as *bandhs*. The then rulers (17th to 19th century) resorted to excavation and renovation of tanks and khals for irrigation and domestic uses in almost all parts of the district, even in eastern part 'O' Malley describes "Bishnupur raj (comprising of present Bankura district) made a simple but effective system of irrigation channels called *shubhankari daura* or *khal*, in the northern portion of Sonamukhi thana to counteract the vulnerability of that area to drought…. In the famine of 1897 the daura was partially re-excavated.… several important tanks and bandhs were also constructed in Gangajalighati thana…the Kusthal bandh, Charuri tank and Vaishnava bandh were excavated at Saltora and much was done to improve the

sacred Shiva Ganga Tank at the foot of Biharinath hill, and also the Krishnapur and Udhampur bandhs. Other minor sources of irrigation are the Jamuna and Krishna bandhs, two artificial lakes of Bishnupur, which supply water to a fairly large area in the vicinity of the town" (O'Malley 1908, 98). The present condition of these *bandhs* will be discussed in latter section of the chapter. Bishnupur has an interesting history of Malla rajas. The founder of the dynasty rose from orphanage to the crown and took care of agriculture and defense of the kingdom by constructing big tanks (Mallik 1921, 3).

The district is endowed with three major rivers, namely, Damodar, Kangsabati and Dwarkeshwar. These rivers discharge ample amount of water. It was estimated that Damodar river discharged over 25 thousand cusecs in 1930s and 40s whereas Dwarkeshwar discharged over 2 lakh acre-feet (Banerjee 1968, 32). These rivers carry greater quantum of water during monsoon period than during the non-monsoon period. There are no natural lakes in the district. However, a few natural pools (*asura panj*- depression made by feet of demon) provide scope for irrigation. The district has a history of *bandhs*/tanks of two kinds- embankments thrown across undulating valley from two side bunds (excavation not required); and tanks and *bandhs* with excavation and embankments on all four sides, for multipurpose use including irrigation. The later category of *bandh* is of 'considerable antiquity'.

By the end of 19th century, the British administration paid attention to re-excavation, erection and repair of *khals* and *bandhs.* British undertook construction of several tanks like the Mathgoda *bandh* and Shyamsundarpur bandh, and erected a dam across Harinmari *khal* in Bishnupur sub-division for improvement of irrigation. It is important to note that the administration preferred to encourage investment by cultivators and *zamindars* for repair and improvement of irrigation. This is evident from two following quotes. "On the present information it would appear that a channel made by the land owners themselves that are similar to *pains*, which existed in very large numbers in Gaya district, would be more suitable than a Government Canal'' (reply of a question in Bengal Legislative Council in March 1908 as quoted by 'O'Malley 1908). *Mukhiya* or *mandal* in Bankura villages were supposed to be authoritative informer about people, cattle and crops; and he was not an employee of the *zamindars*. Fast silting of tanks required desilting and repair. The complete accounts of the exact area irrigated by the tanks are not available for the periods of last two centuries. However, O' Malley makes a mention of 'a considerable area' under tank irrigation. It has been mentioned that almost all parts of the districts had tanks of one kind or other and were utilized for irrigation purposes. In the early part of 20th century the Tank Improvement Act 1931 was passed in West Bengal. Thus it is logical to infer that large areas fell under tank irrigation.

The British administration established a TID in 1940 for the purpose of desilting the old tanks (also *bandhs*) with a view to improve their irrigation potential. Between 1940 and 1952 as many as 1,354 tanks were taken up for the purpose. In such projects, the cost of re-excavation was met partly by the beneficiaries and partly by the government.

The government decided to bear 50 per cent of the cost and remaining 50 per cent was to be realized through water tax from the landowners for the lands benefited by irrigation, and also from the charges collected from leasing of the tank for pisciculture. Benefits were envisioned in: (i) increase in paddy production (ii) reclamation of wasteland (iii) increase in yield of winter crop (iv) pisciculture and (v) production of vegetables. According to the officials, the TID, though exists now, has not taken up any new tasks during the past fifteen years. However, GOWB resorted to various minor and major irrigation schemes in the district. It is interesting to note that the area under tank irrigation was 67.6 per cent of total irrigated area in 1958-59 that reduced to 59.44 per cent in 1962-63. Not only in percentage terms but also the aggregate area under tank irrigation also went down from 2 lac acres in 1956-59 to 1.79 lakh acres in 1962-63. The area under canal irrigation however increased from 28.7 per cent in 1958-59 to 37 per cent during 1961-63 (Banerjee, 1968, 241). Things have changed considerably since then as in 2001-2002 tank irrigated area in the district was 10.3 per cent, compared to 52.2 per cen area irrigated by canal and 24.9 per cent area irrigated by STWs (GOWB 2002).

The rights to access water from the tanks were open to all for all purposes. However, *ghatwali* tenures (O'Malley 1908, 115-16) were granted along the banks of these tanks (Bishnupur tanks) to the resident cultivators with martial traditions. These 'reservoirs' supplied water for irrigation and were also used for drinking and fishing (until 1806 when the properties were sold to Burdman king). The Malla raja had permitted the people of Bishnupur to enjoy unfettered rights of catching fish from these tanks on occasions like marriages etc. According to settlement records, the Bishnupur *bandhs* were allowed to be freely used by the public for fetching drinking water, bathing and for other domestic purpose. No evidence is found to the effect that cultivators were charged for using water from the tank for irrigation. The whole district was originally the territory of Bishnupur raja till 1806 (when the kingdom was sold to Burdwan raj) who allotted portions to subordinate chiefs for the protection. These chiefs held the aboriginal tribes under their control. These tenants locally knew their descendents as rajas. It is notable that the price rise of grains facilitated the use of surplus grains as payment in kind for works of public utility and a large village would have good tanks and bathing *ghats*. The agricultural classes who cultivated land with tank water were benefited by the high prices of food grains (O' Malley 1908). Hence, tank maintenance became the responsibility of tenants and cultivators.

Spread over an area of 16.94 lakh acres with a population of 31,92, 695 (Census 2001), Bankura district has nearly 93 per cent of rural population, for whom agriculture is the main source of livelihood. Like adjoining districts of Purulia and Birbhum, agriculture in Bankura has faced hazards due to its unique unfavourable topography. The eastern and north eastern parts of the district resemble the hilly terrains of Purulia district. The major sources of irrigation in the district are canals and tanks. Usually the district is comprised mostly of marginal and small holdings. Around 66 per cent of total operational holdings and 34.8 per cent of the total land holding belong to marginal farmers. At the same time, 21.9 per cent of the operational holdings and 32.5 per cent of

the land belong to small holders. The average land holding as per 1995-96 agricultural Census comes to 1.2 acres in the district.

Paddy is the principal crop of the district; 92.65 per cent area was under paddy cultivation in 1962-63. This has come down to 87.18 per cent in 1997-98 and 87.79 per cent in 2001-2002 (GOWB 2001, 97-98). Other cereals include wheat, barley, maize, pulses etc. Besides grains, oilseeds, fibre (jute, *mesta*) and miscellaneous crops like potato, chilly, spices, sugarcane are also grown in the district. The temperature and rainfall in the district is conducive for paddy cultivation. The normal rainfall in a year is 1404 millimeters and has highest temperature of 39ºC and minimum of 11ºC. Besides all these conducive rainfall and temperature conditions, the entire district except north eastern part has undulating terrain which results in extensive run off causing top soil erosion and moisture loss in the fields. No doubt the irrigation schemes including STWs in the district have been considerably improved, but their capacity does not match with the requirement, rendering tank irrigation significant.

Declining Trend in Tank Irrigation

A recent survey data reveals that at present the total number of tanks in the district is 35352, about 40 per cent of which are under irrigation use (GOWB 2001). However, area under tank irrigation has been decreasing over the years as is evident from Table 5.3.

Table 5.3: Extent of Tank Irrigation in Bankura

Year	Area under tank irrigation (acres)		Net area irrigated (acres)
1958-59*	2,00,000	(67.6)	2,98,200
1960-61*	1,86,000	(63.7)	2,91,800
1961-62*	1,82,500	(59.0)	3,09,300
1962-63*	1,78,800	(59.44)	3,00,800
1997-98	53,000	(14.9)	3,56,400
1998-99	44,700	(12.1)	3,69,600
1999-2000	44,600	(11.3)	3,92,000
2000-2001	39,500	(11.9)	3,32,700
2001-2002	36,200	(10.3)	3,52,000

Values in paranthesis are in percentage.

Source: * West Bengal District Gazetteer, 1968

District Statistical Handbook 2002.

The data in Table 5.3 shows that tank irrigation in the district has gradually reduced to marginal level. In the decades of fifties and sixties, tanks had been irrigating a major

part of the agricultural land. Whereas in the 1990s, the percentage area under tank irrigation varied between 14.9 and 10.3. Not only in percentage term but also in aggregate terms, tank irrigation has declined. It came down from 53,000 acres in 1997-98 to 36, 200 acres in 2001-02. The decline in the tank irrigation has been a recurring feature despite a fairly large number of tanks desilted by the TID. The number of tanks improved under the provisions of Bengal Tank Improvement Act during 1956- 59 was 67 and the area benefited was 2,896 acres. In the 1960s, a number of such schemes were taken up jointly by the TID and the department of fisheries. Tanks were departmentally selected and their owners were given loan under certain conditions. The decline has been due to reasons such as, the neglect of tanks both by users and the government bodies and farmers' shifting interest towards tubewells of different types and densities. The STW has already been covering a considerable area, and the irrigation under STW has been rising year after year, from 43704 acres in 1997 to 87690 acres in 2001-2002. Besides, the expansion of Kangsabati canal irrigation project in the district has been another reason of decline of tank irrigation.

The most important reason for neglect of private tanks by owners is the multiplicity of ownership. Private tanks have large number of owners, ranging from 15 to 70, even making just one *ansha* (share) of a paisa (64 paisas = one rupee = 100%). In such situations, the owners find it unattractive to invest in system improvement (*samskar*) measures. However in the case of fishery tanks, the owners still have interest in collecting their share of income, however paltry, and invest in protection of fish.

In case of tanks owned by panchayats, there are tank committees in the villages. Two office bearers of the committee maintain the accounts concerning the tanks. These committees handle mainly the pisciculture in the tank, and income generated from it is spent on community activities such as prayer, *kirtan* in temple or other such cultural activities. The repair of the tank is done to the extent it is necessary for protection of fish. Irrigation gets least priority; this is also a reason of decline of tank irrigation.

Birbhum

Birbhum extends over 4538 sq. kilometrs. The importance of the district is justified by three theories postulated about the origin of its name. It has three literary meanings, i.e., the land of braves (*bir+bhum)*), the land of jungles (as *vir* means jungle in *Santal*i) and the land of *Virmati* (vigorous soil). The topography of the district is heterogeneous. The apex is situated at its northern extremity not far from south of the point where river Ganga and hill of *Santhal Pargana* begins to diverge. Almost in the entire district, the terrain is intercepted by a succession of undulations, the general trend of which is from north west to south west. To the south east upland ridges are less pronounced. Due to this, the valleys become narrower and gradually merge into the broad alluvial plains of Gangetic delta. The larger ridges are covered with thick but stunted *sal* (teak) forest and only the bottom of the valley is being cultivated.

As the lands become less steep, paddy is grown in terraces up the sides and only the board flat and usually dry summits are left untilled, forming the rain scantly pasture

grounds. As a whole, the rapidity with which hills changes to ridges, ridges to undulations and undulations to plains varies considerably. The western portions of the Mayureswar and Suri *thanas* are covered with high ridges extending to the southeast. The hollows between the ridges form natural drainage channels, which in wider valleys are streams of considerable size and in a few cases expand into wide rivers. Since the medieval times (13th century), the district was ruled by Mohaummadans, which in the 16th century was brought under Mughal rule. After Maratha invasion, the district came under *zamindari* of Asad-ulla-khan in 18th century. After the famines of 18th century, the British administration took over the rule. The important tribes and castes of the district are *bagdi, muchis, doms, bauris, tari, mals* (all SCs), *sadgops* (OBCs), *brahmins* (HCs), and *bantals* (ST). *Brahmins* were the *zamindar*, tenure holders, occupancy *ryots*, pleaders, muharirs, money lenders and government servants. Besides, *brahmins* and *sadgops* were also good cultivators, owned landed property and some had government service, commonly titled as *mandal*. Landlords' servants were *gumashtas* who looked after the accounts and management of the land and were supervised by a *naib* (O'Malley 1910a).

As in the case of other parts of southwest Bengal, Birbhum district for most part, has porous soil and rapid drainage. This makes irrigation a necessity in years of scanty rainfall, particularly for paddy and cultivation in terraced slopes. The cultivators divide their field into numerous little plots and enclose each one by a bund, which retains the water. Each plot thus becomes a reservoir and lower fields can be irrigated by letting the water into them from a higher level during sufficient rains.

Tanks have been the most useful source from which the fields have been irrigated for centuries. Several of these tanks are old and large in size. Besides, smaller tanks are numerous in the district. It was estimated that each village had at least five tanks on an average. O' Malley (1910a, 60) writes, "In the village of Sankarpur, for instance, there are 111 tanks occupying 167 acres and 46 are too close to each other that only footpaths on the top of the banks separate one from another. Owing, however, to the neglect of *Zamindar* (many of them absentees) and the capacity….of the population at large, many of the irrigation tanks have silted up and become useless, some of them have become so dry that they are let out for cultivation".

When the tanks are full, water is let into the fields through a cut in their banks; when the water level is low, cultivators have to lift water by several means. Earlier, the cultivators used traditional devices such as *cheni* or swing basket or an instrument called *dhuni*. Irrigation by *teura*, a kind of Grecian lever, was also common. The '*do'* fields (a category of land) were largely irrigated by *teura*. The crops which were irrigated by *teura* are sugarcane, oil seeds, flax and vegetables.

Survey Findings

Looking at the age of tanks (Table W-1), based on data from the surveyed tanks, it is found that more than 77 per cent tanks are either ancient/medieval or from the British times, while about 23 per cent of them have come into existence during the post

Independence period. Further, about 10 per cent of them were laid after the 1990s. However, one major difference amongst districts is that while about 20 per cent of tanks in Bankura are of ancient origin, in the other two districts none of the tanks are ancient. The main reason why Bankura contains such tanks as seen in Bishampur, Taldangra, Jaypur and Indpur is that the tradition of irrigation is very ancient here. Contrary to this, in Purulia, about 74 per cent of the tanks belonged to the British period. Another 26 per cent tanks were constructed after Independence, which included about 16 per cent, that were constructed after 1990. The main reason of a spurt in interest in tanks is the district's peculiar geo-hydrology, which makes well irrigation infeasible. Another limitation in Purulia is the absence of any major canal-based irrigation system. The situation is not much different in case of Birbhum and 100 per cent of the tanks surveyed in the district belonged to British period.

As regard the ownership of the surveyed tanks in three districts (Table W-2), it is found that about 65 per cent of the tanks are private, 29 per cent panchayat and 6 per cent government. Among the private tanks, about 42 per cent are with limited ownership while 23 per cent are of multiple ownership[30]. Among the panchayat tanks, it is found that such tanks in all the three districts were earlier under private ownership, including that of *zamindars*, but now belong to government.

Fisheries or minor irrigation departments own government tanks. The nature of ownership over the private tanks in the district is multifaceted such as; (i) private tanks under TID working under District Magistrate; (ii) private tank with induced share of whole of panchayats; (iii) tanks currently under panchayat ownership; (iv) private tanks with multiple ownership. Most of the tanks are still privately owned and some old *zamindari* tanks are now under the control of the panchayat. It is also interesting to note that certain private tanks are virtually controlled by members of the lower castes (SC-*bauri*). The reason behind such a situation is the land reform measures and power transfer from landed upper castes to the middle castes or landless lower castes. A majority of tanks fall in the category of tanks previously owned by *zamindars* and now with the panchayats. Further, over 50 per cent private tanks were found to be having multiple ownership viz., 15 to 30 families owning one tank, each possessing smaller '*anshas*'. These *anshas* (shares) have been tradable, resulting in a rise in the number of shareholders. There is no evidence of exclusive rights over the tank water by anyone. However, the owners engaged in pisciculture or the fish contractors restrict use of tank water in order to protect the fish population.

The irrigation rights over the ponds were different from tank ownership rights. The land-revenue department and the panchayat held what is called *sech* (irrigation) records. These records, reportedly in existence from the British period, record the plot numbers on the cadastral map of land that can legally receive irrigation from a pond. The irrigation rights had been assigned only for those ponds that were found to have

[30] Any tank with 7 or less owners has been treated as private tank with limited ownership, while tanks with more than 7 owners have been treated as private tanks with multiple ownership.

sufficient water for irrigation. The plots mentioned in the irrigation records, irrespective of whether the owners of these plots owned a share in the pond or not, had a legal right to irrigation water from these ponds. However, this delineation of irrigation rights from tank ownership rights was only partial. The *sech* records refer to only the *kharif* and *rabi* crops. As *boro* cultivation was not prevalent at the time when the irrigation potential of the ponds was assessed and because very little water remained even in relatively big ponds by the summer, the *sech* records mentioned provision of irrigation only for the *kharif* and *rabi* crops and not for *boro* cultivation (Rawal 1999, 134)

As regards access to water (Table W-3), about 77 per cent of tanks are accessible to all, and in the remaining 23 per cent tanks, access is confined to owners. The second category of tanks is same as those in which ownership is confined to limited number of families. The district wise pattern shows that in Bankura, access is open to all in all the tanks. In Purulia, 68 per cent tanks are open to all, while 32 per cent are accessible to the owners only. In Birbhum, 50 per cent tanks are open to all while in rest 50 per cent are open to owners only.

Rawal (1999, 133) reports that ponds were used for many purposes: irrigation, cultivation of fish, bathing, washing and cleaning. Access to ponds for irrigation was governed by sets of rules. Ponds were owned both individually and collectively. There were well-established norms for holding of shares (*anshas*) in a pond. Shares of ponds could be traded, and the price was determined primarily by the area equivalent of the share. As ponds were of different sizes, the worth of a share in different ponds (say one hundredth of a pond) was different.

Looking at the size of tanks (Table W-4) in three districts together, it can be seen that nearly half of the tanks (48.5 per cent) have size below 2.5 acres. This very clearly shows that majority of the tanks are of very small size. Tanks with size ranging from 2.5 acres to 10 acres constitute 29 per cent. About 13 per cent of the tanks are in the size range of 21-50 acres. However, there is a lot of variation in the average size of tanks in different districts. In Bankura, it is 27.4 acres, followed by 19.4 acres in Birbhum and then 3.9 acres in Purulia.

Among the districts, the average area irrigated per tank is same in Birbhum (55 acres) (Table W-5), and Bankura, (54 acres). In case of Purulia, a tank irrigates only about 5 acres, which is mainly because nearly 90 per cent of the tanks here are very small. Comparing the ratio of irrigated area per acre of tank area, it is found that it is highest in Bankura where one acre of tank area irrigated 3.6 acres, followed by Birbhum where this ratio is 2.8 acre. The ratio is lowest in case of Purulia where it is 1.2 acre.

In Tables W-6 and W-7 modes of irrigation in relation to three cropping seasons are examined. It is found that maximum area is irrigated during *kharif* (56.2 per cent), followed by *rabi* (40.1 per cent) and minimum in summer (3.7 per cent). It is also found that during *kharif*, gravity irrigation constitutes 85.4 per cent of the irrigated area, followed by pumps, which irrigates 13.2 per cent area. Only 1.4 per cent of the area is irrigated by manual means during *kharif*. During *rabi*, on the other hand, about 53 per cent of the

irrigated area is covered by pumps, about 44 per cent of the area by gravity flow and about 3 per cent by manual means. During summer, very little area is irrigated and pumps do all of it. The pre-eminence of flow irrigation is again discernable when we look at the gross irrigated area (Table W-7). It is found that about 67 per cent of the GIA comes from gravity irrigation, 31 per cent from pump irrigation and 2 per cent from manual irrigation. By and large this broad pattern is applicable to all the three districts. Bankura depends on manul irrigation the most, with 35 per cent of GIA covered by it. Purulia follows it with 21 per cent and Birbhum with 15 per cent.

Area irrigated by tanks varies from one mode to another, one season to another and one type of topography to another. In earlier days, water was taken out of the tank through surface flow modes. However, when the water of tank is either low or tank is situated on a low land, the water was taken out with the help of manually operated mechanisms or energized pump sets. Sometimes, it happens that the bund is extremely high and in such cases water is taken out with the help of siphon pipe to the surface flow structures. After proliferation of diesel engines, most of the farmers resort to lifting water from the tank with these pumps. In some cases, the electric pumps are also hired-in.

The water market in the tank-irrigated area is of three kinds:

1. Hiring in of diesel pumps or electric pumps on the basis of hours or area irrigated. The rate is almost similar throughout the districts i.e., Rs 50-60 per hour or per *bigha* that amounts to Rs. 120 per acre. The rates vary in accordance with the capacity of the machines as well as availability and price of diesel during the peak period. In case the user supplies fuel of the pump, the rental rate for the machine is Rs. 20/- per hour.
2. In tanks having higher embankment than the water level and agricultural field, siphon pipes are used to take water out from tank to distribution system. Not every farmer owns a siphone pipe. Hence, theses siphon pipes are hired-in at the rate Rs.6/- per *bigha*.
3. The other option is to hire-in the panchayat pumps by bearing the cost of fuel which amounts to Rs. 30 for a *bigha*, or Rs. 90 per acre. Such pumpsets in the district are very few in number. Since they have to serve a large number of farmers, the farmers have to resort to renting in pumps from private parties.

Manual irrigation is still practiced in the district. In the very big tanks near Bishnupur town (Bankura district), it is found that these tanks are now mainly in domestic use and whatever irrigation takes place, it is done with canals or manual means. *Dungi* (*karing* type of mode being used in Bihar) is the most common traditional irrigation device. In the winter season, the *dungi* is used to fetch water from the tanks and into field channels. A hole fitted with hume pipe in the bunds makes the outlet. Using the *dungi*, an adult can irrigate nearly one-sixth of an acre in a day.

Irrigation from ponds is by means of gravity when the water level in the pond is higher than the field level and by means of water lifting when it is the other way round. *Simli* is the simplest lifting device and is relatively inexpensive. It is a triangular metal tray tied with ropes on both the sides. The ropes are held by two persons, one on either side and pulled and released successively to throw water. The most commonly used lifting device, however, is a *dungi*, which is a longitudinal vessel about 10-15 feet long, mounted on a pivot with a counterweight. A person who stands on any one side (either in the pond or outside) operates it manually and pushes it up and down to lift water. Though on the whole *simli* is more labour intensive (relative to the amount of irrigation it provides), it requires less force in each cycle to lift water. Women and children often operate them. A *dungi*, on the other hand, is heavy and lifts large amounts of water in each cycle and is usually operated by a man. In 1995, the price of a *dungi* was between Rs. 600 and Rs. 1000, depending on the size (Rawal 1999, 134-135).

The *bandhs* that are built along the downside of a slope easily supply water to the fields through the surface flow structures but only when the sufficient water is available in the tank. In case of shortage of water, the water has to be lifted to the level of surface flow structures to irrigate the fields through manual device or energized water lifting devices.

In Baghudih of Purulia block and Nawagarh and Barua Kocha of Jhalda block, there were very few pumping sets and no water markets of any significance were found. Two pumping sets were found in Baghudih whereas no pump was found in hamlets of Jhalda I blocks. However, the rates of pumping sets were same as that found elsewhere in the state; varying from Rs. 120 to 180 /hour/acre for diesel operated pumps. There was no renting of *debuka* and the needy farmers themselves made them.

It was noticed that a large area in the reservoir of Jamuna *bandh* (Bishnupore) was encroached upon by farmers for vegetable cultivation as the *bandh* got silted up. About 30 acres of land was cultivated in *rabi* and summer seasons. Jamuna *bandh* had three outlets serving the fields of Gopalpur and Tejpal villages. One outlet with a hume pipe of 6'' diameter towards east of the tank was constructed by farmers of Tejpal village in the year 2000 irrigate about 4 acres of land owned by nearly 25 farmers. Lal *bandh*, another big tank in Bishnupur irrigated the area falling in two sides of the tank. Nearly 6-7 acres of land in western embankment falling in Tilbari village, coming mostly under urban settlement, was irrigated by the tank water. The water for irrigation from the tank was taken out through *dungi* and passed through a hume pipe outlet fitted across the *bandh*. All the land belonged to a *brahmin* landlord of Bishnupore, but five scheduled caste farmers were found to be doing sharecropping in this land.

If pressure on tank water for irrigation is examined (Table W-8) a great deal of variations can be seen across districts. Although the average for three districts comes to about 6 irrigators per acre of tank area, in Bankura, the pressure is maximum as about 12 irrigators depend on one acre of tank area. On the other extreme is Birbhum where about 2 acres of tank area is available to each irrigator. In between comes Purulia where the dependence on tank irrigation is 3 irrigators per acre of tank area.

In Table W-9 a, b and c, the depth of storage of water in the tank during rainy season, winter season and summer season are shown. As is expected, in all the districts the depth of water storage level in the tank goes on reducing from rainy season through the winter, till the end of summer. It goes down to such an extent that about 20 per cent of the tanks get dried up during winter season and about 55 per cent get dried up during summer. The main reason for such a high proportion of tanks getting dried up or water level coming down below 3 feet is that an overwhelming proportion of tanks (77 per cent) in the three districts depend exclusively on rains and another 13 per cent depend on rains and canal water (Table W-10). Among the districts, 95 per cent of Purulia tanks depend on rainwater. The high dependence of Purulia tanks on rains is reflected by the fact that 63 per cent of the surveyed tanks in the district dries up during summer, which is the highest figure among the three districts.

Tables W-11, W-12 and W-13 provide data on repair and maintenance of tanks. In Table W-11, the category "Others" refer to maintenance by occupants, fish contractors etc. Owners seem to be responsible for maintaining 58 per cent of the tanks in West Bengal and the proportion goes up to 84 per cent in Purulia district. The second most important category of tanks are those in which the responsibility for maintenance lies with panchayat/community and this accounts for 29 per cent of the tanks. Lastly, there are about 6 per cent of the tanks for which the maintenance responsibilities lie either with the state government or with such persons who occupy the tanks or the fish contractors who have a vested interest in maintaining them.

In respect of maintenance, two main activities, i.e., the repair of embankments and desilting have been examined (Table W-13). Lack of maintenance is reflected by the fact that in 58 per cent of cases, embankments have never been repaired. This figure goes as high as 69 per cent in the case of Purulia, followed by 50 per cent in case of Birbhum and 40 per cent in case of Bankura. However, when we examine the data concerning desilting, it is found that in a much higher proportion of tanks (65 per cent), desilting was never done. The proportion varies between 100 per cent in case of Birbhum, and 60 and 63 per cent respectively in case of Bankura and Purulia. In tanks which undergo some repair of embankments or desilting, the frequency seems to be more in favour of repair of embankments than desilting. It is found that while about 19 per cent of tanks in West Bengal undergo annual repair of embankments, none of the tanks undergo desilting on an annual basis. In the case of 19 per cent of the tanks for which desilting is done, the period varied between 2 and 10 years. Again while in 16 per cent of the cases, repair of embankment is done between 2 and 10 years, the frequency of desilting is once in 11 to 30 years. This indicates that generally there is a time lag of 10 years between repair of embankment and the desilting of the tank.

The next important (Table W-13) issue is who incurs the expenses for maintenance. It is found that most of the tanks fall in a category in which no one spends any money, leading to their deterioration and declining irrigation performance. In the case of 26 per cent of the tanks, money is spent by the panchayats towards maintenance

and community contribution is also found to be forthcoming in the form of physical labour. In 10 per cent of the cases, the state government provides the funds and in another 10 per cent of cases both the state government and the panchayat provide the funds. All this indicates that in about 46 per cent of the cases, funds are coming from either the state government or local government or both. In the rest 22 per cent cases, occupants or those who benefit from the tanks, particularly through fisheries, provide the funds for the repair and maintenance.

In case of private tanks, the responsibility of maintenance was of owners in the first few decades post Independence. When the *zamindari* tanks were turned over to the panchayats after 1960s, the responsibility of maintenance came down to the panchayats. In our study areas, mainly three kinds of tasks were undertaken. First was the repair of the embankments. This was done in the following three ways: a) minor repairs in order to protect fish, almost taking place annually. The responsibility of such repairs went to either owners engaged in pisciculture or by the fish contractors, b) the panchayat body from time to time did some repair work out of development schemes and c) the TID undertook the repair of selected tanks for multipurpose use. Such repairs (category b and c) had taken place only once in the past 20 to 30 years. In 2004-05, cement lining of the tank was done by the panchayat samiti (block level panchayat body) in Manjhi pukur of Lagda village. But this did not serve any purpose.

The second was desilting and enlargement of tank beds. This took place in a few cases through panchayat or development funds. No community action was seen in Purulia district for renovation (*sonskar* in local dialect).

The third was clearing of grass etc., which has taken place in only two tanks out of 18. By and large the same position is applicable in respect of two other districts also.

In the case of Purulia district, the maintenance of such tanks was very poor. A study conducted by an NGO named PRADAN in 1996 revealed that though the tank catchments in Midnapore district received good rainfall, only one sixth of the runoff flowing into the tanks could be harnessed. The poor harvesting of water was due to poor maintenance of tanks. Poor maintenance was because of the multiplicity of ownership, poverty and mono cropping in the commands. PRADAN has undertaken a micro watershed programme in Jhalda area. The programme selects tanks and encourages local people to be involved in their maintenance. Besides, the land in the upper reach is treated and for better harvesting of water, 'seepage tanks' are created at the lower end of the slopes. Several small tanks are also being dug in the operation area named as 5 per cent model (a tank having a water spread area equal to 5 per cent of the agricultural plot that it serves) is dug at the upper reach of the plot with a storage depth of 5 to 6 feet. PRADAN has planned to create 600 to 700 such tanks and also seepage tanks with the involvement of the local people in Nawagarh village in Jhalda.

Some private tanks in Jhalda area were however found to have attracted considerable investments from government for renovation of tanks. For instance,

the capacity of Dubrajsingh's tank in Nawagarh was enhanced with an investment of Rs. 50,000 by the panchayat. This irrigated 8 acres of land owned by the tank owners. Dubrajsingh happened to be a member of Jhaldadarda panchayat who got the funds through his personal efforts made at the panchayat. Similar cases could be found in Barua Kocha under Beladih panchayat of Jhalda I block.

In Bankura district also, tanks were victim of gross neglect by the government as well as the public. Majority of the tanks in the district were not renovated since Independence. Of the eleven tanks surveyed, only one was found to have been repaired almost annually, but was done for protection of fish. Moira *bandh* in Bishunpur subdivision had undergone lining of the banks, which was undertaken by the TID around 1985. Cement lining was done in Devil Beria in Tal Dangra block around 1995, but was done to help fishing, and hence did not help irrigation. In the same block, capacity enhancement of Lal *bandh* tank took place in the year 2000, with Rs. 6 lakh spent from MPLADS[31] for desilting. Then there is Chand *bandh*, which was first deepened in 1978, and thereafter desilting of part of the tank was done in year 2003 with an expenditure of Rs. 1.5 lakh from panchayat.

Dharampur tank was also renovated in 1977-78. However, despite farmers' persistent efforts, no substantial renovation work took place. Nevertheless, the fishing committee invested between Rs. 500 to 1000 every year in order to protect the fish .The size of the great Jamuna *bandh* in Bishnupur had been reducing day by day. The local people had shown great concern for its renovation for various purposes such as irrigation, fishing, tourism, lotus cultivation and boating etc. There is committee named Jamuna Bandh Bachao Committee, which had even written to the President of India for preserving this great tank.[32]

No community action was found in any of the villages for renovation of tanks and the government had also not paid adequate attention to the tanks in Bankura district.The water right for irrigation was not restricted and the practice of restricting the right to use water for irrigation etc., for pisciculture was not exercised here. However, the villagers of Lal *bandh* voluntarily restricted themselves from taking water from the tank when the storage level came down to 4 - 5 feet in order to protect the fish.

Tables W-14 and W-15 deal with the tank uses. Although both the tables deal with same set of categories, the main difference is that while Table W-14 deals with tanks surveyed by us, Table W-15 furnishes data on all the tanks that existed in the villages/ hamlets where tank survey was undertaken. Consequently, while Table W-14 contains

[31] Member of Parliament Local Area Development Scheme (MPLADS) is a scheme formulated by Government of India and initiated in December 1993 that provides that each member of the Indian parliament has the choice to suggest to the Head of the District works to the tune of Rs.1 crore per year, to be taken up in his/her constituency. Elected Members of Rajya Sabha representing the whole of the State as they do, may select works for implementation in one or more district(s) as they may choose. Nominated Members of the Lok Sabha and Rajya Sabha may also select works for implementation in one or more districts, anywhere in the country. The allocation per MP per year stands increased to Rs.2 crores from the year 1998-1999.

[32] One Mr. Somendranath Basu, the secretary of the committee informed the authors that the unregistered committee was making efforts to save Jamuna Bandh since 1995.

data for 31 tanks, Table W-15 contains data for 88 tanks. Among the surveyed tanks, about 65 per cent were multipurpose tanks, followed by 19 per cent used for domestic purpose, 10 per cent for pisciculture and 6 per cent for irrigation purpose alone. In Birbhum, all the tanks were multi purpose in nature while in Bankura such tanks constituted 90 per cent. In Purulia only 48 per cent were multi purpose tanks and a large proportion of tanks (32 per cent) were used for only domestic purposes. At the village level (Table W-15), it is found that as high as 44 per cent of the tanks were abandoned. If we exclude this category and consider only those tanks that are in use, about 63 per cent of them are of multi purpose nature, followed by 20 per cent for domestic, 12 per cent for pisciculture and only 4 per cent for agriculture.

Table W-16 deals with pisciculture aspect of the tanks. The valuation of fishing activities in the tank could be done only in 12 out of 31 tanks surveyed in West Bengal. As a matter of fact, there were 11 such tanks where fishing was being practiced but the annual income could not be ascertained[33]. Based on the data on 12 tanks, the total value accruing from fisheries was estimated to be Rs. 3.11 lakh, annually which comes to Rs. 259 lakh per tank. The annual value of fish production per acre of tank area was estimated to be Rs. 2,806, with Rs. 4,882 for Purulia and Rs. 2,187 for Bankura. Considering the fact, that pisciculture is more popular in West Bengal compared to Bihar and Jharkhand, such a low productivity of pisciculture in West Bengal is inexplicable.

Tables W-17 and W-18 provide data on the surveyed villages/hamlets. In Table W-17 on the left side are the data on the number of households of various caste categories, and on the right side are the data on the land owned by these caste categories. Looking at the overall data, it is seen that 29 per cent of HCs own 41 per cent of the village land. The OBCs, which constitute 15 per cent of the households, own about 21 per cent of the land. As regards the SCs, they constitute about 43 per cent of the households but own only 23 per cent of the village land. In case of STs, it is found that the surveyed villages have 14 per cent ST households, but own 15 per cent of land. The data do not speak very favourably about land reforms. It seems "Operation Bargha", which literally meant "operation sharecroppers", did benefit the OBCs, but SCs, who were to a large extent landless agricultural labourers, were naturally left out. The middle castes/OBCs were the sharecroppers, and hence benefited the same way they were benefited in Bihar and Uttar Pradesh.

If we look at the average land holding (Table W-18) of different caste groups, we find empirical evidences to our contention in the preceding paragraph. It clearly shows OBCs are the ones having the largest land holdings, averaging at 1.2 acre per household, followed by HCs (1.16), and then the ST (0.89). The SCs are found to have a lower land holding, averaging at 0.43 acres per household, which is just one third of the size of the holdings of OBCs.

[33] The reason was either of the following: i) the fish catch was divided among large number of families, some times as many as 70, or the entire village; and ii) the fish was consumed only by the owners/local people with the permission of 16 anna committees. In some other tanks, the entire village was allowed to fish.

CHAPTER VI

ORISSA

The western part of Orissa has the most favourable physical environment for tank irrigation. In a way it is continuation of eastern plateau extending across Jharkhand, West Bengal, Madhya Pradesh and Orissa. Located between Chattisgarh plains in the west and Mahanadi delta in the east; and between Orissa high lands in the north and the Eastern Ghats in the south, western Orissa was relatively isolated till the early part of the 20th century. Fertile plains appearing between the undulating landscapes are crisscrossed by a number of semi-perennial rivers. Monsoons bring plentiful rains in western Orissa. Annual average rainfall in this tract is between 1000mm and 1200mm. The monsoon runoff quickly drains away due to undulating terrain. Indigenous earthen tanks are most appropriate for retaining surface water for use in the dry season. Therefore it is no surprise that every village in western Orissa has a network of tanks. While some of these tanks can be traced to ancient times, others are no more than 50 to 80 years old, constructed by prosperous land owners.

Irrespective of their age, even today tanks are the most reliable source of water in western Orissa for human beings and cattle in the summer months. Further, on account of the ingenuity in design and location, they continue to serve as a sustainable source of protective irrigation for the crops. However, the usefulness of these tanks is severely restricted by age and lack of maintenance. Their maintenance severely suffered after the ownership was vested with the government, including the panchayats. As a result, tanks with broken bunds and silted beds stored much less water and irrigate far less area each year as compared to that in the past (Sengupta 2000, 4695-96).

The importance of tank irrigation in Orissa in the past can be visualized by the fact that nearly three decades ago (1971-72) tanks accounted for about 51 per cent of the net irrigated area (Table-2.3). However, within a span of five years (1976-77), it fell by nearly half, as tanks irrigated about 26 per cent area. In the subsequent years, there is a further lowering of the net irrigated area by tanks so much so that the area fell down to 14.6 per cent in 1999-2000 and to 7.70 per cent by year 2002-2003.

Prior to Independence there were a number of *zamindaries* and feudal states in Orissa. In the early 18th century when the British and Marathas were fighting for dominance, *gond*, *kondh* and *pinjhal* tribal chieftains held most of the *zamindaries.*

Tribal village headmen called *gountias* held villages on the basis of inheritance. They constructed tanks for irrigation purpose. The story on the origin of technology of tank construction has many versions. It is popularly narrated that *kulthos kultas* who migrated to the area around the later half of the 18th century were expert tank diggers and brought with them the unique art and designs of tank building. This position is however contested on account of existence of ancient reservoirs and the living memory of the *binjhals, kondhs and gonds.* They believe that their ancestors had evolved the design of tanks based on the topography of the land (Sengupta 2000, 4700).

It should be noted that *gountias* or the village headman played a very important role in the construction and maintenance of the tanks in Orissa. "During Maratha rule, a system of auctioning villages or giving them out to favourites after deposition of long established headmen became rather wide spread. It was during the latter years of Maratha rule that the village headman began to be displaced by the lessee or the '*thekedar*'. Practically everywhere, the headman became responsible for the payment of land revenue of the entire village to the state" (O' Malley 1909). It is to be further noted that during the renewal of the lease, a large fee called '*nazrana'* was charged and the *gountia* had to pay the *nazrana* out of this profits. Between 1850 and 1870, a large number of villages had been alienated from the tribal *gountia* due to their inability to contribute for the *nazrana.* Thus, the changes in the '*gountiahi*' system accompanied by high revenue demands laid the foundation of intensive agriculture. This was followed by proliferation of tank construction activity. This was so because, when a village was leased out to a *gountia*, he was required to execute an agreement to construct tanks for the agricultural prosperity of the village. British administration recognized that construction of tanks followed improvement in agricultural production. As a reward, the *gountia* was granted a protected status by the British administration, which meant that he would not be evicted arbitrarily from his village (Sengupta 2000, 4696-97).

Selected Districts for the Survey

Based on discussions with the officials of irrigation department, academicians and other knowledgeable persons, we selected districts of Sambalpur, Bolangir and Kalahandi for the survey. While Kalahandi and Bolangir (erstwhile Patna Estate) constituted part of feudatory estates, Sambalpur was a part of the erstwhile Gondwana kingdom. The feudatory states provided the natural features of the country that lends itself to irrigation, and hills on the southern border formed a natural watershed from which many small streams find their way to Mahanadi river. The land covered by the feudatory states provided great prospects for the construction of tanks (Cobden-Ramsay 1982, 193). As regard Sambalpur, the tract revealed the striking features of *gond* settlements where the land was abundantly cultivated and the fields were appropriately terraced and irrigated. The reservoirs also displayed remarkable ingenious engineering skills. The village chief was legally bound to build reservoirs and repair the old ones. Enterprising village chiefs were granted protected status. Rent free service land was given to skilled workers in return for the work of reservoir maintenance. The *lakha bata*

system of Gondwana represented the community ownership and management of land and water resources. Unfortunately by around 1750, political instability, abolition of tribal authority and demand for more revenue caused serious disturbances leading to decay of irrigation works (Agarwal and Narain 1997, 182).

Decline in Tank Irrigation

Although the collapse of the institution of *gountia* (more particularly after abolition of *zamindari* immediately following Independence) was largely responsible for decline in tank irrigation, a variety of other factors, some that are peculiar to tank irrigated areas, caused further decline. We would discuss these factors.

First of all, after Independence there was a great deal of confusion regarding ownership of these tanks. Although many of the tanks had been registered under *'jalchar'* (public ownership), individual *gountias* who had financed the construction of such tanks at one time did not want to forsake their ownership. At the same time, neither were they getting water charges from the water users, nor were they spending money on the maintenance of such tanks. As a result, the irrigation performance of these tanks went on declining. Secondly, a large portion of the tract earlier irrigated by tank, with the completion of Hirakud dam in 1950s, started receiving canal water. Thirdly, most of the large tanks were transferred to the panchayats, but they lacked resources to maintain these tanks. In addition, in many places, they continued to be called by the name of the erstwhile owners. This enabled the erstwhile *gountias* to lay claim on the tanks but refuse to carry out any maintenance. As a result, by late 1950s, many of these tanks got silted up and consequently irrigated less and less area. Fourthly, abolition of the *zamindari* and village headman/*gountia* also marked the end of the custom of *'bethi'* which enabled free labour for the upkeep and repair of tanks and irrigation channels. Fifthly, encroachment of the land forming part of the tank spread area and the catchment was a common feature in all states.

It would be interesting to examine the latest position of various sources of irrigation in Orissa vis-à-vis tank irrigation. In Table 6.1 the data in respect of three study districts are provided. In the state as a whole, large canals provide 61 per cent of irrigation, followed by about 20 per cent from MI lifts and 19 per cent by MI flow projects, which essentially are tanks. A closer look at the three districts shows that while in Kalahandi and Sambalpur, major and medium irrigation projects provide a formidable source of irrigation, in Bolangir, MI flow projects provide the main source of irrigation as they (tanks) account for nearly 48 per cent of the gross irrigated area. Even in the other two districts of Sambalpur and Kalahandi, about 16 per cent and 25 per cent of the area is irrigated by tanks.

Table 6.1: Source of irrgation and Gross Irrigated Area in Orissa (Potential Created in 2000-2001)

Area in '000 ha

Sl. No.	Selected Districts	Major & Medium Irrigation Projects	MI Projects (Flow)	MI Projects Lift	Total from all sources
1.	Bolangir	9	20	13	42
		(21.4)	(47.6)	(31)	(100)
2.	Kalahandi	116	25	16	157
		(73.9)	(15.9)	(10.2)	(100)
3.	Sambalpur	52	19	10	81
		(64.2)	(23.5)	(12.3)	(100)
4.	State Level	1676	520	538	2734
		(61.3)	(19)	(19.7)	(100)

Values in paranthesis are in percentage.

Source: Statistical abstract of Orissa 2002, Directorate of Economics and Statistics, Orissa, Bhubaneshwar, p. 43

Table 6.2 General Abstract of District wise M.I.Ps (Ayacut Less than 40 ha.), Orissa (as in July 2003)

Ayacut in ha.

Sl. No.	District	No. of M.I.Ps				Designed Ayacut		Certified Ayacut	
		Completed	Partly Derelict	Completely Derelict	Total	Kharif	Rabi	Kharif	Rabi
1.	Angul	-	-	14	14	382	-	-	-
2.	Balasore	3	-	2	5	132	-	66.60	-
3.	Bargarh	6	3	41	50	1348.52	4.04	249.83	3.39
4.	Bolangir	18	21	65	104	2786.79	184.06	835.65	85
5.	Bhadrak	-	-	-	-	-	-	-	-
6.	Boudh	4	1	5	10	275.70	-	130.57	-
7.	Cuttack	13	10	41	64	1697.13	35	412.53	-
8.	Deogarh	3	-	7	10	282.39	-	96.62	-
9.	Dhenkanal	2	3	30	35	923	-	121.55	-
10.	Gajapati	15	25	4	44	1272.57	24.27	753.56	-
11.	Ganjam	241	75	34	350	10255.36	265.04	8709.88	-
12.	Jagatsinghpur	-	-	-	-	-	-	-	-
13.	Jaipur	3	5	69	77	1948.61	-	176.50	-
14.	Jharsuguda	11	-	25	36	1041.65	10.13	417.81	-
15.	Kalahandi	3	1	19	23	564	18	63	-
16.	Kendrapada	-	3	4	7	174.14	-	-	-
17.	Keonjhar	11	3	23	37	1007.58	4	454.66	-
18.	Khurda	3	1	40	44	1425	-	64	-
19.	Koraput	2	1	-	3	79	6	70.48	-
20.	Malkangiri	1	1	1	3	78.21	30	35	-
21.	Mayurbhanj	20	5	6	31	945.34	-	778.14	-
22.	Nawarangpur	2	4	1	7	210.31	4	144.67	-
23.	Nayagarh	4	3	30	37	1006	60	48	-
24.	Nuapada	16	-	1	17	462	-	441	-
25.	Phulbani	9	-	5	14	408.10	64	163.06	3.06
26.	Puri	-	-	3	3	93	-	-	-
27.	Rayangada	15	-	6	21	585	8	308.60	-
28.	Sambalpur	8	2	46	56	1636.71	-	275.27	-
29.	Sonepur	24	6	9	39	1051.30	-	746.50	18.21
30.	Sundargarh	19	1	15	35	788.70	8.09	633.32	-
Total		**456**	**174**	**546**	**1176**	**32860.11**	**724.63**	**16196.80**	**109.66**

Source: Chief Engineer, Minor Irrigation, Orissa, Bhubaneshwar

But as mentioned in the preceding section, tank irrigated area has been declining over the years. In Table-6.2 we provide the latest data in respect of MIPs which have an ayacut of less than 40 ha. These are essentially tanks handed over to the panchayats for management. Here an examination of the designed ayacut and certified ayacut area clearly shows a huge gap between the two areas. Whereas for all the 30 districts of Orissa, the certified ayacut for *kharif* is 49.3 per cent of the designed ayacut, for *rabi* the certified ayacut is a mere 15 per cent. This is understandable considering the fact that as *rabi* season progresses, the tanks start drying up. However, if the tanks get dried up in winter, it is mainly on account of over estimation of water availability.

In year 2002, the Directorate of Economics and Statistics, GOO conducted a detailed study of a sample drawn from the MI Census (1993-94). The survey was carried out in year 2000-01 with 1998-99 as reference year. In respect of flow irrigation schemes, which were essentially tanks, it was found that only 48 per cent of the MI schemes that were in use in 1993-94, were actually functional after five years, i.e., in 1998-99. Of the 22 per cent schemes that went out of use, 65 per cent were temporarily out of use, while 35 per cent were permanently out of use, largely on account of lack of adequate inflows and storage capacity.

In terms of loss of CCA, it was found that 12.4 per cent of CCA was not in use, while 87.6 per cent of the CCA of 1993-94 was in use in 1998-99. Of the CCA, which was not in use, 7.2 per cent was permanently out of use, while 5.2 per cent was temporarily out of use. The study also dealt with relationship between tank irrigation and different holding sizes. The data revealed that 75 per cent tanks irrigated the marginal (0-1 ha) holding size. In case of small holdings (1-2 ha), 7 per cent tanks catered to them. In case of medium (2-10 ha) and big (7-10 ha) holdings put together, 17 per cent tanks irrigated such holdings. Taking marginal and small holdings together, it was found that 82 per cent of land holdings still depended on tanks as a source of irrigation. This clearly means that tank irrigation is by and large pro poor (Anon 2002, 80-82). It shows that it is the poor who mostly depend on tanks, as they do not have access to wells, which are more productive, particularly in Orissa where available groundwater is beyond the reach of poor.

Table 6.2 contains data in respect of MIPs with less than 40 ha command that are invariably tanks. The data emerging from the three study districts indicate that in case of Bolangir, the certified ayacut in *kharif* is about 30 per cent of the designed area, whereas in *rabi* certified area is 46.2 per cent of the designed area. In case of Kalahandi, the certified area is 11.2 per cent for *kharif* and nil for *rabi*. In the case of Sambalpur there is no designed area for *rabi* and the certified *kharif* ayacut/area is just 16.8 per cent of the designed ayacut area. This clearly illustrates that while tanks in Bolangir are doing reasonably well compared to those in the rest of the state, tanks in Kalahandi and Sambalpur are doing rather poorly in comparison to the rest of the state. This is understandable considering the fact that major and medium irrigation projects in these two districts irrigate large areas. This is further substantiated by the fact that these two

districts have a very high proportion of MI schemes, which are completely derelict. On the other hand, a much lower proportion of schemes in Bolangir are completely derelict.

Having talked at some length about the present status of tank irrigation in three study districts, it would be useful to have a look at the history of tanks in the three districts.

Sambalpur

The district of Sambalpur has been named after its headquarter,the town of Sambalpur. The origin of town is said to be older than the establishment of Sambalpur kingdom some 450 years ago. It is one of the western most districts of the state of Orissa and is roughly triangular in shape. The district of Deogarh binds it on the north and the northwest. The southern portion of the district is surrounded by the boundaries of three districts, namely Sonepur, Boudh and Angul. On the west lies the district of Baragarh (Senapati 1971, 3). Sambalpur consists of a wide expanse of fairly open country fringed by forest hills as well as a series of low hill ranges of extremely irregular shape. The cultivated plains of the district yield numerous varieties of paddy, some of which are the finest in India.

The areas of the pre-colonial states of Patna (presently Bolangir district) and Sambalpur have the ruins of old irrigation works, reminiscent of the involvement of the entire community in their construction and maintenance. Building of reservoirs for irrigation was the foremost duty of the village chief/*gountia*. Since the present district was for long under the *gond* and *binjhal* chiefs, it had some of the most monumental tanks, irrigating large tract of land.

Although *gonds* had strong central government, the territories were grouped under various chiefs. Villages were formed as autonomous units that remained unaffected by higher level upheavals except perhaps during the Maratha raids. Even when empires were formed, the autonomy of these autonomous units remained unaffected. The administrative system was a natural growth from bottom to top, and democratic in form. The panchayat played an active role in limiting the arbitrary powers of the chiefs at every stage. The village was primarily a settlement of peasants, and its assembly and association of cultivators. Each village was independent in its economy and governance. Its prosperity rested on proper management of land and water resources. Repairs of water-distribution channels and embankments were taken up immediately after the onset of first rains. Rent free land was given to *kodas*, a class of people who were experts in excavating water reservoirs, and looked after the maintenance of irrigation works. Such land grants were known as *sagar rakshya jagir* (Agarwal and Narain 1997, 182-183).

In the past, irrigation in the district was mostly by tanks owing to the favourable physical environment in the district for tank making. In early 1930s, O' Malley observed that no less than 75 per cent of the cultivated area was rice and water was a far more important factor contributing to this than the soil type. In most years the amount of

rainfall was sufficient, the average for the whole district being 58.34" (1482mm) but it was often unevenly distributed and hence irrigation was mainly provided by tanks.

Another way of irrigation commonly used in the district is by building temporary dams across *nullahs* by which water is diverted and carried into the fields. For raising water from a lower to higher level, the common lever lift called *tenda* is used. This consists of a long pole poised between two uprights and with a counterweight at its lower end. It is used invariably when water is to be lifted from a well or from a tank. Where there is only a small difference of level between the field and the water, baskets (*sena*) worked by two men are often used.

There are three kinds of tanks in the district viz., the *kata, munda* and *bandh.* These were the main irrigation sources of *gonds* and were found to be most prevalent modes in the early 1930s as mentioned by O' Malley and King (1932, 127-130). The features of these structures are discussed below.

Kata

Most of the *katas* were built by the village headman/*gountias*, who in turn received land from the *gond* kings. *Kata* is an ordinary irrigation tank, which is constructed by building a strong earthen embankment, slightly curved at either end across a drainage line so as to hold fast flowing sheets of water. The undulations of the country usually determine its shape as that of a long isosceles triangle of which the dam is the base. It commands a valley, the bottom of which is *bahal* land and the sides of which are the mal terraces[34]. As a rule, there is a cutting high up the slope near one end of the embankment. From this, water is led either by a small channel or *tal*, from field to field along the terraces, down its way to land at lower levels. In years when irrigation is not needed, the surplus water is passed along until it falls into the *nullah* in which the small valley ends. Such tanks supply water to at least 5 acres and usually to an area of 30 to 200 acres.

The traditional tanks played a major role in reducing severity of droughts and famine. In 1897, when most parts of the country suffered from one of the worst famines of the century, Sambalpur managed to save half of their crops due to *katas*. This was possible because of the patronage extended by the *gond* kings to the *gountias*, who were responsible for the O & M of the tanks for a certain period of time. *Gountias* were given lands called *bhogra* for personal use at a highly concessional rate, equivalent to only 25 per cent of the rent paid by the *ryots*/cultivators (Chhotroy 1997, 189).

Munda

It is an embankment of smaller size across a drainage channel. Embankments of this sort are very common, as they can easily be constructed by the *raiyats* (individual farmers) themselves for the benefit of their own holding. The *munda* can be useful in case the rainfall deficit is not very major. It may then provide water enough in the latter stage of plant growth to save the crop. The *munda* usually serves small land holdings.

[34] Land is classified into four groups on the basis of its topography; *aat* refers to highland, *mal* is slope land, *berna* is the medium land, and *bahal* is the low land (Chhotroy 1997, 183).

Bundh

It is a four sided tank excavated below the *kata* from which it derives its water by percolation. They are almost invariably used for drinking purposes only and are properly regarded as suitable monuments of piety or charity and are invariably consecrated or married to a god. Apart from their obvious sanitary (hygienic) advantages, they add to the irrigated area by spreading percolation and by rendering it possible in years of drought to empty the irrigation tank completely without danger.

There is a big difference between the methods of irrigation practiced by *agharia* migrants from Chattisgarh, who have settled in flatter riparian tracts to the north, and the Oriya *kultas*, who prefer a comparatively undulating country. One glance at a stretch of rice fields is sufficient to distinguish between *kulta* and *agharia* cultivation. The former, who is a poor tank builder and constructs only the shallow square tank, builds only low and narrow banks between his fields, seldom more than two feet high, as he has to cut them frequently in order to move irrigation water from plot to plot. The *agharia*, on the contrary, builds high field boundaries, making a tank of each field, as each has to capture and keep the rainfall that falls on it. Both the systems suit the tracts to which they are applied. In a normal favourable year, the *agharia* reaps the bumper crop but in a bad year he loses more than the *kulta* does.

Since construction of tanks was so vital for the agrarian economy of the district, special concessions were made to increase their capacity. In addition, land made irrigable by tank construction was secured against assessment at rates for irrigated land, at the ensuring settlement. In addition, in case of *raiyatwari* villages, if a *gountia* or *ryot* made a tank in his land, he was entitled to remittance of the revenue on the area submerged from the date on which the tank construction was completed.

A common feature of the tanks not constructed on the proprietary land and inspite of being recorded as government/public property was that they were vulnerable to most pervasive encroachments on their beds by farmers and conversion of that into private holdings. The distribution of water from such public tanks was left in the hands of panchayat or village committees (O' Malley and King 1932, 129-130).

Arrangements were made during the construction of tanks to prevent their water inlet/outlet, conveyance structures, embankments etc., from being eroded or breached. The operational work included cutting and closing of embankment; and maintenance work included de-silting of tank beds and prevention of embankment erosion. Constant vigil was maintained during the monsoon months against sudden breaches in the embankment. Water distribution was supervised by the village *panch* (Chhotroy 1997, 183).

Bolangir

The district of Bolangir like many other districts of Orissa is named after the district headquarter town's name. Bolangir was also the headquarters of the feudal state of Patna since 1880s. According to historical records, the town of Bolangir was established

by the 12th *raja* of Patna in the mid 16th century (Senapati 1968, 1). The district is flanked in the north west by the Gandha Manda hills, a name of *Ramayan* fame, and in the north east by the rock infested Mahanadi. It is traversed by many hill streams and is interspersed with overgrown woodlands. The district is situated in the valleys of "Aug" and "Tel", the two main tributaries of Mahanadi. The district of Baragarh binds it on the north; on the east lie the districts of Sonapur and Boudh; on the south lies the district of Kalahandi; and on the west lies Nuapada district.

The former *durbar* of Patna encouraged tenants to dig more tanks and develop other water sources with permission of the authorities and to utilize water free of rent during the period of settlement. After the next settlement, such water sources were to be declared as public *jalchar* land. Water from these sources was being distributed to the fields by the village *panchs* and villagers were required to keep them in good condition. An extract from Wajib-ul-urz of 1937 settlement report of ex-state of Patna provides illuminating details in respect of O & M and water distribution of public water reservoirs (Senapati 1968, 138)[35].

The villages of the erstwhile Patna state (present Bolangir district) were prosperous and irrigation tanks were overwhelming. There were more than 3000 tanks in the state irrigating 33,700 ha of land in 1919, which went up to 53,356 ha by 1937.

Compared to the past what is witnessed today is the widespread occurrence of droughts in the region in general and in the district in particular. This is mainly due to complete collapse of the tank irrigation system. Records show that 30.12 per cent of the total cultivable land in Bolangir district was irrigated as early in 1936. The figure dropped to a pathetic 6 per cent by 1996. This is the result of large-scale deforestation and consequently high siltation, making the water bodies partially or completely defunct. The responsibility of maintaining these traditional water bodies is now with the gram panchayats that seldom have the funds for the purpose. The panchayats receive sizeable revenue by auctioning these water bodies for fishing purposes, but are reluctant to utilize funds on their maintenance[36]. Further, once these tanks are auctioned for pisciculture, such tanks are rendered out of bounds for irrigation purposes (Vikalpa 1997, 9).

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[35] "Public Reservoirs – the work of distribution of water from all water reservoirs recorded in the *Jalchar Khation* shall be done under the supervision of the village *Panch* with reference to irrigation *Khatian* of the village. No fee shall be charged for the distribution of water for irrigation. Repair of Irrigation Works – All water reservoirs entered in the *Jalchar Khatian* of the village shall be kept in good repairs by the Rayats working under the direction of the *Ticcadar*. All expenses incurred for keeping the roads and reservoirs in good repairs may be met from subscriptions raised from the villagers by the *Ticcadars* in consultation with the village *Panch* –the *Ticcadar*, his co-shares and members of the village *Panch* also contributing in proportion of the area held by them."

[36] The main sources of fish supply in the district are tanks and rivers. A number of tanks have been taken over by Gram Panchayats, which supply a good amount of fish. They derive good income out of fish contracts and it is one of panchayat's main source of income.

Kalahandi

The word Kalahandi is made of two words i.e., *kala* (black) + *handi* (pot), meaning black pot. The name has originated from the black cotton soil dominant in the district, which brings out black pots from the potter's wheel that are available in plenty in the markets of the district and neighbourhood.

The present district is constituted by a part of the feudal states of Orissa during British time. After Independence, the princely state of Kalahandi was merged with Orissa along with other princely states on 1st November 1949. During colonial period the relations between the princely state of Kalahandi and the British government were regulated by the *sanad* (charter) of 1867, which was revised in 1905 when the state was transferred to Orissa Division. In 1907-8, the total income of the princely state was Rs.2,32,868 and the state paid an annual tribute of Rs. 16,000 to the British government (Cobden-Ramsay 1982, 209). Junagarh was the headquarters of Kalahandi until 1849. The name, "Kalahandi" for the first time occurred in 1718 (Senapati 1978, 2).

Till a few decades ago, Kalahandi was famous for being the home of man-eating tigers. But during the last several years, the district has acquired the notoriety on account of sale of female infants due to extreme poverty caused by frequent occurrence of drought and famine. The latest case reported from the district was in October 2004, which brought out the story of the 27-year old Kusum Majhi of Palisipada village who sold her 20 days old daughter to a neighbour for Rs. 600 (about $13).

The district is bound in the north by Bolangir and Nuapada; on the south by Rayagada; on the west by Nabrangpur; and Raipur (in Chhatisgarh) and on east by the Rayagada and Phulbani. The district headquarters town of Bhavanipatna is almost close to the eastern border of the district.

The district has two distinct physiographic regions, the plain land and the hilly tracts. The plains run southward upto Bhawanipatna and then westward through Junagarh and Dharamgarh and then further up to the boundary of the district. The plains cover about 59 per cent of the total geographical area of the district. The hilly tract (41 per cent) mostly located in the south western part of Bhawanipatna sub-division, covers some of the dense forests in the district. Some big progressive farmers, who have introduced modern farming practices, inhabit the plains of the district. In the hilly tract, which is inhabited by tribal people, agricultural practices are primitive and are dominated by shifting cultivation (Senapati 1978, 122).

The general elevation of the plains is about 900 feet above the sea level. It is intersected by hill ranges and isolated peaks, but contains a large portion of cultivated lands.[37] It is occupied largely by the *kaltuas/kultas*, clever and capable agriculturists, who have constructed numerous embankments and tanks in the tract. Also seen here are

[37] The land in the *feudatory* state of Kalahandi was classified into four following categories. (i) *bahal*, 1st class lands, (ii) *berna*, 2nd class lands, (iii) *mal* or *beda*, 3rd class lands, (iv) *bhata* or uplands. There are also *barchha* or sugarcane plots and homestead land or *bari* (Cobden – Ramsay 1982, 205).

a certain number of *khonds*, who have left their hill habitations and taken to settled agriculture. The *kaltuas* are a race of cultivators nearly allied to *malis* but of a distinct caste. They cultivate generally everything but their special forte is cultivation of sugarcane and preparation of sugar. *Malis*/gardners, on the other hand, cultivate vegetables.

The district has extreme climatic conditions. It is dry except during monsoon. There is a large difference between the day temperature and night temperature. The average annual rainfall in the district is 1378 mm. The rainfall is erratic in nature, and uneven in distribution. The monsoon seasons lasts for four months from June-September, and accounts for 90 per cent of the annual rainfall that the district receives. Drought, as mentioned in the preceding section, is a normal feature of the district.

Tank structures of all sizes from smallest to largest, viz *bandh, munda, kata* and *sagar* are visible all over Kalahandi. Such structures, particularly the largest ones called *sagar,* are the most distinct feature of all feudal states including Kalahandi. Since hilly land and plain land are in the proportion of 41 per cent and 59 per cent respectively and perennial streams intersect valleys, various types of tanks of varying sizes are built all around. The region now forming part of the district never suffered from any serious crop failure, even in 1900 when there was a severe drought. This was quite contrary to what happened in Bishnupur kingdom (part of the present Bankura district) during the famine of 1866 when even rich *Brahmins* were reduced to beggers overnight (Cobden-Ramsay 1982, 133-138)

There was a custom in Kalahandi to make an agreement with the village chief (*gountia*) whenever a village was leased out, to make him accountable for the excavation of tanks for the agricultural improvement of the village. However, by as early as mid 1940s, these practices had started eroding to a great extent. This was mainly on account of some of the policies of the British government that did not favour *gountias* the way the earlier policies did. Earlier, the *gountias* were getting several facilities like protected status. While all this dampened the spirit of *gountias*, the Independence and the subsequent policies of the state government completely removed *gountia* from the scene, leading to progressive decline of tanks in the state (Anon 1946, 7-9). All this does not mean the tank irrigation withered away. On the contrary, even today tank irrigation is one of the most important sources of irrigation in the district.

Sagar

Kalahandi has some of the largest tanks, found in Orissa. In Oriya, the name for such tanks is *sagar*, which means a very large tank. Pant in the course of his field visits to the district during September 2004 and May 2005 visited a number of such tanks. Those visited were Udaya sagar/asursagar, Devi sagar, Asha sagar and Karuna sagar. The others that were also said to be large tanks but could not be visited were, Manabhanga sagar, Deundi Sibsagar, Matigaon sagar, Ram sagar, Baya sagar and Maluma sagar. All these tanks were very large but the one that was most impressive was Asursagar/Udaya sagar located in a small village. Asuragarh is situated in Narla block and is 5 km from

Narla and 3 km from Rupra Road railway station. Close to village is the oval shaped tank with nearly 200 acres (80.934 ha) water spread area. It is said to have the deepest, cleanest and sweetest water[38].

Survey Findings

Considering the fact that the tanks surveyed in Orissa were drawn from the districts which had long tradition of tank irrigation, a large proportion of the surveyed tanks were found to be either ancient or from British times (Table O-1). In fact, of the many tanks surveyed in Orissa, none were constructed after 1990. Thus 19 per cent of the tanks were found to be from the ancient/medieval period, 62 per cent from the British period and another 19 per cent were constructed after 1947, but before 1991.

The ownership of tanks (Table O-2) in Orissa indicates a picture that is quite different from what is seen in Bihar, Jharkhand and West Bengal. In Orissa, an overwhelming proportion of tanks (62 per cent) are owned by government, followed by 33 per cent by panchayats and only 5 per cent by individuals. Part of the reason for this kind of ownership pattern in case of Orissa was that the tanks selected were important from irrigation perspective. Further, unlike other states, in Orissa we received a great deal of cooperation from the MI department who took keen interest in going with us to their tank sites. Since about 95 per cent of the tanks are either owned by the government or by the panchayats, it is natural that all these tanks would be of open access. The same pattern emerges from Table O-3, which shows that 90 per cent of tanks are of open access while in 5 per cent of the cases, access is restricted and open to owners only. In another 5 per cent of cases there are other kinds of restrictions and was mainly seen in case of a MIP in Kalahandi district where water of a MIP in initial reaches was exclusively for a government agricultural farm.

Looking at the size of the tanks (Table O-4) in Orissa, the surveyed tanks are by and large, big in size. This becomes amply clear from the fact that one third of the tanks surveyed are having a water-spread area of 51-100 acres and another 19 per cent are having water spread area of more than 100 acres. Among the districts, Sambalpur is the only districts, which has small size tanks also. Not only are tanks in Orissa big, but also these tanks irrigate large areas (Table O-5). Thirteen of the 21 tanks surveyed, and for which data is available, together irrigate a total area of 2104 acres, which comes to about 162 acres irrigation per tank. However, the real test of tank efficiency comes from the ratio of irrigated area per acre of tank water submergence area. Here also Orissa survey shows excellent results. On an average, the area irrigated by one acre of tank water spread area is 2.76 acres. Among the three districts however, differences in this respect can be seen. The tank efficiency is highest in Sambalpur (1:3.20), followed by Bolangir with a ratio of 1:2.91 and then the lowest in Kalahandi with a ratio of 1:2.55.

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[38] A controversy arose in the village when the taxi driver who took Pant the author there referred to it as *asur sagar* and said it was constructed by an *asur* (demon). The villagers vehemently opposed and said that the name of the tank was Udaya *Sagar*. In fact in MI schemes of Government of Orissa also, it is mentioned as Udaya *Sagar.*

Like other states, in Orissa also an overwhelming proportion of tank irrigation happens during *kharif*, which accounts for 66 per cent of the gross tank irrigated area. During *rabi* about 31 per cent of area is irrigated and about 3 per cent of the irrigation is during summer (Table O-6). The table also provides data on the modes of irrigation. As the table shows, during *kharif* season, flow irrigation is the most common mode accounting for 69 per cent of the area irrigated during the season. This is followed by 27 per cent area irrigated by pumps. During *rabi* the picture is reversed as 57 per cent of area is irrigated by pumps; 40 per cent area by flow irrigation, and 3 per cent by manual means. During summer, although the tank-irrigated area is drastically reduced, 88 per cent of it is irrigated through pumps.

The predominance of flow irrigation is again evident from the analysis of gross irrigated area (Table O-7). It is found that in the three districts flow irrigation accounts for 58 per cent of the GIA, followed by 38 per cent by pumps and about 4 per cent by manual means. All the three districts have almost same pattern emerging with regard to the mode of irrigation. The only noticeable difference is in Sambalpur where more area is irrigated by pumps and less area by gravity method.

The intensity of tank irrigation can be gauged on the basis of the extent to which irrigators have to struggle for the tank water. Hence, it is analyzed in Table O-8. The average size in case of Orissa is found to be 58.6 acre and there are about 43 irrigators scrambling for water in this tank area. Looking at the data from the viewpoint of averages, it is found that there is less concentration of irrigators in terms of demand per acre of tank area. It is found out on an average one irrigator has nearly 1.5 acres of tank area. The concentration is highest in Sambalpur, where one irrigator finds about an acre of tank area available to him. The concentration is lowest in Kalahandi, where one irrigator finds nearly 2 acres of tank area available to him.

Tables O-9a, 9b and 9c provide the data regarding the depth of storage of water in the tank in various seasons. The first thing that strikes is that in comparison to other states, the depth of storage of water is far higher in Orissa. This becomes obvious if data of O-9a Table is closely examined. In 38 per cent of the tanks in Orissa, the storage depth is above 10 feet. Nearly 24 per cent of the tanks have water storage depth ranging between 7-10 feet. In another 29 per cent of the tanks, water storage depth is in 5-7 feet range. All these mean that 91 per cent of tanks have a water depth of more than 5 feet. As found in other states, the storage depth goes on reducing from rainy season through winter and then to have the lowest depth in summer. This becomes obvious from the fact that while no tanks go dry during rainy season, 5 per cent tanks become dry during winter and 19 per cent go dry during summer.

In comparative terms, it is found no tanks go dry in Bolangir, 80 per cent tanks go dry in Kalahandi, and 43 per cent of the tanks go dry in Sambalpur (Table O-9c). As far as sources of inflow into the tanks are concerned, it is found that 57 per cent tanks depend on rains in the catchment, followed by 38 per cent depending on a combination

of sources other than rains such as rivulet, floods, and inflow from another tank. Finally about 5 per cent tanks depend on canal water and rains in the catchment.

Table O-11 to Table O-13 deal with tank maintenance related aspects. The data in respect of responsibility of maintenance (Table O-11) are quite similar to the data relating to ownership of tanks (Table O-2) except that as per Table O-11 responsibility of tank maintenance in about 10 per cent cases lies with "others". This category includes fish contractors, illegal occupants and also in some tanks renovated under the European Union project through some NGOs and tank beneficiary, who have taken the responsibility to repair and maintain these tanks. This is the reason why while as per Table O-2, about 36 per cent of the tanks are owned by panchayats, only in 24 per cent cases beneficiaries mention panchayat/community to be responsible for tank maintenance.

Another important difference in respect of government tanks is that here all the surveyed tanks belonged to MI department and none to the fisheries department. However, the frequency of repair and desilting in Orissa is as poor as in other states. It is found that the frequency of repair of embankments is higher than that of desilting. This becomes obvious when we consider the fact that only in about 10 per cent of the tanks the embankments were never repaired, while in 43 per cent of cases tanks were never desilted. Again while in about 5 per cent of the tank, embankments were annually repaired, none of the tanks were desilted every year. Yet again, while in about 72 per cent tanks, the embankment was repaired once in 2-10 years, only in about 29 per cent of tanks were they desilted with the same periodicity. This brings into fore the question of who provides funds for the repairs of embankments and desilting. Looking at the data (Table O-13), one can see that in 62 per cent of cases, funds come from the government, followed by panchayats in 14 per cent cases and other (such as NGOs, illegal occupants, fish contractors etc.,) in another 14 per cent cases. In 5 per cent cases, owners themselves and in another 5 per cent cases, panchayat and government jointly provide the funds.

The results of analysis of pattern of use of tanks are presented in Tables O-14 and O-15. While in the former table, results for only surveyed tank data are included, in the latter, results for all the existing tanks including the abandoned tanks in the surveyed tank villages are presented. Table O-14 shows that the largest proportion of the surveyed tanks (62 per cent) are of multipurpose, followed by 19 per cent of the tanks catering exclusively to irrigation needs, and another 10 per cent each exclusively for domestic and pisciculture. One of the reasons why nearly one fifth of the tanks in Orissa are exclusively kept for irrigation is that in Orissa a large proportion of the samples were MIPs belonging to the MI department. However, when the larger picture is looked at in Table 0-15, it is found to be slightly different as multipurpose tank constitute a higher proportion (77 per cent) whereas a much lower proportion of tanks (3 per cent) exclusively cater to irrigation. By and large the picture that emerges is more or less same as what is found in other states.

In Table O-16, the estimates of the economic value of fish production from the tanks are presented. Here also data is available for 8 tanks against 21 which were studied.

It is found that these 8 tanks together generate an economic value of Rs. 3.68 lakh, which works out to be about Rs. 46,000 per tank. Further analysis shows that the annual economic value generated per acre of tank area comes to Rs. 765. Comparing the data across districts clearly shows wide variations with the highest value per acre of Rs. 820 obtained for Kalahandi, followed by Rs. 765 for Bolangir and the lowest of Rs. 655 for Sambalpur.

Tables O-17 and O-18 deal with data relating to various castes which dwell in the study villages and their land ownership. Here, the trend is similar to what was found in Bihar and Jharkhand. Analysis shows that the higher castes own a much higher proportion of the village land than the households. Overall, it is found that HCs constituting 6 per cent of the households own about 14 per cent of land, followed by OBCs accounting for 49 per cent of the households, but owning 51 per cent of the land; STs accounting for 27 per cent of the households and owning about 24 per cent of land. The situation of SCs is bad as they own only 11 per cent of the village land, while constituting 18 per cent of the village households. The same fact emerges if the average land holdings of various caste groups are examined. The data (Table O-18) shows that on an average, HCs have the largest land holding at 2.67 acre per household, followed by OBCs with 1.2 acre. The STs have an average holding of 1.03 acre per household. The land ownership is smallest for SCs whose average holding is just 0.72 acre per household. If a closer look at the district wise data on landholding is taken, it is seen that the HCs are not well off in all the districts, as in Kalahandi their condition is worse than all other caste groups, including SCs and the average holding size they own in that district is as low as 0.41 acres per household. Similarly in Kalahandi and Bolangir OBCs do not seem to be well off. While in Sambalpur, OBCs appear to be very well off as their average land holding in that district is as high as 3.07 acre per household.

CHAPTER VII

FISHERY – NON IRRIGATION USES OF TANKS

Tanks have been playing a significant role in agriculture in the entire eastern India as a source of irrigation. Besides irrigation, these tanks have been serving the society in various ways such as provision of water storage for pisciculture and recreation, water for domestic uses and performing religious rites, and water for miscellaneous cultivation (cultivation of water borne fruits). When water storage is available, tanks are used to cultivate *singhara* (a water fruit), *makhana* (a kind of dry fruit grown in water), *bhent* (a flower used as vegetable), and lotus. Then there are several tanks, which are used for religious purposes, such as the Suraj *kund* in Nalanda district. Though this is the case, pisciculture has been one of the most important sources of income and a means of meeting the nutritional requirement of people in the local areas.

Neglect of Fisheries from Tanks by Irrigation Experts

As mentioned in the introductory chapter, "tank fisheries" did not attract serious attention of researchers who worked on tanks in the past. However, as the study proceeded and more particularly after the first phase of the field visit involving reconnaissance in the state of Bihar, West Bengal and Orissa, we found that fisheries was an inseparable part of tanks/ponds. Therefore, it was decided to incorporate fisheries aspect also into our survey in the four states viz., Bihar, Jharkhand, West Bengal and Orissa.

Here it would not be out of context to mention that although fisheries is an integral part of tank activities, it escapes the attention of researchers dealing with tank irrigation. For instance, Vikas Rawal who has done a detailed study of irrigation development in West Bengal (1978-1995) and analyzed patters of irrigation by ponds in Panahar and Muidara villages in Bankura district, mentions that irrigation rights over ponds were different from ownership rights over pond water spread area. He also observes that there was a market for shares of ponds and the price was determined primarily by the area equivalent of the share. As ponds were of different sizes, the worth of a share was different in different ponds, say one hundredth of a pond (Rawal 1999). However, he forgot to mention the concept of *ansha* (share) in respect of ponds in West Bengal and that the value of a tank was largely dependent on the production of fish from that tank. Similarly, a study of tanks done by Saktivadivel for Asian Development Bank mentions different functions of tanks except fisheries (ADB 2006, 3).

Fisheries in Ancient and Pre Colonial Period

Although it may not be possible to cover the historical aspect of tank fisheries, it would be necessary to delve a bit into the history of fisheries. Fishing is referred to in the earliest Indian texts although it has been argued that it was the occupation of the pre-Aryan inhabitants of India, and not an occupation, that the Aryans ever followed. Tarak Chandra Das wrote, in 1931, the word "fish" is mentioned only once in the Rigveda (X. 68,8) where a whole *Sukta*[39] is devoted to it. But it does not indicate fish as an item of food among the Rigvedic Aryans. It refers to the method of catching them with nets and that also by people probably belonging to a different racial stock (Das 1931, 294)[40]

Sadhale and Nene have provided a very interesting description of fishing in the 12th century compendium in Sanskrit titled *Abhilashitarthachintamani* or *Manasollasa* and authored by the western Chalukya king Someshvardeva (1126–1138 AD)[41]. The text includes description of 35 kinds of marine and fresh water fishes, each with a distinct name, the feeds provided to a few fishes and the art of angling. The text also includes a brief description of the procedure for cooking fish. Someshvardeva has given an excellent description of the art of making the ropes required for angling from the local resources. He discussed about materials from which ropes can be made of different strengths, lengths and thickness. Likewise a very useful description of the rods, hooks, baits, and striking, and playing fish has been given. Fishes described in the text include sharks, sawfish, triggerfish, garfishes, carps, croakers, spiny eel, catfishes, arbels, murrels, ray fish, gobies, and snakeheads. It is evident that considerable knowledge of fishes was gathered almost 900 years ago, but was ignored in subsequent centuries (Sadhale and Nene 2005, 177-199).

In the early 1870s, while writing about Nalanda the then Assistant Magistrate and Collector of Patna, A.M. Broadlay mentions that the authentic history of the rise of Nalanda monastery commences in 415AD, when Fa-hien the first of the Chinese Budhist pilgrims, paid a visit to the spot. Although his description mostly gives details of the styles of architecture and sculpture displaced at Rajgir and Burgaon (presently Baragaon), he also gives details of a number of large tanks located there. He mentions that approaching the ruins from Bihar, one first arrives at an enormous tank running east to west for nearly a mile, and about a quarter of a mile broad, which at that time was called **'***Digee Pokar***'**. He also mentions about another tank to the south of the convent, and situated in the midst of a garden of mango trees, which was said to be inhabited by a dragon named Nalanda, which the author identifies with great *Indrapokoor*. Since the monastery was built at this site, it was called the Nalanda–Vihar. Broadlay also mentions of a beautiful square-shaped tank known as *"Suroj–poker"*, which according to him

[39] The word *sukta* in Sanskrit means "that which is well said" and usually refers to Vedic hyms prayers.

[40] This reference has been taken from Reeves (1995).

[41] The Western Chalukya king Someshvardeva or Someshvara III, ruled from Kalyani (near Bidar in northern Karnataka) between 1126 and 1138 AD, composed Manasollasa or Abhilashitarthachintamani around 1131 AD.

measured about 400 feet on each side. Another tank which he mentions in his writings on Nalanda, is *Pansoker.* According to him, the then modern village of Burgaon was located to the north of the ruins and was between *Pansoker* and *Suraj–poker* tanks (Broadlay 1872, 1-6). Since the most glorious times of the monastery was during 500-1000 AD when 2000-4000 students stayed and studied there, it is assumed that these tanks provided sustenance to agriculture at that time.

The evidences of existence of these huge tanks in the ancient periods can also be found in the accounts of Fergussion and Hiuen Tsiang. Fergussion, in his discussion on the architects of ancient India, makes brief description of the tanks. He writes, "It is, of course, always difficult, sometimes impossible, to realize the form of buildings (Nalanda monastery) from verbal descriptions only". While the Chinese pilgrims were not adepts at architectural definition, still Hiuen Tsiang's description of the great Nalanda monastery is important and so germane to our present subject that it cannot be passed over. This celebrated monastery, which was the Monte Casino of India for the first five centuries of our era, was situated at the modern Baragaon[42], 34 miles south, south west of Patna and seven miles north of old capital Rajagriha. This is probably no exaggeration, and with its groves of mango trees, and its immense tanks that still remain, it must have been as he says "an enchanting abode" (Ferguson 1876, 173-4).

Further, Hiuen Tsiang, the Chinese pilgrim visited India during 630 AD to 647 AD; during this period he first reached Nalanda and Rajgriha in 637. In the first leg of his journey he stayed for some time and in the second leg he stayed for fifteen months and left in 642 AD. His total stay at Nalanda was for about two years. The Nalanda monastery had already existed 700 years when he visited place. Hiuen Tsiang writes, "And then we may add how the ***deep, translucent ponds*** bear on their surface the blue lotus intermingled with the *Knaka* flower, of deep red colour and at intervals the *Amra* groves spread all over, their shade". Inference can be drawn that the villagers engaged in agriculture used these tanks from the following lines of the Chinese pilgrim, "There are about 3500 priests in the temple at Nalanda, which is supported by the revenues derived from land (villages) given by a succession of kings to the Monastery" (Hwui Li 1884, iv-xxxviii)

Peter Reeves (1995) who has extensively studied the subject of fishery during the colonial period opines that although fishing was an occupation of antiquity in India, adequate description of its practices, and the controls over it during pre-colonial times, is not readily available. This according to him, was mainly because fishing in earlier times was associated with an occupation of low caste people and in addition, fisheries was never seen as being of the same importance as agriculture.

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[42] The village Muzaffarpur surveyed by us falls under Baragaon panchayat about which Hiuen Tesiang talks. There are seven tanks in the village of which one is at present of big size measuring nearly 30 acres of water spread area.

Fisheries in Colonial India

Buchanan's published account of Patna and Bihar in early 19th century highlights the remunerative role of fisheries. He mentioned that small reservoirs, which were filled with water during rainy season, got dried up by the time winter crops were sown. Since reservoir beds retained enough moisture, it encouraged farmers to grow winter crops like, wheat, barley or pulse. But in case of larger reservoirs where much water remained, no winter crop was possible and hence fishing was practiced. To such families fishing provided sufficient remuneration and compensated the loss of the crop that otherwise would have been sown. As a matter of fact, fishing provided them enough ready money for the upkeep and repair of such reservoirs (Buchanan 1934, 533).

Reeves asserts that in the late 18th and through the 19th century, the British created a new regime for control over, access to and exploitation of inland waters in India. "This new regime was the result of various activities: decisions about riparian rights implicit in the development of British systems for the control and administration of land and the settlement of land revenues; the building of irrigation works to support agriculture and other engineering works; and a range of new uses to which rivers were put in relation to growing urban and industrial areas" (Reeves 1995).

Talking of fisheries in colonial Bengal, Bob Pokrant mentioned that the importance of fish in the lives of Bengalis was not surprising, given Bengal's location at the delta of the three great river systems of the Ganga/Padma, Jamuna/Brahmaputra, and the Meghna. According to him, the waters of these rivers and their many branches and tributaries had remained central to the economic and social lives of both fishing and non-fishing communities. Apart from rivers, various types of water bodies producing fish in Bengal as mentioned by him are, *beels* (open water bodies, sometimes marshy or deeper sections of low-lying natural depressions), *pukur* and *dighis* (ponds and tanks), *baors* (ox-bow lakes or segments of rivers cut off from the main channel), *haors* (low-lying natural depressions), floodplains, *Kaptai* lake, the Sundarbans, shrimp farms and *bheries* - salt water fish enclosures or farms (Pokrant 1996).

On the basis of empirical data, Pokrant (1996) illustrates the high importance of inland fisheries to the economic life of colonial Bengal. He is of the view that although not comparable to rice production in its impact on the economy, it was sufficiently important to involve a majority of the rural population who supplemented their main diet of rice with a wide variety of fishes. He however asserts that fishing was able to sustain a substantial number of professional or full-time fishermen and women drawn mainly from low caste Hindus and poorer segments of the Muslim community. He mentions that there were more than thirty castes, sub-castes or *jati* and other non-Hindu groups that specialised to a greater or lesser extent in fishing as their chief source of livelihood (Pokrant 1996). Pokrant et al (2001) claims that by the end of the 19th century, fish were consumed by an estimated 85 per cent of Bengal's population and by the latter part of the 19th century the price of fish as a commodity rose significantly, especially for

highly valued fish such as *hilsa* which was central to various household ceremonies (Pokrant, Reeves, McGuire 2001).

Discussing the social composition of the fishing community as a consequence of partition, Pokrant et al., (2001) points out that one notable impact of partition was a gradual change in the communal composition of the fishing work force. The full time specialised fishing community, which was predominantly Hindu, left east Bengal for west Bengal and other parts of India or took up other occupations. By the 1960s and 1970s signs of increasing population pressure and environmental degradation were becoming apparent. This resulted in an increase in population of Muslim landless labourers and marginal farmers, many of whom shifted to fishing which appeared more lucrative than farming. It also led to new fishing practices as more and more Muslims abandoned their traditional prejudices against fishing and entered the profession. These changes added pressure on the Hindu fishing community, that have been reduced to more of a minority. This shift according to them, may also have resulted in the loss of traditional skills in professional fishing as well as the development of new ones among the new entries (Pokrant, Reeves, McGuire 2001).

The position of Bengali fishing community, according to Pokrant, under the British was shaped by various legal changes which began in the 18th century, which led to a number of important changes in the management and organisation of Bengali fisheries that were later inherited by governments of India, Pakistan and Bangladesh. "The essence of these changes was to vest in indigenous estate holders and local rulers known as *zamindars* (from the Arabic *zamin* or `earth/land' and the Hindi *dar* meaning `one who holds') the right of private ownership of water bodies or *jalkar* (from the Sanskrit *jal* meaning `water' and *kara* meaning `tax') attached to their estates. Such *jalkar* rights covered non-navigable rivers, *beels*, ponds, *haors* and tanks." As a result, during the colonial period, fishermen and women were subject to the twin pressures of people with rent seeking and commercial interests who were able to appropriate the lion's share of the surplus product (Pokrant 1996).

In fact in a survey of Burma's fisheries at the end of the colonial period, U. Khin argued that expansion of fishing industry was of great importance because it involved three distinct interests: the revenue of the state; the welfare of the large community engaged in the industry; and the needs-considerable in a country where fish was the main accompaniment to the staple food (rice) of a large body of home consumers (Khin, 1948, 2).[43]. Consequently Maxwell's picture of fisheries (as reported by Reeves et al., 1999) was one of an industry in which control had moved from the administration to powerful local interests for whom fishing was merely labour and a source of extortionate rents and payments.[44]

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[43] This reference has also been taken from Reeves et al 1999. Furnivall in 1943 but it was not published until after Burma's independence in 1948.

[44] Maxwell, *Report on Inland and Sea Fisheries* (1904).

Although Reeves's paper "Regional diversity in South Asian inland fisheries: colonial Bengal and Uttar Pradesh" is essentially a 'work in progress' paper, some of the secondary data provided in the paper points to the regional diversity, particularly between Bengal and Uttar Pradesh with regard to fisheries. Comparing the two states he observes that while about 12 per cent of Bengali fishermen and women were part-timers, in Uttar Pradesh about 30 per cent of fishermen and women were part-timers. He further points out that in spite of the fact that the two provinces had nearly the same population (Bengal 50 million plus; Uttar Pradesh 49 million plus in 1931) and that both had the same sort of basis – in their rivers, lakes and private tanks and ponds, - for important fishing activity, fishing among the Bengal population was larger and more stable than that in Uttar Pradesh. According to him one important difference between the two provinces was that Bengal was settled 'permanently' while Uttar Pradesh, except for the Benaras Division, was 'temporary' – which usually meant that the *zamindars* had a land tenure of 30 years, for which revenue assessment was made. He concluded that it could be quite possible that the developments arising from the permanent settlement in Bengal, that prompted the development of the *ijara*[45] as the basic form for the control of the *jalkar,* made a difference. This may have prompted a stronger base from which the commercial side of the inland fisheries was developed by providing for the creation of a group of strong capitalist, controllers of fishing activity. But then he also raises the question, if that was the case, it would be of interest to study, whether or not Benaras, which also had a permanent settlement, showed signs of *ijara* development, and if not, why? (Reeves 2002).

Post Independence Period

In Cuttack, Government of India (GOI) established a research sub-station in the mid-sixties for composite fish culture. Since its inception it has come a long way through various research and extension projects of the ICAR, central/state governments and the agricultural universities. Later on, with a view to providing intensive extension support to development of composite fish culture, the GOI initiated the establishment of Fish Farmers' Development Agencies (FFDA) under the chairmanship of the district collectors from 1974–75. This led to establishment of hundreds of such agencies in Orissa. These agencies are autonomous registered societies. Besides popularising composite fish culture, they are expected to coordinate the activities of various institutional agencies engaged in inland fishery development. As a result, a large number of derelict tanks have been renovated, new ponds developed, institutional finance provided, inputs availability increased and training of farmers organised. Although fish production in FFDA ponds is not very high, yield rates are increasing in almost all the states.

On one hand, the GOI took upon itself the major responsibility for the development of pond and tank fisheries in almost all the States through its Fish Farmers' Development

[45] *Ijara* pronounced as *ijarah* is related to the usufructs of assets and properties. In this sense it means 'to transfer the usufruct of a particular property to another person in exchange for a rent claimed from him.' In this case, the term *ijara* is analogous to the English term leasing.

Agencies and Total Aquaculture Technology Centres (TATC). On the other, State Agricultural Universities too strengthened their research capabilities, and built up infrastructure facilities for seed production, demonstration and training for effective technology transfer. The newly developed technology has been considerably updated over the years and thoroughly adapted to major agro-ecological zones existing in different parts of the country.

The National Fisheries Development Board (NFDB), India, located in Hyderabad, was formed by a decision of the Union Cabinet on June 16, 2006. It was established on the assumption that rural livelihoods can be improved by connecting the "large untapped potential in fisheries and aquaculture" to the vast reservoir of fish consumers in the country, through "adoption of new and innovative production technologies". The NFDB aims at increasing fish production from aquaculture and culture-based fisheries: enhancing the value of fish output through better post harvest practices; and providing effective marketing facilities and employment opportunities. In the process, the NFDB seeks to ensure better returns on investment to fish farmers, in particular, and greater availability of quality fish to the consumers. Mathew (2006, 4943) feels that NFDB does not really address issues that persist in fish production, processing and marketing; neither does it engage in sustainable utilisation of fishery resources through far-sighted institutional and legal reforms. It is felt that the wisdom of creating a top-heavy structure with poor stakeholder consultation and participation and without incorporating the right lessons from history under the assumption that what really matters is the adrenaline of technology and capital, is questionable. The NFDB has often been compared to the NDDB. But, it should be recognised that the NDDB laid as much emphasis on building cooperatives in production, processing and marketing and ensuring an incentive price to primary producers of milk, as on promotion of technology and enhanced production of milk.

Production of Fish

There has been phenomenal growth in fish production in India during the past five decades. The total fish production in the country increased from 0.752 m ton in 1950-51 to 5.657 m ton during 1996-2000. Of this increase, 2.834 m ton came from marine fisheries. The average annual growth rate in fish production during the period from 1955-56 to 1999-2000 was 7.48 per cent. The growth recorded in the marine and inland sectors were 5.07 per cent and 2.46 per cent per annum, respectively, during the period 2002-03. The average annual growth rate from 1990-91 to 2002-2003 was 4.45 per cent (Dehadrai and Yadav 2004, 43).

Looking at the data in Table 7.1 from the view points of eastern and southern regions, it is found that the contribution of eastern states in respect of inland fish production is much higher than that of the four south Indian states. During the last 10 years the four east Indian states have contributed 51 per cent to 59 per cent in country's inland fish production. The contribution of the four southern states on the other hand, has varied between 19 per cent and 25 per cent. Together, these eight states contribute

74 per cent to 79 per cent of country's inland fisheries, which clearly indicates the predominant position of these eight states in India's inland fisheries. It is ironical that while in respect of tank irrigation about two third of area is irrigated by the four south Indian states and about one third of the area is irrigated by four east Indian states, in respect of inland fisheries the picture is just opposite. Although, not all inland fish production comes from tanks/reservoirs, the same contribute a great deal in the production of inland fisheries. An interesting trend emerging from the data is that while in case of east Indian states, there was a consistent decline in the percentage contribution to national fish production over the years, in case of south Indian states, there has been an increase in contribution over the years. The increase was so much so that the contribution of east Indian states went down to about 51 per cent in 1999-2000 from 59 per cent in 1990-91. Here, it is notable that this decline took place despite a consistent increase in fish production over the years[46]. Among the states which contribute most to growth in fish production are West Bengal and Bihar from the east and Andhra Pradesh from the south. The contribution of West Bengal in relation to the country's total production has varied from 31 per cent to 36 per cent, followed by Bihar, whose contribution went up from 9 per cent to 11 per cent and then Andhra Pradesh, whose contribution went up from a mere 8 per cent to 13 per cent during the last 10 years.

Among the Asian countries, India ranks second in aquaculture and third in capture fisheries. The growth in marine fish production over recent years has been rather slow (an average annual growth 2.2 per cent during the period from 1991-1992 to 1999-2000) as compared to inland fisheries (average annual growth of 6.55 per cent during the corresponding period).

The inland fisheries have shown a significantly higher growth rate during the last three Five Year Plans as compared to that in marine fisheries. Fish production from inland fisheries (including aquaculture) has increased from 1,536.25 tons in 1990-1991 to 2,822.70 tons during 1999-2000 as shown in Table 7.1. Presently, fish catch from inland waters contribute about 49 per cent to the total fish production, while the rest comes from marine water (Dehadrai and Yadav 2004, 46). The pattern is almost same as that existed at the time of partition. However at that time, a Government of India committee report on fisheries, prepared as a part of the post war rehabilitation planning, pointed out that while in India, freshwater fisheries produced less than half the quantity of fish produced by marine fisheries, the value of freshwater fisheries was more than twice the value of the marine catch (GOI 1948, 5).[47]

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[46] For instance, fish production in the four East Indian states in 1991was 0.9 million tones it rose to 1.4 million tones in 1999-2000**.**

[47] The reference has been taken from Reeves (2002), who mentions that the figures (inland figures first) were as follows: production - 62.6 lakh maunds compared to 116.7 lakh maunds; value - Rs 742.3 lakh to Rs 302.7 lakh.

Table 7.1: Inland Fish Production in Selected States

(in '000 Tonnes)

	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
Eastern India										
Bihar	159.93	184.97	164.07	200.71	195.37	239.58	249.78	208.54	202.29	254.74
	(10.41)	(10.82)	(9.17)	(10.06)	(9.32)	(10.68)	(10.49)	(8.55)	(7.88)	(9.02)
Orissa	83.29	95.03	93.76	128.36	134.77	134.55	143.50	153.43	159.90	135.30
	(5.42)	(5.56)	(5.24)	(6.43)	(6.43)	(6.00)	(6.03)	(6.29)	(6.23)	(4.79)
Uttar Pradesh	104.26	113.31	121.43	132.37	139.90	145.70	149.43	160.02	183.03	192.71
	(6.79)	(6.63)	(6.79)	(6.63)	(6.67)	(6.50)	(6.27)	(6.56)	(7.13)	(6.83)
West Bengal	555	592	612	653	669.22	740	765	786.02	823.50	865.70
	(36.13)	(34.63)	(34.21)	(32.72)	(31.92)	(33.00)	(32.12)	(32.24)	(32.10)	(30.67)
Sub Total	**902.48**	**985.31**	**991.26**	**1114.44**	**1139.26**	**1259.83**	**1307.71**	**1308.01**	**1368.72**	**1448.45**
	(58.75)	(57.64)	(55.41)	(55.85)	(54.33)	(56.18)	(54.91)	(53.65)	(53.34)	(51.31)
South India										
Andhra	136.25	138.88	151.48	167.05	195.13	203.97	207.31	226.31	260.83	380.58
Pradesh	(8.87)	(8.12)	(8.47)	(8.37)	(9.31)	(9.10)	(8.71)	(9.28)	(10.17)	(13.48)
Karnataka	53.00	64.34	65.70	74.63	70.29	87.35	101.65	95.28	95.00	126.65
	(3.45)	(3.76)	(3.67)	(3.74)	(3.35)	(3.90)	(4.27)	(3.91)	(3.70)	(4.49)
Kerala	36.36	40.37	38.16	45.48	48.19	49.59	52.10	57.51	65.86	73.90
	(2.37)	(2.36)	(2.13)	(2.28)	(2.30)	(2.21)	(2.19)	(2.36)	(2.57)	(2.62)
Tamil Nadu	82	84	98	107.20	108	108	109	109.50	110.20	112
	(5.34)	(4.91)	(5.48)	(5.37)	(5.15)	(4.82)	(4.58)	(4.49)	(4.29)	(3.97)
SubTotal	**307.61**	**327.59**	**353.34**	**394.36**	**421.61**	**448.91**	**470.06**	**488.60**	**531.89**	**693.13**
	(20.02)	(19.16)	(19.75)	(19.76)	(20.11)	(20.02)	(19.74)	(20.04)	(20.73)	(24.56)
Grand sub total (E+S)	**1210.09** (78.77)	**1312.90** (76.81)	**1344.60** (75.16)	**1508.80** (75.61)	**1560.87** (74.44)	**1708.74** (76.20)	**1777.77** (74.65)	**1796.61** (73.69)	**1900.61** (74.07)	**2141.58** (75.87)
Total States & UTs	**1536.25** (100)	**1709.33** (100)	**1789.05** (100)	**1995.50** (100)	**2096.76** (100)	**2242.32** (100)	**2381.43** (100)	**2438.04** (100)	**2565.81** (100)	**2822.70** (100)

Values in paranthesis are in percentage.

Source: Planning Commission, GOI, 2001 (Adapted from Dehadrai and Yadav, 2004, pp. 47-48)

Bihar

During the reconnaissance and later during the tank survey one obvious fact that came to light was that a large number of old private/zamindari tanks were taken over by the Fishery Directorate. This was mainly on account of a shift in the governmenment policy. The Government of Bihar of late had decided to make use of all categories of tanks for pisciculture even at the cost of irrigational uses. Since the government believed that fish farming was more beneficial than its irrigational use, the erstwhile irrigation tanks were not considered to be improved for irrigation purposes. Keeping in mind the

fact that the fish produce increased with passage of time on account of biological reasons whereas agricultural farming decreased year after year. Consequently, the emphasis had shifted to fisheries and the banana cultivation.

Although water turns more fertile in *jalkars*, yet taking out water for irrigation hampers fish cultivation[48]. However, if figures relating to *jalkars* during the year 2004-05 and the subsequent year are taken in to consideration (table 7.2), it is found that the number of *jalkars* decreased by 362 in 2005-06 in comparison to the pervious year but the water spread area increased by 1287.53 ha. This could have been possible because of renovation of old tanks. However, this can be verified if table 7.3 is examined. As per this table, the enhancement through renovation in 2005-06 is only to the extent of 33.98 ha.[49] This clearly means that there is no way to explain an enhancement of 1287.53 ha of water spread area during 2005-06. The problem does not end here because the moment data relating to fish production in table 7.2 is examined; it is found that here again the fish production has decreased by 12.02 MT. This indicates that there is lack of consistency in maintaining and recording the data regarding tanks by the government agencies and, though there is no data to prove it, there is wide spread corruption in respect of excavation of new tanks, renovation of old tanks and yields of fish production from these tanks.

Table 7.2 Fish Production in Jalkars*

Sl. No.	Districts	No. of Jalkars		Water Spread Area (ha.)**		Production of Fish ('000 MT)***	
		2004-05	2005-06	2004-05	2005-06	2004-05	2005-06
1.	Patna	975	973	1207.43 (1.24)	1204.23 (1.24)	8 (6.64)	8.5 (7.05)
2.	Nalanda	823	818	2175.09 (2.64)	2089.34 (2.55)	4 (1.83)	5.05 (2.41)
3.	Jamui	163	160	1373.33 (8.42)	1351.62 (8.44)	2.12 (1.54)	2.33 (1.72)
4.	Bihar (Total)	28616	28254	55598.07 (1.94)	56885.60 (2.01)	279.53 (5.02)	267.51 (4.70)

Source: Directorate of Fisheries Department, Government of Bihar, Patna

* *Jalkar* means Tanks, *Pokhar, Ahar*, river, water course, *Chaur, Dhav*, reservoir lake, ox-bow lake etc under fisheries department in which *makhana*, *singhara* and fish is reared

**Figures in brackets denote the water spread area (in hectares) per *jalkar*

***Figures in brackets denote the production (in Metric ton) of fish per hectare of water-spread area

In Table 7.2 latest figures of fish production and tank renovation work undertaken by the fisheries department of Bihar government for the districts under our survey as well as that of the state as a whole are provided. In Table 7.3 the data relating to excavation of new tanks and renovation of old ones are provided.

[48] The Director Fisheries Mr. Raghunandan Choudhary expressed these views in an interview conducted by Dr. R. K. Verma on 16-6-2006.

[49]The data was taken from the files of the Fisheries Directorate which was not consolidated and renovation figures relates to the maintenance work undertaken by the Fisheries Department only

Table 7.3 Maintenance Work Undertaken by the Fisheries Department

Sl. No.	Districts	New Tanks excavated		Renovation of old tanks (in ha.)	
		2004-05	2005-06	2004-05	2005-06
1.	Patna	Nil	Nil	Nil	2.13
2.	Nalanda	Nil	Nil	Nil	0.25
3.	Jamui	Nil	Nil	Nil	Nil
4.	Bihar (Total)	46.09	Nil	35.04	33.98

Source: Directorate of Fisheries, Government of Bihar

Table 7.4 below shows area irrigated by tanks (inculding *ahar pynes*) in the state of Bihar during corresponding periods of research. It also reinforces the declining trend in share of irrigation from tank sources.

Table 7.4 Area Irrigated by Tanks in Comparison to Total Area Irrigated

Year	Total Area Irrigated ('000 ha)	Area Irrigated by Tanks ('000 ha)	Percentage of Area Irrigated by Tanks
2004-05	4768.24	431.21	9.04
2005-06	4830.56	332.56	6.88
2006-07	4926.25	332.56	6.75

Source: Government of Bihar, Economic Survey 2009-10, Department of Finance, Patna 2010

Shift in Policy Context

Keeping in view the high priority given to fisheries, the Bihar government has passed a legislation which restricts taking out water for irrigation from the *jalkars* and fishing during the two month period from 15 June to 15 August every year as this is the breeding season and it is believed that fishing during this period would have adverse impact on the fish production as population of egg-bearing fishes in the tank would decline affecting the future fish yields. Mr. Choudhary argued that one healthy fish bears nearly ten thousand eggs[50].

Taking out water for irrigation from *jalkars* after a certain level (minimum of five feet deep water) has been restricted by the law.[51] Section 12(vi) of the law mentions that drawing water from tanks, reservoirs and ponds for irrigation shall be prohibited. Accordingly, district fisheries officer may order stoppage of water withdrawals for irrigation when the water level nears five feet in these *jalkars. Makhana*, *singhara* and fish is reared in these water bodies.[52] The law makes provisions of punishment for

[50] In Kerala the issue has generated a controversy over the ban on fishing during these months. An ongoing study shows that this is largely a wrong perception, and breeding takes place at some other time

[51] Bihar Fish *Jalkar* Management Act 2006 recently passed by Bihar Legislature in April, 2006

[52] Section 2 of the Act defines as such

violating the fishing prohibitions, disfiguring of structures of such water bodies, encroaching tank area and water drawals. Arrests of violators and imposition of fines have been envisaged under section 17 of the law.

Although the Act is silent on the issue of responsibility for maintenance of these water bodies, it makes provisions to entrust the fishermen (organized as fishermen committees consisting of trained fishermen of the locality) with the responsibility as conditions of settlement of fishing contract. There is a provision of creating a 'managing committee' at district level consisting of District Magistrate, Deputy Development Commissioner, fisheries officials of the concerned district and two of the beneficiaries nominated by the government of Bihar. The committee has the power to hand over tanks to beneficiary fishermen. The selection of such fishermen is done in such a way that every member beneficiary gets a share of at least one acre of *jalkar* area. These fishermen are required to deposit the rent in advance.

The data obtained from survey (Table 7.7) reveals that the tanks in Bihar have been more productive in terms of income from pisciculture than those of both West Bengal and Jharkhand. Out of 17 surveyed tanks in the districts of Patna and Nalanda in Bihar, six were found either having no fishing or too little to be commercial. In the rest eleven tanks, six were such that the value of fish production was more than one lakh; three were such that the value of fish production was in the range of Rs. 51,000 and Rs. 1 lakh, and among the rest two, value of production from one was in the range of Rs. 25,001 and Rs. 50,000 and the other was below Rs. 10,000.

Jharkhand

According to the Directorate of Fisheries GOJ, as in August 2006, the total number of tanks in Jharkhand were 28,735 having an area of 29,900 ha, indicating average area of about one acre per tank. Of these, 12,229 (43 per cent) were government tanks under FFDA, having a total area of 9600 ha (32 per cent of the total). It thus clearly indicates that the tanks under FFDA are much smaller in size compared to private tanks. In addition to these tanks, the state has 104 reservoirs, which have a gross water spread area of 94,000 ha, making an average of 904 ha per reservoir. There are 66 fishermen co-operatives in the state to guide, aid and assist fishermen.

Policy of the Government

The government of Jharkhand finds pisciculture a potential sector for strengthening the economy of rural Jharkhand, creating opportunities of self-employment in the rural areas and fulfillment of nutritional requirements of the poor. Thus the policy changes that have been brought out in the fisheries sector include: encouraging the use of modern technology in tanks and other water bodies for fish cultivation; providing financial support for renovation to tanks, construction of new tanks and other such inputs; providing subsidy for construction of 30 decimal tanks on the private land of tribal farmers; ensuring joint ventures for enhancement in fish production and increase the fish productivity from 12 quintals to 30 quintals per ha per year; and providing insurance policy for fishermen.

How these policies get translated in reality can be seen to some extent from the data relating to construction of 0.3 acre tanks. As per the data (provided in Table 7.5), from 2001 to 2005, there was a progressive increase in the number of such tanks constructed at the state level, recording a 182 per cent growth rate. While the growth rate slowed down each successive year, in 2006 this received a set back as a major decrease was registered that year.

Table 7.5 Construction of 0.30 acre (30 Decimal) Subsidy Tanks

Sl. No.	District and State		Number of tanks			
		2001-02	2002-03	2003-04	2004-05	2005-06
1.	Ranchi	3 (4.5)	0	10	20	20
2.	Plamau	5 (7.5)	25 (13.4)	6	30	25
3.	Gumla	-	5 (2.7)	0	35	20
4.	Jharkhand	66 (100)	186 (100)	206	271	245

Figures in parentheses denote the percentage.

Source: Directorate of Fisheries, Government of Jharkhand, April, 2006. The prescribed expenditure of such tanks is between Rs. 45,000 and 50,000 and in addition a grant of Rs. 2,500/3,000 has been prescribed for the initial input.

Table 7.6 Transfer of Tanks to Fisheries Department

Sl. No.	District and State	No. Tanks transferred	Area of the tanks (Ha)	Revenue before transfer (in Lakh Rs.)	Secured Revenue under Fisheries (2005-06) in lakh
1.	Ranchi	559 (4.7)	534.31 (5.6)	3.06 (0.14)	6.25 (0.12)
2.	Palamau	244 (2.1)	205.5 (2.1)	1.24 (0.05)	0.0
3.	Gumla	367 (3.1)	232.8 (2.4)	3.03 (0.14)	3.91 (0.07)
4.	Jharkhand	11765 (100)	9613 (100)	2103 (100)	5382 (100)

Figures in parentheses denote the percentage

Source: Directorate of Fisheries, Government of Jharkhand, Ranchi (Upto April, 2006).

The data concerning transfer of tanks to the FD is provided in Table 7.6. It shows that a total number of 11,705 tanks constituting a total area of 9613.2 ha have been transferred to the FD. The area per tank comes to 0.82 ha. Our study districts however, do not show any significant role in this respect because while the three districts together represent about 14 per cent of the total 22 districts of the state, in case of transfer of tanks to the FD the combined proportion of three districts comes to about 10 per cent each both in respect of number of tanks and the area involved.

The reason why the state government is keen to transfer tanks to the FD becomes obvious when the data in Table 7.6 in respect of generation of revenue (before and after the transfer) is examined. It is found that the revenue has more than doubled after the transfer representing a hike of 64 per cent. However the same does not hold good for our study area, where the combined increase for the three districts comes to 28 per cent. Among the districts, the highest increase was found in Ranchi where the increase is 51 per cent, while Gumla showed an increase of 29 per cent and Palamau a loss of 100 per cent after the transfer. What is however inexplicable is the data pertaining to fish production in the three districts during 2005-06. The data in Table 7.7 clearly show a much-improved fish production in 2005-06 in comparison to past years, including in Palamau. Therefore, there is no logic in the data presented in Table 7.6 which shows that revenue from fish production in Palamau has become nil in 2005-06. The two tables taken together for the state as a whole show that while the increase in fish production goes up by 22 per cent, the increase in revenue as already mentioned is to the extent of 64 per cent.

Table 7.7 Fish Production in Surveyed Districts and Jharkhand

Sl. No.	Districts and State	Year and Fish Production (in Mt Tons)				
		2001-02	2002-03	2003-04	2004-05	2005-06
1.	Ranchi	1400 (10)	1600 (10.7)	1800 (9.9)	2400 (8.8)	3700 (10.6)
2.	Plamau	250 (1.8)	250 (1.7)	300 (1.7)	775 (2.9)	1000 (2.9)
3.	Gumla	1200 (8.6)	1200 (8)	1400 (7.8)	2100 (7.7)	2600 (7.4)
4.	Jharkhand	14000 (100)	15000 (100)	18050 (100)	27125 (100)	34970 (100)

Figures in parentheses denote the percentage calculated on the basis of data

Source: Directorate of Fisheries, Government of Jharkhand, Ranchi (Up to April, 2006)

The data from the study districts (Table 7.7) reveals that fish is not as much part of the food habits of tribal people as in West Bengal. However, pisciculture has been a considerable source of income in Jharkhand. Unlike West Bengal, fish production in our study villages in Jharkhand is more lucrative, accruing greater income. The fishery

tanks are either government owned tanks that were earlier *zamindari* tanks, or are purely private tanks. Out of the eight government tanks studied, six belong to the fisheries department and one each to minor irrigation and revenue departments. Pisciculture in these tanks of Jharkhand is practiced in the following ways: (i) government leasing out tanks to private contractors for fishing; (ii) tank owners cultivating fish on their own; and (iii) owners leasing out their tanks to private contractors.

West Bengal

Fish, an important source of nutrition, is an integral part of daily diet in Bengal. In all the auspicious ceremonies of social and cultural importance, the fish is considered to be an essential item in food served. Besides, pisciculture has been an important source of income in the state. West Bengal has witnessed a considerable growth in fish production from inland sector, mainly from tank fisheries. The fish production in the state has gone up to 988,000 ton in 2003-04 from just 340,000 ton in 1980-81 in inland sector alone (GOWB, Economic Review 2003-04; Statistical Appendix 2004).

Four patterns of undertaking pisciculture were found in our study area. They were as follows: (i) one year/three years contract, leased out by the owners of the tanks either on negotiated cash or kind; ii) shared farming of fish in which 50 per cent of the production was given by the farmers to the tanks owners, iii) the entire fish produce was consumed by the owners themselves; and, iv) pisciculture by the panchayat body. In case of the third pattern, the amount of fish or value of the produce could not be assessed. In case of shared farming also, it is difficult to estimate the actual amount of fish produced. During our survey it was found that the tank owners of Lagda village had no option but to lease out tanks for pisciculture to the *bauris* or fishing castes (SCs) as they held the *barga* rights[53]. The rent fixed for pisciculture was divided among the owners in the proportion of *'anshas'* or shareholding of the individual owners in the tank.

Bankura district has almost similar pattern of pisciculture with a minor difference, (i) pisciculture by 16 *ana* (100 per cent) tank committee (committee for the entire tank), (ii) tank leased out (contracted out) by the owners for pisciculture on annual rent, (iii) tank contracted out by government to the private party for fishery production; iv) pisciculture by the panchayat body. The multiple owners of tanks got their trivial shares of fish produce at the time of harvesting, which could not be measured as each owner got only consumable amount of fish.

Moira *bandh* in Bankura gets water from Kangsabati canal, as a result the tank does not go dry in summer. Sufficient water remains in the tank in season too, rendering fish cultivation profitable. The tank was renovated by TID around 1985 and leased out for fish cultivation. At present a person named, Paltu Gorai is the contractor who produces

[53] Barga rights refer to land reforms initiative taken by the left front government of West Bengal for recording the names of sharecroppers (bargadars) while avoiding the time-consuming method of recording through the settlement machinery. It bestowed on the bargadars, the legal protection against eviction by the landlords, and entitled them to the due share of the produce. Operation Barga was launched in 1978 and concluded by the mid 80's.

over 20 quintals of fish, value of which amounts to over Rs. 60,000. Paltu is considered a powerful man. In Tatir *bandh*, the fish cultivation is done on shared basis, i.e., the fish contractor would give 50 per cent of the catch to the *ansha* holders in proportion to their share in the tank. The exact income could not be ascertained. However, it is estimated that more than 10 quintals of fish is produced in Tatir *bandh.* Purno *pukur* in Deol Beria village was renovated by the panchayat in the year 2000. The banks of the tank were repaired with cement lining and the main purpose of repair was pisciculture. The tank ownership is peculiar viz., the eight *ana ansh* (50 per cent share) is held by four families of *khan* caste from the Muslim community and the rest eight *ana ansh* is held by the whole village. Every villager receives a trivial amount of fish to complete 50 per cent of the total produce and rest 50 per cent of produce is taken by the four *khan* families as they are the traditional owners of the tank.

Lal *bandh* tank having five acres of water spread area was renovated in 2004-05 on a large scale. Here also fish is cultivated by the *khans* of Deol Beria on contractual basis. The produce is marketed through *bazaar samiti*. The value of fish produced from the tank is estimated to be Rs. 50,000 annually. It was claimed that the Lal *bandh* village had introduced fishing in Bengal. Dharampur *bandh* is also a big tank and the villagers through the 16-*ana* tank committee practice pisciculture and market the produce. The value of fish it produces is about Rs. 20,000 a year. In the same village, there are two more tanks. Two 16-*ana* committees manage Mondal *pukur* and Nautun *pukur* specially meant for pisciculture, one each separately. In all such committees, *brahmins* hold the dominant offices. The income of the tanks is invested in community functions of the village, and not used for any individual benefits. The work carried out of the income earned from sale of fish are mainly of two types: (i) minor repair of bunds embankments of the tanks, (ii) religious functions such as *kirtan* (reciting prayer), construction and repairs of temples, and organizing folk music and drama. The religious collective efforts, it seems, are owing to the fact that *brahmins*, the worshiping high caste, mainly constitute the village. It is estimated that the Chand *bandh* of Gokulnagar, Indpur produces fish worth Rs. 25,000. Chand *bandh* was previously a private *bandh* of Chand and Dutta families. But since the inception of new panchayats raj system in 1978, it was taken over by the panchayat. The panchayat is responsible for maintenance of the tank and cultivation of fish.

In Birbhum too, pisciculture has been a characteristic feature of tanks. Earlier the tank owners themselves cultivated fish in the tanks and marketed the produce in large quantities. But now fishing is done by the panchayat. It is interesting to note that a sizable share of the produce is given to members of ST community who have settled around the tank. These ST settlers are supposed to look after the tank and get share in lieu of the duty they performed. It seems that these families had been enjoying *ghatwali*[54] tenures. The rest of the fish produce is marketed and income is used for buying *ponha*

[54] Ghatwali tenure is a kind of tenure system granted to Scheduled Tribes with martial traditions who had settled around the tank. In this system these settlers were expected to look after the tanks and get share in lieu of their duty.

Table –7.8: Average Annual Value of Fish Produced from the Surveyed Tanks

Sl. No.	State	Number of tanks having value of fish produce (in rupees)						Total
		None*	<10,000	11000 to 25000	25001 to 50000	50001 to 1 lakh	Above one lakh	
1.	West Bengal	10	10	3	4 (1,59,000)	4	-	31
2.	Jharkhand	1	7 (42,000)	3 (60,000)	3 (1.35 lakh)	1 (90,000)	2 (6.5 lakh)	17
3.	Bihar	6	1 (4,000)	-	1 (50,000)	3 (2.15 lakh)	6 (12.5 lakh)	17
Total		**17**	**18**	**6**	**8**	**8**	**8**	**65**

Note: The figures in brackets show the total value of the fish produced in the tanks falling under the respective categories. The table does not include our tank survey data in respect of Orissa and in case of Jharkhand, data is confined to tanks surveyed by July 2005 in Ranchi and Gumla distrcts.

(fish seeds) and maintenance of structures. Though the exact amount of produce or income from it could not be ascertained, the income must be sizable. As per rough estimates the value of fish produce from the tank would be around Rs. 70,000.

Domestic and other Purposes

The people are closely connected to the tanks owing to their domestic uses. Historical account reveals that people used tanks for bathing, cleaning, cattle cleaning, and even drinking. The entire kingdom of Bishnupur during Malla *raja* and later periods depended on big *bandhs* of Bishnupur (discussed earlier) for drinking and bathing etc. This practice still continues. The domestic uses of tanks can be categorized into four: a) bathing, cleaning and drinking water, b) religious functions like worship of Gods and Goddesses and performing religious rituals at the *ghats*; c) performing last rites like burning dead bodies along the banks; and, d) cleaning of cattle.

The use of tanks for domestic purposes is not restricted to anyone in the entire region. One cannot find the discriminatory treatment on the basis of any caste or class. However, in certain cases, particularly fish contractors impose some restrictions if a particular use of tank is found to hamper fish cultivation. There has been a contention between the high caste (*brahmins*) tank owners and scheduled castes *bauri* fish contractor in Lagda village of Purulia district on the issue of using tank-*ghat* as the place of performing last rites. It is reported that the *bauris*, who cultivate fish in the Burhi *bandh* on contractual basis, opposed the practice. After a great fuss, the high caste members were prevented from using the tank for performing last rites. The tanks in Patna and Nalanda district of Bihar were used for domestic purposes. In Salarpur village of Patna district, the nearby residents have encroached upon the government-owned *khatas* (tanks) for fishing and domestic use. They do not allow people from other localities in the village from taking bath and cleaning cattle.

The scenario was no less different in Orissa and tanks were being used for all kinds of human and cattle needs. The most unforgettable memory of Pant was that of the Narayan Sagar in Bolangir and Udaya Sagar in Kalahandi district. The ancestor of the erstwhile raja, a 72-year-old graduate was still living in an old, sprawling palace complex in the village/pachayat/block Loisingha, and had constructed the first tank in that area. The tank was spread over an area of 130 acres. During the visit, all sides of the tank were found occupied by men, women and children, bathing, washing clothes and utensils. Some others were engaged in ritualistic prayers and some were preparing their nets and boats for fishing. In fact the whole scene put up a fair-like/festive atmosphere. It looked as if the whole town of Loisingha had descended on the tank site. An important noticeable point was that there was clear segregation of the crowd on gender grounds, except in the case of children. In the lower reaches of the tank, a large number of farmers were found to be engaged in irrigating fields or repairing the channels that took water to their fields.

The Udaya Sagar tank was a huge one, and was spread over an area of 200 acres. As the author had reached this tank site in the afternoon, a big crowd around the tank was missing. Nevertheless, women were seen involved in various domestic activities. Some men were bathing or guarding some of the many pumps located on various spots on the embankment around the tank. A unique aspect of this tank, unlike the former one, was that the bathing location for women was completely invisible from other places around the tank.

The storage of water in tanks also enables cultivation of water borne fruits like *singhara* and *makhana*. *Singhara* is another edible and nutritional fruit found in the entire eastern region and is grown naturally in water bodies. Those tanks that can retain water throughout the year can be used for cultivation of these fruits.

In West Bengal, Jharkhand and Bihar, cultivation of *singhara* is a common practice. Although no tank in West Bengal under survey was found having *singhara* cultivation, in Jharkhand and Bihar the surveyed tanks were found to be cultivating *singhara* and people were accruing income out of it. In Jharkhand one tank named Burha *bandh* at Danadih village had *singhara* and lotus cultivation. It was interesting to note that the tank owners did not restrict anyone from plucking lotus or *singhara.*

In Bihar, *makhana* is grown in the tanks of north Bihar plains, particularly in Darbhanga, Madhubani and Samastipur districts and *singhara* is grown in Nalanda and Patna districts.

Tanks can also be developed as places of tourist attraction. The big ancient/ medieval tanks at Bishnupur named Jamuna *bandh*, Lal *bandh* etc. are still places of tourist attraction. During the field visit to Bishnupur in January 2004, the authors saw a number of tourists, but were greatly enthused by a British scholar who told them that he liked the place so much that he visited the place every year around that time. The researchers were informed that very big tanks like Jamuna *bandh* could be developed for boating and other recreational activities[55]. In Jharkhand, *Bada talab* at Bundu has been undertaken by Central Government for its improvement as a tourist place.

[55] Interview with S.N. Chattopadhayay in January 30, 2005.

CHAPTER - VIII

INTER STATE VARIATIONS AND SUMMING UP

Inter-State Comparison – Part - I

Looking at the origin of the tanks in the states where the survey was carried out (Table E-1), 19 per cent of the tanks in the four eastern states belonged to the ancient/ medieval period. However the largest proportion of tanks (60 per cent) belonged to the British period. Twenty two per cent of tanks were built after Independence. Of these only about 4 per cent were built during the last sixteen years. This findings of ours does not auger well particularly because in almost all the studied states, tank construction and rehabilitaion was being done in a big way under GOI sponsored watershed programme.

In terms of origin, it seems the respondents have not distinguished ancient period clearly from the British period. If the two categories are merged, it can be seen that that Bihar has the largest proportion of tanks belonging to the ancient/British period (95 per cent). About 81 per cent tanks in Orissa, 77 per cent in West Bengal, and 70 per cent in Jharkhand also come under the same category.

Based on the ownership of the tanks (Table E-2) it is found that about 44 per cent of tanks are owned by government, closely followed by 37 per cent, owned/occupied/ captured by individuals. This is followed by 19 per cent, owned by panchayats. If we take a close look at these categories, it can be seen that there is great deal of variation across states.

In case of government tanks it is found that their proportion is as high as 64% in case of Jharkhand, immediately followed by Orissa (62 per cent). On the other hand, in West Bengal, only about 7 per cent of the tanks from the survey sample belonged to this category. In respect of panchayat owned tanks, it is found that their proportion is again quite high in Orissa (34 per cent), whereas they constitute a mere 9 per cent of the sample tanks in Jharkhand.

As regards private tanks, they constitute 64 per cent of the surveyed tanks in West Bengal, and they were of substantial portion of the tank samples in both Bihar (40 per cent) and Jharkhand (30 per cent). On the other hand, only about 5 per cent of the tanks surveyed in Orissa belong to this category. However when it comes to the question of accessibility of these tanks (Table E-3), about 83 per cent of tanks are open to all, while

about 10 per cent are accessible to only owners and about 7 per cent have some other kind of restrictions. Looking at this data in relation to the fact that 37 per cent of tanks are privately owned/possessed or captured, it is clear that even in such tanks, non-owners do not have any accessibility problems.

As far as the size of the tanks is concerned (Table E-4), it is found that the largest proportion of tanks across states are in the size category of 2.5-10 acres (36 per cent), followed by those having area less than 2.5 acres (32 per cent) and the proportion of tanks in the size category of 11-20 and 21-50 acres is 9 per cent each. It is found that beyond this size as we move to the higher size categories, their proportion goes on decreasing. This becomes obvious as only 8 per cent of the tanks fall in the size category of 51-100 acres and only 5 per cent of the tanks in the size category of above 100 acres. However, there are inter-state variations and it is found that while Orissa had a high proportion of large sized tanks, Jharkhand, West Bengal and Bihar have a high proportion of smaller size tanks, particularly in the size category of below 2.5 acres and 2.5-10 acres. While about 52 per cent of tanks in Orissa are of size above 50 acres; 90 per cent of the tanks in Jharkhand, 77 per cent of the tanks in West Bengal and 60 per cent of the tanks in Bihar are of size below 10 acres.

The estimates of net area irrigated per tank and irrigation efficiency of tanks are provided in Table E-5. The figures reveal that 105 tanks across four states irrigate a net area of 4061 acres that comes to about 44 acres per tank. The irrigation efficiency of tank water comes to about 2.5 acre irrigated field area per acre of tank area. This means that one acre of tank area irrigates about two and a half times its size. However, this figure is not representative of all states and is highly influenced by the condition in Bihar and Orissa as the tanks of these two states irrigate nearly 75 per cent of the total irrigated area of all four states. The ratio of irrigated area in relation to tank area varies across states, and is highest in Bihar where it is 2.9 followed by Orissa with 2.8 and then West Bengal with 2.6. The lowest area irrigated per acre of tank area is found in case of Jharkhand with a ratio of 1.5.

Tables E-6 and E-7 provide data on season wise irrigation and modes of irrigation used by farmers across states. In all four states, major proportion of irrigation is done during *kharif*, followed by *rabi*. Summer irrigation from tanks form a meager portion of the gross tank irrigated area. Although across the board, *kharif* irrigation accounts for 62 per cent of gross irrigated area, the variation is between 51 per cent in Jharkhand and 66 per cent in Orissa. As regards *rabi* irrigation, the average for the four states comes to about 36 per cent. Again, there are variations across the states, from 31 per cent in case of Orissa to a maximum of 43 per cent in case of Jharkhand. Two points need to be explained here:

First, the main reason why Jharkhand lags behind other states during *kharif* but marches ahead of other states in case of *rabi* is that most of the tank irrigators in Jharkhand use pumps for irrigating their *rabi* crop, while during *kharif* most of them depend on surface flow. The low level of *kharif* irrigation in Jharkhand is on account of high

monsoon rains. The reason why West Bengal lags behind other states except Jharkhand in terms of irrigation during *kharif* season is the farmers' preference for *rabi* paddy. This is borne out of the fact that in West Bengal about 40 per cent of GIA is achieved during *rabi*. Since increasingly large number of farmers in West Bengal go for *boro* paddy, large scale *rabi* irrigation is becoming essential. During *kharif* also they grow paddy as in Jharkhand and depend on high monsoons. Irrigation is required only when rain fails. Since the monsoon rains in the state are adequate for *kharif* paddy and rains during the year of survey (2004-05) were normal, perhaps there was not much need of irrigation. As against this, irrigation is a must for *aus* (February/March to April/May) paddy. In contrast to West Bengal, *kharif* paddy is the most popular crop in Orissa, and it is on account of this, that *kharif* irrigated area goes up to as high as 66 per cent in this state.

Looking at GIA vis-à-vis modes of irrigation (Table E-7), it comes out very clear that while in the three states gravity flow irrigation is the most important mode of irrigation, in the case of Bihar energized lifting is very much in use. In fact, all kinds of pumping devices are used to cover 73 per cent of the GIA and only in about 21 per cent GIA, gravity irrigation is used.

One of the reasons for such a large use of energized pumping devices is that in south Bihar, more particularly districts of Patna and Nalanda have a flat topography compared to the other regions of eastern India where the topography is undulating. Due to flat topography, tank water has to be lifted as soon as its level goes down even a bit. Hence all kinds of pumps such as diesel and kerosene are used. The other reason is that all these districts form part of the alluvial plains having the finest aquifers and water level in wells during rainy season is very close to the ground level. In fact during the reconnaissance, Pant saw a large number of pumps working in the fields and found the Chinese diesel pumps to be most popular. The local farmers called it CD (Chinese diesel). In respect of other states, since the topography enables a great deal of water to flow to fields by gravity owing to the fact that they are generally located lower down the reaches, a large area is irrigated by flow irrigation. This aspect becomes obvious as about 67 per cent of GIA area in West Bengal, 59 per cent in Jharkhand and 58 per cent of GIA area in Orissa utilizes gravity flow for irrigation.

As regard manual irrigation, although only 4 per cent of GIA is covered through this mode of irrigation, Bihar again tops the list of states as over 6 per cent of GIA in Bihar is irrigated manually. Again the main reason of greater prevalence of this mode in Bihar than in other states is the flat topography and high water level in the tanks. During the field reconnaissance it was observed that tanks/*khatas/pynes* were brimful with water but it still required water to be lifted by a couple of feet. The farmers were found to be using a variety of traditional water lifting devices such as *karing, latha-kundi* and swing baskets requiring a great deal of human power.

Table E-8 provides data on the tank area in different states. It needs to be explained here that although 119 tanks from four states were surveyed, the data on this aspect was

available for only 91 tanks and only for a small proportion of the tanks in Orissa and Bihar. The total area of these 91 tanks was about 1428 acres giving an average size of 16 acres per tank. The figures varied across states. The largest tanks were found in Orissa where the average size of the tank was 59 acres. The smallest tank was found in West Bengal with an average area of 6.4 acres, preceded by 6.6 acres in case of Jharkhand. In the case of Bihar the average size of the tank was 19 acres. The main reason for such a large size in Orissa was the sample included a number of MIPs. In the case of Bihar also, the focus of enquiry was the large tanks of Nalanda district that were found near the ruins of the ancient university.

Tables E-9a to E-9c deal with an important physical attribute relating to the performance of tanks during the three seasons of monsoon, winter and summer i.e., water storage depth. Across the states, the storage depth is largest during the monsoon and lowest during summer and this is on expected lines. The interesting aspect of examination would be, which state tanks have high depth and where the depth is low. Looking at the depth during rainy/monsoon season it is found that across the states, tanks are distributed more or less evenly across all depth categories. To elaborate, on an average, 29 per cent of the tanks fall in above 10-feet depth category. The proportion is highest in case of Orissa with about 38 per cent of tank falling in this category. Orissa is followed by Bihar where 35 per cent of tanks fall in this category. Whereas in West Bengal, about 23 per cent of the tanks fall in this category and in Jharkhand about 28 per cent of tanks find a place in this category.

Another way of looking at this aspect of the tank would be to see which state has the highest proportion of tanks falling in each depth category. First of all, largest proportion of tanks in the 7.5-10 feet depth category is from Jharkhand (47 per cent) (Table E-9a). In the 5-7.5 feet depth category, Bihar tanks have the largest proportion of 45 per cent. The data further shows that all Bihar tanks are in this category or in the higher depth categories. In other words, it means that, by and large, Bihar tanks are of larger size when compared to West Bengal and Jharkhand. The same is true of Orissa also where over 90 per cent of tanks fall in these categories.

In case of West Bengal the largest proportion of tanks (36 per cent) are found to be having a storage depth of 3-5 feet, as against the average of 14 per cent tanks of all the states taken together. More or less the same trend continues in winter and summer seasons with a lesser number of tanks finding place in higher depth categories in all states. The most dramatic effect of the change in seasons can be seen from this. While none of the tanks become dry in monsoon in any of the states, 5 per cent of the tanks turn dry during winter (Table E-9b) and 37 per cent turn dry during summer (Table E-9c). Of the tanks that turn dry during summer, the Bihar tanks make the largest proportion (55 per cent), followed by West Bengal (45 per cent) and Jharkhand with 30 per cent. Orissa has the lowest proportion of tanks getting dry (19 per cent) in summer. This more or less explains the higher storage capacity of tanks of Orissa. The devastating impact of high aridity on the storage of tanks is evident from the fact that in total 37 per cent of the tanks dry up during summer and another 12 per cent have a water level below 3 feet,

which render them unusable for irrigation. Thus, 49 per cent of the tanks across the 4 states are redundant in providing irrigation services (Table E-9c).

About 60 per cent of the tanks across the states receive their inflows from rains in the catchment. However, there are inter-state variations. While about 78 per cent of tanks in West Bengal receive their inflows from catchment rains, 45 per cent of Bihar tanks receive their inflows from rains. The next important source consists of a combination of sources such as rain + rivulet + another tank + flood water. Across the states, 21 per cent of tanks get their inflows from these combined sources. The proportion varies across states with 38 per cent in Orissa; followed by 35 per cent in Bihar; 17 per cent in Jharkhand. In the case of West Bengal, only 5 per cent of tanks get their filling through these combined sources. Another source is a combination of rains and canals. They provide inflows to about 6 per cent of the tanks across states. Looking at state-wise scenario, about 13 per cent of West Bengal tanks get water from this combined source, while in the case of Bihar and Orissa 5 per cent in each case get their inflows from this source. There are about 11 per cent tanks, which get filled up by "other sources". They mainly consist of artesian wells and drainage from villages. There are no such tanks in Orissa, while a negligible proportion of tanks in West Bengal are of this type. Nevertheless, 17 per cent of the tanks in Jharkhand and 15 per cent of the tanks in Bihar belong to this category.

As regards the responsibility for maintenance (Table E-11), it is found that the largest proportion of tanks (45 per cent) across the states is to be maintained by the government. The government tanks are of two types: those under the FD; and those under the MID. The rest (32 per cent) are expected to be maintained by the owners, which consist of both rightful owners and illegal occupants. The extent to which illegal occupants rule the roost can be understood from the fact that while in about 19 per cent of cases; the ownership is with the panchayats, only in about 14 per cent of cases panchayat is supposed to be responsible for maintenance. This aspect becomes more obvious if the next category denoted as "others" is taken into consideration. This category has about 10 per cent of tanks and consists of *defacto* occupants, fish contractors etc., and this phenomenon is noticeable mainly in Bihar where "public" resource might be converted into "private" resource by grabbing and encroachment.

One of the main reasons for the decline of tank irrigation is the deterioration in the physical condition of the tanks, in lieu of lack of proper maintenance. During the survey this question has been addressed, and maintenance was divided into two categories. The first one concerns the frequency of repair of embankment, and the other concerns the frequency of desilting. Looking across states, it is found that generally desilting takes place less frequently in comparison to repairs of embankments. The only exception in this regard are tanks in Bihar, where in 15 per cent cases, repairs of embankments and desilting takes place annually. These are the tanks which are managed by individuals who own the tanks or have occupied them, when cases are pending in courts for the settlement of the title.

Looking at frequency of repairs of embankments across states, it is found that in about 10 per cent cases, embankments are repaired annually. This happens in 19 per cent of the tanks in West Bengal, followed by 15 per cent in Bihar and about 5 per cent in Orissa and 4 per cent in Jharkhand. In largest proportion of tanks (31 per cent) embankments were repaired once in 2-10 years. Looking at the states, nearly 71 per cent of the tanks in Orissa find a place in this category. In addition, 26 per cent of the tanks in Jharkhand, 25 per cent of the tanks in Bihar and 16 per cent of the tanks in West Bengal also fall in this category. The next category consists of those tanks where embankments get repaired once in 11-30 years and about 12 per cent of tanks from the four states find a place in this category.

As regards the frequency of desilting, it is found that only in Bihar and Jharkhand, the tanks are annually desilted. While in Bihar 15 per cent of the surveyed tanks are desilted annually, the percentage is just four in Jharkhand. In other states whatever desilting takes place, it is done once in 2-10 years. About 24 per cent tanks across the states fall in this category. About 29 per cent of the surveyed tanks of Orissa are desilted once in 2-10 years. The percentage is 23 and 19 for Jharkhand and West Bengal, respectively. Only a small proportion of the tanks (5 per cent) in Bihar fall in this category.

The most disturbing aspect of tank maintenance is that in 47 per cent of the cases embankments are never repaired and in 55 per cent of the cases, tanks are never desilted. Looking at state level survey data, in 62 per cent tanks in Jharkhand, repair was never undertaken. The same applies to 58 per cent tanks in West Bengal and 35 per cent in Bihar. But the proportion is a meager 10 per cent in the case of Orissa. Coming to the scenario within each state, West Bengal has a very high proportion of such tanks (65 per cent), followed by Jharkhand (57 per cent) Bihar (50 per cent) and Orissa with 43 per cent.

As regards the funds for maintenance, in about 32 per cent of the cases it is reported that there is no agency to provide funds for the maintenance. In 68 per cent of the cases where some funds are available, the largest proportion (36 per cent) is from the government. In another 13 per cent cases, funds come from panchayat and community provides the labour. In another 4 per cent cases, government and panchayat together provide the funds. This feature is more rampant in West Bengal compared to other states as about 10 per cent of tanks in West Bengal get funds in this manner. In about 7 per cent of the cases, owners provide the funds. In Bihar the proportion is 20 per cent. Finally there is a category of "others" which provide funds in about 9 per cent of cases. The others constitute defacto occupants, fish contractors, NGOs etc. Looking at state wise details, it is found that in Orissa and Jharkhand, government is the main funding agency. In case of West Bengal, the panchayat and the state government appear to be the main funding agencies. In Bihar, the panchayat and the owner/occupant appear to be the most important funding sources.

The results of analysis of data relating to tank use pattern are presented in Table E-14. It can be seen that majority of the surveyed tanks (71 per cent) are of multipurpose.

About 11 per cent of the tanks are used exclusively for irrigation. Nine per cent of the tanks are exclusively for the domestic purposes, and another eight per cent exclusively for fisheries. The tank use pattern is also examined for all the tanks in the villages/ hamlets where the surveyed tanks are located. The size of this sample is three times bigger than the earlier survey sample. The results are presented in Table E-15. The first striking point that emerges from the results is that about 16 per cent tanks are found to be abandoned because the deterioration had reached a stage where no repair can be undertaken. The proportion of such tanks was as high as 44 per cent in West Bengal. In Jharkhand, 12 per cent of the tanks were dilapidated, while no such tanks in disuse are found in Orissa and Bihar. In village tank survey, we find lesser proportion of multipurpose tanks (68 per cent compared to 72 per cent in case of tanks in the sample survey). The proportion of tanks used for pisciculture and irrigation is lesser, but those used for domestic purpose was more or less the same.

The estimates of income accrued from tanks are presented in Table E-16. Overall it is found that a total of 73 tanks for which data is available put together generate a value of Rs. 43.9 lakhs. The value accrued per tank across the states comes to Rs. 60,200, but varies from a highest of Rs.1.13 lakhs per tank in Bihar to a lowest of Rs. 25,960 per tank in West Bengal. To assess the comparative performance of tanks in different states, the incomes per acre of tank area is estimated. It is found that in Bihar, tanks generate the highest income of Rs. 7,677 per acre of tank area, immediately followed by Jharkhand (Rs. 6,573 per acre of tank area), West Bengal (Rs. 2,806 per acre) and then lowest is for Orissa with an income of Rs.765 per acre tank area.

Tables E-17 and E-18 present figures of landholdings of different castes that are represented as beneficiaries of the commands of tanks surveyed. The figures are irrespective of the extent and the quality of irrigation received by them. The data in Table E-17 show that the HCs and the STs have larger holdings as compared to OBCs and SCs. Further, these averages are for tanks from all the states put together. But there is great deal of variation across the states. For instance, HCs enjoy the best position in Bihar where they constitute 17 per cent of the households, but own about 35 per cent of the land. In comparison to this, they are in the lower position in West Bengal. But even here their position is better than that of other castes. As regards OBCs, their position is comparatively better in Bihar than in other states. But in Jharkhand OBCs' status with regard to landholding is very bad. The land holding of SCs is poor in all states except Jharkhand where they constitute 5 per cent of the beneficiary household and also own about 5 per cent of village land. STs are found to be in the best position in Jharkhand where 43 per cent households own 53 per cent of village land.

A better idea of the comparative position of various castes vis-à-vis land holding in various states comes from Table E-18. Here, the average for all castes in all states comes to 1.11 acre. But there are differences in this respect. In Orissa the average size of the holding is 1.35 acre and is the largest. Bihar has the second position with an average holding size of 1.34 acres. Jharkhand comes next and the average holding is 1.10 acres. West Bengal is at the bottom position, with an average holding of 0.81 acres.

As regards the position of different castes across states, HCs with an average holding of 2.54 acres are better positioned in all states except West Bengal where their average holding is just 1.16 acres[56]. The HCs' average holding is largest in Jharkhand with 3.9 acres per household. The STs have an average holding of 1.24 acres. It is highest in Jharkhand (1.33 acre) and lowest in West Bengal (0.91 acre). OBCs have an average holding of 0.89 acre. Their position is better in Bihar with an average holding of 1.44 acre and their land holding in Jharkhand is least (0.58 acre). SCs land holding average at 0.61 acre, with highest holding in Jharkhand (1.11 acre) and least in West Bengal (0.43 acre).

SUMMING UP - PART II

The rationale behind writing a book on tanks in eastern India was the utter neglect of tanks in this region. Tanks are the most important source of irrigation in the southern and eastern Indian states. As per the Land Use Statistics (2002-03), the four south Indian states together constitute 59 per cent of India's tank irrigated area and the four (rather three because Uttar Pradesh contains negligible area) east Indian states together cover 32 per cent of NIA. The ratio of tank irrigated area in the south and east is 65: 35. Even from the perspective of contribution of tanks in total irrigated area in each region, the available data for 1998-99 for five states shows the following: West Bengal (14 per cent), Orissa (15 per cent), Karnataka (10 per cent), Kerala (13 per cent) and Tamil Nadu (23 per cent). South Indian tank irrigation gets more attention, while the tanks of east suffer from an utter neglect in respect of research and funds for their rejuvenation. Also, researchers and funders have been preoccupied with south India tanks which led to greater publication and publicity. This showcasing of south India tanks led to funds being made available for their rehabilitation/rejuvenation by both government and foreign donors.

The need of such a study is further stressed because despite the pivotal role played by tanks in the eastern region over the centuries, this remains an unknown territory for researchers. In terms if irrigated area, this region may lag behind south India but in terms of number of tanks it surpasses the south. Hence, from the point of view of livelihoods of rural families, they have greater importance in eastern India, As per MI census 1986-87, there were a total of 4,74,427 tanks and ponds in India. As per this data, the four south Indian states of Andhra Pradesh, Tamil Nadu, Karnataka and Kerala together constitute 35.6 per cent of the ponds /tanks, while the four states of east constitute 56 per cent of the total ponds/tanks in India.

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[56] A closer look at the WB data reveals that HCs do not have such large holdings as they are found to have in other states. The second thing is the gap between the OBC land holding size (1.10 acre) and the HC land holding size (1.16 acre) is marginal. The third thing is the SC position is miserable. All this suggests that land reforms have redistributed land from HCs to OBCs as a result of "Operation *Barga*" which literally meant operation in favour of sharecroppers. Since SCs were landless agricultural labourers, they were left out of the land reform scheme. The fact that OBCs were sharecroppers, they benefited most from operation *barga* and thereby from the process of land reforms.

The Glorious Past

Agriculture being the main source of livelihood in India, has been important for both the people and the country's rulers for ages. But the need of irrigation arises from the fact that the spatial and temporal distribution of rainfall does not generally come in accordance with the requirements of the crops cultivated over space and time. This makes conservation, storage and conveyance of the rain water imperative. The types of irrigation system created for a region has to take into account the geographical specialties and pattern of social and power relations there. The most common types of irrigation systems were water harvesting and storage structures for tapping stream flows generated from rains. Tanks being the most significant and feasible structure for irrigation in eastern India, had been part and parcel of rural life as they served multiple needs of the rural populace in these parts. The topography of this region facilitated the tank irrigation for centuries. Despite having different kinds of topographical specialties, the entire eastern region have suitable topographical conditions for creation of water harvesting and storage structures known differently in different regions like *bandh, talab, pokhar, pukur, ahar, pains, khata, goria* etc. These structures served the multiple needs of the local people, besides irrigation and pisciculture.

Historically, tanks were very much significant for rural life in general and agricultural practices in particular in the eastern region of the country. Tanks had been considered a big boon for the people, which harvested run-off and captured floodwater for use in the periods of scarcity. Besides, tanks provide ideal field for rabi cultivation when the same are dry. Pisciculture, cultivation of *makhana, singhara*, lotus etc., were practiced and still continues. It is for this reason that no village can be found without tanks. It is no coincidences that in the sample villages, an average of three tanks per village were found across the states.

In the past, the skills of association and cooperation were fostered and developed to a degree that the tasks which had been beyond the means and enterprise of the individual cultivators had been successfully carried through by united efforts of the community. The cooperation was seen not only in the construction, but also in the maintenance and repair of *bandhs*, tanks and other irrigation works. People's collective action found place in operation and maintenance works as well. The maintenance work included desilting of *ahar* and *pyne* beds, and regular repair of embankments. Apart from these routine activities, an important task was to keep constant vigil, particularly during monsoon against sudden damage of protective works, which could occur due to natural cause or due to man-made reasons. The operational works included cutting and closing embankments for diversion, erection of *bandhs* or *garandis* across the *pynes*, opening and closing of outlets and at times even resorting to manual water lifts to irrigate uplands. Repairs of feeder and water-distribution channels and embankments were taken up immediately after the onset of first rainfall.

Although *gonds* had strong centralized governance, the territories were grouped under various chiefs. Villages were formed as autonomous units that remained unaffected by higher-level upheavals except perhaps during Maratha raids. Even when empires

were formed, the autonomy of these small administrative units remained unaffected. The administrative system was a natural growth from bottom to top, and democratic in form. The panchayat played an active role in limiting the arbitrary powers of the chiefs at every stage. The village was primarily a settlement of peasants, its assembly and association of cultivators. Each village was independent in its economy and governance. Its prosperity rested on proper management of land and water resources.

Water allocation, managed by the cultivators, was a potential source of conflict. Hence, the *parabandi* system was used to distribute water amongst the villages from a common source (usually a tank). *Parabandi* was exercised for water allocation / distribution. Each village had its fixed turns of so many days and hours to avail the water. These turns were assigned by mutual agreements or ancient customs. The operation and maintenance works, particularly overseeing of water distribution, was looked after by functionaries such as headman, *barahill* (supervisor) and *gudait* (watchman).

Social Context of Tank Irrigation and Fisheries

In the ancient times, kings, warlords, rich and the influential built tanks. But the actual construction was undertaken by communities of professional earth workers, such as *vadders* and *boyas*, under the supervision of members of the dominant castes/families (Subbhalakshmi 1988).

Rent-free land was given to *kodas*, a class of people who were experts in excavating water bodies and looked after the maintenance of irrigation works. Such land grants were known as *sagar*, *rakshya, jagir* etc., and *ryot* (tenant) were free to construct embankments and lot of concession was given to them in this respect. The landlords were self-restrained to interfere with the work of improvement of tanks, and left individual *ryots* free to think and execute their own ideas of the same for irrigation and agriculture. The *lakha bata* system of *gondwana* represented the community ownership and management of land and water resources. It should be noted that *gountias* or the village headman, who held an inherited position till the beginning of the Maratha rule, played a very important role in the construction and maintenance of the tanks in Orissa. When a village was leased out to a *gountia*, he was required to execute an agreement to construct tanks for the prosperity of agriculture in the village.

Besides the farmers, the other main actors in tank irrigation in the context of south India were the *neerkattis*, literally meaning 'water binders'. *Neerkatties* were water regulators who actually distributed water from the tanks to the various fields. They usually belonged to the untouchable castes of *malas* and *madigas*. Occasionally, they came from other castes as well. More than one *neerkatti* was required for bigger tanks. The *neerkatti's* right was passed on from one generation to the next, i.e., it was an inheritance right. If a *neerkatti* had more than one son, the ayacut could be divided into different sections, each under one *neerkatti*. If the ayacut was small enough to be handled by one *neerkatti*, they could hold the office by rotation. In the next generation, the

children of the eldest son could enjoy the right. However, the rules of transmission of this right were not very rigid (Shankari 1991, 97-98)

Similar customs are seen in eastern India also. A unique feature of tank management system in some parts of south Bihar was that some functions are associated with particular castes alone. For instance, only *dusadh*, scheduled caste persons were hired for the job of watch and ward. Similarly, the drumbeaters used to be from the Muslim caste of *dafalis.* A special feature of tanks in Orissa as also in Bihar was the association of particular castes with tank construction and its management. For instance, people of *chunkar* community, were consulted for brick working and lining in the tank. An excellent practice of the *gond* kings in Orissa was to grant a rent-free land to anyone who made a tank. During this period rent-free land was given to *kodas*, a class of people who were experts in excavating water reservoirs, and looked after the maintenance of irrigation works.

In case of fisheries also, association of certain communities and castes was found to be more prominent in the colonial Bengal. Before partition of Bengal, Hindu castes were more prominent in fishery activities, while Muslim presence was negligible. According to Pokrant in undivided Bengal there were more than thirty castes, sub-castes or *jati* and other non-Hindu groups who were specialised in fishing, which was their chief source of livelihood. Fishing rights were often separated from the surrounding lands and when owned by a single person, separate accounts were kept. The "rights to *jalkar* formed part of landed estates and were rented out to *mustajirs* who in turn, employed fishers to do the actual work. The relation between *mustajirs* and fishers took various forms with some paying wages for the fish caught while others took a share of total catch. Others re-let river stretches which may have involved giving fishermen exclusive rights to fish there." He also talks about the special place of particular castes in various fishery related activities, and drawing from Buchanan-Hamilton, he describes one such activity from Shahabad district. Pools called *chharan* cut off from the main channel during the dry season provided the best fishing. Landlords owned these pools and fishermen paid rent to fish in them. While fishing in tanks was found, the owners generally consumed the fish caught. Much fishing was of the trap and basket variety and carried on by low caste *musahars, chamars* (leather workers) and *dosadhs* (Pokrant 1996).

The Decay in the Present

The indigenous agrarian social order was fundamentally transformed with the advent of the British. The British were attached to the notion of private property, made arable land either the private property of the *zamindars* or that of individual *ryots* (*ryotwari*). Tenurial relations changed from collective obligations of the community to individual obligations of the *zamindar* or the farmer. On the other hand, the government started controlling the access to forests, grazing lands and village commons including tanks, henceforth redefined as the non-arable lands. Meanwhile, land revenue was enhanced to as much as 50 per cent of the gross produce and this was ruthlessly collected

as well. The *zamindars* had to pay nine-tenths of their revenue collection while their counterparts in England had to pay only one-tenth. Farmers were reduced to a state of utter deprivation. The indigenous institutions of local self-government took a severe blow and even gradually disappeared as a result of this change (Dharampal 1983, 1988).

An important aspect of decline of tanks was the British practice of dividing irrigation works into 'productive works' yielding relatively enhanced revenues and 'protective works' yielding relatively low revenues. While a lot of resources were spent on productive works, protective works such as tanks were neglected. It was when the revenues started falling drastically that the British government woke up to realize the importance of these 'minor' irrigation works. In view of the enormous cost and effort involved, for which the government had no means, it favoured the view that *ryots* themselves should look after the routine maintenance of these works and thus initiated the concept of *kudimaramath*, which meant community maintenance of irrigation works. The *ryots* however simply refused to undertake *kudimaramath* in spite of tremendous pressure from the government to do so. As a result, by 1930 the government had to accept its obligations to repair and maintain the 'minor' irrigation works (Mukundan 1988; Reddy 1988).

The tanks in eastern India have been of great significance since ancient times. However, the extent of tank irrigation has been declining sharply particularly post 1960s in the entire region. These tanks have been serving the needs of all social sections in varying degrees. The way tank ownership patterns emerged in different regions adversely impacted tank irrigation. Despite gross neglect by both the society and government, the tanks were still of much significance in the rural areas of eastern India. In this study of tanks, the extent of water harnessing capacity, pattern of storage of water, modes and extent of irrigation and socio-economic viability of these tanks, water rights, efforts for maintenance of tanks, management of water for irrigation and non-irrigation uses have been examined by the authors through detailed survey of individual tanks.

It is argued that if these tanks are improved and integrated with the whole hydrological system of the sub basins/watersheds in which they are falling, the farmers and the rural society as a whole can reap dividends and that too with relatively smaller investments and with community action. If this happens, tanks can become effective tools of sustainable rural development.

The community has not only been neglecting the tanks, but have also been encroaching the tank area. The powerful farmers in the village illegally occupy the dry portions of tanks for unauthorized cultivation on a regular basis resulting in reduction of tank area. This encroachment continues because this part of the tank normally does not get submerged due to insufficient inflow. This has been happening in all the states without any exception. Similarly some tanks have grown shallow, full of grass, becoming unfit for irrigation and other economic purposes. The tanks have been falling prey to negligence, both in the case of public and private tanks. In case of private tanks, due to the increasing number of owners with the passage of time, the income from tanks gets

further divided reducing the stake of each owner. This has made the owners reluctant to make investments in the tanks.

On the other hand, share of income from the fishing can be easily distributed. Hence, the owners are more interested in contracting out tanks for fishing. Multiple owners have paltry shares *(anshas)* in *paises* (64th part of the tank) and that is marketable. That makes the small shareholders disinterested in tank development. (Lagda and Baghudih in West Bengal). Government tanks also fall prey to negligence. Government policies are also more leaning towards fishing than irrigation and the officials are also having more interest in fishing for optimizing their individual income by way of fishing contract (Nalanda the actual fishing contract amounted to lakhs of rupees whereas on paper it was for Rs. 22,000 only). Government funds for private tanks have been accrued by those owners who have connections in or part of the local power structure. Such investments have not been made after proper assessment of the tanks in terms of irrigation potential, and rather by keeping pisciculture in mind. The government investments for renovation of the old public tanks have been either improper or inadequate. In other words, such constructions or repair works are of no use for irrigation. The West Bengal government through TID had identified and selected village tanks in order to renovate them for proper use and made investments 20 years ago. The investment was realised from the increase in income generated from the tanks. Such tanks were subsequently handed over to the owners. But this programme has now wound-up. For the last ten years, the department has not selected any tank for improvement.

Sometimes *singhara*/*makhana* cultivation and fishing hamper the use of tank water for irrigation. The persons who take these tanks on contract for fish farming do not allow farmers to take water as it may damage the prospects of fish farming. This practice has adversely affected the irrigation use of the tanks. The rise in groundwater use that ensures independent and demand oriented water availability has also affected tank irrigation in south Bihar as has the introduction of canal irrigation in parts of Sambalpur (Hirakud) and Bankura (Kangsawati).

Although estimates are available about their number as well as area irrigated by them, nowhere does one find any estimate about the number of farmer managed tanks and the area irrigated by such tanks, at all India or at state level. The collective efforts of people are becoming a remote thing. *goam* or *kudimaramat, gilandazi and nazrana* have become things of past. Though many instances are cited of collective efforts in case of our surveyed tanks, there were hardly cases of beneficiaries participation in tank maintenance, except sometimes when panchayat provided the funds. It was found that in case of all states, collective efforts had not taken place for the last ten years. As far as the maintenance and repair of tank structures are concerned, funds come only from the government. Further, the maintenance and repairs are not integrated with ongoing irrigation modes and no collective action is evoked. The government money is spent without any community involvement. In the absence of active farmer involvement and lack of maintenance in both public and private/occupied tanks, the tanks have deteriorated greatly, leading to a decline in their irrigation performance. The principle reasons behind

decline of tanks are similar but the factors leading to them vary from state to state and system to system.

In case of Bihar there are three important reasons for the decline of *ahar-pyne* system: First, till the abolition of *zamindari* system**,** the *zamindars* used to maintain these systems because they had the capital resources and had a vested interest in doing so. Second: a large number of alternatives became available to the farmers during the post Independence period in the form of new canal schemes and tubewells. The growth of tubewells, particularly during the post green revolution period is phenomenal. The third reason was the non-integration of these systems in the new diversion schemes built after Independence. The problem got accentuated on account of not taking over these systems formally and legally.

The reasons behind neglect of tanks by their owners in case of West Bengal are: (i) increase in number of owners owing to family divisions, (ii) change in agricultural practices like use of the improved implements besides seeds, fertilizers and mechanical irrigation facilities that required dependable supply of water, (iii) growing disinterest of the owners in cultivation and (iv) lack of a sense of responsibility among tenants for the lands they cultivated. Traditionally *zamindars*, rajas or high caste landlords in the state owned the tanks and *bandhs*. But with the passage of time, they lost control or ownership over the tanks gradually due to abolition of *zamindari*. Finally, due to land reforms in West Bengal, the owners either lost ownership rights, or the tank title was given to too many farmers. The multiple ownership owing due to division in families has also adversely affected the care farmers used to take of their tanks[57].

The sharp decline in the tank irrigation is caused by a number of factors such as, disappearance of labour intensive traditional modes of fetching water from the tank; growing disinterest of traditional tank owners in agriculture owing to land reforms and non owner's control over the tanks; new power equations at the society level and increasing use of tanks for pisciculture at the cost of irrigation for getting cash income.

In case of Orissa, the disappearance of the institution of *gountia* after *zamindari* abolition was the first and the foremost reason. After Independence the *gountias* were neither getting water charges from the users in any form, nor were they spending money on the maintenance of such tanks. Consequently, the irrigation from tanks went on declining. Second, in a large portion of the tract earlier irrigated by tanks, by 1950s with the completion of Hirakud dam, farmers started depending on canal water. Thirdly, most of the large tanks were transferred to the panchayat. This did not go in favour of tank irrigation as panchayat lacked resources to maintain them. Fourthly, abolition of the *zamindari* and the post of erstwhile village headman/*gountia* also marked the end of the custom of '*bethi*', which enabled provision of free labour for the upkeep and repair tanks and other related networks such as irrigation channels etc. Fifthly, encroachment of the land forming part of the tanks was found to be a common feature in all states.

[57] Such private tanks have large number of owners amounting from 15 to 70 owners of one tank, making ownership of even one *ansh* of a paisa (64 paise equals 100 per cent).

The social settings are almost similar in all the states of eastern India. The castes are placed in the following hierarchy: forward or general castes, other backward castes (OBC) and scheduled castes. In Bihar, the land owning castes (other than forward castes) among OBCs are *kurmi, koiri and yadav* whereas in West Bengal they are *ghosh* and *mondal*. The scheduled castes do not hold much land in any of the states. Although, access to tank water is not restricted on the basis of caste, one can mark the hidden grudge and rivalry. The socially well off people grab the land of the tank for unauthorized cultivation. But the lower caste people cannot do so. In case of private tanks, this does not happen, if owners belong to the same hamlet.

Prospect of Revival

The integration of tanks with large irrigation works was a matter of deliberate policy on the part of British colonial rulers. In 1854, they devised a definite irrigation policy laying a criterion for investments on irrigation works by establishing PWD. The PWD provided separate funds for minor works like tanks. Later, in 1903 Irrigation Commission recognized the importance of small irrigation works and assessed that such works were responsible for more than half the irrigated area in the country. Today tanks come under various agencies, departments and tiers of government within a state; there is no proper coordination among them

Rawal in his study of two villages of Bankura district in West Bengal highlights the significance of canal and pond/tank irrigation that had come about accidentally rather than in a planned way. He mentions that use of ponds significantly changed in the study villages as a result of the absence of institutional mechanism for the distribution of canal water. Ponds were no more just the reservoirs for collecting runoff from the rainfall, but were also reservoirs to store canal water. This led to increased use of ponds for irrigating *rabi* and *boro* crops (November-March). The use of ponds for storage of canal water had been associated with a number of problems for the canal irrigation as a whole, the integrated use of a large irrigation scheme like the Kangsabati Project with local reservoirs of water introduced additional flexibility in the use of canal water. Such an informal arrangement is quite crucial, particularly when the scheme provides irrigation to areas that have very different cropping patterns and water requirements on the one hand and highly fluctuating rainfall conditions on the other. (Rawal 1999, 135).

The most promising part of tank rejuvenation programme lies in the integration of these tanks with other larger irrigation systems in the hydrological system of watersheds and basins of which the tank form a part. As a matter of fact, planning of irrigation through tanks is not integrated with the larger irrigation development interventions within the hydrological system. Thus a lot of the initiatives to rehabilitate the tanks are not effective. This can be explained in the context of *ahar-pyne* systems in Bihar. In the decade of 1950's, particularly during the first and the second Five Year Plans, a number of diversion schemes were undertaken in south Bihar. In most of the cases, the area

brought under the command of these schemes had very elaborate system of indigenous irrigation through *ahars* and *pynes*, particularly in the upper reaches. The planners realising the valuable contribution of this indigenous system in subsidiary storage and water distribution, dovetailed it in their plan, thereby increasing the capability of the run-off-the-river scheme on rivers, whose performance was highly susceptible to monsoon fluctuations. They relied on the contribution of the existing *ahars* so much that they planned for about two thirds of the command area to be irrigated during the critical *hathia* period through the *ahars* which were to be filled up from canal networks by drawing maximum possible water during favourable period of river flow. However, the envisaged integration of *ahar-pynes* with the new schemes could not be done in a large number of cases and this indigenous system was made to languish over time. Considering the fact that today's per ha cost of canal irrigation comes to over 1 lakh rupees and keeping in mind that 46 per cent of the total annual precipitation of 350 mham in India is lost to the sea as river flow, the rejuvenation, development and integration of tanks with new diversion schemes offer great potential. The reason being, it mainly involves mobilisation of local material and manpower with very little capital requirement. The focus of attention is on institutional reforms, centering on participatory irrigation management as against physical rehabilitation of small tank systems. There is need to address both physical as well as the governance aspects to keep these multipurpose water bodies in good form.

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Annexure - I

Interview Schedule

Village Schedule

1. Name of the village_____Panchayat_____Block_____

   District_____State_____.

2. Social Structure and Land ownership (Total agricultural land and number of house holds)

Sl. No.	Castes	No. of h/h	Land owned at present	Land before land reforms	barga	vested
1.						
2.						
3.						
4.						
5.						
6.						
7.						

3. Number of land holdings

4. Description about influential persons of the village and factors of influence.

5. Total irrigated land in the village_____(acres)

6. Sources of Irrigation in the village a) canal_____ b) DTW/STW_____

   c) Tanks_____ d) others (river/rivulets)_____(in acres)

7. Number of tanks and their uses

Sl. No.	Uses of the tanks	Number of tanks
1.	Only irrigation	
2.	Only pisciculture	
3.	Multipurpose*	
4.	Only domestic	
5.	Abandoned	

Schedule for the Tank Visited

1. Name of the tank_____.
2. Age of the tank – Ancient-Medieval /British period / 20< but>50/ Less than 20 years
3. Ownership over the tank
   a) Public tank (specify panchayat/Govt.M.I./Govt. FD/Previously private
   b) Private tank – number of owners_____Major share holders_____
   c) Private tank having control of non-owner (specify who are they?_____)
   d) Public tank under private control of local farmers (who are they?_____)
4. Area of tank (water spread area)_____(in acres)
5. Percentage of water spread area: Rainy season_____Winter season_____ Summer season_____.
6. Depth of water during different seasons : Rainy season_____Winter season_____ Summer season_____.
7. Source of water of the tank: i) only rain ii) rain with river/rivulet iii) rain with canal iv) rain with other tank v) mixed
8. Area irrigated by tanks with modes of fetching water and net area irrigated _____ (in acres)

Sl.no.	Modes	Kharif	Rabi	Summer	Total
1.	Surface flow				
2.	Mechanical				
3.	Manual				
4.	Total				

9. Number of Irrigators_____.
10. Specify the socio-economic category of user farmers_____

_____

_____

11. Is there any specific water rights to any person or socio-economic category of persons (specify)_____.

12. Water market in the tank irrigation

    a) diesel pump set Rs._____p/h or p/acre (without fuel) Rs._____p/h or p/acre

    b) electric pump set Rs._____p/h or p/acre

    c) Siphon pipe Rs._____p/h or p/acre

13. Who is responsible for maintenance of the tank?_____

    Types of maintenance work undertaken for the tank?

    a) Repairing of embankments :Annual/once or twice in 10 yrs/ 11 to 25 yrs/25<yrs/Never

    b) Desilting of tank-bed : Annual/once or twice in 10 yrs/11-25 yrs/ 25< yrs/Never

    c) Cleaning of grass etc : Annual/once or twice in 10 yrs/11-25 yrs/25<yrs/never

    d) Enlargement of tank :when took place_____(year)

14. Who invested the expenditure and how much ?_____

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15. Uses of Tank Other than irrigation

    15.1.0 Pisciculture

    a) Value of fish produced in the tank annually Rs_____/- (average)

    b) Amount of the fish produce in the tank annually Qtls_____/- (average)

    15.1.1 Who does the Pisciculture: Owners/owners contract-out/Government contracts our/Private persons who have captured the public tank/Panchayat Villagers' Committee/Others_____

    15.2 Cultivators of Singhara/Makhana/Lotus

        a) Value of the produce in tank annually Rs. _____/-

        b) Amount of the produce in the tank annually Qtl/Kg_____/-

    15.3 Domestic Uses

        a) free for all

        b) restricted for non-owners

        c) restricted for certain social category (specify)

16. Suggestions of the interviewee

17. Notes of the researcher

Annexure - II

Table 1: DST - 1

DETAILS OF SURVEYED TANKS

BIHAR, October 2004

Sl. No.	District	Block	Panchayat	Village/ Town	Name of Tank
1.	Patna	Daniawan	Salarpur	Salarpur	Mahadeosthan Khata
2.	"	"	"	"	Ramsuhawan Talab
3.	"	"	"	"	Bangalapar Khata
4.	"	"	"	"	Laxmi Narayan Khata
5.	"	Pali	Kalayanpur	Kalayanpur	Kalayanpur Ahar
6.	"	Maner	Baank	Gopalpur	Gopalpur Ahar
7.	"	"	"	"	Gopalpur Pokhar
8.	"	"	"	"	Gopalpur Pokhari
9.	Nalanda	Silaw	Badgaon	Muzaffarpur	Indraprastha Sarovar
10.	"	"	"	"	Kardigia Pokhar
11.	"		"	"	Dudhaura Pokhar
12.	"	"	"	"	Suraha Pokhar
13.	"	"	"	"	Bania Pokhar
14.	"	"	Surajpur	Surajpur	Puskarani Talab
15.	"	Rajgir	Kool	Kool	Bania Pokhar
16.	"	"	"	"	Chamgodi Pokhar
17.	"	"	"	"	Hasni Pokhar
18.	"	"	"	"	Doma Pokhar
19.	"	"	"	Panhesa	Mian pokhar
20.	"	"	"	"	Judwa Mian Pokhar
21.	Jamui	Laxminagar	Chinveria	Chinveria	Karma Ahar

Table 1: DST - 2

JHARKHAND, February, July 2005 and August 2006

Sl. No.	District	Block	Panchayat	Village/ Town	Name of Tank
1.	Palamau	Chainpur	Neora	Neora	Jethia talab
2.	"	"	"	"	Neora Talab
3.	"	"	N.S. Pathra	Narsingh Pathara	Purana Pokhar
4.	"	"	Rabda	Nenua	Nenua Talab
5.	"	"	Majhgawa	Majhawa	Majhgawa Talab
6.	"	"	"	Bhairawa	Bhairwa Talab
7.	"	"	"	Nagwa	Nagwa Talab
8.	"	"	Chainpur	Chainpur	Bathi Talab
9.	"	"	Harbhanga	Nimiya	Nimiya Talab
10.	"	"	Taleya	Bhabundi	Ahari Talab
11.	"	"	"	"	Nawka Pokhar
12.	"	"	"	"	Baduraha Pokhar
13.	"	"	Chainpur	Semra	Semra Pokhar
14.	"	"	"	"	Budhwa Pokhar
15.	"	"	"	Semra	Tal Ahar
16.	Ranchi	Bero	Khukhra	Khukhra	Naya Talab
17.	"	"	"	"	Dhobkar Talab
18.	"	"	"	"	Bhating Talab
19.	"	"	"	"	Bair Talab
20.	"	Sonahatu	Sonahatu	Sonahatu	Nimdi bandh
21.	"	"	"	"	Brahman bandh
22.	"	"	"	"	Babu bandh
23.	"	"	Baruhatu	Danadih	Burha bandh
24.	"	"	"	"	Gopal bandh
25.	"	Bundu	Baradih	Tunju	Garia Talab
26.	"	"	Reladih	Chitodih	Darisokra
27.	"	"	"	"	Uturraidyar
28.	"	"	Kanchi	Kanchi	Kalibandh
29.	"	"	Baradih	Amjora	Nichla Talab

Sl. No.	District	Block	Panchayat	Village/ Town	Name of Tank
30.	"	"	"	"	Mansingh Talab
31.	"	"	Bundu	Bundu	Boda Talab
Gumla District visited during August 2006					
32.	Gumla	Bharno	Turiumba	Turiumba	Math Talab
33.	"	"	"	"	Khas Talab I
34.	"	"	"	"	Khas Talab II
35.	"	Sisai	Kudhra	Gurugaon	Pachimari Bara bandh
36.	"	"	"	"	Pahani Don
37.	"	"	"	"	Bar Garha
38.	"	"	"	"	Majhesh Pokhar
39.	"	Bharno	Domba	Domba	Math Talab
40.	"	"	"	"	Purna Talab
41.		Sisai	Sidhnathpur	Chhoti Sainda	Vishra Talab
42.	"	"	"	"	Panchayat Talab
43.	"	"	"	"	Sainda bandh
44.	"	"	Sisai	Sisai	Sisai talab
45.	"	"	Kudhra	Kudhra	Purana talab
46.	"	"	Bargaon	Pilkhi	Rosanpur talab
47.	"	"	Redwa	Digdon	Dadi Doin

Table 1: DST - 3

WEST BENGAL, October-December 2004

Sl. No.	District	Block	Panchayat	Village/ Town	Name of Tank
1.	Purulia	Purulia I	Lagda	Lagda	Budhi bandh
2.	"	"	"	"	Mukherjee bandh
3.	"	"	"	"	Bodo Pukur
4.	"	"	"	"	Raidas bandh
5.	"	"	"	Baghudih	Mahato bandh
6.	"	"	"	"	Gadhir bandh
7.	"	"	"	"	Nautun bandh
8.	"	"	"	"	Tal Goria
9.	"	"	"	"	Bamni Goria
10.	"	"	"	"	Banka bandh
11.	"	"	"	"	Bakhla Goria
12.	"	"	"	"	Asman Goria
13.	"	"	"	"	Manjhi bandh
14.	"	Jhalda	Jhaldadarda	Nawagarh	Nehal bandh
15.	"	"	"	"	Rengtu Singh bandh
16.	"	"	"	"	Dubrajsingh bandh
17.	"	"	"	"	Gansa Bandh
18.	"	"	"	Baruakocha	Bamesar bandh
19.	"	"	"	"	Barin bandh
20.	Bankura	Indpur	Dharampur	Gokulnagar	Chand Bandh
21.	"	"	"	Dharampur	Dharampur bandh
22.	"	"	"	"	Nautun Pukur
23.	"	"	"	"	Mondal Pukur
24.	"	"	Hadmauli	Moira	Moira bandh
25.	"	"	"	"	Tatir bandh
26.	"	Panchmuda	Devil Beria	Lalbandh	Lalbandh
27.	"	"	"	Devil Beria	Purnopukur
28.	"	Bishnupore	Bishnupore (sub-urban)	Gopalpur, Tejpal	Jamuuna bandh
29.	"	"	Bishnupore (sub-urban)	Tilwari	Lal Bandh
30.	Birbhum	Suri II	Maipur	Maipur	Subhas Mondal Bandh
31.	"	Suri I	Bhuguna	Dolgobindpur	Budhnath Dey Bandh

Table 1: DST - 4

ORISSA, September 2004 and May 2005

Sl. No.	District	Block	Panchayat	Village/ Town	Name of Tank
September, 2004					
1.	Sambhalpur	Dhankauda	Sasan	—	Lamal Kata (I & II)
2.	"	Sambhalpur Sadar	Kilasama	Bhurwaballi	Rani Kata
3.	"	Rengali	Nisanbhanga	Nisanbhanga	Bar Kata
4.	"	"	—	Babuchakdi	---
5.	Bolangir	Loisingha	Loisingha	Loisingha	Narayan Sagar
6.	"	Deogaon	Deogaon	Deogaon	Jogi Sagar
7.	Kalahandi	Bhawani Patna	Mednipur	Sairagalangi	Khiri Kota (Kara Munda)
8.	"	Narla	Sargiguda	NA	**Asurgarh/Uday Sagar**
9.	"	"	Tulapadi	NA	Tulapada
10.	"	"	Bhanpur	Bhanpur	Bhanpur Tank
11.	"	"	Santpur	Goihrapahar	Suknabhata/ Khajuri Kata
May, 2005					
12.	Sambhalpur	Jujumura	Ghenupali	Ghenupali	Padma Kata
13.	"	"	Nuabarangamal	Nuabarangamal	Badasahir Kata No.9
14.	"	"	"	"	Badasahir Kata No.8
15.	Kalahandi	Bhawanipatna	Mednipur	Sujanpur	Pipalnala
16.	"	Bero	"	Kauntabanji	Devi Sagar
17.	"	"	NA	Munispal B.P	Asha Sagar
18.	"	Kesinga	Kasurpada	Kantesir	Kantesir
19.	"	"	"	Kasurpada	Karuna Sagar
20.	"	Junagarh	Kalia Kundal	Kalia Kundal	Badobandh
21.	"	"	Chhooriagarh	Chhooriagarh	—
22.	"	Sadar (B.P.)	Dwarson	Dwarson	Duarsuni Kata (Sundhi Munda)

Annexure -III

Tables of Tank Irrigation (Bihar)

Table B-1 (Bihar)

Age of the Surveyed Tanks

Districts	Categories of age of the tank				Total
	Anc/Med	British period	Post independence	Post 1990s	
Patna	-	7 (87.5)	1 (12.5)	-	8 (100)
Nalanda	8 (72.7)	3 (27.3)	-	-	11 (100)
Jamui	-	1 (100)	-	-	1 (100)
Total	**8 (40)**	**11 (55)**	**1 (5)**	**-**	**20 (100)**

Table B-2 (Bihar)

Pattern of Ownership of the Tanks

Districts	Categories of ownership			Total
	Government	Panchayat	Private	
Patna	4 (50)	-	4 (50)	8 (100)
Nalanda	3 (27.2)	4 (36.6)	4 (36.2)	11 (100)
Jamui	-	1 (100)	-	1 (100)
Total	**7 (35)**	**5 (25)**	**8 (40)**	**20 (100)**

Table B-3 (Bihar)

Nature of People's Access to the Tanks

Districts	Open to All	Categories of Restrictions		Total
		Owners	Others	
Patna	4 (50)	1 (12.5)	3 (37.5)	8 (100)
Nalanda	11 (100)	-	-	11 (100)
Jamui	1 (100)	-	-	1 (100)
Total	**16 (80)**	**1 (5)**	**3 (15)**	**20 (100)**

Table B-4 (Bihar)

Tanks by their size (in acres)

Districts	Categories by size of Tanks						Total
	< 2.5	2.5-10	11-20	21-50	51-100	> 100	
Patna	2(1)	2(8)	2(27)	1(50)	1 (75)	-	8(161)
Nalanda	1(1.6)	6(34.9)	2(29)	1(34)	1 (60)	-	11(159.5)
Jamui	-	1(3)	-	-	-	-	1(3)
Total	**3(2.6)**	**9(45.9)**	**4(56)**	**2(84)**	**2(135)**	**-**	**20(323.5)**

Note **:** Figures in the brackets show the total area of tanks

Table B-5 (Bihar)

Ratio of Irrigation per acre of Tank Area

Districts	No of Tanks with Total Area	Net Area Irrigated by tank	Ratio of Irrigation per acre of tank area	Per tank irrigated area
Patna	8 (161)	410.3	1: 2.6	51.3
Nalanda	11(159.5)	483.6	1:3.1	44
Jamui	1 (3)	60	1:20	60
Total	**20(323.5)**	**953.9**	**1:2.9**	**47.7**

Table B-6 (Bihar)

Area Irrigated by Tanks in Different Seasons (in acres)

Kharif				
States	**Modes of Irrigation**			
	Manual	**Mechanical**	**Surface flow**	**Total**
Patna	20	106	120	246
Nalanda	50	301.9	134.3	486.2
Jamui	-	55	5	60
Total	**70 (8.8)**	**462.9 (58.5)**	**259.3 (32.7)**	**792.2 (100)**
Rabi				
Patna	1	59.3	-	60.3
Nalanda	6	405.3	-	411.3
Jamui	1	24	-	25
Total	**8 (1.6)**	**488.6 (98.4)**	**-**	**496.6 (100)**
Summer				
Patna	-	0.7	-	0.7
Nalanda	4.5	11.3	-	15.8
Jamui	-	-	-	-
Total	**4.5 (27.3)**	**12.0 (72.7)**	**-**	**16.5 (100)**

Table B-7 (Bihar)

Gross Area Irrigated by Tanks in a Year

Districts	Manual	Mechanical	Surface flow	Total
Patna	21	166	120	307
Nalanda	60.5	718.5	143.3	922.3
Jamui	1	79	5	85
Total	**82 (6.2)**	**963.5 (73.3)**	**268.3 (20.5)**	**1314.3 (100)**

Table B-8 (Bihar)

Irrigators per tank and average tank size (area in acres)

Districts	No of Tanks (with total area)	No of Irrigations	Average No.of Irrigators per acre of tank area	Average Irrigators per tank	Average size of tank
Patna	7(160.5)	462	2.9	66	22.9
Nalanda	6(86.5)	369	4.3	61.5	14.4
Jamui	1(3)	NA	-	NA	NA
Total	**14(250)**	**831**	**3.3**	**58.1**	**19**

Table B-9a (Bihar)

Tanks by depth of water column in **Rainy Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7-10	5-7	3-5	< 3	Dry	
Patna	6(75)	2(25)	-	-	-	-	8(100)
Nalanda	1(9.1)	1(9.1)	9(81.8)	-	-	-	11(100)
Jamui	-	1(100)	-	-	-	-	1(100)
Total	**7(35)**	**4(20)**	**9(45)**	**-**	**-**	**-**	**20(100)**

Table B-9b (Bihar)

Tanks by depth of water column in **Winter Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7-10	5-7	3-5	< 3	Dry	
Patna	2(25)	3(37.5)	2(25)	-	-	1(12.5)	8(100)
Nalanda	-	-	3(27.3)	7(63.6)	1(9.1)	-	11(100)
Jamui	-	-	-	1(100)	-	-	1(100)
Total	**2(10)**	**3(15)**	**5(25)**	**8(40)**	**1(5)**	**1(5)**	**20(100)**

Table B-9c (Bihar)

Tanks by depth of water column in **Summer Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7-10	5-7	3-5	< 3	Dry	
Patna	-	1(12.5)	-	4(50)	-	3(37.5)	8(100)
Nalanda	-	-	-	2(18.2)	1(9.1)	8(72.7)	11(100)
Jamui	-	-	-	-	1(100)		1(100)
Total	**-**	**1(5)**	**-**	**6(30)**	**2(10)**	**11(55)**	**20(100)**

Table B-10 (Bihar)

Tanks by sources of water

Districts	Rain	Rain+Rivulet+Tank+Flood	Rain+Canal	Others	Total
Patna	2(25)	3(37.5)	1(12.5)	2(25)	8(100)
Nalanda	6(54.5)	4(36.4)	-	1(9.1)	11(100)
Jamui	1(100)	-	-	-	1(100)
Total	**9(45)**	**7(35)**	**1(5)**	**3(15)**	**20(100)**

Table B-11(Bihar)

Tanks by Responsibility of Maintenance

Districts	Government	Panchayat/ Community Action	Owners	Others	Total
Patna	4(50)	-	1(12.5)	3(37.5)	8(100)
Nalanda	2(18.2)	1(9.1)	3(27.3)	5(45.4)	11(100)
Jamui	1(100)	-	-	-	1(100)
Total	**7(35)**	**1(5)**	**4(20)**	**8(40)**	**20(100)**

Table B-12(Bihar)

Tank by frequency of Maintenance

Districts	Frequency of Repair of Embankments					Frequency of Desilting of tank bed				
	Annual	2-10 yrs	11-30 yrs	Never	Total	Annual	2-10 yrs	11-30 yrs	Never	Total
Patna	1(12.5)	3(37.5)	-	4(50)	8(100)	1(12.5)	-	-	7(87.5)	8(100)
Nalanda	2(18.2)	2(18.2)	4(36.4)	3(27.2)	11(100)	2(18.2)	1(9.1)	5(45.5)	3(27.2)	11(100)
Jamui	-	-	1(100)	-	1(100)	-	-	1(100)	-	1(100)
Total	**3(15)**	**5(25)**	**5 (25)**	**7 (35)**	**20 (100)**	**3(15)**	**1(5)**	**6(30)**	**10(50)**	**20(100)**

Table B-13 (Bihar)

Tanks by Agency Incurring Funds for Maintenance

Districts	Agency incurring funds for Maintenance						Total
	Govt.	Panch/Comm Action	Govt.+ Panchayat	Owners/ Occupans	Others	None	
Patna	-	-	1(12.5)	3(37.5)	-	4(50)	8(100)
Nalanda	2(18.2)	4(36.4)	-	1(9.1)	1(9.1)	3(27.2)	11(100)
Jamui	-	1(100)	-	-	-	-	1(100)
Total	**2(10)**	**5(25)**	**1(5.0)**	**4(20)**	**1(5)**	**7(35)**	**20(100)**

Table B-14 (Bihar)

Tanks by their uses

Districts	Categories of age of the tank				Total
	Domestic	Pisciculture	Irrigation	Multipurpose	
Patna	-	2(25)	1(12.5)	5(62.5)	8(100)
Nalanda	-	2(18.2)	1(9.1)	8(72.7)	11(100)
Jamui	-	-	1(100)	-	1(100)
Total	**-**	**4(20)**	**3(15)**	**13(65)**	**20(100)**

Table B-15 (Bihar)

Pattern of use of Tanks in study villages/hamlets.

Districts	Categories of various Uses of the Tanks					Total
	Only Irrig.	Only Pisci.	Only Domestic	Multipurpose	Abandoned	
Patna	3(5.7)	2(3.8)	-	48(91.4)	-	53(100)
Nalanda	3(15)	3(15)	-	14(70)	-	20(100)
Jamui	5(100)	-	-	-	-	5(100)
Total	**11(14.1)**	**5(6.4)**	**-**	**62(79.5)**	**-**	**78(100)**

Table B-16 (Bihar)

Tanks by Value of Fish Produce

Districts	No of Tanks (with total area)	Annual Value (in Rs.)	Annual Value Per acre (in Rs.)	Value per tank
Patna	7(86)	4,95,500	5,762	61,937
Nalanda	9(148.6)	13,05,500	8,785	1,45,055
Jamui	1(3)	No pisciculture in the tank		
Total	**16(234.6)**	**18,01,000**	**7,677**	**1,12,562**

Note: Values are per acre and per tank and therefore total does not tally

Table B-17 (Bihar)

Caste and Land holding in surveyed villages/hamlets

Districts, No. of villages	Frequency of Repair of Embankments					Frequency of Desilting of tank bed				
	HC	OBC	SC	ST	Total	HC	OBC	SC	ST	Total
Patna	69 (4.9)	974 (69.4)	360 (25.7)	-	1403 (100)	370.6 (17.6)	1687.6 (80.3)	42 (2.1)	-	21002 (100)
Nalanda	398 (43)	297 (32)	232 (25)	-	927 (100.0)	915.3 (79.3)	220 (19.1)	18.0 (1.6)	-	1153 (100)
Jamui	-	200 (50)	200 (50)	-	400 (100)	-	210 (50)	210 (50)	-	420 (100)
Total	**467 (17.1)**	**1471 (53.9)**	**792 (29)**	**-**	**2730 (100)**	**1285.9 (35)**	**2119.6 (57.7)**	**270 (7.3)**		**3675.5 (100)**

Table B-18 (Bihar)

Average Landholding Size among different Caste Groups

Districts	Average Landholding Size and Caste groups (acres)				Total (Average)
	HC	OBC	SC	ST	
Patna	5.37	1.74	0.12	-	1.49
Nalanda	2.29	0.74	0.08	-	1.24
Jamui	-	1.05	1.05	-	1.05
Total	**2.75**	**1.44**	**0.34**	**-**	**1.34**

Tables of Tank Irrigation (Jharkhand)

Table J-1 (Jharkhand)
Age of the Surveyed Tanks

Districts	Categories of age of the tank				Total
	Anc/Med	British period	Post independence	Post 1990s	
Palamau	-	10(66.7)	5(33.3)	-	15(100)
Ranchi	8(50)	5(31.3)	2(12.5)	1(6.2)	16(100)
Gumla		10(62.5)	5 (31.3)	1(6.2)	16(100)
Total	**8(17)**	**25(53.2)**	**12(25.5)**	**2(4.3)**	**47(100)**

Table J-2(Jharkhand)
Pattern of Ownership of the Tanks

Districts	Categoriesof ownership			Total
	Government	Panchayat	Private	
Palamau	10(66.7)	2(13.3)	3(20)	15(100)
Ranchi	7(43.8)	1(6.2)	8(50)	16(100)
Gumla	13(81.3)	-	3(18.7)	16(100)
Total	**30(63.8)**	**3(6.4)**	**14(29.8)**	**47(100)**

Table J-3 (Jharkhand)
Nature of People's Access to the Tanks

Districts	Open to All	Categories of Restrictions		Total
		Owners	Others	
Palamau	14(93.4)	-	1(6.6)	15(100)
Ranchi	16(100)	-	-	16(100)
Gumla	10(62.5)	3(18.8)	3(18.7)	16(100)
Total	**40(85.1)**	**3(6.3)**	**4(8.6)**	**47(100)**

Table J-4 (Jharkhand)
Tanks by their size (in acres)

Districts	Categories by Size of Tanks						Total
	< 2.5	2.5-10	11-20	21-50	51-100	> 100	
Palamau	3(4.5)	11(60.5)	1(13)	-	-	-	15(78)
Ranchi	8(14.5)	6(21.5)	-	1(23)	-	1(109)	16(168)
Gumla	9(10.9)	6(43.1)	1(14)	-	-	-	16(68)
Total	**20(29.9)**	**23(125.1)**	**2(27)**	**1(23.0)**	**-**	**1(109)**	**47(314)**

Note : Figures in the brackets show the total area of tanks

Table J-5 (Jharkhand)

Ratio of Irrigation per acre of Tank Area

Districts	No of Tanks with Total Area	Net Area Irrigated by tank	Ratio of Irrigation per acre of tank area	Per tank irrigated area
Palamau	15 (78)	141	1:1.8	9.4
Ranchi	16 (168)	202	1:1.2	12.6
Gumla	16(68)	141.5	1:2.1	8.8
Total	**47 (314)**	**484.5**	**1:1.5**	**10.3**

Table J-6 (Jharkhand)

Area Irrigated by Tanks in Different Seasons (in acres)

Kharif				
States	**Modes of Irrigation**			
	Manual	**Mechanical**	**Surface flow**	**Total**
Palamau	-	18	106	124
Ranchi	1	17	166	184
Gumla	-	10	3	13
Total	**1 (0.3)**	**45(14.0)**	**275(85.7)**	**321 (100)**
Rabi				
Palamau	-	45	15	60
Ranchi	6	60.5	5	71.5
Gumla	-	141.5	-	141.5
Total	**6(2.2)**	**247(90.5)**	**20(7.3)**	**273(100)**
Summer				
Palamau	-	-	-	-
Ranchi	1.5	17	10	28.5
Gumla	-	13	-	13
Total	**1.5 (3.6)**	**30 (72.3)**	**10 (24.1)**	**41.5 (100)**

Table J-7 (Jharkhand)

Gross Area Irrigated by Tanks in a Year

Districts	Manual	Mechanical	Surface Flow	Total
Palamau	-	63	121	184
Ranchi	8.5	94.5	181	284
Gumla	-	164.5	3	167.5
Total	**8.5 (1.3)**	**322(50.7)**	**305(48)**	**635.5**

Table J-8 (Jharkhand)

Irrigators per tank and average tank size (area in acres)

Districts	No of Tanks (with total area)	No of Irrigations	Average No.of Irrigators per acre of tank area	Average Irrigators per tank	Average size of tank
Palamau	13 (63)	232	3.7	17.8	4.8
Ranchi	12 (138.5)	245	1.8	20.4	11.5
Gumla	15 (61)	140	2.3	9.3	4.1
Total	**40 (262.5)**	**617**	**2.4**	**15.4**	**6.6**

Table J-9a (Jharkhand)

Tanks by depth of water column in **Rainy Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Palamau	4(26.7)	7(46.7)	3(20)	1(6.6)	-	-	15(100)
Ranchi	1(6.2)	8(50)	4(25)	3(18.8)	-	-	16(100)
Gumla	8 (50)	7 (43.5)	1(6.5)	-	-	-	16(100)
Total	**13(27.7)**	**22(46.8)**	**8(17)**	**4(8.5)**			**47(100)**

Table J-9b (Jharkhand)

Tanks by depth of water column in **Winter Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Palamau	1(6.6)	3(20)	5(33.4)	6(40)	-	-	15(100)
Ranchi	-	5(31.2)	4(25)	5(31.2)	1(6.3)	1(6.3)	16(100)
Gumla	3 (18.7)	2 (12.6)	3 (18.7)	8 (50)	-	-	16(100)
Total	**4(8.5)**	**10(21.4)**	**12(25.5)**	**19(40.4)**	**1(2.1)**	**1(2.1)**	**47(100)**

Table J-9c (Jharkhand)

Tanks by depth of water column in **Summer Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Palamau	-	-	1(6.7)	9(60)	1(6.7)	4(26.6)	15(100)
Ranchi	-	-	2(12.5)	7(43.7)	3(18.8)	4(25)	16(100)
Gumla	1(6.2)		2(12.5)	7(43.7)	-	6(37.5)	16(100)
Total	**1(2.1)**		**5(10.7)**	**23(48.9)**	**4(8.5)**	**14(29.8)**	**47(100)**

Table J-10 (Jharkhand)

Tanks by sources of water

Districts	Rain	Rain+Rivulet+Tank+Flood	Rain+Canal	Others	Total
Palamau	9(60)	4(26.6)	-	2(13.4)	15(100)
Ranchi	7(43.7)	4(25)	-	5(31.3)	16(100)
Gumla	15(93.8)	-	-	1(6.2)	16 (100)
Total	**31(65.9)**	**8(17)**	**-**	**8(17)**	**47(100)**

Note: Figures in parenthesis indicates area of tank.

Table J-11(Jharkhand)

Tanks by Responsibility of Maintenance

Districts	Government	Panchayat/ Community Action	Owners	Others	Total
Palamau	11(73.4)	1(6.6)	3(20)	-	15(100)
Ranchi	7(43.7)	-	9(56.3)	-	16(100)
Gumla	13(81.3)	-	3(18.7)	-	16(100)
Total	**31(65.9)**	**1(2.2)**	**15(31.9)**	**-**	**47(100)**

Table J-12 (Jharkhand)

Tank by frequency of Maintenance

Districts	Frequency of Repair of Embankments					Frequency of Desilting of tank bed				
	Annual	2-10 yrs	11-30 yrs	Never	Total	Annual	2-10 yrs	11-30 yrs	Never	Total
Palamau	-	4(26.7)	1(6.6)	10(66.7)	15(100)	-	5(33.3)	-	10(66.7)	15(100)
Ranchi	-	5(31.2)	1(6.2)	10(62.6)	16(100)	-	5(31.5)	1(6.2)	10(62.6)	16(100)
Gumla	2(12.5)	3(18.7)	2(12.5)	9(56.3)	16(100)	2(12.5)	1(6.2)	6(37.5)	7(43.8)	16(100)
Total	**2(4.3)**	**12(25.5)**	**4(8.5)**	**29(61.7)**	**47(100)**	**2(4.3)**	**11(23.4)**	**7(14.9)**	**27(57.4)**	**47(100)**

Table J-13 (Jharkhand)

Tanks by agency Incurring Funds for Maintenance

Districts	Agency incurring funds for Maintenance						Total
	Govt.	Panch/Comm Action	Govt.+ Panchayat	Owners/ Occupans	Others	None	
Palamau	9(60)	-	-	-	-	6(40)	15(100)
Ranchi	7(43.7)	-	-	-	-	9(56.3)	16(100)
Gumla	8(50)	-	-	2(12.5)	-	6(37.5)	16(100)
Total	**24(51.1)**	**-**	**-**	**2(4.3)**	**-**	**21(44.6)**	**47(100)**

Table J-14 (Jharkhand)

Tanks by their uses

Districts	Non-Irrigation Uses of the tank				Total
	Domestic	Pisciculture	Irrigation	Multipurpose	
Palamau	-	1(6.6)	-	14(93.4)	15(100)
Ranchi	-	-	2(12.5)	14(87.5)	16(100)
Gumla	3(18.7)	-	11(68.8)	2(12.5)	16(100)
Total	**3(6.5)**	**1(2.1)**	**4(8.5)**	**39(82.9)**	**47(100)**

Table J-15 (Village Jharkhand)

Pattern of use of Tanks in study villages/hamlets.

Districts	Categories of various Uses of the Tanks					Total
	Only Irrig.	Only Pisci.	Only Domestic	Multipurpose	Abandoned	
Palamau	1(5)	1(5)	-	18(90)	-	20(100)
Ranchi	-	2(2.9)	3(4.5)	53(79.2)	9(13.4)	67(100)
Gumla	4(17.4)	1(4.4)	-	14(60.9))	4(17.4)	23(100)
Total	**5(4.5)**	**4(3.6)**	**3(2.6)**	**85(77.2)**	**13(11.8)**	**110(100)**

Table J-16 (Jharkhand)

Tanks by Value of Fish Produce

Districts	No of Tanks and area in acres	Annual Value (in Rs.)	Annual Value Per acre (in Rs.)	Value per tank (in Rs.)
Palamau	15(78)	8,22,000	10,538	54,800
Ranchi	14 (164.5)	9,65,000	5,866	68,928
Gumla	8(48.6)	1,26,500	2,603	15,812
Total	**37(291.1)**	**19,13,500**	**6,573**	**51,716**

Note: Values are per acre and per tank and therefore total does not tally

Table J-17 (Jharkhand)

Caste and land holding in surveyed villages/hamlets

Districts, No. of villages	No. Households in caste groups					Land owned by Caste-groups (acres)				
	HCC	OBC	SC	ST	Total	HC	OBC	SC	ST	Total
Palamau	139 (6.3)	1669 (75.4)	406 (18.3)	-	2214 (100)	1816 (58.6)	959 (30.9)	325 (10.5)	-	3100 (100)
Ranchi	371 (8.6)	2983 (69.3)	165 (3.8)	786 (18.3)	4305 (100)	264 (5.5)	1364 (28.5)	306 (6.4)	2858 (59.6)	4792 (100)
Gumla	44 (1.1)	789 (20.1)	-	3100 (78.8)	3933 (100)	265 (5.8)	819.5 (17.8)		3520 (76.4)	4739.5 (100)
Total	**554 (4.8)**	**5441 (47.1)**	**571 (4.9)**	**4986 (43.2)**	**11552.1 (100)**	**2145 (17.1)**	**3142.5 (25.1)**	**631 (5.0)**	**6628 (52.8)**	**12546.5 (100)**

Table J-18 (Jharkhand)

Average Landholding size among different Caste Groups

Districts	Average Land holding size and Caste groups (acres)				Total (Average)
	HC	OBC	SC	ST	
Palamau	13.06	0.57	0.80	-	1.40
Ranchi	0.71	0.46	1.85	3.64	1.11
Gumla	6	1	-	1.1	1.20
Total	**3.87**	**0.58**	**1.11**	**1.33**	**1.09**

Tables of Tank Irrigation (West Bengal)

Table W-1 (West Bengal)

Age of the Surveyed Tanks

Districts	Categories of age of the tank				Total
	Anc/Med	British period	Post independence	Post 1990s	
Bankura	2(20)	6(60)	2(20)	-	10(100)
Purulia	-	14(73.8)	2(10.5)	3(15.7)	19(100)
Birbhum	-	2(100)	-	-	2(100)
Total	**2(6.4)**	**22(71)**	**4(12.9)**	**3(9.7)**	**31(100)**

Table W-2 (West Bengal)

Pattern of Ownership of the Tanks

Districts	Categoriesof ownership			Total
	Government	Panchayat	Private	
Bankura	2(25)	7(62.5)	1(12.5)	10(100)
Purulia	-	1(5.2)	18(94.8)	19(100)
Birbhum		1(50)	1(50)	2(100)
Total	**2(6.4)**	**9(29.2)**	**20(64.4)**	**31(100)**

Table W-3(West Bengal)

Nature of People's Access to the Tanks

Districts	Open to All	Categories of Restrictions		Total
		Owners	Others	
Bankura	10(100)	-	-	10(100)
Purulia	13(68.4)	6(31.6)	-	19(100)
Birbhum	1(50)	1(50)	-	2(100)
Total	**24(77.4)**	**7(22.6)**	**-**	**31(100)**

Table W-4 (West Bengal)

Tanks by their size (in acres)

Districts	Categories by Size of Tanks						Total
	< 2.5	2.5-10	11-20	21-50	51-100	> 100	
Bankura	2(2)	4(16)	-	2(73)	1(74)	1(109)	10(274)
Purulia	12(12.8)	5(20.5)	1(11.5)	1(30)	-	-	19(74.8)
Birbhum	1(0.8)	-	-	1(38)	-	-	2(38.8)
Total	**15(15.6)**	**9(36.5)**	**1(11.5)**	**4(141)**	**1(74)**	**1(109)**	**31(387.6)**

Note **:** Figures in the brackets show the total area of tanks

Table W-5 (West Bengal)
Ratio of Irrigation per acre of Tank Area

Districts	No of Tanks with Total Area	Net Area Irrigated by tank	Ratio of Irrigation per acre of tank area	Per tank irrigated area
Bankura	6(89)	323	1:3.62	53.8
Purulia	17(72.5)	87.2	1:1.20	5.1
Birbhum	2(38.8)	109	1:2.80	54.5
Total	**25(200.3)**	**519.2**	**1:2.6**	**20.8**

Table W-6 (West Bengal)
Area Irrigated by Tanks in Different Seasons (in acres)

District	Modes of Irrigation or Fetching Water to the field (area in acres)			
	Manual	Mechanical	Surface flow	Total
Kahrif				
Bankura	-	43	252.5	295.5
Purulia	5.6	11.5	76.8	93.9
Birbhum	-	-	24	24
Total	**5.6 (1.4)**	**54.5 (13.2)**	**353.3 (85.4)**	**413.4 (100)**
Rabi				
Bankura	7.5	140	95	242.5
Purulia	1.1	12	15.6	28.7
Birbhum	-	4	20	24
Total	**8.6 (2.9)**	**156.0 (52.8)**	**130.6 (44.3)**	**295.2 (100)**
Summer				
Bankura	-	20	-	20
Purulia	-	3.3	-	3.3
Birbhum	-	4	-	4
Total	**-**	**27.3 (100)**	**-**	**27.3 (100)**

Table W-7 (West Bengal)
Gross Area Irrigated by Tanks in a Year

Districts	Manual	Mechanical	Surface flow	Total
Bankura	7.5 (1.4)	193 (35.2)	347.5 (63.4)	548 (100)
Purulia	6.7 (5.3)	26.8 (21.3)	92.4 (73.4)	125.9 (100)
Birbhum	-	8 (15.4)	44 (84.6)	52 (100)
Total	**14.2 (2)**	**227.8 (31.3)**	**483.9 (66.7)**	**725.9 (100)**

Table W-8 (West Bengal)

Irrigators per tank and average tank size (area in acres)

Districts	No of Tanks (with total area)	No of Irrigations	Average No.of Irrigators per acre of tank area	Average Irrigators per tank	Average size of tank
Bankura	6(56)	690	12.32	115	9.33
Purulia	16(58.3)	171	2.93	10.7	3.64
Birbhum	2(38.8)	26	0.67	13	19.4
Total	**24(153.1)**	**887**	**5.79**	**37.06**	**6.37**

Table W-9a (West Bengal)

Tanks by depth of water column in **Rainy Season**

Districts	Categories of Depth of Water (in feet)							Total
	> 10	7.5-10	5.5-7	3-5	< 3	NA	Dry	
Bankura	1(10)	3(30)	2(20)	2(20)	-	2(20)	-	10(100)
Purulia	4(21.2)	1(5.2)	3(15.7)	9(47.4)	2(10.5)	-		19(100)
Birbhum	2(100)							2(100)
Total	**7(22.6)**	**4(12.9)**	**5(16.2)**	**11(35.5)**	**2(6.4)**	**2(6.4)**		**31(100)**

Table W-9b (West Bengal)

Tanks by depth of water column in **Winter Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7-10	5-7	3-5	< 3	Dry	
Bankura	-	-	2(20)	6(60)		2(20)	10(100)
Purulia	-	5(26.3)	-	6(31.4)	4(21.2)	4(20.1))	19(100)
Birbhum	1(50)	1(50)					2(100)
Total	**1(3.2)**	**6(19.5)**	**2(6.4)**	**12(38.6)**	**4(13.8)**	**6(19.5)**	**(100)**

Table W-9c (West Bengal)
Tanks by depth of water column in **Summer Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Bankura	-	-	-	-	5(50)	5(50)	10(100)
Purulia	-	3(15.8)	-	3(15.8)	1(5.2)	12(63.2)	19(100)
Birbhum		2(100)					2(100)
Total		**5(16.1)**	**-**	**3(9.7)**	**6(19.4)**	**17(54.8)**	**31(100)**

Table W-10 (West Bengal)
Tanks by sources of water

Districts	Rain	Rain+Rivulet+Tank+Flood	Rain+Canal	Others	Total
Bankura	6(60)	1(10)	2(20)	1(10)	10(100)
Purulia	18(94.8)	1(5.2)	-	-	19(100)
Birbhum	-	-	2(100)	-	2(100)
Total	**24(77.4)**	**2(6.4)**	**4(13)**	**1(3.2)**	**31(100)**

Table W-11(West Bengal)
Tanks by Responsibility of Maintenance

Districts	Government	Panchayat/ Community Action	Owners	Others	Total
Bankura	2(20)	7(70)	1(10)	-	10(100)
Purulia	-	1(5.2)	16(84.3)	2(10.5)	19(100)
Birbhum		1(50)	1(50)	-	2(100)
Total	**2(6.4)**	**9(29)**	**18(58.2)**	**2(6.4)**	**31(100)**

Table W-12(West Bengal)
Tank by frequency of Maintenance

Districts	Frequency of Repair of Embankments					Frequency of Desilting of tank bed				
	Annual	2-10 yrs	11-30 yrs	Never	Total	Annual	2-10 yrs	11-30 yrs	Never	Total
Bankura	3(30)	2(20)	1(10)	4(40)	10(100)	-	2(20)	2(20)	6(60)	10(100)
Purulia	3(15.8)	2(10.5)	1(5.2)	13(68.5)	19(100)	-	4(21.2)	3(15.8)	12(63)	19(100)
Birbhum	-	1(50)	-	1(50)	2(100)	-	-	-	2(100)	2(100)
Total	**6(19.3)**	**5(16.1)**	**3(6.4)**	**18(58.2)**	**31(100)**	**-**	**6(19.3)**	**5(16.1)**	**20(64.6)**	**31(100)**

Table W-13 (West Bengal)

Tanks by Agency Incurring Funds for Maintenance

Districts	Agency incurring funds for Maintenance						Total
	Govt.	Panch/Comm Action	Govt.+ Panchayat	Owners/ Occupans	Others	None	
Bankura	2(20)	4(40)	1(10)	-	-	3(30)	10(100)
Purulia	1(5.2)	4(21.2)	2(10.5)	2(10.5)	4(21.2)	6(31.4)	19(100)
Birbhum	-	-	-	-	1(50)	1(50)	2(100)
Total	**3(9.7)**	**8(25.7)**	**3(9.7)**	**2(6.4)**	**5((16.2)**	**10(32.3)**	**31(100)**

Table W-14 (West Bengal)

Tanks by their uses

Districts	Uses of the Tank				Total
	Domestic	Pisciculture	Irrigation	Multipurpose	
Bankura		1(10)	-	9(90)	10(100)
Purulia	6(31.5)	2(10.5)	2(10.5)	9(47.5)	19(100)
Birbhum				2(100)	2(100)
Total	**6(19.3)**	**3(9.7)**	**2(6.4)**	**20(64.6)**	**31(100.0)**

Table W-15 (West Bengal)

Pattern of Use of Tanks in the Study Villages/hamlets

Districts	Categories of various Uses of the Tanks					Total
	Only Irrig.	Only Pisci.	Only Domestic	Multipurpose	Abandoned	
Bankura	-	2(20)	-	8(80)	-	10(100)
Purulia	1(1.9)	-	10(18.5)	22(40.7)	21(38.9)	54(100)
Birbhum	1(4.2)	4(16.6)		1(4.7)	18(75)	24(100)
Total	**2(2.3)**	**6(6.8)**	**10(11.4)**	**31(35.2)**	**39(44.3)**	**88(100)**

Table W-16 (West Bengal)

Tanks by Value of Fish Produce

Districts	No of Tanks (with total area)	Annual Value (in Rs.)	Annual Value Per acre (in Rs.)	Value per tank
Bankura	5(85.5)	1,87,000	2,187	37,400
Purulia	7(25.5)	1,24,500	4,882	17,785
Birbhum	--	-	-	
Total	**12(111)**	**3,11,500**	**2,806**	**25,958**

Note: Values are per acre and per tank and therefore total does not tally

Table W-17 (West Bengal)

Caste and land holding in surveyed villages/hamlets

Districts, No. of villages	No. Households in caste groups					Land owned by Caste-groups(acres)				
	HC	OBC	SC	ST	TOT	HC	OBC	SC	ST	TOT
Bankura	229	265	423	75	992	423.8	240.2	86	20	770
	(23.1)	(26.7)	(42.6)	(7.6)	(100)	(55)	(31.2)	(11.2)	(2.6)	(10)
Purulia	328	5	451	156	940	184.1	3.0	173.6	150	510.7
	(34.9)	(0.5)	(48)	(16.6)	(100)	(36)	(0.6)	(34.0)	(29.4)	(100)
Birbhum	70	46	49	70	235	120	137	140	100	497
	(29.8)	(19.6)	(20.8)	(29.8)	(100)	(24.1)	(27.6)	(28.2)	(20.1)	(100)
Total	**627**	**316**	**923**	**301**	**2167**	**727.9**	**380.2**	**399.6**	**270**	**1777.7**
	(28.9)	**(14.6)**	**(42.6)**	**(13.9)**	**(100)**	**(40.9)**	**(21.4)**	**(22.5)**	**(15.2)**	**(100)**

Table W-18 (West Bengal)

Average Landholding size among different Caste Groups

Districts	Average Land holding size and Caste groups (acres)				Total (Average)
	HC	OBC	SC	ST	
Bankura	1.85	0.90	0.21	0.26	0.75
Purulia	0.56	0.60	0.38	0.96	0.31
Birbhum	1.71	2.97	2.85	1.42	2.11
Total	**1.16**	**1.20**	**0.43**	**0.89**	**0.71**

Tables of Tank Irrigation (Orissa)

Table O-1 (Orissa)

Age of the Surveyed Tanks

Districts	Categories of age of the tank				Total
	Anc/Med	British period	Post independence	Post 1990s	
Sambhalpur	2(28.6)	4(57.1)	1(14.3)	-	7(100)
Kalahandi	1(8.3)	8(66.7)	3(25)	-	12(100)
Bolangir	1(50)	1(50)		-	2(100)
Total	**4(19)**	**13(62)**	**4(19)**	**-**	**21(100)**

Table O-2 (Orissa)

Pattern of Ownership of the Tanks

Districts	Categoriesof ownership			Total
	Government	Panchayat	Private	
Sambhalpur	3(42.8)	4(57.2)	-	7(100)
Kalahandi	8(66.7)	3(25)	1(8.3)	12(100)
Bolangir	2(100)	-		2(100)
Total	**13(61.7)**	**7(33.5)**	**1(4.8)**	**21(100)**

Table O-3(Orissa)

Nature of People's Access to the Tanks

Districts	Open to All	Categories of Restrictions		Total
		Owners	Others	
Sambhalpur	7 (100)	-	-	7 (100)
Kalahandi	10(83.4)	1(8.3)	1 (8.3)	12 (100)
Bolangir	2(100)		-	2(100)
Total	**19(90.6)**	**1(4.7)**	**1 (4.7)**	**21(100)**

Table O-4 (Orissa)

Tanks by their size (in acres)

Districts	Categories by Size of Tanks						Total
	< 2.5	2.5-10	11-20	21-50	51-100	> 100	
Sambhalpur	-	2(12)	2(36)	1(45)	2(105)	-	7 (198)
Kalahandi	-	-	2(43)	3(121)	5(256)	2(275)	12 (695)
Bolangir	-	-	-	-	-	2(243)	2 (243)
Total	**-**	**2(12)**	**4(79)**	**4(166)**	**7(361)**	**4(518)**	**21 (1136)**

Note **:** Figures in the brackets show the total area of tanks

Table O-5 (Orissa)
Ratio of Irrigation per acre of Tank Area (by Net Area Irrigated by tank in acres)

Districts	No of Tanks with Total Area	Net Area Irrigated by tank	Ratio of Irrigation per acre of tank area	Per tank irrigated area
Sambhalpur	4(113)	362	1:3.20	90.5
Kalahandi	7(406)	1036	1:2.55	148
Bolangir	2(243)	706	1:2.91	353
Total	**13(762)**	**2104**	**1:2.76**	**161.8**

Table O-6 (Orissa)
Area Irrigated by Tanks in Different Seasons (in acres)

District	Modes of Irrigation or Fetching Water to the field (area in acres)			
	Manual	Mechanical	Surface flow	Total
Kahrif				
Sambhalpur	13	122	215	350
Kalahandi	40	226	732	998
Bolangir	27	189	452	668
Total	**80 (4)**	**537 (26.6)**	**1399 (69.4)**	**2016 (100)**
Rabi				
Sambhalpur	7	98	55	160
Kalahandi	14	272	158	444
Bolangir	11	167	162	340
Total	**32 (3.4)**	**537 (56.9)**	**375 (39.7)**	**944 (100)**
Summer				
Sambhalpur	1	10	-	11
Kalahandi	2	34	2	38
Bolangir	4	39	2	45
Total	**7 (7.4)**	**83 (88.3)**	**4 (4.3)**	**94 (100)**

Table O-7 (Orissa)
Gross Area Irrigated by Tanks in a Year

Districts	Manual	Mechanical	Surface flow	Total
Sambhalpur	21 (4)	230 (44.1)	270 (51.8)	521 (100)
Kalahandi	56 (3.8)	532 (35.9)	892 (60.3)	1480 (100)
Bolangir	42 (4)	395 (37.5)	616 (58.5)	1053 (100
Total	**119 (3.9)**	**1157 (37.9)**	**1778 (58.2)**	**3054 (100)**

Table O-8 (Orissa)

Irrigators per tank and average tank size (area in acres)

Districts	No of Tanks (with total area)	No of Irrigations	Average No.of Irrigators per acre of tank area	Average Irrigators per tank	Average size of tank
Sambhalpur	4 (113)	120	1.06	30	28.3
Kalahandi	7(406)	252	0.62	36	58
Bolangir	2 (243)	180	0.74	90	121.2
Total	**13(762)**	**552**	**0.72**	**42.5**	**58.6**

Table O-9a (Orissa)

Tanks by depth of water column in **Rainy Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7-10	5-7	3-5	< 3	Dry	
Sambhalpur	1 (14.3)	2 (28.6)	3 (42.9)	-	1(14.3)	-	7(100)
Kalahandi	5 (41.7)	3 (25)	3 (25)	1 (8.3)	-	-	12 (100)
Bolangir	2 (100)	-	-	-	-	-	2(100)
Total	**8(38.12)**	**5(23.8)**	**6 (28.6)**	**1 (4.7)**	**1 (4.7)**	**-**	**21(100)**

Table O-9b (Orissa)

Tanks by depth of water column in **Winter Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Sambhalpur	-	1 (14.3)	2 (28.6)	2 (28.6)	1 (14.3)	1 (14.3)	7 (100)
Kalahandi	2 (16.7)	3 (25)	5 (41.7)	1 (8.3)	1 (8.3)	-	12 (100)
Bolangir	1 (50)	1 (50)	-	-	-	-	2 (100)
Total	**3 (14.3)**	**5 (23.8)**	**7 (33.3)**	**3 (14.3)**	**2 (9.5)**	**1 (4.8)**	**2 (100)**

Table O-9c (Orissa)
Tanks by depth of water column in **Summer Season**

Districts	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Sambhalpur	-	-	1 (14.3)	2 (28.6)	1 (14.3)	3 (42.9)	7 (100)
Kalahandi	-	2 (16.7)	7 (58.3)	1 (8.3)	1 (8.3)	1 (8.3)	12 (100)
Bolangir	-	1 (50)	1(50)	-	-	-	2 (100)
Total	**-**	**3 (14.3)**	**9(42.9)**	**3 (14.3)**	**2 (9.5)**	**4 (19)**	**21 (100)**

Table O-10 (Orissa)
Tanks by sources of water

Districts	Rain	Rain+Rivulet+ Tank+Flood	Rain+Canal	Others	Total
Sambhalpur	4 (57.1)	3 (42.9)	-	-	7(100)
Kalahandi	6 (50)	5 (41.7)	1 (8.3)	-	12(100)
Bolangir	2(100)	-	-	-	2(100)
Total	**12 (57.1)**	**8 (38.1)**	**1(4.8)**	**-**	**21(100)**

Table O-11 (Orissa)
Tanks by Responsibility of Maintenance

Districts	Government	Panchayat/ Community Action	Owners	Others	Total
Sambhalpur	4(57.1)	2(28.6)	-	1(14.3)	7(100)
Kalahandi	8(66.7)	3(25)	1(8.3)	-	12(100)
Bolangir	1(50)	-	-	1(50)	2(100)
Total	**13(61.9)**	**5(23.8)**	**1(4.8)**	**2(9.5)**	**21(100)**

Table O-12 (Orissa)
Tank by frequency of Maintenance

Districts	Embankment					Desilting				
	Annual	2-10 yrs	11-30 yrs	Never	Total	Annual	2-10 yrs	11-30 yrs	Never	Total
Sambhalpur	-	6 (85.7)	1 (14.3)	-	7 (100)	-	2 (28.6)	2 (28.6)	3 (42.8)	7 (100)
Kalhandi	1 (8.3)	7 (58.3)	2 (16.7)	2 (16.7)	12 (100)	-	4 (33.3)	4 (33.3)	4 (33.3)	12 (100)
Bolangir	-	2 (100)	-	-	2 (100)	-	-	-	2 (100)	2 (100)
Total	**1 (4.7)**	**15 (71.5)**	**3 (14.3)**	**2 (9.5)**	**21 (100)**	**-**	**6 (28.6)**	**6 (28.6)**	**9 (42.8)**	**21 (100)**

Table O-13 (Orissa)

Tanks by Agency Incurring Funds for Maintenance

Districts	Agency incurring funds for Maintenance						Total
	Govt.	Panch/Comm Action	Govt.+ Panchayat	Owners/ Occupans	Others	None	
Sambhalpur	3 (42.8)	2 (28.6)	1 (14.3)	-	1 (14.3)	-	7 (100)
Kalahandi	8 (66.7)	1 (8.3)	-	1 (8.3)	2 (16.7)	-	12 (100)
Bolangir	2 (100)	-	-	-	-	-	2 (100)
Total	**13 (61.9)**	**3 (14.3)**	**1 (4.7)**	**1 (4.7)**	**3 (14.3)**	**-**	**21 (100)**

Table O-14 (Orissa)

Tanks by their uses

Districts	Uses of the Tank				Total
	Domestic	Pisciculture	Irrigation	Multipurpose	
Sambhalpur	1 (14.3)	1 (14.3)	1 (14.3)	4 (57)	7 (100)
Kalahandi	1 (8.3)	1 (8.3)	3 (25)	7 (58.4)	12 (100)
Bolangir		-	-	2 (100)	2 (100)
Total	**2 (9.5)**	**2 (9.5)**	**4 (19)**	**13 (62)**	**21 (100)**

Table O -15 (Orissa)

Pattern of Use of Tanks and in the study villages/hamlets.

Districts	Categories of various Uses of the Tanks					Total
	Only Irrig.	Only Pisci.	Only Domestic	Multipurpose	Abandoned	
Sambhalpur	1 (4.3)	2 (8.7)	4 (17.4)	15 (65.3)	1 (4.3)	23 (100)
Kalahandi	1 (2.4)	2 (4.9)	4 (9.8)	34 (82.9)	-	41 (100)
Bolangir	-	-	-	2 (100)	-	2 (100)
Total	**2 (3.0)**	**4 (6.1)**	**8 (12.1)**	**51 (77.3)**	**1 (1.5)**	**66 (100)**

Table O-16 (Orissa)

Tanks by Value of Fish Produce

Districts	No of Tanks (with total area)	Annual Value (in Rs.)	Annual Value Per acre (in Rs.)	Value per tank
Sambhalpur	4 (79.4)	52,000	655	13,000
Kalahandi	2 (159.1)	1,30,500	820	62,250
Bolangir	2 (243)	1,86,000	765	93,000
Total	**8(481.5)**	**3,68,500**	**765.3**	**46,062.5**

Note: Values are per acre and per tank and therefore total does not tally

Table O-17 (Orissa)

Caste and land holding in surveyed villages/hamlets

Districts, No. of villages	No. Households in caste groups					Land owned by Caste-groups(acres)				
	HC	OBC	SC	ST	TOT	HC	OBC	SC	ST	TOT
Sambhalpur	32 (2.2)	314 (21.9)	379 (26.4)	709 (49.5)	1434 (100.0)	611 (23.5)	964 (37.1)	310 (11.9)	715 (27.5)	2600 (100)
Kalahandi	290 (8.2)	2020 (57.3)	550 (15.6)	666 (18.9)	3526 (100)	181 (5.9)	1952 (63.6)	375 (12.2)	560 (18.3)	3068 (100)
Bolangir	6 (1.4)	313 (75.1)	30 (7.2)	68 (16.3)	417 (100.0)	80 (13.4)	285 (47.9)	10 (1.7)	220 (37)	595 (100)
Total	**328 (6.1)**	**2647 (49.2)**	**959 (17.9)**	**1443 (26.8)**	**5377 (100.0)**	**872 (13.9)**	**3201 (51.1)**	**695 (11.1)**	**1495 (23.9)**	**6263. (100)**

Table O-18 (Orissa)

Average Landholding size among different Caste Groups

Districts	Average Land holding size and Caste groups (acres)				Total (Average)
	HC	OBC	SC	ST	
Sambhalpur	19	3.07	0.81	1.01	1.81
Kalahandi	0.41	0.93	0.68	0.84	1.11
Bolangir	13.3	0.91	0.33	3.23	1.23
Total	**2.67**	**1.20**	**0.72**	**1.03**	**1.35**

Tables of Tank Irrigation (Eastern India)

Table E-1 (Eastern India)
Age of the Surveyed Tanks

States	Categories of age of the tank				Total
	Anc/Med	British period	Post independence	Post 1990s	
Jharkhand	8 (17.1)	25(53.2)	12 (25.5)	2(4.2)	47(100)
Bihar	8 (40)	11(55)	1 (5)	-	20 (100)
W. Bengal	2(6.5)	22(70.9)	4(12.9)	3(9.7)	31(100)
Orissa	4(19)	13(61.9)	4(19.1)	-	21(100)
Total	**22(18.5)**	**71(59.7)**	**21(17.6)**	**5 (4.2)**	**119 (100)**

Table E-2 (Eastern India)
Pattern of Ownership of the Tanks

States	Categoriesof ownership			Total
	Government	Panchayat	Private	
Jharkhand	30(63.8)	3(9.4)	14(29.8)	47(100)
Bihar	7(35)	5(25)	8 (40)	20(100)
West Bengal	2(6.5)	9(29.2)	20 (64.3)	31(100)
Orissa	13(61.7)	7(33.5)	1(4.8)	21(100)
Total	**52(43.7)**	**23(19.3)**	**44 (37)**	**119(100)**

Table E-3 (Eastern India)
Nature of People's Access to the Tanks

States	Open to All	Categories of Restrictions		Total
		Owners	Others	
Jharkhand	40(85.1)	3(6.3)	4(8.6)	47(100)
Bihar	16(80)	1(5)	3 (15)	20(100)
West Bengal	24(77.4)	7(22.6)	-	31(100)
Orissa	19(90.6)	1(4.7)	1 (4.7)	21(100)
Total	**99(83.2)**	**12(10.1)**	**8(6.7)**	**119(100)**

Table E-4 (Eastern India)
Tanks by their size (in acres)

States	Categories by Size of Tanks						Total
	< 2.5	2.5-10	11-20	21-50	51-100	> 100	
Jharkhand	20(29.9)	23(125.1)	2(27)	1(23)	-	1(109)	47(314)
Bihar	3(2.6)	9(45.9)	4(56)	2(84)	2(135)	-	20(323.5)
W est Bengal	15(15.6)	9(36.5)	1(11.5)	4(141)	1 (74)	1(109)	31(387.6)
Orissa	-	2 (12)	4 (79)	4 (166)	7 (361)	4 (518)	21 (1136)
Total	**38(48.1)**	**43(219.5)**	**11(173.5)**	**11(414)**	**10 (570)**	**6(736)**	**119(2161.1)**

Note : Figures in the brackets show the total area of tanks

Table E-5 (Eastern India)
Ratio of Irrigation per acre of Tank Area (by Net Area Irrigated by tank in acres)

States	No of Tanks with Total Area	Net Area Irrigated by tank	Ratio of Irrigation per acre of tank area	Per tank irrigated area
Jharkhand	47 (314)	484.5	1:1.5	15.04 (6.5)
Bihar	20 (323.5)	953.9	1:2.9	48.00
W. Bengal	25 (200.3)	519.2	1:2.6	20.77
Orissa	13 (762)	2104	1:2.8	161.85
Total	**105 (1599.8)**	**4061.6**	**1:2.5**	**38.68**

Table E-6 (Eastern India)
Area Irrigated by Tanks in Different Seasons (in acres)

States	Modes of Irrigation (area in acres)				Percent of gross irrigated area
	Manual	Mechanical	Surface flow	Total	
Kahrif					
Jharkhand	1	45	275	321	50.5
Bihar	70	462.9	259.3	792.2	60.7
West Bengal	5.6	54.5	353.3	413.4	56.2
Orissa	80	537	1399	2016	66
Total	**156.6**	**1099.4**	**2286.6**	**3542.6**	**61.8**
Rabi					
Jharkhand	6	247	20	273	42.9
Bihar	8	488.6	-	496.6	38
West Bengal	8.6	156	130.6	295.2	40.1
Orissa	32	537	375	944	30.9
Total	**54.6**	**1428.6**	**525.6**	**2008.8**	**35.6**
Summer					
Jharkhand	1.5	30	10	41.5	6.6
Bihar	4.5	12	-	16.5	1.3
West Bengal	-	27.3	-	27.3	3.7
Orissa	7	83	4	94	3.1
Total	**13**	**152.3**	**14**	**179.3**	**3.1**

Table E-7 (Eastern India)
Gross Area Irrigated by Tanks in a Year

States	Manual	Mechanical	Surface flow	Total
Jharkhand	8.5 (1.7)	322 (39.3)	305 (59)	635.5 (100)
Bihar	82 (6.2)	963.5 (73.3)	268.3 (20.5)	1313.8 (100)
West Bengal	14.2 (1.9)	227.8 (31.4)	483.9 (66.7)	725.9 (100)
Orissa	119 (3.9)	1157 (37.9)	1778 (58.2)	3054 (100)
Total	**223.7 (3.9)**	**2670.3 (46.6)**	**2835.2 (49.5)**	**5729.2 (100)**

Table E-8 (Eastern India)

Irrigators per tank and average tank size (area in acres)

States	No of Tanks (with total area)	No of Irrigations	Average No.of Irrigators per acre of tank area	Average Irrigators per tank	Average size of tank
Jharkhand	40(262.5)	617	2.4	15.4	6.6
Bihar	14(250)	831	3.3	58.1	19
West Bengal	24(153.1)	887	5.8	36.9	6.4
Orissa	13 (762)	552	0.7	42.5	58.6
Total	**91(1427.6)**	**2887**	**2**	**31.7**	**15.7**

Table E-9a (Eastern India)

Tanks by depth of water column in **Rainy Season**

States	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry-N.A.	
Jharkhand	13 (27.7)	22(46.8)	8 (17)	4(8.5)	-	-	47(100)
Bihar	7(35)	4(20)	9(45)	-	-	-	20(100)
WestBengal	7(22.6)	4(12.9)	5(16.1)	11(35.5)	4(12.8)	-	31(100)
Orissa	8(38.2)	5(23.8)	6(28.6)	1(4.7)	1(4.7)	-	21(100)
Total	**35 (29.4)**	**35(29.4)**	**28(23.5)**	**16(13.5)**	**5(4.2)**	**-**	**119(100)**

Table E-9b (Eastern India)

Tanks by depth of water column in **Winter Season**

States	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Jharkhand	4(8.5)	10(21.4)	12(25.5)	19(40.4)	1(2.1)	1(2.1)	47(100)
Bihar	2(10)	3(15)	5(25)	8(40)	1(5)	1(5)	20(100)
W Bengal	1(3.7)	6(22.2)	2(7.4)	12(44.4)	4(14.8)	2 (7.4)	27(100)
Orissa	3 (14.3)	5 (23.8)	7 (33.3)	3 (14.3)	2 (9.5)	1 (4.8)	21 (100)
Total	**10 (8.7)**	**24(20.9)**	**26(22.6)**	**42(36.6)**	**8(6.9)**	**5(4.3)**	**115(100)**

Table E-9c (Eastern India)

Tanks by depth of water column in **Summer Season**

States	Categories of Depth of Water (in feet)						Total
	> 10	7.5-10	5.5-7	3-5	< 3	Dry	
Jharkhand	1(2.1)	-	5(10.7)	23(48.9)	4(8.5)	14(29.8)	47(100)
Bihar	-	1(5)	-	6(30)	2(10)	11(55)	20(100)
W. Bengal	-	5(16.1)	-	3(9.6)	6(19.4)	14(45.2)	28(100)
Orissa	-	3 (14.3)	9 (42.9)	3 (14.3)	2 (9.5)	4 (19)	21 (100)
Total	**1(0.8)**	**9(7.7)**	**14(12.1)**	**35(30.2)**	**14(12.1)**	**43(37.1)**	**116(100)**

Table E-10 (Eastern India)

Tanks by sources of water

States	Rain	Rain+Rivulet+ Tank+Flood	Rain+Canal	Others	Total
Jharkhand	31(65.9)	8(17)	-	8(17)	47(100)
Bihar	9(45)	7(35)	1(5)	3(15)	20(100)
W Bengal	24(77.5)	2(6.4)	4(12.9)	1(3.2)	31(100)
Orissa	12 (57.1)	8 (38.1)	1(4.8)	-	21(100)
Total	**76 (63.9)**	**25(21)**	**6(5)**	**12(10.1)**	**119(100**

Table E-11(Eastern India)

Tanks by Responsibility of Maintenance

States	Government	Panchayat/ Community Action	Owners	Others	Total
Jharkhand	31(65.9)	1(2.2)	15(31.9)	-	47(100)
Bihar	7(35)	1(5)	4(20)	8(40)	20(100)
W Bengal	2(6.4)	9(29.1)	18(58.1)	2(6.4)	31(100)
Orissa	13 (61.9)	5(23.8)	1(4.8)	2(9.5)	21(100)
Total	**53(44.5)**	**16(13.5)**	**38(31.9)**	**12(10.1)**	**119(100)**

Table E-12(Eastern India)

Tank by frequency of Maintenance

States	Frequency of Repair of Embankments					Frequency of Desilting of tank bed				
	Annual	2-10 yrs	11-30 yrs	Never	Total	Annual	2-10 yrs	11-30 yrs	Never	Total
Jharkhand	2(4.3)	12(25.5)	4(8.5)	29(61.7)	47(100)	2(4.3)	11(23.4)	7(14.9)	27(57.4)	47(100)
Bihar	3(15)	5(25)	5 (25)	7 (35)	20(100)	3(15)	1(5)	6(30)	10(50)	20(100)
West Bengal	6(19.3)	5(16.1)	2(6.4)	18(58.2)	31(100)	-	6(19.3)	5(16.2)	20(64.5)	31(100)
Orissa	1 (4.7)	15(71.4)	3(14.3)	2 (9.5)	21(100)	-	6(28.6)	6(28.6)	9(42.8)	21(100)
Total	**12(10.1)**	**37(31.1)**	**14(11.7)**	**56(47.1)**	**119(100)**	**5(4.2)**	**24(920.2)**	**24(20.2)**	**66(55.4)**	**119(100)**

Table E-13 (Eastern India)

Tanks by Agency Incurring Funds for Maintenance

States	Agency incurring funds for Maintenance						Total
	Govt.	Panch/Comm Action	Govt.+ Panchayat	Owners/ Occupans	Others	None	
Jharkhand	24 (51.1)	-	-	2 (4.3)	-	2 (44.6)	47 (100)
Bihar	2 (10)	5 (25)	1 (5)	4 (20)	1 (5)	7 (35)	20 (100)
W Bengal	4 (12.5)	7 (22.6)	3 (9.6)	2 (6.5)	5 (16.1)	10 (32.4)	31 (100)
Orissa	13 (61.9)	3 (14.3)	1 (4.7)	1 (4.7)	3 (14.3)	-	21 (100)
Total	**43 (36.1)**	**15 (12.6)**	**5 (4.2)**	**9 (7.6)**	**9 (7.6)**	**38 (31.9)**	**119 (100)**

Table E-14(Eastern India)

Tanks by their uses

States	Uses of the Tank				Total
	Domestic	Pisciculture	Irrigation	Multipurpose	
Jharkhand	3 (6.5)	1 (2.1)	4 (8.5)	39 (82.9)	47 (100)
Bihar	-	4 (20)	3 (15)	13 (65)	20 (100)
W Bengal	6 (19.3)	3 (9.7)	2 (6.4)	20 (64.6)	31 (100)
Orissa	2 (9.5)	2 (9.5)	4 (19)	13 (62)	21 (100)
Total	**11 (9.2)**	**10 (8.4)**	**13 (11)**	**85 (71.4)**	**119 (100)**

Table E-15 (Eastern India)

Pattern of Use of Tanks in the Study Villages/Hamlets

States	Categories of various Uses of the Tanks					Total
	Only Irrig.	Only Pisci.	Only Domestic	Multipurpose	Abandoned	
Jharkhand	5 (4.5)	4 (3.6)	3 (2.6)	85 (77.2)	13 (11.8)	110 (100)
Bihar	11 (14.1)	5 (6.4)	-	62 (79.5)	-	78 (100)
West Bengal	2 (2.3)	6 (6.8)	10 (11.4)	31 (35.2)	39 (44.3)	88 (100)
Orissa	2 (3)	4 (6.1)	8 (12.1)	51 (77.3)	1 (1.5)	66 (100)
Total	**20 (5.9)**	**19 (5.6)**	**21 (6.1)**	**229 (66.9)**	**53 (15.5)**	**342 (100)**

Table E-16 (Eastern India)

Tanks by Value of Fish Produce

States	No of Tanks (with total area)	Annual Value (in Rs.)	Annual Value Per acre (in Rs.)	Value per tank
Jharkhand	37 (291.1)	19,13,500	6,573	51,716
Bihar	16 (234.6)	18,01,000	7,677	1,12,562
West Bengal	12 (111)	3,11,500	2,806	25,958
Orissa	8 (481.5)	3,68,500	765.3	46,065.5
Total	**73 (1118.1)**	**43,94,500**	**3930.3**	**60198.6**

Note: Values are per acre and per tank and therefore total does not tally

Table E-17 (Eastern India)

Caste and land holding in surveyed villages/hamlets

States No. of villages	No. Households in caste groups					Land owned by Caste-groups(acres)				
	HC	OBC	SC	ST	TOT	HC	OBC	SC	ST	TOT
Jharkhand	554 (4.8)	5441 (47.1)	571 (4.9)	4986 (43.2)	11552 (100)	2145 (17.1)	3142.5 (25.1)	631 (5.0)	6628 (52.8)	12546.5 (100)
Bihar	467 (17.1)	1471 (53.9)	792 (29)	-	2730 (100)	1285.9 (35)	2119.6 (57.7)	270 (7.3)	-	3675.5 (100)
West Bengal	627 (27.8)	316 (15.3)	923 (40.9)	302 (16)	2167 (100)	727.9 (39.6)	380.2 (20.7)	399.6 (21.7)	270 (18.0)	1777.7 (100)
Orissa	328 (6.1)	2647 (49.2)	959 (17.9)	1443 (26.8)	5377 (100)	872 (13.9)	3201 (51.1)	695 (11.1)	1495 (23.9)	6263 (100)
Total	**1976 (9.1)**	**9875 (45.2)**	**3245 (14.9)**	**6731 (30.8)**	**21826 (100)**	**5030.8 (20.7)**	**8843.3 (36.5)**	**1995.6 (8.2)**	**8393 (34.6)**	**24262.7 (100)**

Table E-18 (Eastern India)

Average Size of Land holding of Different Caste Groups

States	Average Land holding size and Caste groups (acres)				Total (Average)
	HC	OBC	SC	ST	
Jharkhand	3.87	0.58	1.11	1.33	1.09
Bihar	2.75	1.44	0.34	-	1.34
W. Bengal	1.16	1.10	0.43	0.91	0.81
Orissa	2.67	1.20	0.72	1.03	1.35
Total	**2.54**	**0.89**	**0.61**	**1.24**	**1.11**

Annexure - IV

Case Details of Studied Villages - Bihar
(Material not covered in tables)

1. Village: Salarpur, **Panchayat:** Salarpur, **Block:** Daniawan, **District:** Patna

Location:

The village Salarpur has two hamlets, namely, Salarpur Dih and Salarpur Bigha. It is situated at a distance of 8 kms east from Daniawan block of Patna district on the Patna – Biharsharif road near Faridpur. Faridpur is the bus station for the village, and the village is two km north from it. It is connected with a semi metalled road nearly one and half km long. From the end of the road, the lowland starts. At the beginning there is *baha* (drainout channel) and after crossing the *baha* the deep ditches (about 12 to 15 feet deep) known as *khata* can be seen along the earthen barrier. There are 9 *tolas* in the Panchayat, namely, Garibuchak, Pir Badauna Dih, Badauna bigha, Jodhanbigha, Faridpur, Taraura and Tekabigha. The village is not electrified.

Topography:

The topography is plain with mild slope from west to east and the *baha* was earlier constructed to drain out the water into the Matmaen River which merges into Falgu River to save the damage from the flow of water. Now the *baha* remains dry round the year as, at the source of the *baha*, a *bandh* was constructed on the bank of Matmaen River at Nawichak village to the west. Matmaen along with Falgu joins Ganga in Mokama *tal* (riverine). As large amount of water flows through the area into the lower side of the Matmaen River, ditches were dug to contain flowing water, and are called *khata* by locals. These *khatas* are deep tanks dug across the blocked slope. The Matmaen River is silted up at the receiving end in the east and does not receive all the water from the catchment during rainy season. As a result, nearly 400 acres of land remain inundated (covered under water) for most parts of the year. The total area of Salarpur mauja (two hamlets) is about 1200 acre (1786 bigha). Such *khatas* cover nearly 276 acres of land altogether and are 36 to 40 in number in Salarpur mauja. These *khatas* are on government land and used for all purposes.

Social:

Muslims earlier dominated the village. But after a riot which broke out during the partition of India, they left the village and now no Muslim family resides here. The village is demographically, politically and economically dominated by OBCs. But there are two power centres among them: one is *Kurmis* (Mahato) with 225 households and nearly 800 acre of land, and the other is *Beldars* (land digging works are their traditional profession) with 100 households and 55 acres of land. But the neo-dominants are the

Scheduled Castes mainly *Dusadh* and *Chamar* who have acquired positions in the Panchayat bodies owing to their population and caste-based reservation policy. There are 135 households belong to this caste, and they have over 35 acres of land. One *Chamar* (Bilas Ram) has recently bought 15 acres of land. There are altogether 19 castes (five SCs, five general castes and rest nine castes are of OBC category) in the village. Only five households of the village belong to Brahmin (general castes), who together own 16 acres of land. The important persons of the village are from different castes. Sarju Prasad *(kurmi)* owns 15 acres of land and Ramji Prasad a postgraduate owns 21 acres of land. They are social actors in the village. One Kameshwar Prasad (*sonar*-goldsmith) is Mukhia of nearby Badauna panchayat. Kedar Nath Pandey, a Senior Audit Officer in the Accountant General of Bihar's office, commands respect in the village. Arjun Paswan**,** whose wife is elected member of Salarpur Panchayat**,** is also an important person in the village who claims to be the leader of SCs. Lal Subhash is influential because his wife is also elected to the panchayat. Ramashish manjhi is an active SC member in the village. It is important to note that the use of such *khatas* is limited to the command area of the *khata*. People have captured the *khata* falling along their land and exercise ownership over the *khata*. There are 4500 voters in the village.

Irrigation:

All the agricultural land of the village has irrigation facilities. The major sources of irrigation are tubewells and tanks *(khatas)*. Over 275 acres of land is irrigated by tubewell. Every third field has a bore well. There is a large number of diesel and kerosene-run agro pumps. The villagers have 20 to 25 Chinese CD portable diesel operated pumps, 150 diesel engine (5 hp) and 75 to 80 Grieves Wheeler (3.5 hp) kerosene operated pumps. The renting of pumpsets is widespread in the village. The owners charge Rs 20 per hour without fuel. The tanks irrigate rest of the land in the *mauja*. Although all types of water pumps are used for lifting water from these *khatas,* a number of traditional lift irrigation devices such as *Karing* and *Lathta Kudi* were found to be widely prevalent. It was said that nearly 400 acre of land remain under water most of the time, and hence do not need any irrigation. It was said that these *khatas* exist from the Moughal period. These khatas are 12 to 15 feet deep and are full in rainy season. The source of water to these khatas are direct precipitation, water flowing down from upland and khatas on the uplands. In some khatas, water remains throughout the year, but most of them dry up by winter itself. In September 2004 the *khatas* had water up to the brim, and during December 2004 most of the khatas were found to be dry, because of scanty rain in 2004. Therefore in September a number of traditional modes of lifting water was observed but during December in the same year, no irrigation activities were seen.

The *khatas* are all in the government land. But the government had no control over these khatas for either fisheries or irrigation. The farmers from all castes have captured the *khatas* which fall near their land irrespective of caste. In some cases the banks (upside land of waterspread area which gets dry after rainy season) of the *khata* are cultivated in Rabi season. The farmers having captured the *khatas,* use them for various purposes. In case there are more than one occupant, all the occupants enjoy

equal rights over the tank. One Arjun Paswan and his brothers have captured *Mahabir* Sthan Khata having a waterspread area of 4 acres. Their houses are near the *khata*. They earn Rs 90,000 to 1,20,000 per year by growing fish in that khata. All brothers share the income and investment. The *khata* irrigates a maximum of 6 acres and a minimum of one acre. The occupants have very little amount of land there, but irrigation is not restricted to the non-occupant farmers. They fetch water with the help of portable pumpsets. They grow vegetables and earn Rs.10,000 per bigha/per season. Here, the renting rate for machine is different say Rs. 6 per katha (0.03 acres).

There are domestic uses of khatas, such as cleaning cattle, worship, bathing etc. The water rights in this village are of a peculiar kind. The water is free for those who fall in the area of the *khata*. Water is not allowed to be taken to any area outside the command of the *khata*. The people of other localities of the village are also restricted from using the tanks even for domestic purposes.

The maintenance of the *khata* is the responsibility of the occupants. It was seen that the occupants maintained the *khatas* properly and repaired almost every year. The villagers once mobilized community action to prevent floods. Six years ago, the *bandh* of Matmaen River was broken, the *goam* of villagers gathered to control the water by preparing *guds* (earthen boulders quickly made with husk and mud). They controlled the flooding within 7 to 8 hours and the village was saved.

Other Uses:

Two tanks in the village are specially used for pisciculture (including cultivating fish seeds) which generates handsome income. One of the owners of these tanks, Ramsubhawan Prasad, earns nearly one lac sixty thousand rupees from these tanks every year. The fish seeds are grown in 15 days. He brings the smaller seeds from the market and they grow up to a transferable size within 15 days and he sells it out to put the next batch of fishlings. The price of fish seeds comes in the range of Rs. 100 and 150 per kg. There are some *khatas* where water remains round the year and in those *khatas* cultivation of fish is very profitable. As discussed earlier, the villagers illegally occupy khatas falling near their land. One Arjun Paswan has occupied *Mhadevsthan khata* of nearly 4 acres and earns around rupees one lac from the tanks. He keeps the *khata* well maintained and keeps an account of the fish production and sale proceeds, as he has to share the income and expenses with his two brothers. The villagers have also filed case in court of law for allowing the *khatas* to be under their occupation. It was said the case is pending for last ten years and they believe they will get the ownership legally. Rameshwar Paswan and his brothers occupy another *khata* named Banglapar *ka khata* for last several years. It gets dry in summer season and has very little water in winters. At the time of survey (9-12-2004) the khata was almost dry and rabi crops such as mustard and masoor (a kind of pulses) were sown in the tank area.

The *khatas* are used for all domestic purposes irrespective of the amount of water that remains in the tanks. However, people from the commands of other khatas are not allowed to use a khata's water for any purpose except irrigation.

2. Village: Kalyanpur, **Panchayat:** Kalayanpur-Paipura, **Block:** Paliganj, **District:** Patna

Location:

It is situated at the distance of nearly 60 km in the south west direction from Patna near the border of Jehanabad district. Village Khapuri in the north, Baduri in the west, Raksipura in the east and Paliganj in the south surround it.

Social:

In the social constitution of the village, *bhumihars* (a land owning upper caste with nearly 60 h/h) dominate in terms of social and economic status. However, in terms of population, *binds* (fishing caste in nearly 100 h/h) constitute the largest part of the village social setting. *Binds* fall under the category of BC-I. (extremely other backward castes). *Kahar, kumhar* and *tanti* all BC-I (29 h/h), *yadav, koeri* and *teli* all BC-II (upper OBC), *chamar* and *musahar* of SC category (27 h/h) and Muslim (2 h/h) constitute the social structure in small numbers. *Bhumihars* enjoy the power supremacy as posts of both the *mukhia* and *up-mukhia* are held by *bhumihar* (Lalit Singh and Ram Udaya Singh respectively).

Land holding pattern is heavily in favour of *bhumihars* who own nearly 350 acres out of total area of 400 acres. *yadav, tanti* and *bind* (20, 15, 12 acres respectively) are the other major owners of agricultural land. Out of 400 acres nearly 350 acres have irrigation facilities. The source wise division is as follows – Canal (*Sone* Canal System) – 175 acres, Tubewells – 25 acres and Tank/*Ahar* – 150 acres. There are 125 marginal farmers, 30 small farmers and nearly 10 medium farmers.

Kalayanpur *Ahar:*

Water spread area of the *Ahar* is 50 acres, which irrigates nearly 150 acre of land in *kharif* season and all through surface flow. It benefits nearly 200 farmers. The tank is maintained by fisheries department but no maintenance work has taken place in the last 25-30 years. The annual fish production is over 50 quintals amounting to nearly Rs. 2 lakh in monetary terms (estimate of the villagers). The actual contract amount fixed by the Government (fisheries department) is not known.

The villagers complained that the dried up area of the *Ahar* has been grabbed by the dominant castes in the village and the *Ahar* has not been desilted/enlarged or undergone repair in the embankment for long. Now, villagers also do not take collective effort as it is under control of fisheries department and any attempt may hamper the pisciculture. They suggested that government should forcibly evacuate the encroachers and resort to regular maintenance work for making it more productive for agriculture.

3. Village: Gopalpur, **Panchayat:** Baank, **Block:** Maner, **District:** Patna

Location:

It is situated at the distance of nearly 32 km in the west of Patna near the Patna – Ara highway in Patna district.

Social:

In the social constitution of the village, upper OBC *kurmi* (a land owning upper OBC caste in 250 h/h) dominate in terms of social and economic status. However, lower OBC castes such as *tanti, hazam/barber* and *kahar* constitute 60 h/h (30, 5 and 25 h/h respectively) constitute a small part of the village. *Yadavs*, and *teli* of BC-II (upper OBC) in eight households, *chamar* and *musahar* of SC category (165 h/h) and *brahmins* (4 h/h) constitute the social structure. *Kurmis* enjoy supremacy in the village. Two villagers hold important positions. One Jay Prakash Roy holds the post of *mukhia* and another Harinarayan Roy is the member of *Panchayat Samiti* of Maner block.

Land and topography:

Land holding pattern is heavily skewed towards *kurmis* who own nearly 600 acres out of total area of 650 acre. Others having very small holding are *tanti, hazam* and *kahar* all falling in category of OBC-I[58] who own 10, 2, and 2 acres respectively. *Yadav* and *teli* (4, 3 acres respectively) are the other owners of agricultural land in small sizes.

Irrigation:

Out of 650 acres, nearly 600 acres of land have irrigation facilities. The source wise division is as follows: Tubewells – 200 acres, Tank/*ahar* – 250 acres and 150 acres from river/rivulets (may be *pynes*). There are altogether 8 tanks/*ahars* in the village of which three have been surveyed – first an *ahar*, second a big tank and third a small tank. There are 100 marginal farmers, 40 small farmers and nearly 20 medium farmers in the village.

Tanks and Irrigation:

Gopalpur *Ahar* - Water spread area of the *ahar* is 75 acres which irrigates nearly 200 acres of land in *kharif* season of which, 80 acres through surface flow, 100 acres through mechanical modes and 20 acres through traditional manual modes. It benefits nearly 200 farmers. Panchayat bodies are responsible for the maintenance of tank and maintenance works are undertaken mostly annually as per requirements. In 2005, One lakh rupees was spent on maintenance work of the tank. No pisciculture is practiced in the tank. Total number of irrigators in the command area of tank is 200.

Gopalpur Pokhar - Water spread area of the tank is 15 acres which irrigates nearly 25 acres of agricultural land. In *kharif*, 25 acres of land is irrigated through surface flow whereas similar amount of land (25 acres) is irrigated in Rabi season through mechanical modes. No irrigation could be done in summer season. The total number of irrigators of the tank is 25 and all of them belong to *kurmi* caste. Although the maintenance responsibility lies with the fisheries department, which has never undertaken any maintenance work.

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[58] BC-I and BC-II constitute OBC BC-I and BC-II are two lists under OBC. BC-I has extremely backward casts listed in it while BC-II lists the upper sections under OBC.

Pisciculture is practiced in the tank and FD contracts out the tank on the annual basis. According to villagers, nearly Rs. 80,000 is earned from the tank from fisheries production of over 20 quintals per year. The villagers complained that the tank has not been desilted or its embankment repaired for a long time.

Gopalpur Pokhari - Water spread area of the tank is 12 acres which irrigates nearly 15 acres of agricultural land. In *kharif*, 15 acres of land is irrigated through surface flow whereas similar amount of land (15 acres) is irrigated in *rabi* season through mechanical modes and no irrigation is given in summer. The total number of irrigators of the tank is 20 and almost all are of *kurmi* caste. Like the bigger tank in the village, although the maintenance responsibility is with the fisheries department, it has never undertaken any maintenance work. Pisciculture is practiced in the tank and government contracts out on the annual basis. According to villagers nearly Rs. 40,000 is earned from the tank from fisheries production of over 10-15 quintals per year.

4. Village: Kool, **Panchayat:** Kool, **Block:** Rajgir, **District:** Nalanda

Location:

It is situated nearly 1.5 km away from Nalanda-Rajgir road at Nalanda Mod (turning) towards south. It is surrounded by village Saken in the north, Manhori in the south, Bhadari in the east and agricultural land in the west.

Social:

The village is dominated by *bhumihar* caste both in terms of population size and socio-economic resources. The main actors of the village are Ashutosh Kumar (present mukhia), Rajeshwar Prasad (ex-mukhia), Jamo Singh, Bipin Singh, Kameshwar Singh and Ramashray Singh all *bhumihars*. Three out of them have formed a social organization in 1998 named Gram Vikash Samiti. The Samiti looks after development of the village and contracts out the tanks for pisciculture. The income from the fish produce is invested in development work of the village like drains, transformer etc. the Samiti has three office bearers – Rajeshwar Singh as Chairman, Ramashray Singh as Secretary and Ashutosh Kumar as Treasurer. The Samiti has an account with Canara Bank, Nalanda Mod Branch. It is ironical to note that since its inception it has not spent any money for repair of tanks. It is also noteworthy that non-Bhumihar castes are against the *bhumihars* on the tank issue. They have not been given representation in the Samiti. They blame that *bhumihars* have virtual control over the tank and they contract it out for fishing to only youths of their fellow caste-member arbitrarily. Once some village people, who were against the *bhumihars*, poisoned the Doma *pokhar.* However, they did not want to speak about it in the open out of fear of *bhumihars*. The village has a middle school situated near one of the tanks. There are 1800 voters in the village. It is an electrified village.

Topography:

The topography of the village is plain with 'dih' lands (homestead up land). The village has nearly 500 acres of agricultural land of which 300 acres have irrigation

facilities. The main crops of the village are paddy in kharif season and wheat, gram, masoor and other pulses like moong. The *dih* land is used for growing vegetables round the year like potato, brinjall, cabbage and other green vegetables.

Irrigation:

Major source of irrigation in the village is private tube wells with pumpsets. The fields have borings and the diesel operated portable pumpsets are used. Nearly 200 acres of land is irrigated by tube wells. A branch of Chani canal touches the village that is at the tail end and irrigation water does not reach. There are no wells for irrigation purposes in the village. Tanks and *pynes* irrigate a considerable amount (nearly 100 acres) of land. The main method of fetching water from the tanks in scarce periods is lifting by using pumpsets. The practice of manual modes of fetching water from tanks and pynes is in use through *karing* and *lathakudi*, but rare. But irrigation from tanks is reducing year after year due to pisciculture. The tanks are contracted out for pisciculture by the panchayat. The contractors do not allow diversion of water for irrigation after the water level drops to a certain mark in the tanks. There are four tanks and a *pyne* in the village. Irrigation from *pyne* depends on rain and under most favourable conditions nearly 50 acres land is irrigated. All the tanks in the village are in public land (*gairmajarua* land) and managed by villagers' committee as mentioned in social section. The four tanks are – Bania *pokhar*, Chamgodi *pokhar*, Hasani *pokhar* and Doma *pokhar*. The former two tanks are of relatively bigger size (16 acres and 13 acres respectively) and the latter two are of smaller size (4 acres and 6 acres respectively). During the past ten years, the tanks were neither renovated nor repaired. The village was declared as a drought-affected village in 1966.

Other Uses:

All four tanks of the village are used for pisciculture. The value of fish produce comes in the range of Rs 1,60,000 and 2,00,000 in Bania *pokhar* and in Chamgodi *pokhar* each, in the last five years and between Rs 80,000 and 1,20,000 in Hasani *pokhar* and Doma *pokhar* each, in last five years. The village committee (Gram Vikash Samiti) manages the practice of pisciculture. The contracts are taken by the *bhumihars* of the village; sometimes two or more persons take fishing contract. These contractors restrict farmers from taking water from the tanks in the interest of fish cultivation, when water in the tanks is insufficient. They invest money for fish seeds but do not spend money for renovation or repair of the tanks.

The tanks are also used for domestic purposes such as bathing, cleaning cattle, etc. The cultivation of water fruits or flowers is not undertaken in these tanks.

5. Village: Panhesa, **Panchayat:** Kool, **Block:** Rajgir, **District:** Nalanda

Location:

Panhesa falls under Kool panchayat and is a smaller village. It is one km west from Nalanda Mod, on the Nalanda-Rajgir road. It is surrounded by a powerhouse in north, Fatehpur in south, Madhopur in west and Kool in the east. This village was declared a drought village in 1966.

Social:

The village consists of OBCs, SCs and Muslims, of which Muslims are the dominant community. They are the largest constituents (100 h/h) and land (100 acres) owners. Among SCs (*mushars* and *nats*) constitute 75+5 h/h and own nearly 20 acres land. The important persons of the village belong to Muslim community – Jamal Mian, Shafique Mian, Bakasur Mian and Farukh Mian are social workers of the village.

Topography:

The land is plain with a few low-lying patches. The main crops are paddy, wheat, pulses with mustard and vegetables.

Irrigation:

The major irrigation source is tubewells fitted with pumpsets (diesel operated). Nearly 70 bighas (55 acres) of land is irrigated by tube wells. The canal also irrigates about 30-35 acres; when there is sufficient rain, otherwise left un-irrigated as it is situated at the tail end. The tanks also irrigate a considerable amount of land (nearly 25-30 acres).

There are three tanks in the village. All are private and used for irrigation, pisciculture and domestic purpose. In *kharif*, irrigation is through surface flow but in scarce periods water from tank is lifted using pumpsets. The biggest tank of the village, named Mian *pokhar*, has nearly 10 acres of waterspread area and is in existence since the British period. The tank has five owners, namely Md. Jamal, Jaqui Ahmed, Jubair Ahmed, Md Adar Hussain and Safi Ahmed, all having equal shares. It irrigates nearly 22 acres of land of which 16 acres belong to the owners and rest 5 to 6 acres belong to non-owners. But non-owners are not charged for irrigation. Two other tanks are situated side by side. These tanks are also of the British period. The waterspread area of the two tanks amounts to 1.6 acres (1+0.6). These two tanks have five owners with equal shares. The owners are same for both the tanks. These tanks are called Judwan Mian *pokhar.* Tanks are used for irrigation, pisciculture and domestic purposes. It was said that one owner takes the contract for fishing on Rs 30000, which is distributed among rest four shareholders, and the contractor-owner takes the income exceeding the contract amount.

It is interesting to note that all these tanks of the village are repaired and renovated every year. All the owners incur expenses in equal amounts for repair and maintenance. These tanks are in better position than the government maintained tanks of village Kool.

Other Uses:

All the three tanks in the village are private property and the five owners themselves carry out pisciculture. For last fifteen years one of the owners Jamal Mian takes the contract of fishing in these tanks on Rs. 30,000 per year, which is shared by the other four owners. But as the contractor-owner incurs investments including that for renovation/ repair of tanks, the net earnings are solely with Jamal. It is also considered that by this arrangement the other owners indirectly pay the share in expenses of repair and renovation of tanks.

The domestic uses like bathing, cloth cleaning and cattle cleaning are done in the tanks. For this no restriction is exercised. Cultivation of water fruits and flowers is not practiced in these tanks.

6. Village: Muzaffarpur, **Panchayat:** Badgaon, **Block:** Rajgir, **District:** Nalanda

Location:

The village is located just behind the walls of Nalanda University ruins on the metal road connecting Nalanda township, nearly half kilometer away from Nalanda Nav Mahabihar (A Prakrit Research Institute) and in front of Huen Sang Memorial. It falls under Badgaon panchayat of Silaw block.

Social:

The village is dominated by *kurmis* (land owning OBC caste) and *bhumihar* (General Caste). These two castes have nearly 100 households and 166 acres of land each. The other OBC castes are *barahi* (carpenter), *kahar, dhanuk, kumhar* (traditionally manufacturing earthen pots) together constituting 64 h/h with 35 acres of agricultural land. The SCs of the village are *musahar* and *chamar* (cobbler) together constituting 42 h/h and almost landless (only 1 acre of land). Mr. Shiv Nandan Prasad Kesari (65) a *kurmi*, Kishori Prasad Singh and Yogendra Singh both *bhumihars*, Ashok Kumar alias Suresh Bhante a *barahi* turned Budhist and Brijnandan Ram an employee of Nalanda Nav Mahabihar are the important persons of the village. Mr. Keshari owns 50 acres of land and is a political worker attached to J.D. (U), the ruling party. He had earlier gifted 0.30 acres of land for residential purpose to SCs. He exercises control over the tanks. Mr. Kishori Singh is a retired Veterinary Doctor and provides veterinary services for the cattle of the village free of cost. Mr. Bhante runs a public school and imparts education free of cost with financial support of Buddhist Circuit. Mr. Ram renders social service, runs evening school and works for adult education. Mr. Yogendra Singh is Ward Member of Badgaon panchayat. The village has no government school but has a degree college. The children of the village go to the government school situated in a nearby village of Surajpur panchayat. The village has a club for social work and promotion of sports. The Club consists of mainly youths of both *kurmi* and *bhumihar* castes. Although the club objectives do not include tank related activities, the young people still get involved in tank activities. The village has a population of approximately one thousand people.

In 1985, there was a conflict between village farmers and fish contractors on the issue of taking water from the Indrprastha Sarovar. One Binda Kewat of another village Nirmalbigha had taken contract of fishing in the tank, and he prevented farmers from taking water from the tank for irrigation when the water was just three feet deep. There was a tussle between villagers and fisherman and violence was about to break out. But local administration interfered and villagers were allowed to take water for winter crops in 1985**.** Since then no such incident took place.

Topography:

The land of the village is plain, but undulated patches of land can be found in the side of Nalanda monuments. It was said that these ditches might have been dug in the

ancient times for constructing the buildings of the University. There are certain uplands (*tilhas*) here and there. The village is said to have existed from the ancient times. Major crops of the village are paddy, wheat, and pulses like *moong*, gram, oilseed like mustard, and cattle fodder. The village also produces vegetables, specifically green vegetables in considerable quantity. In some of the tanks, there has been practice of growing water fruit *singhara*, but this has now reduced considerably. In the last ten years, cultivation of vegetables has increased.

Irrigation:

The total agricultural land is about 300 acres and all the land has irrigation facilities. Tubewells irrigate nearly 36 acres of land and the rest is irrigated by tanks. There are a few tubewells (both diesel and electric operated) in the village. Tank is the major source of irrigation. Nearly 75 per cent of the irrigation is dependent on tanks. These tanks also irrigate some land of another village named Murgiachak. There are ten tanks in the village, of which 7 exist since the ancient period and the rest three were constructed in recent years by individual farmers for fishing. The biggest tank Indraprastha Sarovar has about 36 acres of water spread area of which nearly a 3–4 acre portion is silted up and used for cultivation in *rabi*. This tank is a government tank, looked after by the forest and fisheries department. Kardigia *pokhar* (4 acres of waterspread area) is also a government tank under fisheries department and its source of water is rain and also the Indraprastha Sarovar. Dudhaura *pokhar* (4.6 acres) is a private tank owned by Munni Singh (*bhumihar*) and his five brothers of Surajpur village. The Suraha *pokhar* is government tank, but now is captured by the farmers having their land around the tank like Kamala Singh, Umesh Singh and Bipin Singh (*barahi* carpenter), Ramnath Prasad (*kurmi*) and a few others. Banail *pokhar* was earlier owned by *bhumihar* of Badgaon but now the tank is taken over by fisheries department. Two tanks named Satauti *pokhar* I and II are owned by Shivnanadan Keshari and his nearest kins. It was dug during the British period. The rest three ponds belong to Brijnandan Ram and Bipin Singh, each having less than half an acre area, and were constructed in 1994 for fishing. The owners consume the fish produce and in case of surplus sell it.

All the three modes of irrigation from tank (surface flow, manual and energized lifting) are practiced. Both diesel operated and electric motor operated pumps are used. In order to carry water from tank to the fields, delivery pipes are used in place of surface channels for the last 6-7 years as the farmers feel that carrying water through field channels cause wastage of water and time. The delivery pipes are not very expensive and easily available in the market. When water is in abundance, irrigation is done through gravity flow method, and pumps are not used. It happens only in the *kharif* season. In the years of scanty rain, nearly 170 acres of land are irrigated through delivery pipes in *kharif* and nearly 60 acres in *rabi* season. The practice of lifting water from the tank has now considerably reduced and at present, 0.7 to 2.5 acres of land is irrigated manually. Generally farmers having their land at the bank of tanks use this method to cultivate vegetables in summer season. Fodder grass is also irrigated manually. The modes are '*Karing'* and *'Latha Kundi'*. The renting of diesel pumps is in practice, the rates of

which is Rs. 60 per hour with fuel and in case of electric pump Rs. 20 is charged per bigha (0.6 acres). The electric pump owners pay a fixed monthly charge for electricity, irrespective of hours of power availability.

The major source of water of these tanks is rain. But in the case of Indraprastha Sarovar, there is a *pyne* connecting the tank with *Giriyak Chhilka* (checkdam) constructed on the Panchane river which confluences into Ganga near Bakhtiarpur. The rain is the only source of water for the rest of the tanks in the village. There have been community actions for repair of the tanks and *pynes*, details of which are given below:

1. Desilting of *pyne* and outlets – twice before 1975
2. Repair of Structures by *shramdan* and money contribution (total of Rs. 5,000) – twice in 1990 and 1992
3. Cleaning of banks of the Sarovar by village volunteers for *Chhath Puja* from time to time

Other maintenance works done by the following agencies:

1. Cleaning of grass and weeds – by fish contractor almost seasonally
2. Construction of ghat (bank for bathing) – forest department in 1994
3. Desilting of tanks by fisheries department – once in last ten years

Some powerful villagers have illegally captured the dried out portion of the tank area for cultivation. Nearly 3–4 acres of land was captured from the Indraprastha Sarovar alone by three of the *bhumihar* farmers and they grow gram in the dried up tank bed. Same is the case with other tanks of the village.

Other Uses:

The tanks in the village have numerous non-irrigation uses. Pisciculture is practiced in seven of the ten tanks. The fisheries department contracts out the Indraprastha tank for a paltry sum of Rs.22,000, but the net income earned by the contractor is over one lac. Same is the case with other tanks under the control of the fisheries department in the village. In the small private tanks, the fish produce in very less and three of them are such that they fulfill the owners' requirements only.

Three such tanks have earlier been used for cultivation of *singhara*, but in the year of survey *singhara* was seen in only one Kardigia *pokhar.* The singhara was sown along with fish and Rs. 3,000 to 4,000 per season was given as the lease charge. It hampered irrigation use, hence now it is not being cultivated.

The tanks have also various other uses such as worshiping, bathing, cleaning cattle and clothes. Indraprastha Sarovar is used for the most auspicious and pious worship of Sun God known as *Chhath*. The villagers contribute labour for washing and cleaning of the banks for the *Chhath Puja*. The tanks are renovated by forest department and trees were planted along the banks and new ghats were constructed with a view to attract tourists as it falls in front of the Nalanda Nav Mahabihar, now run by Central Government.

7. Village: Chinveria, **Panchayat:** Chinveria, **Block:** Laxmi Nagar, **District:** Jamui

Location and Social Constitution:

Village Chinveria is the largest hamlet of Chinveria panchayat, which consists of 12 other small hamlets. It is a revenue village under Lakshamipur block of Jamui district. It is situated at a distance of 7 km south from Kenhat on the Mallayapur – Lakshipur road. It is connected by a metal road of five km and two km un-metalled road from the inhabitation. The village is not electrified. It has a population of nearly 4000 people, with 2000 voters. It is demographically and economically dominated by SCs particularly, *rabidas chamar, paswan* and *mushahar.* There is no general caste or forward caste population in the village. The other backward castes (OBCs) like *yadav, mandal koiri, nai* and *kumhar* are settled in different hamlets. One hamlet is inhabited by Scheduled tribes. It is interesting to note that *rabidas* were the landlords-Zamindars of the village unlike in other villages in the state.

Topography and Agriculture:

The topography of the land is mostly undulating. It is situated in a hilly terrain and the slope runs from north to south. There are two very old and whethered (eroded) small hills (locally called dead hills) namely Chinveria and Singhia *paharis* found in the north side of the village. The fields looks less fertile and the soil is hard (*pathrili*). There is one incomplete panchayat *bhawan* and a well-constructed *samudaik bhawan* which is used for teaching children. It was informed that the villagers themselves with the help of C.I. Dev informally ran those schools (an NGO by the name C.I. Dev is supported by a South Korean NGO named World Head Quarters of Cannon Farmers Movement of South Korea). The government primary school of the village is abandoned, as the teachers have not been attending the school for long. It was claimed by the NGO that 75 per cent of the children of the village are getting primary education in these schools. The village has 12 women self-help groups (SHGs) and one of men. Besides, there is a Chinveria Vikas Club consisting of 25 members of whom 10 are below 25 years of age and rest fall in the age category of 26-45 years.

The village has nearly 400 acres of agricultural land of which *rabidas* collectively has 150 acres, *mandal* 100 acres, *yadav* 90 acres and rest is owned by other castes. The land is not properly tilled or irrigated and the cropping intensity of the village is just above 100 per cent. Majority of the field are sown once in a year due to water shortage. The main staple crops are paddy in *kharif* and gram, *arhar, masur*, barley and wheat in *rabi* and in summer, vegetables are grown on a few patches of lands. The productivity is low and vegetable cultivation is not so profitable.

Irrigation:

Agricultural productivity depends, in India, on assured irrigation due to uncertain monsoon rains. The steep slope of the village makes the rain water run down fast to the nearby river. As such, soil does not absorb rainwater adequately**.**

Ahars : The only sources of irrigation in the panchayat are the five *ahars* namely, Madua Tariyani, Kumhartoli, Domajot, Mandaltola and Karma *ahars* in which Karma *ahar* is situated adjacent to the village Chinveria. These *ahars* were constructed way back during the early 20th century and are now in a dilapidated condition. The beds of the *ahars* are silted up and covered by grasses and weeds. All this makes the harvesting of rain water inefficient. The dilapidated *ahar* structures render most of the water to flow down. The nearby farmers have further narrowed the water carrying structures by encroachment of land. The maintenance of the *ahars* has not been undertaken for many decades. The farmers use both manual and mechanical modes to fetch water from these *ahars. Latha-kundi* is the main manual mode, which costs Rs. 600. This device is used for irrigating small patches of land near the *ahars.* The mechanical mode of fetching water involves the use of diesel pumpsets. The panchayat has nearly 25 pumpsets of which five are in the village, all owned by members of *rabidas* community. Water from the *ahars* is taken to the fields in two ways – (i) using the surface flow structures and (ii) using pumps fitted with delivery pipes (flexible and portable). Farmers prefer delivery pipes in order to avoid wastage during conveyance. The pump owners charge Rs.50 per hour from the users. This includes the cost of diesel.

Karma Ahar: is situated adjacent to the village and has a command area of over a 100 acres, but, its irrigation potential is now reduced to 50-70 acres. The area of the *aha*r is 3 acres whereas the water spread area is 2 acres. The bed of the *ahar* is silted up and is full of grass and weeds. Peripheral area of the ahar is also dry and grassy. It has three outlets on the southern bank. Two outlets are earthen and situated at the extreme west and extreme east of the embankment. The third one is situated in middle between the two outlets and is a large (6 feet) cemented *chhilka* (check dam). The check dam is very old and low too. This renders the overflow of water down the slope. The banks are in a dilapidated condition and other structures are also not in good shape.

The maintenance of the *ahar's* structures was undertaken in the 1970s and since than no maintenance has been undertaken for more than thirty years. As *ahar*'s maintenance was the joint responsibility of the villagers earlier and now of the panchayat body, but it is nobody's concern. The embankment of the *ahar* was hitherto repaired and desilted by *'goam'* (collective community action). *Goam* was summoned by '*dugdugi*' (informing villagers by beating *drums*). The then *mukhia*-(village head) took the lead for the maintenance work. The poorly maintained *ahar* irrigates between 50-70 acres of land in *khari*f season, 10-40 acres in *rabi* season and 1-2 acres in the summer with the help of *latha kundi*. Irrigation in *kharif* is mainly done through gravity and through diesel pumps fitted with delivery pipes in *rabi*. A very few farmers grow vegetables on small patches of land and irrigate it with *latha kundi.*

The *ahar* is not used by villagers for non-irrigation uses such as pisciculture, *singhara* (water fruit) cultivation, domestic purposes such as bathing, drinking, worship etc. The reason as shared by the villagers is the shallow water column and dirty water.

Villagers also use the *ahar* for disposal of night soil. Non-maintenance, dilapidated condition and irresponsible treatment by the village community is making the *ahar* less useful.

***Canal*:** the other source of irrigation to village is a minor canal named Bazan Nahar taking off from Bhurahwa river barrage. This canal was constructed 30 years ago but is abandoned for the last two decades as no water reaches the village. It is said that the canal is blocked by silt at the mouth, which has not been cleaned for long. The mouth of the canal does not fall in the jurisdiction of the panchayat and the responsibility lies with the MI department.

The note on the village Chinveria can be concluded with the following observations

- As the community has disowned the *ahars*, these are in poor conditions and have reduced their *(ahars'*) irrigation potential and income generating ability
- The village panchayat is not taking care of *ahars*, but it prefers concentrating on construction of roads
- Irrigation potential of the *ahars* can be enhanced by repair and proper maintenance
- Collective community action is urgently required as only then can sound economic viability of the *ahars* be achived
- Pisciculture and *singhara* cultivation are feasible in the *ahars*, if people take to voluntary action
- The income generated from non-irrigation use of such *ahars* can be used for community welfare and public works
- There is urgent need of government investment to initiate improvement in the *ahars.* Karma *ahar* appears to be more feasible for the purpose
- This will instigate village community to come-up, as there is no glaring caste rivalry in the village
- The villagers have already been mobilized by the initiatives of C.I. Dev. They need proper direction for fast development

Annexure - V

Case Details of Studied Villages - Jharkhand (Material not covered in tables)

1. Village: Turiumba, **Panchayat:** Turiumba, **Block:** Bharno, **District:** Gumla

Location and Topography:

Turiumba is a big village spread over three hamlets, and begins at 1.5 km away, towards south, from the 46.5 km mark on Ranchi Gumla Road (NH) and stretches deep into 2.5 km towards west from the un-metalled link road. It forms the panchayat (Turiumba panchayat) under Bharno block of Gumla district. A river Ghaghari flows from east to west in the south of the village which forms a deep gorge; as a result the river water cannot be used particularly for irrigation purposes by the villagers. The total area of agricultural land is more than 850 acres. The village has sufficient number of hand pumps for drinking and other domestic purposes. However, these seem to be recently dug. The people use tanks for domestic purposes. The agricultural land is highly undulating and the slope is from east to west. At some places, the slope is too steep. There are unmetalled roads inside the village, which are motorable because of the red sandy soil locally called *'muram mitti'*. The *muram* kind of soil also hampers pisciculture in the tanks. The village has a big dancing floor locally known as *'Akhara'*, constructed 15 years ago by the villagers with governmental support for performing traditional tribal dance.

Social/Power Constitution:

This is a tribal village. It is inhabited by four kinds of tribes namely *oraon, mahli, lohra* and *cheek baraik. Oraon* is placed at the top in the social hierarchy. Traditionally they were cultivators and have average land holding of 2.42 acres compared to 1.3 acres among lower Scheduled Tribes. *Mahlis* a backward tribe, with basket weaving and drum beating as their traditional occupation, constitute nearly 10 households. The drum beating was earlier used for information dissemination. *Lohra*, is a backward tribe with traditional occupation of blacksmith is low in the social hierarchy and constitutes nearly 10 households. *Cheek Baraiks*, another lower tribe, constitute nearly 30 households; traditionally, are weavers.

Besides tribes, there are 45 households of 4 Hindu castes who have migrated from other places. They are *yadavas, koiri/mahato,* and *brahmins.* There are nearly 25 h/h of *yadavas,* 10 h/h each of *brahmins* and *koiri/mahatos*. They have migrated from Bihar plains five generations ago. Together they own land of over 150 acres in the village, of which *brahmins* have an average holding size of nearly 5 acres, compared to 3.42 acres of all OBCs (*yadavas* and *koiris/mahtos*).

Most influential persons in the village belong to *oraon* tribe. Chandernath Bhagat (56) is a cultivator (owns seven acres of land) and has been *mukhia* of the village since

1978 (elections of panchayat has not held after 73rd Amendment). He is a *brahmin* who commands respect in the village, as he works for the tribes. He is also a progressive cultivator and has connections with the local bureaucracy. Suraj Mohan Oraon, a retired military man, is another influential man in the village who happens to be a progressive farmer and involves himself in social activities. Sukhdeo Oraon, another retired army man also commands a lot of respect. Both these have sizeable amount of agricultural land (7 and 10 acres of land respectively). Balram Das, a *brahmin*, is also an influential person of the village as he works in the Jharkhand Electricity Board as a meter reader. He is helpful in providing the villagers approach to the local bureaucracy. There is a Self Help Group (SHG) in the village led by one Mrs. Chandramani Bhagat (*oraon*) whose husband is a cultivator having five acres of land. It is interesting to note that all these influential persons work in tandem with no power rivalry in the village. Chandernath Oraon and Suraj Mohan Oraon take lead in organizing cultural and festival ceremonies and they motivate other tribes to engage themselves in agriculture. The village is affected by naxal activities (MCC). A solar power plant was installed in the village five years ago, but the MCC people took the solar panels away, leaving the plant defunct.

Agriculture and Irrigation:

The village has terraced fields due to undulating land topography. Main crops in the village are paddy, maize, peas, potato, ginger and vegetables. The cultivation of potato, ginger and vegetables has been practiced during the past ten years with inspiration of the progressive *oraon* cultivators with a view to improve income from farming. They plough the fields with bullocks but a few tribes have tractor, power tiller and some other improved agricultural implements. There is good number of pumsets in the village provided by the government under various schemes. Men and women both work in the field but some well off tribal families do not allow their women to work in fields. The only source of irrigation in the village is tanks. It is difficult to dig wells in the village due to hard rock texture.

Irrigation and Tanks:

Nearly 10 per cent of the total agricultural land has the assured irrigation from tanks and ditch type water bodies, particularly in the *rabi* and summer seasons. There are a number of such small structures. 'Guard walls' can be found constructed along the slopes to check the runoff. These guard walls prevent the water flowing out towards the northern low land and help water reach the upper reaches during *kharif* season to irrigate fields. There are four tanks in the village, of which three are multipurpose and one is exclusively for irrigation as it is not fit for the pisciculture.

Tank I (Math Talab): *Math talab* is situated at the eastern most side of the village flanked by unmetalled road in the east and south. It is the tank transferred to fisheries department from revenue department. Hitherto, the tank was the property of a Hindu math, which does not exist now, and was constructed during the British period after a famine in the 19th century. There is a big inlet constructed on the eastern bank of the

tank. Although the tank area is 15 acres, the water spread area is 10 acres and the rest of the land, forms embankment and space for the guard wall. The tank is 20 feet deep, but water in peak season is 17 feet deep (rainy season), 15 feet deep in winter and 7 feet deep in summer. The main source of water of the tank is rain and catchment runoff.

Tank irrigates nearly 30 acres of land in *rabi* season and 6 acres in summer, serving about 20 farmers belonging to *mahli, oraon* tribes and *yadav* castes. The water cannot be taken out through surface flow structures due to the undulating topography and the high banks. The farmers fetch water with diesel operated pump sets. Some of the irrigators grow potato, ginger and vegetables in summer. There is no practice of pump renting. Farmers borrow the machines free of cost as government has provided the machines to the farmers under welfare schemes. So far as the maintenance of structures is concerned, there have been government investments thrice in the tank. In 1989-90 the tank was desilted. In the year 2005 the tank was desilted again and the guard wall was constructed by the Rural Engineering Organisation, Government of Jharkhand.

The extraction of tank water is restricted after the water level reaches a certain depth, for cultivation of fish alone. The tank is used for pisciculture and fisheries department contracts out the tank to *oraon* and *mahli* farmers whose land falls near the tank, on an yearly bid of Rs. 6,000. It was told that the actual value of fish production per season ranges from Rs. 8,000 to Rs. 10,000. All kinds of domestic uses like bathing, washing clothes, cattle washing, cattle drinking etc are in practice in the tank. A greater level of cooperation among farmers of the village, in irrigation matters, was found and they take all possible local measures collectively to prevent water flowing out of the village. It was opined by the villagers that if the tank was desilted properly, and lift irrigation system introduced, it would be more beneficial to the farmers.

Tank II (Khas Talab I): It is also an old tank of the British period under the fisheries department of the state. The water spread area of the tank is 3 acres and is situated in the northern most side of the village. The water column of the tank is 8 feet deep in rainy season, 3 feet deep in winter season and is dry in the summer season. The guard wall constructed in the eastern part of the village directs the runoff into this tank. A guard wall is also constructed near the southern bank of the tank to guide water from rain and the catchment runoff to the third tank of the village. This tank was desilted in the year 1990 under the JRY scheme and Rs. 60,000 to 70,000 was spent. An amount of Rs 1,45,000 was sanctioned under a development scheme for deepening of the tank and work had also started after the rainy season in 2005.

From irrigation point of view, the tank does not seem to be of much significance. It irrigates only five acres of land in *rabi* season and ten farmers are benefited.

Water is fetched using diesel pump sets and there are no rent charges for the pump. The irrigators belong to all tribes and castes. Others with land at a distance from the tank, are not allowed to take water from the tank for irrigation in view of water shortage. The water in *rabi* season is used for cultivation of potato and other vegetables.

The tank is used for pisciculture and domestic purposes. There is no restriction on anyone using the tank for domestic purpose. It is a FD tank and government contracts out the tank for fishing. This year it was contracted out for Rs. 2,000. It was learnt that the actual worth of fish produce from the tank is nearly Rs. 5,000 per year.

Tank III (Khas Talab II): This tank is situated on the western most side of the village, at a distance of 3.5 km from the NH. The tank exists since the British period. It has also been transferred to the fisheries department of the government of Jharkhand. The water-spread area is 1.5 acres. It has an 8 feet deep water column in the rainy season, 3 feet deep in the winter season and it is dry in the summer season. The source of water is rain and runoff. A farmer Suraj Mohan claims that he lifts water from the river to fill the tank for irrigation purposes. If the guard walls of the upper region of the village work properly the water runoff will be directed to the tank. He argues that if the government makes provision to deepen the tank, check the water running off to the low-lying land and lift the water from the river to the tank, it will be of much benefit for agriculture. He is working hard to get his idea implemented. He has personal interest in the tank as he grows ginger in nearby field, which needs irrigation, and is also interested in reclamation of land in the nearby areas, which are fallow. This tank is solely used for irrigation.

The tank irrigates an area of 10 acres in *rabi* season and water is fetched through pumpsets. There are nearly five irrigators under this tank who grow peas, potato and ginger in the field. Although Suraj Mohan takes care of the tank, the fisheries department takes the responsibility of the tank. As no person comes up to obtain the fishing contract from the government, the FD has so far not invested in renovation of the tank. However, Suraj Mohan has managed to get an amount of Rs. 95,000 under Rural Labour Employment Guarantee Programme (RLEGP) sanctioned for renovation (desilting) of the tank. As the tank is far away from the locality, the villagers do not come to this tank for domestic uses. Also, there is no pisciculture practiced in the tank. Suraj Mohan suggested making provisions for lifting water from river so that the tank remains full in summer also.

2. Village: Gurugaon **Panchayat:** Kudhra **Block:**Sisai **District:**Gumla

Location and Topography:

The village falls under Kudhra Panchayat of Sisai block under Gumla district. It is located at a distance of 2 km north from the national highway (NH), 70 km from Ranchi on the Ranchi-Gumla road. An unmetalled link road leads to the village. The topography of the village is relatively less undulating and the soil texture is better in comparison to that of Turiumba. It has also the *tanr* land. The total agricultural area of the village is approximately 300 acres.

Social/Power Constitution:

The village has nearly 130 households of which 109 households are of *oraon* tribe. The *lohras* (7h/h) and *cheek baraiks* (7 h/h) add to the tribal population. There are two castes of Hindu, namely *mahatogope* (*yadav*) and *brahmin* 2 h/h each. *Oraon* alone

own 235 acres of land that gives them an average land holding size of 2.16 acres. *Lohra* and *baraik* tribes own 50 acres of land and the rest 15 acres of land belong to *mahatogope* (*yadav*) and *brahmins* 5 acres and 10 acres respectively. There is an institution of *Pahan* among the tribes. The *Pahan* is considered to be religious leader who commands influence over the villagers. Fagua Oraon is the *Pahan* of the village and keeps knowledge of land and social relations in the village. He is 65 years old, engaged in social work and commands respect by virtue of his position as *Pahan*. He claims to have 63 acres of land in his name. Sukra Oraon, having 3 acres of agricultural land, is also a knowledgeable person and supports the tribes. He has good leadership qualities. There is a Gram Vikas Samiti in the village. It had collected money for making efforts to get the village electrified. But its members embezzled the money and work was not done. Hence *Pahan* disregard this samiti. Late Hira Sao (*vaishya*) was a rich man who invested money in agriculture in the village and his son Dwarika Sao developed agricultural practice in the village. Now Dwarika Sao has sold off his land and resides elsewhere. The Saos were influential persons till recently but now they have left agriculture for doing business in Gumla and Ranchi. Now these lands belong to tribes of the village. Hira sao and his son Dwarika sao were the owners of this tank. But, now it is under the control of the fisheries department. The people of the village go to urban areas for earning a livelihood. People in this village are not progressive and not willing to work hard in the fields. Some are indulged in activities of the leftist outfits. The youth is not interested in farming at all (as informed by Fagun Oraon, the *Pahan* of the village).

Agriculture and Irrigation:

The land of village is undulating but the terraced fields are of bigger size than that of Turiumba. The land slopes towards the north. The tribals of the area have very little interest in agriculture. The major crops are paddy, maize, peas, potato and vegetables. The agriculture mainly depends on rain and tank water for the *rabi* crops with no other source of irrigation in the village. There are four tanks in the village. But no irrigation is possible through gravity.

Tank I (Pachchimari Bada Bandh): The tank is situated on the western side of the village. It is an old tank of British period and now under the ownership of the fisheries department. At present the water spread area of the tank is 4.5 acres. In the year 1970, Hira Sao raised the capacity of the tank by investing his own money as he owned a large piece (14 acres) of land in the neighbourhood of the tank. He renovated the tank to make his land productive. Later in 1990 Rs. 80,000 was spent for repair of its embankments under a development scheme. The depth of the water column in the tank during the rainy season is 11 feet, 7 feet in winter and 5 feet or less in summer season. Earlier the tank was irrigating 14 acres of land, but now it irrigates only 6 acres of three farmers belonging to *oraon* tribes. The water is fetched through diesel operated pumpsets. The crops irrigated by this tank are peas, potato and vegetables. The farmers of far off area are not allowed to take water from the tank because the people want to reserve sufficient water for pisciculture.

The tank is used in both the domestic purposes and pisciculture. Government contracts out the fishing activity to the local people. The contracts are normally taken by *oraons* of the village. The present rate for obtaining the fishing contract is Rs. 27,000 for six years. The value of the annual production of fish in the tank is nearly Rs. 10,000 per year. The tank is free for all for domestic purposes. The people are not allowed to take water for any purpose, including irrigation, if the water level drops down to 5 feet deep. Fagun Oraon who is also a beneficiary of the tank wants the capacity of this tank to be raised to make it more useful in agriculture.

Tank II (Pahnai Don): The tank is situated in the eastern part of the village and it is named after *'Pahan'* the religious leader of the village. It is located near the *'don'* land patch. This tank was dug in 1985 under a government scheme, and is a government property. The water-spread area is 2 acres. It has 8 feet deep-water column in rainy season, 5 feet in winter season, but the tank remains dry in summer season. The tank has not been renovated since long. The banks of the tank are not in good shape and much mud has accumulated in its bed and hence the capacity has been reduced.

The tank irrigates 2 acres of land owned by 11 farmers. These farmers use the tank water to grow peas and potato on small pieces of land. Fagun Oroan lamented that the tank could have irrigated larger area, but farmers here are reluctant to farm. They do cultivate the farms only to meet their consumption requirement of food. The villagers have adopted the cultivation of peas and potatoes only in the past 10 to 12 years. There are no restrictions imposed on taking water from the tank. The reasons behind it are the non-interest of farmers in agriculture and also that pisciculture is difficult due to unruly attitude of some of the people.

There is ample use of the tank for various domestic purposes, however pisciculture has not been successful. There were several unsuccessful attempts to cultivate fish in the tank. Some people tried to practice pisciculture by collective efforts. Some progressive persons from *oraon* community came up to start pisciculture by collecting money from interested parties for putting fish seeds and fingerlings in the tank twice. But other local people started poaching after some time. As such every time the donors (chanda givers) had to bear the losses. Thus, nobody dares to take contracts for fishing or invest any money for fishing. Tank urgently requires renovation and community efforts for pisciculture and irrigation, as noted by *Pahan*.

Tank III (Bar Garha): Bar Garha tank is also a post independence tank. It was dug in 1985 under government development scheme of minor irrigation. The name of the scheme and amount involved could not be ascertained. The water-spread area of the tank is 1.5 acres. It is a bit deeper than the *Pahan don*. The depth of water column in the tank is 10 feet in rainy season, 6 feet in winter season and 5 feet in summer. It has also not been renovated for long. The tank irrigates a meager 1.5 acres of land owned by three farmers in *rabi* and summer period for cultivation of potato and peas. The farmers of nearby tank could cultivate more land from the tank but they do not do so here because the cattle left for free grazing in this area, destroy the crops. These cattle also damage the tank bund.

The tank is fit for pisciculture. But organized pisciculture is not practiced in the tank for fear of poaching. The fish naturally grow in the tank and people can catch these fishes from the tank at their will. So it was difficult to estimate the production of fish from the tank. They call it '*dehati machchali*' (local fish that grows without cultivation). All have rights over the tank fish. Nobody is prevented from fishing in the tank and also nobody puts fish seeds or fingerling. No discrimination on the basis of caste or tribe was noticed in the village.

Tank IV (Majhesh Pokhara): The tank is called majhesh that means second in size. The water-spread area of the tank is 2 acres. The depth of water column is 8 feet in rainy season and 5 feet in winters. The tank gets dried up in summer. Dwarika Sao the son of late Hira Sao, who desired to provide irrigation to his fields from this tank, dug it in 1990 by investing his own personal funds. The amount invested by him could not be ascertained but the villagers informed that he invested several thousands of rupees for digging this tank. Now Dwarika Sao has sold off his land and settled at Gumla for business and the tank belongs to government of Jharkhand.

The tank irrigates 2 acres of land in the *rabi* season for cultivation of peas and potato. The *kharif* crops do not need any irrigation as a rainfall is high and the land in the command is low-lying wetland. Three to four farmers, who belong to *oraon* and *yadav* community, are benefited from the tank. The tank is getting abandoned and nobody takes care of it. It has not been renovated since it was first dug. One Jyotish Bara (32) told that if the tank is deepened, it could retain more water to be used both for irrigation and pisciculture. It can motivate farmers of nearby field.

3. Village: Domba **Panchayat:** Domba **Block:** Bharno **District:** Gumla

Location and Topography:

Domba is big village and constitutes the panchyat under Bharno block of Gumla district. This village is located at a distance of about 5 km south of the Ranchi Gumla Road (NH) between 58 and 60 km milestone. There is a metalled road leading to the village. However, the metalled road starts only after nearly 1 km of *kuchcha* road from the NH. The topography of the village is hilly and constitutes parts of Chhota Nagpur plateau. Some dome-shaped hard rocks can be found here and there. People use these rock pieces as floor of their houses and courtyards. The front open place of one Jagdish Choudhary's house is built of such rock pieces. The slope of the locality is from south to north. It has over 500 acres of agricultural land. Again, the fields are terraced in this tribal village.

Social/Power Constitution:

The tribal people dominate the village numerically but migrated Hindu castes are in sizeable number in the village. Most of them have migrated four generations ago from Rohtas district of Bihar. There are 400 households of *oraon* tribe that own nearly 300 acres of land at present. The land household ratio in this village is lower than that of

other *oraon* villages. It comes to an average holding size of merely 0.75 acres among *oraon* in comparison to much greater holding size in other villages of the *Bharno* block. There are three OBC castes in the village namely *koiri* (100 h/h), *vaishya* (5 h/h) and *nai*-Barber (4 h/h) who together own 151.5 acres of land. Among these, *vaishya* families have average holding size of 10 acres compared to 1 acre of *koiris*, 0.37 acres of *nai* and 0.75 acres of *oraon* tribe. There are 40 h/h of Muslims. They belong to the most backward caste category (*ansari* –weavers). They also own 40 acres of land. There are two more castes in the village, namely, *ghashi*, a scheduled caste, whose traditional occupation is fishing, constitute 4 households (own 10 acres of land). Only one *brahmin* family does not own any land in the village and earns his livelihood from *Jajmani*[59] (priestship) for the other Hindu families in the village. Jagdish Choudhary, a *vaishya* rules the roost in the village. He commands respect among *oraons* also. He has been *Pramukh* of Bharno block under the previous panchayat system and owns 20 acres of land. He has a stone crusher machine and he sells crushed stones as building material. Besides, he has a tractor and a showroom dealing in pumping set and other machines at Sisai. He takes the contracts of supplying such machines and stones from the government, particularly to be used in the village. He prevails over the social domain of the locality through participation of his sons. They dominate in the fish committees in taking contract of fishing from fisheries department. He informed that four-generations ago his forefathers migrated to this area from the then Shahabad district (presently Rohtas district) of Bihar. They introduced agriculture in this area. Now with change in social and economic pattern of life he expanded his activities in the business field along with agriculture. Other influential persons of the locality are Dudha Pahan, a *Pahan* religious leader of *oraon* tribe and Jairam Oraon. Dudha, the owner of 10 acres of land, commands respect among the tribes as he is a *Pahan*. Jairam Oraon owns 8 acres of land and is a social activist.

Agriculture and Irrigation:

The agriculture is practiced on terraced lands, and paddy and maize are mainly grown. But some people grow vegetables in small plots. Important *rabi* crops are peas, potato and other vegetables. Cultivation of wheat is very rare. The people of this area are reluctant to take up farming and therefore reclamation of land did not take place. Jagdish Choudhary termed them as *kodiya* (lazy, not willing to work), which was confirmed by the local people. Farming is mainly dependent on rains and the tanks and ditches irrigate very little area. At present use of tanks as a source of irrigation is considerably less. Out of the 500 acres of land in the village, the tanks irrigate only 16 acres.

[59] Castes are often linked in what has been called the *jajmani* system, after the word *jajman*, which in some regions means patron. Members of various service castes perform tasks for their patrons, usually members of the dominant caste, that is, most powerful landowning caste of the village (commonly castes of the *Kshatriya varna*). Households of service castes are linked through hereditary bonds to a household of patrons, with the lower-caste members providing services according to traditional occupational specializations. Thus, client families of launderers, barbers, shoemakers, carpenters, potters, tailors, and priests provide customary services to their patrons, in return for which they receive customary seasonal payments of grain, clothing, and money. Ideally, from generation to generation, clients owe their patrons political allegiance in addition to their labors, while patrons owe their clients protection and security.

Tanks and Irrigation:

There are two tanks in the village. Earlier these tanks were the main source of irrigation. But now these tanks are neglected because of change in work pattern and the attitude of the native population. They prefer to go for daily wage labour in the nearby town (Sisai) for their livelihood instead of developing agriculture.

Tank I (Domba Math Talab): The tank is an old one constructed during the British rule after the great famine. At present the tank is under the fisheries department. The water-spread area of the tank is 8.64 acres. Its depth was earlier much greater but at present the maximum water column depth is 12 feet in rainy season, 5 feet in winter season and 3.5 feet in summer season. The main source of water of the tank is rain. There is big culvert constructed for smoothening the water inlet to the tank in eastern side. But the inlet culvert was not found in a good condition. Five years ago the tank was transferred to fisheries department. But the department is not taking care of the tank. Nearly 25 years ago, the tank was renovated with an investment of Rs.1,50,000 under the Food for Work Programme by the Rural Development Department of Bihar. Since then no renovation, embankment repair or desilting of the tank has taken place. Neither the people nor the local leaders seem to be concerned about its dilapidated condition. The embankment of the tank is nearly 18 feet high.

The tank earlier irrigated nearly 30 acres of land but now it irrigates hardly 14 acres of nearly 25 farmers belonging to different caste categories. The irrigation takes place in *rabi* season for crops like potato and vegetables in small plots of land. The water is lifted by using pumpsets. As the water level is much lower than the bank, it becomes a bit difficult to fetch water. The other uses of the tank include pisciculture and domestic uses such as bathing, cleaning cattle and clothes etc. The tank water is never used for the drinking purpose. Private individuals practice pisciculture by obtaining contract from the government. There is a fish committee that takes the fishing contract. The committee is dominated by *vaishyas* of the village. It was informed that the value of the annual fish production amounts to Rs. 25,000.

Tank II (Purana Talab): This tank has a water-spread area of 7 acres, and was also built during the British period. It has much lesser depth of water than that of the Math *talab*. The depth of water column remains between 10 feet to 3 feet from rainy season to the summer season. This tank has also been transferred to fisheries department 5 years ago. The embankments are not in good condition. There has not been any renovation of the tank for long.

It irrigates merely 2 to 3 acres of vegetables. The water is lifted with the help of pumpsets. Unlike in other places, the pumping machinery is lent out free of charge and the user has to bear the cost of fuel only. But the farmers of the locality are not much interested in agriculture and hence no progress has been seen.

Like other tanks, this tank is also a multipurpose tank used for pisciculture and domestic purposes. Sons and kins of Jagdish Choudhary take the contract of fishing in

the tank from fisheries department and the value of the fish produce is Rs. 25,000. It was suggested that the renovation and care of the tank was required to be taken up by the government. A dire need was also felt for motivating the native tribes to take up farming.

4. Village: Chhoti Sainda **Panchayat:** Sidhnathpur **Block:** Sisai **District:** Gumla

Location and Topography:

The village is located in the remote interior of the Sisai block of Gumla district. It is situated at a distance of 7 km from the NH at the point 3 km towards Gumla after Sisai bus stand. From this point Charda road (Banda-Lohardagga link road) starts and goes towards north. After 2 km on this road, another road goes towards west that leads to the village. The entire region is a high altitude plateau. The dome shaped landscape of hard rocks can be seen around the locality. The intensively undulating land has a slope from east to west. The agricultural fields are terraced, the soil is laterite (red and sandy loam) and brown in colour. The Kanas River flows from east to west in south of the village. The village Chhoti Sainda is a hamlet of Sidhnathpur panchayat. A big dome shaped hilltop divides Badi Sainda and Chhoti Sainda. Badi Sainda has a tank with water spread area of 10 acres. Chhoti Sainda a truly hilly tribal village, located in the midst of the plateau, has 508 acres of agricultural land of which 35 acres receive irrigation from the tank and river.

Social/Power Constitution:

The village is of the *oraon* tribe with only two households of *yadavas*. Out of total 508 acres of agricultural land, 500 acres belong to *oraon*, the native inhabitants. There are 110 households of the *oraon* tribe and 2 h/h of *yadavas* who own merely 8 acres of land. It is obvious that these *yadavas* might have migrated from Bihar.

All the influential persons of the village belong to *oraon* community. It is interesting to note that ex-servicemen and persons having a government job of any category command respect here. Ignis Tirky (55), an ex-service man retired from Bihar Regement, holds the post of Vice President of Jharkhand Mukti Morcha (JMM), Sisai block. He is an active political worker in the locality and is as a link between villagers and administration at the block level. He has a small house in the outskirt of Sisai. Another influential person John Kundo is also an ex-serviceman of *oraon* community and owns 15 acres of agricultural land in the village. Lakho Oraon, working in the Jharkhand Police also commands respect of the villagers. He owns approximately 17 acres of land. A social worker Kailash Oraon does also have influence over the villagers. He has the largest landholding (37 acres approximately) as told by Mangra Oraon (40) and confirmed by Tirky. Bhaua Oraon, the ex-Mukhia of the village, is also an influential person.

Agriculture and Irrigation

Paddy, maize and potato are the major crops grown in the village. The cultivation of vegetables is gaining popularity in the village. The main source of irrigation in the

village is tank and river. Nearly 35 acres of land of the village gets irrigation during the *rabi* and summer seasons. There are three tanks in the village, two are private tanks and one is government tank. One of the private tank is abandoned.

Tank I (Vishra Pokhar): The tank is relatively new, dug around 1985. It is a private tank owned by four brothers of an *oraon* family, who look after the tank. The water-spread area of the tank is 0.5 acres. The depth of water column is 15 feet in the rainy season, 7 feet in winter and 4 feet in summer season. The main source of water to the tank is direct rainfall and runoff. The net area irrigated by the tank is nearly 8 acres. The responsibility of the repair and maintenance of the tank lies with the owners, among whom Ignis Tirky takes greater interest in the tank. Unlike government tanks, the owners restrict others from taking water from it for any purpose other than domestic uses, which is free for all. The tank was desilted in 2001 and the owners had invested Rs. 2,000 for this purpose.

The gross area irrigated by the tank is 10.5 acres. The tank with surface flow structure irrigates 1 acre of *kharif* crop. Nearly 7.5 acres of land is irrigated in *rabi* and 2 acres in summer season by mechanical devices. The irrigators are the four share holders of the tank. The access to tank water is limited to the owners only. Besides domestic purposes, pisciculture is also practiced in the tank by the owners, and on an average the value of fish produce ranges from Rs 2,500 and Rs 3,000 per year.

Tank II (Panchayat Tank): The panchayat tank is an old one, dug during the British period and water spread area of the tank is merely 0.4 acres. It has 5 feet deep water column in rainy season, 3 feet in winter season and goes dry in the summer season. It is located at the low land with shallow embankments. This facilitates the farmers to take water from the tank through gravity method. All the farmers using water from the tank belong to *oraon* community. In 1990, the tank was desilted through community action. The villagers were also interested in taking the silt out from the tank bed for spreading it in their agricultural fields as manure. The tank irrigates two acres of land through surface flow structure. The land irrigated by this tank belongs to 3 *oraon* families who cultivate moong dal (a kind of pulse) in *rabi* season.

There is no restriction on the use of tank water for domestic purpose. People were seen bathing and children use the tank for recreation purpose. The tank has no organized pisciculture, but fish grows naturally in the rainy season, which can be caught by any villager without restriction.

Tank III (Vishra Talab II): The tank is situated on the western side of the village. It belongs to the same owners as the Vishra *talab* I. The water-spread area of the tank is 0.75 acres and the depth is nearly 7 feet. But interestingly the tank was dry when Verma visited it on 20th August when it was raining. It was told that the water in the tank bed percolates down into in the nearby lower field; hence, water harvesting is not possible. This tank has not been included in the surveyed tank.

5. Village: Digdon **Panchayat:** Redwa **Block:** Sisai **District:** Gumla

Location and topography:

The village is situated nearly four kilometers away from NH at Redwa turning, which is five kilometers away from Sisai towards Gumla. From this turning, after two kilometers on Sogra Road, an unmetalled road leads west up to the village. Digdon village has a bit different topography than that of Domba and Sainda. It mainly consists of don type of soil, which is more fertile than the *tanr* land. As usual in this region, the topography is undulating and the fields are terraced. Dome shaped landscape cannot be found in this locality. However, the roads are found with brown sand soil (*kankarili mitti).* The slope of the topography is from east to west and as usual undulating.

Social/Power Constitution:

Although *oraon* and a few other tribes dominate the village demographically, Hindu Rajputs are socially important and dominant. Five tribes *oraon, nagasia, kharia, cheek baraik* and *lohra* are native inhabitants of the village. All these tribes together have nearly hundred households of which 65 households are of *oraon*. Rajputs are in 15 households and *ahirs* and *kumhar* (OBCs) have 15 households. The village has a total of 126 households. Rajputs constituting merely 12 per cent of households but have approximately 22 per cent share in land ownership at the village level. The average landholding size of the Rajputs is nearly six acres whereas for the *oraons* the average holding size is nearly 3 acres. *Oraons*, who constitute 52 per cent of the village households, own a bit less than 50 per cent of the land. These two communities are the major landholders in the village. Among the landless families 4 households are from *cheek baraik*, 5 from *lohra* and *kharia* (all STs) and 4 from Rajput households.

All the influential persons of the village belong to Rajput castes except one tribal *pahan* (the tribal religious leader). Vikram Babu, a professor at Sisai College, holds 32 acres of land. He is also a social activist. He has lost nearly equal amount of land under the Land Ceiling Act (land reforms), which were distributed among the Scheduled Tribes (*cheek baraik, kharia* and *lohra*) of the locality. It was said that for a long period of time, he held actual control of the land which was given off. But now the beneficiaries are in possession of the land. Another Rajput, Suhai Singh commands respect in the village. He has a land holding size of 15 acres. He is a social activist. The tribal *Pahan,* Khari Panhia, holds 25 acres of land. He commands respect among all the tribes.

Agriculture and Irrigation:

The village has over 400 acres of agricultural land. All the agricultural land is terraced. The major crops of the village are paddy, potato, vegetables and *moong*. In some fields, maize, bajara and such other crops are also grown. Out of the 405 acres of land, 60 acres are irrigated from tanks and wells irrigate 15 per cent of the total irrigated land. The water from the wells is lifted with the help of pumpsets. There are three tanks in the village; one is very old and two new tanks have been dug recently under 0.30 acres scheme. It is a fisheries department scheme, helping those farmers who are ready

to spare 30 decimals of land for constructing tanks. The amount incurred for tank construction could not be ascertained.

Tank I (Darhi Doin): It is an old tank constructed during the British period. It is a private tank owned by two Rajput families. The water-spread area of the tank is 0.5 acres. Although it is a small tank, it serves agricultural purposes beyond its capacity. The depth of water column in the tank is 12 feet in rainy season, 10 feet in winters and more than 5 feet in summer season. The tank has a peculiar feature that its major source of water is artesian. Water comes out from the aquifer automatically. As such the sources of water for the tank are artesian and rain. The amount of water is greater in the rainy season. Another peculiarity of this tank is related to fetching water. The owner has constructed an underground water channel of nearly 2000 feet length along the divider (*merdha*, constructed between two fields) leading to a well type structure. The water which comes to the well is later lifted mechanically to the fields in the upper reach. The banks of the tank have been lined with stone to keep it intact. The channel is also lined with stones so that water does not seep. Although the responsibility of the maintenance of the tank lies with the owners, they manage to get governmental financial support for its improvement and renovation. The desilting of the tank was done in 1990 and again five years ago Rs. 35,000 was incurred for the repair of its banks under a development scheme. The Rajput owners are very conscious of irrigated agriculture and the importance of tanks, whereas none of the *oraon* tribal landholder was found to have dug a tank for irrigation. Their fields are irrigated by wells.

The tank irrigates 10 acres owned by its two owners. Ten acres of land are irrigated in *rabi* season for cultivation of crops like moong, peas etc., and 4 acres in summer season for cultivation of all kinds of vegetables using water lifting devices. The owners also irrigate *kharif* paddy from the tank when there is scanty rain. However, such situation is very rare. There is no practice of hiring in or hiring out the pumpsets. The entire ten acres of land falls on the lower side of the tank. But some patches of land near the tank are of other farmers who are not allowed water from the tank. The practice of pisciculture was not found when visited. Earlier the owners themselves cultivated fish in the tank but the villagers stole fishes. Hence they have stopped cultivating fish. However, no one is restricted from using the tank for domestic purpose. It is also a fact that the location of the tank is such that it is difficult to use it frequently.

Tank II (Ambadarh Talab): The tank was constructed in 2004 under the scheme of "30 decimal pond" of the FD. Vishun Singh from the village managed to dig a 10 feet deep tank located on the south east part of the village. The tank is yet to function as no water has accumulated in it. Hence the tank is not included in the survey.

Tank III (Lauka tongari Darh): It was dug during 2005. It is also a 30 decimal tank dug by fisheries department on the land of Bandhan Oraon. The tank is situated on the north west part of the village. It is also a non-functional tank. The benefits will be seen only after some time. This tank has not been included for the survey either.

6. Village: Sisai **Panchayat:** Sisai **District:** Gumla

Location and Topography:

The village is located on NH 23 at a distance of 65 kilometer from Ranchi and its outskirts have been developed as a tiny township. It is a big village stretched through a large area and has over 1000 acres of agricultural land (as told by Sri Kameshwar Sharma). Kameshwar Sharma said that the village land records are in 10 sheets. One sheet contains more than hundred acres of land. The topography of the village is same as that of other villages of Sisai block. However, it seemed to be relatively more fertile than the land in the hilly terrain. The soil is sandy brown. Kudhra binds it in the east and Padaria in west and a tiny township in the south.

Social/Power Constitution:

It is dominated by tribal population. But the migrant *brahmin* family, which is now divided into three families, is powerful and has ample financial resources. It was revealed that the family, when migrated to the area (nearly 400 years ago) was the royal priest in the court of Chintamani Sharan Sahdeo, the king of Chhota Nagpur. The king had gifted a large piece of land amounting to nearly 100 acres in the area besides the big tank of 14 acres. They migrated from Bhaluni Dham of Rohtas district. According to Kameswar, the family now has 50 acres of land. There are nearly 1000 *oraon* households in the village. The *oraons* have 150 acres of land. Besides *oraon*, there are *lohra* tribe families constituting 10 households, having 10 acres of land. Other major constituent of the village belong to the Muslims community (*ansari*-the most backward caste) with nearly 500 households. They have nearly 300 acres of land. The non-tribal castes like *sahu* (*vaisya*) have 30 households with 50 acres of land, *yadavas* having 15 households with 30 acres of land. Among the influential persons of the village, Pramod Sharma, an advocate, comes first. He is also an advisor of a local NGO. The families command respect among tribals. Another influential person in the village is Deo Nandan Yadav who is a social worker. There is an NGO named, Gramin Yuva Vikas Sangathan, working in the village. The members of Sharma family dominate the constitution of the Sangathan. I.P. Sharma and Yugal Kishore Sharma are office bearers of the organization and have control over other members. The living standard of Sharmas is quite high in comparison to other tribes and castes. The *vaishyas* (according to Manager Sahu, President of the Jharkhand Mukti Morcha) migrated to this place from Bhagalpur, much before the tribes migrated to this area, perhaps after Santhal rebellion.

Agriculture and Irrigation:

The village seems to be agriculturally progressive. The major crops grown in the village are paddy, wheat and potato. The cultivation of wheat in the village is unusual for the area. The only source of irrigation in the village is tank but now, the tank has become insignificant for irrigation. There are two tanks in the village – first is Sisai tank under private ownership locally called Kalibabu's tank. The other tank is located almost adjacent to the Kalibabu's tank, and belongs to the agriculture department.

Tank I (Sisai talab/ Kalibabu' tank): The water-spread area of the tank is 14 acres. The banks of the tank are not in good shape, but the embankment is very high. The tank is of the British period owned by Kalibabu's successors. The three major sharers of the tank are Arvind Prasad Sharma, Pramod Sharma and Kameshwar Sharma. The depth of water in the tank is 20 feet in the rainy and winter seasons but it goes down to 15 feet in the summer season. The tank is never dry and sufficient water remains in the tank and hence may be used both for the irrigation and pisciculture. The source of water in the tank is only precipitation in the catchment. No major repair or desilting has been done in the tank for long. But Mr. Kameshwar claimed that the owners spend some money in repair of the embankments and other work in maintenance almost every year. But the expenditure being incurred is paltry, between Rs. 1,000 to 5,000. This investment is made to protect the fish in the tank.

Irrigation from the tank has now drastically reduced. But till recently it irrigated nearly 10 acres in *kharif* and 10 acres in *rabi* with the help of pumpsets. The field channels were constructed for irrigating from the tank. But the channels were in very bad shape and there was a lot of weed growth in these channels. It reveals that the channels were earlier used to carry water to the farm.

Among the other uses of the tank, domestic use and pisciculture are dominant. The value of fish production from the tank amounts to Rs. 40,000 yearly. All the owners incur expenses in fish seeds and fingerlings and they share the income in proportion to their share in the tank. At the time of visit (August 2006), the fingerlings were released into the tank by making a boundary using a mosquito net nearly 200 square feet area within the tank. Later the net would be lifted and fishes freed into the tank. The villagers without any restriction use the tank for non-consumptive domestic purposes. But the owners do not allow anybody to take water from the tank for irrigation purpose.

Tank II (Agricultural talab): The tank is situated adjacent to the Kalibabu's tank, with a water-spread area of one acre. The tank was dug by the agriculture department in order to support irrigation. But it remains dry most of the time and it is neither used for irrigation nor for pisciculture.

7. Village: Pilkhi **Panchayat:** Bargaon **Block:** Sisai **District:** Gumla

Location and Social Constitution:

The village Pilkhi under Bargaon panchayat is located at a distance of one km north from the NH and 2 km after Sisai. The topography of the village is similar to that of other villages in the area. There are 150 h/h of *oraon*, 15 of *mahato*, 10 of *mahali*, 4 of *lohra*, 8 of *yadav*, 15 of *kumhar* and 3 of *kayastha* (*lala*). The land details could not be obtained as it was raining in the area and transportation was difficult.

Tank I (Roshanpur Talab): The tank was dug in 1990 with the development fund provided by the government. The water-spread area is 1.5 acres. Although tank is 20 feet deep, it contains water only up to 8 feet in *kharif*, 3 feet in winter and it is dry in

summer season. The maintenance of the tank is the government's responsibility. This year (2006) the tank was renovated by FD. The desilting and fortification of embankments were seen to have been carried out recently.

Until last year, it has irrigated 4 acres of land belonging to three *oraon* farmers. It was informed that it would now irrigate more than ten acres of land and there will be pisciculture as well. The irrigation water is fetched mechanically and there is no gravity flow structure. The government contracts out the tank for fishing and the value of the fish produce has been nearly Rs. 5,000 annually. The tank is not used for domestic purposes. The reason behind it is that the habitation is a kilometer away from the tank and only a few some houses are built around the tank.

8. Village: Kudhra **Block:** Sisai **District:** Gumla

Location and Topography:

The village is situated on NH 23. It is a very big village and its topography is the same as that of Sisai. It is the bordering panchayat of Sisai.

Social/Power Constitution:

It is a tribal village consisting of nearly 800 households of *oraon*, 20 h/h of *mahli*, 50 h/h of *lohra* and merely 3 h/h of *cheek baraik*. Besides, there are 10 h/h of Rajputs and 3 h/h of *yadavas* in the village. The average landholding size of *oraons* comes to 0.63 acre, *lohra* and *mahli*, 0.5 acres each and *baraiks*, 6 acres. The average landholding size of Rajputs comes to 5 acres and *yadavas* above 3 acres. The total area of land amounts to 615 acres. The influential and active persons of the village are Arjun Singh, Sudama Singh (both Rajputs), Bichnu Ram, Vikram and Bijula Ram. Of these, Arjun Singh is a young man of 32 and a field officer of Sahara India. He holds 32 acres of land. Sudama Singh, an educated cultivator, commands respect among the villagers. Bichnu Ram a tribe is also an educated cultivator. Bijula Ram (50) and Vikram Singh (50) are ex-servicemen and are respected persons of the village.

Agriculture and Irrigation:

Tanks, wells and rivulets irrigate about 50 acres of land. There are four tanks in the village of which one is a multipurpose tank, two are for pisciculture exclusively and one is exclusively for irrigation.

Purana Talab: It is a tank built during the British period and is under the control of the fisheries department now. The water-spread area of the tank is one acre. It has a water depth of 15 feet in rainy season, 10 feet in winter and 5 feet in summer season. The sources of water to the tank are drainage and rain. The tank has been renovated twice after Independence with government funds. But it is still full of silts and the embankment is also not in a good shape. It irrigates 10 acres of land belonging to 25 farmers in *rabi* season. Pisciculture is practiced in the tank. The value of fish production is Rs. 4,000 annually. The villagers take the contract of fishing. They also use the tank for domestic purposes.

Special Case Details

9. Village: Hariharpur **Panchayat:** Jamtoli **Block:** Bero **District:** Ranchi

The village Hariharpur is a unique example of development of agriculture and reclamation of land engineered by community effort and by the use of local knowledge with quality leadership of a traditional institution named *padaha raja* (chairman of the tribal social institution). First of all *Bhuinhar,* the landlords, migrated to this area for their livelihood. But they did not do reclamation of forestland and improve the agriculture. This was why they suffered and led a miserable life. But their leader *padaha raja* Sri Simon Oraon (a septuagenarian) took the initiative intially and then got support from both the people and the government. First of all he applied his wisdom to increase the agricultural land. By using field experiences he stepped up reclamation of forestland, improved the ditches and *chanwra* (inundated land patch). He also identified suitable soils for cultivation of paddy in the locality. Later, embankments were constructed across the streams to check the water for future use. A 35 feet high and 45 feet long embankment can be seen. Simon claims that he first invested Rs. 12,000 to construct Deshbali *bandh*. Later, impressed by his efforts, the District Commissioner provided funds for improvement of tanks and *bandhs* in the village. For meeting the financial needs of the community work and the needy, he has created a *Jamin Bank* (land bank) in which certain amount of paddy is stored for such exigencies and improvement of agriculture in the village. There are four major water bodies (tanks) in the village namely Deshmali *bandh*, Jharianala *bandh*, Antmalu *talab* and Gayaghat *bandh*. There are channels constructed from these water bodies. An 8000 feet channel (they call it nahar-canal) from Jharianala *bandh*, 5500 feet from Gayaghat *bandh* and 5000 feet from Deshmali *bandh*. For all these constructions funds were obtained from the *jamin bank* and external sources like DC, Soil Conservation Department and Rural Development Department and the Christian Mission, a charitable trust. The Christian Mission had provided 30 quintals of paddy for construction of channels.

Simon Oraon informed that these structures and water bodies irrigate nearly 1,000 acres of land during *kharif* and *rabi* and 20 acres during summer season. The irrigation is done through surface flow structures and energized water-lifting devices. The village has practice of hiring in and hiring out of pumps and the rate is in the range of Rs. 100 and 150 per hour with fuel, depending upon availability of fuel.

The villagers carry out maintenance of these structures, sometimes individually and at other times collectively. Pisciculture is also practiced in the village through voluntary action. All those farmers who are involved get their proportionate share in fish produce. Nearly 25 to 30 acres of land is *pahan khet* (tax free land, locally called *pujar* or *girahi*). The *padaha raja* is the Supreme Court of Tribes. Simon claimed that not only their social disputes but serious cases such as murder and assaults have also been settled by the raja.

Following are the findings of these case details:

Topographical conditions

- The land topography facilitates the construction and sustenance of tanks in this region.
- The land resource is poor in the sense that the soil of the area is not as fertile as in the plains.
- The source of water for the tanks are fourfold – rain, runoff, drainage rivulet and artesian sources. These are all due to uniqueness of the topography.
- The construction of guard walls in some of the localities is the outcome of the topographical requirements and local wisdom.

Natives and Migrants

- Among the tribes, *oraons* are not only the cultivators and landowners in the area but they are progressive agriculturists too. They also enjoy power owing to land ownership and knowledge of agriculture.
- The migrant inhabitants introduced progressive agriculture in the area, particularly in terms of reclamation of land for agriculture and improvement in agricultural pattern.
- Most of the migrants are from different areas of Bihar, particularly from old Shahabad district (now mainly Rohtas) and Bhagalpur districts settled here and acquired land for agriculture.
- The non-tribal migrants, (*rajputs, vaishyas, koiris* and *yadavas*) enjoyed influence and power over the tribal people because of the tribes' ignorance and reluctance in agriculture.
- Except *oraons*, the tribal attitude has not been agriculture-friendly.

Structures and Management of Tanks

- People of the region realize the importance of tanks and other water bodies
- The average size of tanks is not large as found in West Bengal, Orissa and in some cases in Bihar.
- The migrants do also realize the importance of tanks. They have invented devices to make use of natural water in the scarce periods.
- They made efforts to obtain government support for the betterment of the tanks

- In those areas where the tribal population was reluctant to do farming, the condition of land and tanks are very poor. They not only leave the natural resources unharnessed, but lead a miserable life too.
- Wherever the local people were active and progressive, the situation turns better. The tanks can be sustainable source of income and livelihood if people volunteer wholeheartedly or provisions are made to create participatory organizations
- Tanks have begun to lose their significance for agriculture and are turning into fish production units because they provide the farmers with tangible income and quick cash.

The Policy Contexts and Community Action

- Government of Jharkhand has been investing money in the tanks through various schemes but it seems the potential and prospects of such tank projects are undertaken without judging the local factors and their conduciveness.
- Such unfruitful constructions and repair of tanks may also be caused by some other factors like people influencing the echelons of power for their own benefits.
- The government policies have been conducive for turning tanks into fish ponds, which is evident from the fact that large number of tanks belonging to either revenue department or agriculture department have been transferred to fisheries department.
- The traditional social institutions, particularly those among the tribes like *pahana, padaha raja* etc., have played important role in the management of tank-systems in the villages.

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