CHAPTER VI

Field Visit Reports from Kathar, Badgaon and Surtana Irrigation Systems

Introduction

Ashutosh Shukla[1]

The second part of this workshop included two days of field visits to three of the farmer managed irrigation systems in East Chitwan. The participants were divided into three groups and each group worked with three different techniques for collection and investigation of resource information. The group using Inventory and Institutional Analysis and Development (IAD) Framework visited Surtana Irrigation System. The other two groups using Participatory Rural Appraisal (PRA) and Geographic Information System (GIS) techniques visited Kathar and Badgaon Irrigation Systems.

This section presents the findings and experiences of each of the three groups. The participation in the groups was multidisciplinary; each member attempted to investigate the resource system pertaining to his/her own discipline. Each group was led by experts in respective techniques: Elinor Ostrom in Inventory/IAD group and Jamy Mascarenhas and Samuel Joseph in PRA/GIS groups.

A discussion session was organized prior to the field visit to set the goals of field visit. The following attributes were identified to be investigated by the groups using their respective techniques:

1. Characteristics of physical system as they affect the performance and outputs.
2. Institution and management system.
3. Characteristics and performance of Agricultural System.
4. Issues of water rights both at the inter and intra-system.
5. Irrigation - Forestry inter-relationship.
6. Who gains, who loses within the resource boundary?

After the first day of field visits, each group discussed and shared their experiences. They identified their weaknesses and missing information to be collected the following day.

A reporting session was organized at the end of the field visits. Each group reported on their investigation of the resource system they visited and commented on following issues:

- Strengths and weaknesses of their techniques
- Comparability
- Usefulness
- Timeliness
- Ease of update
- Cost
- Adaptability and change
- Complimentarity with other techniques
- How to get the information back to the farmers

The most important achievement of the field visit was the development of a sense of appreciation for each methodology used, which helped eliminate, at least partially, methodological biases. The practitioners of PRA, for example, agreed that given short time frames, PRA may not be an effective tool for resource information since PRA is like peeling an onion - one can't dig deep without first building trust with the resource users. GIS, though effective in handling spatial data, needs the backup of PRA for ground validation, if the information is to be used for policy analysis. While Inventory technique uses descriptive presentation of resource information, PRA uses diagrammatic presentation. The participants agreed that PRA is a detailed inventory at the micro level conducted in a participatory manner[2].

Notes

[1] Ashutosh Shukla is faculty member at the Department of Agricultural Engineering and Co-ordinator-Irrigation Management Systems Study Group, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.

[2] Selected maps and diagram prepared by Kathar and Badgaon field teams using PRA tools are presented in Appendix I.

Kathar Irrigation System

OVERVIEW OF THE KATHAR KULO SYSTEM COMMITTEE

The Kathar Kulo System Committee comprises the following positions:
Chairman: Bharat Mahato
Vice Chairman: Khadga Prasad Pande
Secretary: Jian Choudhary
Eight other members: including a Vice Secretary and Treasurer

The committee used to conduct meetings 3-4 times a year. The maximum land holding of farmers is 14 bighas, and the minimum is 2 kathas. The cost of land varies from Rs. 100,00 to Rs. 400,00 per bigha. Production capacity of the land is 40 muri of rice per crop per bigha.[1] According to the farmers, it was known that the productivity of the land was quite high around 15-20 years ago but currently it is quite low. They used to grow only one crop during those days and for the rest of the year, the fields would remain fallow. They are currently shifting three crops per year.

Kathar Kulo System: Demands of the Beneficiary's Committee

These are the demands made by the committee in a meeting conducted in the presence of about 60 farmers and special presence of officials (engineers) from East Rapti Project.

1. Repair works to be done in the Headwork site.
2. Stone Masonry wall for the site from Logai village to Gohai Khet.
3. Division Box for "Syal Ko Dulo" and "Phaphaini Mauza".
4. Repair works of Regulator in Phalman ko Muhan, Upreti ko Muhan, Ramesh Choudhari ko Muhan, Bika ko Muhan.
5. Repair works of overpass in Dhamala ko Kulo.
6. One side masonry wall in the canal for Bans ko Bandh Phaphaini and from Bans ko Bandh to Bishram ko Muhan.
7. Repair works of the Escape Structure in the beginning of the Phaphaini village and its tail.
8. Construction of three super-passages for Badgaon Kulo.
9. Construction of Regulator for "Jogi ko Muhan"
10. Construction of a culvert near to Bagaicha.

11. Construction of a culvert for Upreti ko Klo.

12. HDPE pipe for the land of "Bishnu Prasad Sitaula"

13. Construction of a culvert in "Badgaon Kulo near the land of "Khadga Prasad Pande"

14. Construction of regulators in Beldia ko Muhan, Bishram ko Muhan, "Chokat, "Khebu", and for Laxman's land.

DOCUMENTING THE SOCIAL MAP OF KATHAR VILLAGE

Process

Fortunately we found a threshing cement floor to draw the social map. Few villagers--old and young--gathered around us. Sam Joseph took some chalk and began by drawing the map on the threshing floor in which we were standing and explained to the villagers. He then asked them to draw the closest building and road first.

Sensing he had to draw the whole village map, he first began with roads and canals (called Kholas) and he indicated North, South, East and West on the map. A couple of elders and youths corrected the location and redrew some parts; thereby arriving at a consensus about the infrastructure and major land use patterns. They then indicated the ward numbers of the village on the map, agricultural land, forests and locations of schools. A youth then started again, and was later joined by two more boys, plotting the houses. Most of the plots along the streets on both sides gave the impression of a linear pattern. All the backyards of the houses were facing towards agricultural land.

After this, he was requested to give distinct numbers to each house, to indicate the house owner's name. For a while he thought, "Oh, one more Job!" Then he said, "O.K., let me try. He asked help from friends. Then he started from the plots in the East, since he was standing on those plots of the map. He filled numbers in the plots, which were big enough for writing numbers, while small plots he left unnumbered. We suggested to put a number next to those plots as well. Along with putting numbers, he also mentioned the owner's name. One of the team members noted them down. During the process of numbering, few houses got erased, as they were not really there, few more added in suitable locations. Numberings, ownership and name thereby increased the accuracy of the house locations.

After two hours, the youth and his few friends left. We had an elder-contact person with us from the very beginning who then proceeded to help us identify more on the map. Sam briefed us to locate caste and households which benefitted from irrigation during all 3 seasons and those that benefitted less. We used grains to help identify the above.

Meanwhile, some school children arrived. A team member requested the boys to get different grains to put on the house plots according to caste. The school boys, thrilled by a request from a stranger and looking at the map which was something new for them, ran to their houses and brought back maize, wheat and rice (paddy). Others brought mustard and linseed. Now the boys started putting grains based on caste on the houses. Beginning with maize, for the Tharu caste, a dominant caste, (including Chaudharys) followed by paddy, wheat, mustard and linseed and also stones and green leaves. It looked quite colorful.

Then came another request to pick out the grains from the houses, which benefit the least from irrigation. Our contact person asked somebody to show this. In turn, they brought an old man, who seemed to have knowledge of water distribution. While for the tail enders, somebody else came in and picked out the grains.

The whole process took three and 1/2 hours. Villagers slowly gathered and dispersed three

times, as though a show were over, or became less interesting to them. Interactions were high during location of the houses, peak while caste identification and benefit from irrigation for were being located. For every task, they discussed first, then drew or plotted them. For house plots and irrigation benefits, the villagers contacted specific people, who had more knowledge than they had. Throughout the duration of the exercise, we did not control any item.

Observations

Through asking only 2-3 difficult questions, you can get extensive information with maximum interaction and participation with the villagers through PRA. Since this village has been visited many times by outsiders, they were curious to know why we were collecting all the information. We must return the information to the farmers.

Findings

Social Mapping of Castes was as follows for ward no. 2 and 3 of Kathar Village Development Committee.

Caste #	Households
1) Tharu	138
2) Praja (Chepang)	3
3) Kami (Blacksmiths)	3
(Migrants from hills)	
4) Pahadi (Migrants from hills)	68
4.1 Brahmin	
4.2 Chettry	
4.3 Newar	
4.4 Gurung	
4.5 Tamang	
5) Desi (Migrants from Eastern Terai)	16
5.1 Sah	
5.2 Miya	
5.3 Thakur	
5.4 Maji	
TOTAL	

DOCUMENTING INFRASTRUCTURE AND SOCIAL SERVICES OF KATHAR VILLAGE

Process and Observations

It was a rainy day. The Study Team started to identify the infrastructures in Kathar Village through the Participatory approach with the farmers themselves. Farmers were provided with a plain drawing sheet and color pens. The Team then asked them to identify where the social services were in relation to their locality and how they were using them.

They first pointed out the houses where everybody was sitting under the roof. Then they drew the "Kaccha" or non-metal road to show the nearest entry point to the highway, which they also drew. Then, with the colored pencils, they drew 1) the school/college where their children are presently studying, 2) livestock procurement locations, 3) post offices, 4) rural market places, 5) the part of the road where complete cut-off to transportation occurs during some parts of the rainy season, 6) agri-product market centers, 7) milk collection locations, 8) telephone facilities, 9) ADB/N, 10) Veterinary service centers and 11) Agri-Input Procurement Centers.

Findings on Infrastructure and Services

Table 1 shows both the number of certain infrastructures providing services to the Kathar Village, and the distance in kilometers of that service from the city center.

TABLE 1. Infrastructure in and around Kathar Village

Infrastructure	#/ (Dist. in km)
1) Roads	
a. Cache (non-metal road)	4*
b. Motorable road	122
2) Community drinking water hand pumps	3
3) Private drinking water hand pumps	19
4) Flour mills	1
5) Provision shops	1 (12)
6) Education	
6.1 Secondary schools	1
6.2 College (nearest)	1 (13)
7) Local Administration	1 (12)
7.1 Village Development Office	(3)
8) Post Office	(3)
9) Telephone	(3)
10) Nearest Town	(12)
11) Nearest market center	(3)
12) Agri-Produce markets	(50)
13) Milk collection center	(3)
14) Agri-Development Bank	3
15) Veterinary services	
16) Cattle fair (to buy)	
17) Agri-Inputs	
18) Private fish ponds	
19) Flood affected roads-2 (sites which cuts off transportation in the rainy season).	

* Those services without a demarcated distance, mean the service is in the village center.

DEVELOPMENT OF KATHAR VILLAGE RESOURCE MAP

Process and Observations

In the beginning, three farmers started drawing the resource map on the ground with a white piece of chalk. They were later joined by a couple of more farmers. Before they could finish the map, they realized that the size of the map boundary was not large enough to include all the resources clearly. They therefore, started another map with a wider boundary. During the process, a few more farmers joined the team. After they had finished the drawing on the ground, a young man (high school graduate), proposed that the map could be traced on the drawing sheet nicely.

When the map was being redrawn, several villagers joined in and made changes on the original map. A separate group of villagers drew a different map on the ground using the colored powder. Soon, it was like a festival of map drawing and everyone was trying to add to the maps in meaningful ways and indicating the locations on the map of their own fields as well as the fields of the others. They also indicated the flow of water from different sources as well as the types of crops grown on them.

Findings

In order to have a clear distinction between different resources, village people suggested to shade different structures and areas with different colors. In the original map made by the village people, it could be seen as:

Color	Resource Elements
Blue	Irrigation canals, including main and secondary canals
Yellow	Irrigated areas
Red	Roads (motorable and non-motorable)

Brown	Low-lying areas
Light Green	Community forest
Dark Blue	Water logged areas
Dark Green	Jungle (dense forest)

As pointed out by the farmers, they face some drainage problems in the downstream side. As far as the physical characteristics of the system boundary are concerned, it was found that those who have easy access to the source (ie. irrigation, road, forestry) benefit more. Through discussion, the group identified that there was a lack of irrigation water in Kahirghri village of Kathar VDC. Migrants in this area have had a lot of influence on the prevailing agricultural practices.

DOCUMENTING CROP PREFERENCES IN KATHAR VILLAGE

Process

This was during the second day of our field work. During the first day, we prepared a social map using PRA. With the help of this map, we randomly selected one part of the village where our exercise was done to identify crop preferences of a certain group of villagers.

We reached a locality, inhabited by the Tharu caste households. All are semi-structured houses--with bamboo screens plastered on both sides with mud, used as walls, burnt tiles and dry grasses used for the roofs. Most of the household good are made of wood, including large size wooden plates.

As the team members explained about our visit from the day before, other members mentioned today's focus. The villagers and the team sat together on the wooden cot. They started with explaining their crops. On clarification, they described all the crops and vegetables. Every time a team member asked them to explain why they prefer to grow particular crops or vegetables, determinant factors described by them were listed.

Later, based on each determinant factor, we asked them to rank the crops according to their preferences from 1 to 4 as shown in Table 2. We added a few more determinants like inputs, and climate. Once these crop rankings were established, we asked the villagers to demonstrate it on the ground. Crops were represented by actual grains/pulses. Determinant factors were represented by symbols. At the end, we asked their opinions on cropping patterns both historical (over the past 20 years) and current patterns and preferences.

OBSERVATIONS

According to the farmers, the exercise and resultant table revealed, 1) an increase in their visual knowledge, 2) problems identified and 3) knowledge of crop yields. The PRA group learned the advantage of asking the right questions; problems with asking improper questions; advantage of demonstration of the villager's knowledge, and that we can get more information and understanding in a short time through using PRA.

OVERALL OBSERVATIONS

- People in the village were very cooperative.
- Tharus (original inhabitants) who tend to get marginalized, also participated in mapping and analysis, with a little encouragement.
- Migrants had more special knowledge on planting and harvesting times.
- First time ever observed: Cutting of heads of maize plants to spot parrots (improved visibility).
- Migrants introduced the making of field "bunds" or boundaries.

TABLE 2. **Crop Preferences for Kathar Village**

Indicator	paddy	wheat	seed	mustard	masur	potato	gr.veg.	maize
Subsistence	4*	3	2	2	3	2	1	3
Probs. w/wild anim.	0	4	0	1	1	4	2	3
Good taste	4	2	4	4	4	4	4	3
Easy marketing	3	2	4	4	4	0	0	2
Higher earning	3	4	1	1	1	0	0	2
Higher yield	3	4	1	1	1	0	0	2
Easy to cultivate	2	3	3	3	4	3	3	3
Suitable soil	4	4	3	3	3	2	2	4
Heavy rainfall effect	1	2	4	4	4	4	3	2
Seed available	4	2	4	4	4	2	1	3
Fertilizer availability	4	4	2	2	4	0	0	4
Pesticides	4	4	4	4	4	4	0	0

*4=very good, 3=in-between, 2=little better, 1=not good

- Information generated in the PRA exercise was easily understood, comprehended, commented upon, and corrected by all ages, genders, and by both the villagers and outsiders.
- Village people were very interested in and concerned about the accuracy of the information in all types of maps.
- Migrants provided a lot of input to the maps and diagrams in random-encountered groups.
- Village people were most comfortable when mapping/drawing on the ground, less so with paper.
- Expectations of the village people seemed to be high because of a combination of factors--many cars, many trips, many officials, many nationalities, more intense interaction.
- PRA seems to be quick and more accurate because of the group interaction and process.
- People can draw and analyze on maps and diagrams, surveys are not always necessary.

RECOMMENDATIONS

To Ourselves

- More clarity is needed in understanding Kathar village systems and the Kathar water system.
- More understanding is needed about PRA. Four/five hours of total time on actual PRA is not enough.

To the Farmers

- Explain your (the farmers) problems through maps, symbols, pictures, diagrams, and actual site-visits drawn and conducted by you (the farmers).

To the E. Rapti Project

- One farmer's field which is now under project control is not being farmed. As a result, there is no irrigation of this field which means farmers downstream have no water. Please irrigate this field.
- Minutes of the Water User's Committee have a list of problems which need further discussion.

To Policy Makers

- Before executing any projects, please spend time with the users of a system, in the system, so that complex connections, mutual dependencies and their management mechanisms are understood and supported to ensure equity and sustainability.

Notes

[1] Conversion is as follows: i) 2 muri = 1 Quintal, 2) 20 Katha = 1 Bigha, 3) 1.5 Bigha = 1ha.

Badgaon Irrigation System

INTRODUCTION

In order to obtain as much information on the Badgaon irrigation system, this team was divided into three groups. The first group, through using PRA techniques, documented the history of Badgaon's irrigation system, and identified the present management system of water rights, distribution and conflicts.

The second group had the villagers map the entire irrigation system, identifying all relevant physical infrastructures. They then conducted an irrigation system matrix, identifying all the irrigation systems of the Amrit Khola and various characteristics pertaining to each system such as diversion work or dam type, irrigated land/command area, seasonal water availability, etc. They and the villagers together were thus able to make hydro-ecological connections.

Group 3 obtained information on the area and productivity of different crops in different seasons in upland and lowland fields using a Trend Matrix. Using a Seasonality Diagram, they were able to identify rainfall and canal water distribution, cropping patterns, and contribution as well as gender-wise distribution of labor input.

All three groups reflect on the benefits and shortcomings of the methodology used. In particular, they discuss the strengths and weaknesses of the PRA methodology, and its capability in bringing information to the villagers. Finally, the groups discuss potential integration options between the three methods presented at the Workshop: PRA, GIS and Inventory.

For the first two types of information obtained, a) the History of Badgaon's Irrigation System and b) the Present Management of Water Rights, Distribution and Conflicts, the objective was to uncover the management system in Badgaon--to look at the question, "Who gains, who loses?"

GROUP I: HISTORY OF BADGAON'S IRRIGATION SYSTEM

The original system is three generations old, originally pure Tharu but now mixed due to 1950 onwards migration of Pahadias from the hills. Prior to in-migration, a maintenance system whereby each individual contributed labor existed. This system was replaced by one where each household sends only one representative.

The system was badly affected by a flood in the sixties. Reconstruction was self-funded and management institutionalized with a User's Group, written rules, sanctions system etc.

Later, at the farmers' request, there has been some government intervention to improve physical structures. Similar intervention in upstream Surtana system resulted in less water for Badgaon; however, a settlement whereby rights are secured has been reached.

The following is an historical account of events having a significant effect on the irrigation system of Badgaon. The information was provided by the villagers using PRA methodology:

YEAR	EVENTS
1) 2-3 generations ago	Initial construction
2) 1938	The system was asked by another system to select only one source. They subsequently chose Dhungre as their main source.
3) 1958	Major migration began from the hills, especially from Dhading and Ghorka. This resulted in increased labor contribution, particularly in repair and maintenance. The "Jharai" or migrants slowly became established with "households".
4) 1970	Big flood at Dhungre washed away the canal. The canal was reconstructed with the source at Budhirapti. Cash mobilization for reconstruction was on the basis of landholding size. As a result, about Rs. 2700/- was obtained in this fashion in addition to labor contribution for 7 days by all the households. Resulting from this event, a committee was formed and documentation of rules and regulations was initiated.
5) 1972	Water at the Budhirapti source was not sufficient. They again started reconstructing the canal towards the Dhungre source.
6) 1983	Brushwood diversion structures were improved to gabion type through assistance from FIMOD at the Dhungre source.
7) 1984-85	A great conflict with the Surtana system (upstream system) arose due to decreased water at the source. This was caused by the construction of the semi-permanent diversion structure of the Surtana System. The conflict was resolved when the water from the source was reported to the CDO, and both systems agreed to provide 1/6th of the water to the Badgaon system.

PRESENT MANAGEMENT: WATER RIGHTS, DISTRIBUTION AND CONFLICT

The system appears relatively free from both inter- and intra- scheme conflict regarding rights and access to water. This is primarily due to well-established rules and regulations. Everyone with land in the service area is a member of the User's Group; the committee of which is nominated by consensus.

The "tail-enders", however, claim to receive proportionally less water than the "head-enders", particularly during periods of water scarcity. While this problem appears to be the major source of conflict, according to the farmers, the root of the problem is mainly of a technical/physical, rather than of an ethnic/socio-economic nature.

REFLECTION ON PRA METHODOLOGY

We selected what we thought would be the most appropriate methods for looking into "software" issues; i.e. initial transect, timeline, attempts at social and resource maps as well as group discussions. On the first day we spoke mostly with "head-enders"; hence in order to off-set potential bias, we decided to spend most of the second day with "tail-enders".

Two half-days of field work can hardly be considered sufficient for uncovering the depth of potential conflicts in an irrigation scheme. We only started "peeling the very extreme layers of the onion". Therefore, the main benefit, and

perhaps the actual objective of the exercise, should be the opportunity to use specific PRA techniques in practice.

The information collected would undoubtedly have been more valid, had farmer's groups been more representative of the different reaches of the canal, and if we had talked to more people including women. This, we feel, goes to show that PRA demands thorough preparation, flexibility, skills and certain attitudes and lots of time on the part of practitioners. It is a situation specific approach and should never be perceived as a blueprint approach, as this would completely defeat its purpose.

GROUP II: IRRIGATION SYSTEM MAPPING

In the field we could feel for the first time a formal PRA being tested. We talked with the people informally but politely. We followed them to the places that were important to them. Slowly we started to get the information we were looking for. All the bits and pieces slowly came together; sometimes spontaneously, sometimes we had to collect and compile them from their prolonged and mixed subject matters they discussed. We did not have to compete; no one loses here. We simply listen and add our interests as curiosity without making them feel that they were deviating from their subject matter.

They then started plotting the complete irrigation system. We added input from our curiosity and they expanded to quite a large area. They prepared four map sheets to cover all features from adjacent areas. A novice GIS user will have to think how to put all sheets together in an ARC/INFO. Villagers are good map makers, good geographers.

Findings

It was possible, with the help of the local people, to obtain everything we wanted. With the participatory approach, we were able to obtain the following information about the Budi Rapti (Amrit Khola) irrigation system as outlined in the following paragraphs.

The physical infrastructure

- The Badgaon and Jivanpur canals are fed by a common Bush-mud diversion work, each irrigates 220 and 75 Bighas of land respectively.
- There are a large number of multi-level (small change in elevation) field channels to supply irrigation water to the land at various elevation levels.
- Few channels which collect drain water (drain channels) provide water to the system; these have formed a means of sustaining and balancing water budget in the system.
- There were a number of areas where problems of siltation caused by the soil dumped along the canal bank existed. Also, there were areas that crack during dry periods and cause leakage of water during supply periods. At certain places, there was much demand for inlet channels; people dug every where to get access to the irrigation water. This has caused temporary conflicts at those places.
- The mouth of the Panch Muhane canals has deposited heavy silt and mud. This causes an unequal flow of water at all five branch canals. Because of this, Panch Muhane has had some conflicts too.
- The common, mud-bush diversion work did not efficiently serve the Jivanpur (2/3 of water) and Badgaon (1/3 of water) canals. The Badgaon canal, which is at upper portion from Jivanpur gets more water than the Jivanpur system despite the agreed proportion of the share. As a result, there have been some conflicts over the water issues.

- The farmers were upset about the irrigation project (ERIP) not being able to aid them. ERIP constructed the canal ways very far from their village and were locked up during monsoon flood as there was no bridge over the Dhungre Khola.

IRRIGATION SYSTEM MATRIX

Process and Observations

The second day of the field visit, we collected some attributes on a broader scale by considering its usefulness with the computer GIS. We also needed more understanding of the system. We inventoried all the irrigation systems of the Amrit Khola in a matrix. The top row were all irrigation schemes with their geographic names and the left column consisted of various characteristics (diversion work or dam type, irrigated land/command area, seasonal water availability, conflicts/water rights, degree of maintenance (manpower), management status (failure or success) and the user groups and *samitis*.

Findings

The following paragraph outlines the information obtained (originally a matrix was made by farmers):

- There are 14 main canals at the Budi Rapti (Amrit Khola), the source of Amrit Khola, and the last diversion downstream which is 16 km.
- The last 2 diversion works are concrete structures built by CARE/Nepal. Above this, at Dharmapur and Janakpur, canals are fed by gabion blocks.
- Only the system constructed by the agencies had registered user committees.
- There were some conflict areas identified which were caused by changing water availability.

Hydro-ecological Connections

- The Budi Rapti, also known as "Amrit Khola", in English means "Nectar or life giving river". This serves water to many canals. "Wherever you construct a diversion, you get water".
- The Amrit Khola, at present, obtains water by seepage of the main Rapti from the Kuchkuche's mixed forest.
- The forest has still preserved the conditions required for this to happen.
- There are 2 gabion boxes and two concrete diversion works and all ten are bush-mud type.
- The Dhungre khola was a canal many years ago. The Lothar river entered into it, wreaked havoc to the irrigated land, and now is an active river which is not possible to cross during monsoon. (There is no bridge as well).

COMMENTS ON THE FIELD VISITS

On the first day, we listened sympathetically to the farmers' demands for developing strong engineering irrigation structures. On the second day, we developed a deeper understanding of the system in terms of the human-nature interdependence. The Budi Rapti irrigation system's self-sustainability involving the ongoing cycle of natural deterioration and maintenance by humans is quite remarkable. It can be viewed as a "man-nature *Dharma*".

The floods wash the weak diversion works away and fill the canals with silt. The silt is then used as fertilizer as well as providing the people with local materials to fix the embankments and diversion works using their indigenous knowledge. All canals, and subsequently farmers downstream get their fair share, naturally. Any permanent

obstructions to divert water to a particular system would create conflicts over water sharing; only people upstream would benefit. In this regard, nature knows no nemesis. By adapting appropriate technology, harmony is maintained.

There were some canals channeled via the settlements even though they were not necessary for irrigation. They served as 'air coolers' in hot seasons, and recharged the ground water table for their tube wells for water consumption (drinking and cooking, food that came from their irrigated land, irrigating orchards and kitchen gardens, and water for animals).

REFLECTION ON METHODOLOGIES

We were concerned with learning the degree and methods of understanding phenomena occurring at a very micro-scale. We realized that using the method of Participatory Rural Appraisal or PRA provided sufficient information on the spatial linkages of hydrology/ecology and human interactions, and the existence of both subjects at the micro level.

We learned that the PRA technique can be used to compile micro-level data which can be expanded into a larger space using Geographic Information Systems (GIS). PRA, for us (GIS users), can be used as a method to ground truth, or map the resources in a participatory approach. Anyone handling spatial data for rural development can use this method to understand the real ground phenomena and make continual updates.

PRA can be used to map localities more accurately (the graphics part) and to collect associated attributes to be linked to the graphics in a GIS.

The objectives of the research and information needed must be clear to the PRA facilitator. The nice thing about PRA is something like "the end is the beginning and we discover new things...". There is so much anti-current idea in PRA from the current "hoopla" world. It will take a while for the transformation to take place among the "Educateds". One must be so humble and alike the village folk. This in itself is important, kills arrogance, helps intellectual growth to take place and, all the more, a good PRA is like meditation (sorry, there is still some cunningness in PRA).

PRA and inventory both, with a little forethought, can become a part of the GIS activity. Information collected in this manner can be used with a GIS to make more it more understandable.

GIS/PRA can be used together to collect and represent information in an enhanced way so that the policy makers are tempted to enact laws accordingly.

The PRA is more effective if used in conjunction with maps or aerial photographs or satellite imagery of the local area to locate the features of interest. This will also provide the villagers some understanding about their neighbors, distant places and their relationships.

PRA has some purpose. It seems to be a means to knowing the rural environment, people and development, programs and impacts by involving the people from their land. It does not stand on its own; it can be used by various disciplines as long as the village people do not think they are obliged to respond to a "development worker". Should the subjects be subjected to an experiment or be made partners in development? The main question is, "What should the farmer get?"

If information is being easily and smoothly obtained and flows only upward, (this can happen by any means of data collection- from PRA to space technology), and nothing flows downward, then the people are left alone and cheated. They are not real development partners. If the PRA is only being used as an experiment, the people should know about it.

What do the Villagers Get?--Ideas on Integration

What should the villagers get? Should the farmers be fed with the data we collected and polished? Or should the information obtained from the farmers be used to make appropriate policies and translated into actions? Who should be responsible for it?

The policies are coming, having been influenced by data collected using whichever methodology. But what can the farmers get, other than that?

- Integrated PRA, inventory and GIS can provide a better understanding of the spatial linkages between what exists in their land in relation to their neighbor's and further, by using maps. Visual maps are better than providing raw data and statistics to the people.

- This will enable them to realize how their indigenous knowledge and appropriate technology are more sustaining than a government or agency-funded large structure with their imposing ideas.

- With a broad view of the system, in addition to the realization of the importance of their use of local materials in the construction of the diversion works and canals, the farmers can better understand the dependence of the downstream inhabitants and the system. GIS helps in resolving the conflicts over water resources sharing.

- With the display of pertinent information collected by the use of PRA, integrated into a GIS, the farmers can visualize the importance of natural resources and their relations with irrigation. This will make them unite and work together in additional tasks of conservation and management of natural resources such as forests and floodplains. GIS promotes cooperation among the villagers and enriches their knowledge.

- In summary, appropriate technology, environmental inter-relationships, conflict resolution, conservation of natural resources and enriched harmony among people are better realized/developed by integrated PRA/GIS. This is possible only by coming back from "the data fields" and sharing the information in map forms with the farmers, in their fields.

GROUP III: TREND MATRIX

Process

On the first day, Group 3 identified the area and productivity of different crops in different seasons in upland and lowland fields using a Trend Matrix. First, we went to the farmers, introduced ourselves, and explained our purpose of visit. To build rapport, we were led by a small group of farmers up a canal. While doing so, we had a chance to interact with the farmers and were able to get an overall view of the agricultural situation of the village, particularly with respect to irrigation. Upon return to the village, we met in the tea stall and began discussion while taking tea, encouraging other farmers to participate and developing further rapport. When we began our work, a group of 10 farmers were ready to participate. Throughout the duration of the exercise, there were as many as 20 farmers actively participating.

On this first day, we developed a Trend Matrix. This involved making a semi-structured matrix and encouraging the farmers to fill in the information related to crops, area, and productivity. They began by giving the total area, 220 bighas, (1 bigha=.67 ha.), then crop coverage percentage-wise.

We originally had planned to ask the farmers to use seeds to demonstrate crop productivity. The farmers providing the information, however, were educated and therefore felt comfortable working with percentages and numbers.

After having completed the current productivity matrix, they prepared the same matrix for approximately 20 years back. While filling out the matrix, we discovered that there had been a radical change in their cropping pattern and intensity, only after the introduction of a high yielding variety of rice some 20 years back.

SEASONALITY DIAGRAM

On the second day, group 3 identified rainfall and canal water distribution, cropping patterns, and contribution and gender-wise distribution of labor using a Seasonality Diagram.

Process

When we arrived the second day, we met a group of farmers including several from the first day, cleaning and de-silting the irrigation canal. As a result, we had the opportunity to discuss issues related to water rights, distribution and conflicts involved. This gave us the opportunity to discuss with more and more farmers and have them participate in our discussions, thereby strengthening the likelihood of triangulation.

The goal for this day was to develop a Seasonality Diagram. In order to obtain information regarding rainfall and canal water distribution, we gave the farmers a sheet of paper and several sticks. We asked them to write down the months across the bottom of the paper and place different length sticks vertically, according to the amount of rainfall per month. This led to lively discussions and consensus before deciding upon the final length of the stick. In the process, we encouraged the silent farmers to participate in the discussion by asking his reaction to what others said.

To demonstrate cropping patterns, the farmers placed different lengths of straw (horizontally) to represent the duration of each crop. In order to obtain information regarding seasonal labor contribution and gender distribution, we provided the farmers with 100 kernels of maize. Supposing that 100 units of labor are required per year, we asked them to distribute the kernels month-wise. Afterwards, we asked them to distinguish between male and female input. During this last process, there was lively and lengthy discussion regarding women's participation. Some questioned whether domestic labor should be included, while others stated that we should only focus on field production.

We observed that if this PRA were to result in action-programs, it is possible to encourage discussions to address, for example, women's issues. Our initial goal was to look at rainfall and cropping patterns, yet the discussions evolved, quite naturally, to focus on the status of women for some time. PRA is quite flexible in this respect.

Observations

From the Production point of view, we observed four salient things:

1) In Rice-Rice-Rotation, the second rice yield was less as compared to the maize-rice rotation, where rice yield was more when grown after maize.

2) In Rice-Rice Rotation, in the Spring Season, the prevailing variety is CH-45 which is not a heavy consumer of nutrients. So, if fertilizer is applied, the yield is reduced due to lodging. This variety is less chemical fertilizer responsive. They are looking for alternative varieties which can maximally exploit the existing soil nutrients.

3) In Rice-Rice Rotation, they need a shorter duration variety than the existing one so that there will be no overlap between harvesting of preceding crop and transplanting of succeeding crops.

4) In Maize crops, the upper part of the plant during maturity is cut and removed. The other PRA group observed this practice as

serving to "open up" the view of the plants to watch for hungry birds. According to "technical experts", this activity is called "de-tassling" which increases the yield of Maize crops. It's amazing to see that farmers have been following this practice by their own experiences for a long time.

STRENGTHS AND CAUTIONS WHILE USING PRA METHODOLOGY

The methodology used in PRA is extremely effective for many reasons.

- Active Participation of Farmers: This holds their interest and they feel that their say is being documented. We, as researchers, can observe their group dynamics and learn from them. This exercise also provided the farmers with a forum to discuss issues relevant to their context.
- Equal participation of literate and illiterate farmers by using local materials such as sticks and seeds to document information.
- Both of the methods used not only provided us with information we were initially interested in, but indirectly raised other issues relevant to understanding community dynamics.
- PRA is fun for both the practitioners as well as the villagers. The use of seeds, sticks etc., makes the process like a game--this results in good group dynamics and is easy for consensus decision making.

There are a few items which our group encountered that we feel PRA practitioners must be aware of.

- Methodology should be kept as simple as possible to ensure that both farmers and PRA practitioners don't get confused.
- We should record the information as they reported it, not as we interpret it.
- When trying to obtain general information, efforts should be made to have a diverse representation of farmers, including gender.

INTEGRATION BETWEEN METHODS

PRA--GIS integration: Using PRA methodologies, very good maps can be constructed. PRA collects detailed micro-level information that can be extended spatially using GIS. PRA is a very good participatory device to collect attributes for use in GIS. PRA makes a GIS data base more accurate.

By providing a GIS map to the farmers, they can get a broader view of the overall irrigation system as well as the inter-linkages between other sectors, such as forestry. For example, by viewing the GIS visuals, the farmers can see that the source of their river is also feeding 15 other systems. They therefore have a broader view of the overall system and the linkages, so that:

- they themselves will consider appropriate technologies,
- it can help them with resource sharing and avoiding conflicts, because they can visualize the macro system and understand the linkages,
- their spatial understanding of the hydro-ecological significance in their system will be enhanced. They will be empowered with this information to make their own location-specific decisions with regard to development interventions.

GIS and PRA/Inventory data collection methodologies are complementary of each other. GIS can be used to bring a spatial/visual component to both PRA and Inventory methods, while PRA

provides the qualitative input to the GIS and Inventory methods.

How do you bring the information obtained back to the farmers? PRA can help the farmers, or the existing user groups, articulate their interests, through participatory consensus decision making. Concerned agencies to help the farmers can then act as intermediaries to the policy makers, by "translating" the farmers' decisions into a form that policy makers can understand- perhaps by using GIS. What is the channel from the farmers to the policy makers? User Group-VDC-DDC-National or perhaps an even more complicated link. These are factors which make the question, "How do you get the information back to the farmers?, or even to the Policy Makers?" even more complicated.

In sum, PRA should be seen in a broader decentralizing perspective of articulating popular interest hence mobilizing local resources to design their own development objectives. Looking at it from this perspective, it appears that the information obtained never "leaves the farmers." On further thought, PRA is very useful for specific development projects. The question remains, how can it influence policy?

Surtana Irrigation System

DESCRIPTION OF SURTANA SYSTEM

Brief Overview

The source of water for the Surtana System is the Dhongre Khola which is related to underground sources of water fed by other sources and by irrigation systems located on the upstream side. Dhongre Khola was originally a canal and the farmers used big wooden pipes to draw water from the Lothar River. In a major flood occurring in 2027 B.S., the Lothar River destroyed many of the diversion works. A course of the river subsequently entered into this canal turning it into a bigger stream. Since this canal was diverted using wooden culvert locally called *Dhongro*, the stream thus developed was called Dhongre Khola. Dhongre Khola serves a total of 26 FMIS in the East Rapti Irrigation Project (ERIP) area. The systems are located quite close together. On average, there is an irrigation intake every 1200 meters along its course.

No one knows exactly when this system was constructed. The current irrigators are certain, however, that they and their ancestors have been maintaining and using this system for four generations. A *Zamindar* and his family have been living there for a full four generations.

This system irrigates between 260 and 300 bigha of land during the monsoon season. There are five fish ponds currently getting their supply of water from the Surtana canal. This rapid appraisal took place in March, 1993 at the time of planting of spring paddy.

History of Development

The Surtana irrigation system was built originally as a traditional system using the existing available technology. The current system irrigates about 260 bigha of land during the monsoon season. Long ago the Tharu villages were organized into *pargana* -- each of which contained several villages. Each village was headed by Zamindar Chaudhary. The Pargana was headed by Pargana Chaudhary who used to have skills of laying out canals. When an irrigation system was to be constructed, the head of the village would call the Pargana Chaudhary and organize a feast for him. While the feast was being prepared, the head of the village would show him where they wanted the system. He would validate their plan or suggest changes. The Pargana Chaudhary would then lay out the system in detail. The farmers were then obligated to work based on the total amount of work estimated. Specific amount of work was assigned to all the able bodied men using a Laggi stick (the equivalent of 8 cubits) to assign the work (see discussion below of Laggi stick).

Physical Structure

The headworks were a traditional brushwood check dam for many years. A gabion weir was installed at the headworks 7 or 8 years ago with the external assistance of Farmer Irrigation and Water Utilization Division (FIWUD). It is important to note that the canals of this system form a network rather than a set of straight lines. They appear to follow the contours of the land. For someone trained in engineering, they may

not have the aesthetic feel of a nice straight canal. For those who enjoy seeing nested technologies drawing on local knowledge, there is a definite aesthetic feel.

The most important thing for farmers is that the canal is functional. The structures are all there for a purpose. The farmers pointed out the main diversion structures and stressed the importance of keeping this well maintained.

There is one main canal that comes off of Dhongre Khola. It has an idle length of 700 meter before reaching the first irrigated field. It is this main canal that appears to be the source of considerable work for the farmers. There is a lot of silt that enters the canal at this point. Cleaning it of weeds and silt twice a year (before spring planting and before the monsoon season) requires substantial manpower (300 to 500 work days per year). The height of the embankments at the head of the canal is 2 to 3 meters; this is quite high for this kind of system. There is a lot of new silt on the banks.

There are several major branch canals (see list in Inventory). In every Tharu system, there is a Zamindar kulo. All of the Tharu systems were initiated at the time of the Zamindars -- so the presence of a Zamindar kulo does not mean that the current Zamindar owns all of the land served by that kulo. The diversion works are cement, stone masonry built by FIWUD within the last decade. The cross structures were intended to be wooden gates but they were not currently used. One farmer said they were in storage since they were easily stolen. It appears that the farmers regulate the flow of water into the branch canals by using stones, brush, and mud. Since 2026 B.S., the Zamindar system no longer exists. The former Zamindar's sons, however, who are the dominant and influential leaders in the village are still referred to as Zamindars.

Members of our team noticed considerable settlement of the diversion structures -- much more than should be the case given the age of the structure. Some flashing of gabion wire crates was showing on the headwork diversion structure and some stones had already fallen out. There appeared to be some deflection occurring. The sealing of the gabion box with sod and mud turfs was also observed.

The river water is completely diverted during spring season, which is the lowest water supply time of the year. The group felt that the local method of water diversion was fairly effective.

From each of the branch canals, there are many sub-canals which they call *Phadke*. Bamboo check structures have been constructed at the turnouts of the branch canals into sub-branch but not from sub-branch to the field. Farmers have placed hume pipes for field turnouts. Control points for the two branches are simply regulated using local materials. The small number of permanent control structures involved in this system permits considerable flexibility for the farmers to manage the flow of water through the system.

Embankments of branch canals were reasonably well maintained. The embankments in some of the sub-branches were not in good shape. Desilting some of the sub-branches had recently occurred. No cement lining exists. Canal embankments were very high and wide relative by to the irrigated area.

The team observed caving-in, undercutting and over-extension of embankments along the main and branch canals at several points, which disturbed or ate into agricultural land. One farmer asked Mr. Parajuli, the ERIP Engineer, when ERIP would repair the embankment. His response was that they should talk to the Zamindar. The Zamindar, when asked, indicated that farmers do complain about this, but something is done only if a whole group complains and is willing to work on it. A group of downstream beneficiaries is constituted to repair this -- all those benefited by the system up to the point of the repair. Contributions are

mobilized according to the area of the landholding. The committee has records of the maintenance labor. If the problem is small, the Zamindar will ask the farm house near the area to repair it.

The whole system is simple in design and hydraulically functional. There are no checks or farm turnouts along sub-branches and no field channel outlets from the branches. Mud, stone and sticks are used at the control points either to control the flow or to raise the head.

For the maintenance of the canal, a person is assigned maintenance (and construction) work on the canals in terms of *Laggis*. A Laggi is a wood measuring stick which is supposed to be 8 cubits, or 4 yards in length. In practice, the length may differ somewhat and the interpretation of a Laggi may depend on how hard the job would be. The amount of Laggis assigned to a farmer to clean or repair will depend on the amount of land the farmer owns. The exact "length" of the laggi will depend on the conditions of the canal in a location so that farmers receive equivalent work assignments.

Agricultural Patterns

Farmers currently irrigate 256 bigha (perhaps as much as 300 bigha) during the monsoon season all for paddy. Concurrently, there is about 8 bigha of upland rice planted. During the spring season, the farmers plant between 150 to 175 bigha in spring paddy, and 50 to 55 bigha in maize. About 56 bigha is left fallow during this season. During the winter season, farmers plant mustard, wheat, legumes, oilseed, and maize. There is more crop diversification during the winter. We saw plots with vegetables being grown for market.

Fifteen to 20 years ago, farmers grew primarily only one irrigated crop a year during the monsoon season. Most farmers had more land and could grow enough paddy for the year on their land. There was no paddy grown in the spring season. (We did get some information that some of the fields may have grown spring paddy for as long as 15 years which, given that spring paddy had been introduced in the area about 20 years ago, is quite reasonable.) Thus, land fragmentation has led to more intensive land uses.

In recent times some of the farmers have begun to plant sisso (*Dalbergia sisso*) trees on some of their plots. These are timber trees that would bring a high financial return when sold. About 34 bigha of land along the Dhongre Khola are sisso plantations. This was started after the Lothar River flood, as a means of flood protection, as well as for the eventual commercial value.

We asked about availability of inputs to the agricultural process and were informed that they had no difficulty obtaining fertilizer and other inputs, if they had the necessary funds. They are close enough to the market to have no transportation difficulties, although the main bridge to town was currently broken down.

Ram Deen Chaudhary's family has been quite influential in this region for some time. In recent times, Ram Deen Chaudhary has asked for a telephone extension to the area and for electricity to the village; both requests have been accepted by the government. It now looks promising that an all-weather road will be coming from Parsa bazaar to Surtana.

Water Rights

The water rights within the system are not tightly regulated. During the monsoon season, the water flow in the canals is continuous. During the winter and spring seasons farmers rotate water between the two branch canals. One of the branches which has 110 bigha, receives water for 48 hours; the other branch (Badki kulo) which has 90 bigha, receives water for 24 hours.

The logic of the 2 to 1 ratio is based on the more porous nature of the soil in the unit that receives water for 2 days.

This rotation system is only 7 years old. They started rotating when the water supply became scarce for the new crops introduced to the area, mainly wheat in winter and spring paddy during spring. Some of the farmers in the 90 bigha area are finding that their water supply is comparatively scarce and they wish to change the rotation system so that it is a 3 to 2 ratio rather than a 2 to 1 ratio. The brother of the Zamindar, who exercises considerable day to day management of the system, owns land in the 90 bigha area. Thus, they have been experimenting with a rotation system that may have some further experimentation in the future.

The Badki kulo farmers are proposing a different rotation system that would involve a 3 to 2 ratio. If this request is not agreed to, they will propose that the whole system go to a simply proportional land size rule.

Governance and Management

A six member water users committee locally called ***kulo samiti*** is nominated by the users of this system. The functionaries of the kulo samiti include:

Ram Saran Chaudhary	-	Chairman
Bannu Mahato	-	Vice-chairman
Channu Chaudhary	-	Secretary
Pandit Chaudhary	-	Treasurer
Maralla Mahato	-	Member
Dhaneswor Chaudhary	-	Member

Access to water is based on land. Thus, the person irrigating is the one who has access, whether he is a share cropper or an owner. Similarly, labor mobilization is related to the amount of land cultivated. This is related to their patterns of labor mobilization. The small farmers tend to plant paddy in the spring season on all of their land. The large land-owners are less likely to put all of their land into spring paddy because they face tight labor constraints during May and June. This is because of the need to transplant monsoon paddy and harvest the spring paddy in a short period of time in June. If sufficient migrant labor does not come through at this time, there is always the danger of spring paddy germinating in the field, resulting in heavy crop loss and delay in the transplanting of monsoon paddy.

The large land holding farmers are therefore apt to let out their land during spring season to share croppers. The share croppers, however, are required to contribute labor during the spring maintenance period when labor needs for canal maintenance are large.

Substantial labor mobilization occurs twice a year--before winter and before spring, when major canal cleaning (desilting and weeding) is done. The labor mobilization for both these periods is based on the size of land holding.

If a farmer does not fulfill the labor mobilization requirements, a fine is assessed based on whether the labor was supposed to help maintain the main canal (fine = 50 rupees per laggi) or a branch canal (fine = 35 rupees per laggi). Given how high the embankments have become on the main canal, this difference is quite understandable.

The amount of labor mobilization is based on the amount of irrigation land holding size. A farmer who holds 3 1/2 bigha reported that he had to contribute two labor days last year. Another farmer who owned 1 bigha was assigned one day of work. The Laghara, who assigns the repair work told us that he has all the records of the land. It is hard to make a farmer work for 1.75 days -- it is difficult to figure out what 0.75

day is, so he roughly calculates assignments in the metric of days. We then calculated that about 300 to 500 man days of work were spent last year. But some adjustments in assigning the work are done, to make the work allocation more proportional to land-holding size.

In regard to the history of labor mobilization, the Zamindar indicated that earlier it was not based on land holding. All the able-bodied farmers used to contribute labor. The reason was that the number of households were smaller and Zamindar had a lot of people who worked for him under a form of *Haruwa* or bonded labor. Under this arrangement, the Zamindar provided some land and was responsible for feeding the family.

The Kulo Samiti raised funds to purchase 0.5 bigha of land immediately above the diversion to use that soil to reconstruct the diversion. This system is a typical traditional Zamindar system. The management characteristics are similar to the earlier system. The distribution of water is not exactly measured nor controlled quantitatively. By experience, farmers learn to divide water according to qualitative assessment of need.

The system appears to be quite well managed. One of the reasons for this is the homogeneity of the users. In a socially more diverse system, it would be more difficult; the farmers mentioned this to us. The Samiti employs a full-time peon or *Chowkidar* who is remunerated in cash and in kind. He works as a messenger to call the people and inform them of the time and place where maintenance work is to be done. He receives ten muri of paddy per year plus 30 rupees per household for those who own land but live outside. He receives about 2000 to 2500 rupees per year, plus the 10 muri of paddy.

CURRENT ISSUES

Expansion and Intensification

The system has undergone steady intensification during the last fifty years. Some recent expansion of the system has also taken place. Some of the area that was forest is now being irrigated.

In 1987 B.S., public land was sold to 13 households who bought 14 cubit by 16 cubit plots for Rs. 125. In 2040-2041, 8 katha of land per family was provided to 25 landless farm families. A wooden aqueduct was built to irrigate this new area. Another 7 bigha of land was irrigated by another aqueduct, which collapsed in 2047.

There are several elements of a current discussion about the extension or expansion of the system. Three landless Tharu families have recently been resettled in the system at the tail end and have become members of the Samiti; they are already receiving water. The Samiti distributed 12 to 15 bigha of land to these families.

Farmers have also put an escape structure in one of the branch canals and let water go into another system whenever the water is available. A possible further expansion seems to be an issue. ERIP is proposing to the Samiti that they should build new regulating structures to improve their water use efficiency. The engineer estimates they are using water at about 30% efficiency. He thinks they could expand about 20 bigha in the rainy season. In the spring season, they could irrigate as much as 20 to 30 bigha more land. There are now about 150-750 bigha under irrigation during spring; this could be expanded to 200 bigha, if proper water management is practiced. The farmers, however, think differ-

ently. The engineer is determined that, unless the farmers agree to expansion of the system, ERIP will not build some of the improvements they want. They will eventually have to contribute 10 percent to the cost of whatever improvement is built.

One of the improvements they would like is the replacement of the many wooden aqueducts spread throughout the system with plastic pipes. (We saw one wooden log all ready to go into the location where the old aqueduct must be replaced -- so they are preparing to continue without help on this front if they do not get it.)

The water requirement was observed to be quite high. A lot of water is lost in conveyance. But the users who already have prior rights are reluctant to expand the area irrigated. The ERIP engineer feels that they could easily reduce the amount of water used in their fields during the winter and spring, and expand their irrigated area by another 20-30 bigha. This expansion would include migrant people who are not now members of their Samiti or tied to other families in social traditions. The current irrigators, however, are reluctant to include newcomers.

As one farmer indicated to us, "We are like one family. If there are 2 more families living in the same structure, it is not a good situation. You lose track of who is doing what. The rules that are present now will break with the entry of outsiders." Those who are applying for new membership are all migrants; of whom people are suspicious. One farmer indicated that they would rather see the migrants kept as a minority, given some of the past experiences they and others have had in other Tharu systems.

Part of the suspicion goes back to 1958 when a land survey was conducted. The surveyors were quite corrupt. They demarcated the land as if no one had long-term ownership and accepted bribes readily for recording land ownership. The land survey eventually had to be entirely cancelled. It was redone in 1968. The mistrust has remained.

Relation to Other Systems

The dispute with the lower system started when they constructed the gabion weir. The farmers of Badgaon, the lower system, were uncertain about the affect of this new technology used by this system located only 200 meters on the upstream side. They feared it would take all of their water rights away. Badgaon uses Dhungre Khola as a supplemental source, not as their main source. They filed a court case. The District Development Committee members acted as arbitrators to resolve the issue. The resolution was that the lower system had a right to two shares out of sixteen.

At the current time Badgaon is not using the Dhongre Khola as a source so they do not need to develop a measurement weir to insure that one/eighth of the water flows to Badgaon. If the farmers of Badgaon do want to exercise their right, both systems will have to hire an engineer to develop a proportioning weir to insure this division. The Badgaon diversion structure, which is down stream of the Surtana intake, was also constructed by FIWUD.

The field team asked a group of farmers including the Zamindar to name as many systems as he could above and below Surtana. They mentioned 10 of the 26 systems that take water from the Dhungre Khola. Four of these systems were downstream and six were upstream. The team asked how many systems they have had relations with in any way. They responded with the names of the systems located immediately above and below Surtana.

Subsurface and drainage water from upstream enter into Dhongre Khola. When the Rapti Pratapur kulo is operated from Rapti river, during spring, the water supply in Dhongre Khola increases. Groundwater flow and seepage from other systems also contribute to the source. Water is relatively abundant so the disputes are not difficult.

When the systems change the technology of their diversion works, disputes often arise. Incidence of dispute was also reported with Majhui system located just upstream of Surtana, when Majhui system constructed a gabion weir 8-10 years ago with FIWUD assistance.

Relation to ERIP

There is a current dialogue between the ERIP and the Kulo Samiti about the expansion. The farmers want help in replacing wooden aqueducts with pipes, but are not very interested in adding control structures as suggested by ERIP, at least not immediately.

The farmers did have to register their system in 2049 B.S. Registration turned out to be a relatively expensive process. They spent Rs. 100 on the registration fee and Rs. 600 went for transportation, stationery, letter, stamps etc. Since fines are the only source of revenue, they used up their Samiti fund. They used to have a feast at the end of the year with the money raised from fines but now they have to use it for small repair costs and other items.

Relation of Irrigation System and Forests

The general hydrology of the area is closely interlinked. The heavy forest cover that used to exist in this area before 2020 B.S. was responsible for relatively higher recharge for Dhongre Khola. This also reduced the flood incidence in the area. With the depletion in forest cover, reduction in the amount of water supply in the Dhungre Khola has been realized over time.

With the introduction of a gabion weir at the intake the dependence of the system on the forest for brush wood has decreased. However, all of their aqueducts are made of wood and these require very large trees. One of the reasons they have requested ERIP to help them replace aqueducts with plastic pipe is the increased constraints to obtain logs from the forest to make the aqueducts.

Several farmers told us that they have now started to plant sisoo trees. This is a slow growing, indoor lumber producing tree. It takes at least 15 years to be eligible for harvest. There is a disease called sisso dieback that has occurred elsewhere and hurt such crops substantially.

METHODOLOGICAL CONCERNS

Strategies Used in Data Collection and Analysis

The Inventory and IAD group decided to break into three teams in the field: one to the tail, one to the middle, and one to the head of the Surtana system. Each of the teams was asked to try to cover the full set of questions that we had all developed together the day before:

- What are the characteristics of the physical irrigation system that are relevant to the farmers of this system?
- What are the characteristics of the agricultural system that are most relevant to the diverse farmers?
- How do these relate to marketing and transportation?
- How do these characteristics affect who benefits and who loses in various dimensions?
- How are the water rights within this system (and between this system and others in the hydrological set of nested systems) defined and how do these work in practice?
- How are forestry resources related to this irrigation system?

We found both in the field and in our own discussion that these issues were intricately intertwined. For future work of this kind, one of the strategies that is important is to find the maps, charts and reports that are already available in an area and to build on them.

Experience Relating to the Themes of the Workshop

- Try to collect from secondary sources everything that you can do before you reach the field.
- Obtain information on indigenous traditions relevant to resource use in advance of the PRA or inventory.
- Developing a hand drawn sketch of the system should be done early in the PRA.
- Macro perspective gives a great advantage, but if you take official-looking maps into the village, they think it is a project and it intimidates the villagers, or raises their expectations about a future project.

CHRONOLOGY OF SURTANA KULO

100 years ago — About 8 or 9 Tharu households moved to this area and agreed to clear the land in exchange for obtaining rights to the land. There would have been around 10 to 15 members in a family. The headworks to the Surtana system have remained in the same location since it was first started.

1957 B.S. — Up to this era, land, water and forests were plenty. There were many naturally flowing springs in the area. Government officials were far away and did not disturb farmers much.

1962 B.S. — The first land survey in the area; the Zamindar was given the official red book for recording lands and records. Thus, he was given the authority to register or cancel the names of all individuals cultivating and owning land in the area.

Names of the Zamindars:
Kanu Chaudhary
Thanu Chaudhary
Brijald Chaudhary
Ram Saran Chaudhary,
Current Chairman of Water Users Committee.

2012 B.S. — Malaria eradication program was started, making it possible for those who could not have settled earlier in this region to do so now.

2010-2012 B.S. — The forest division was established in East Chitwan. Before that, the Tharus were free of any external government control so long as they paid their taxes. The forest guards punished the Tharus if they cut Sal trees to build their homes. This is the reason why Tharus do not build sal wood houses, and largely use thatch. Only the Zamindars were allowed to cut Sal wood for mak ing homes or some of the migrant settlers who had close relations with those in the forestry division.

2012 B.S. — Resettlement began in Chitwan. Many people from the hills started migrating to this area.

2015 B.S. — Beginning of first Rapti (Doon) valley development project assisted by USAID, and the first democratic election in Nepal.

First land survey team came. Unfortunately, the land survey team did not do an accurate and impartial job of recording the land tenure of the area. Suspicion of Tharus with migrant settlers began. The survey had to be redone in 2026.

2017 B.S. More and more of the forests given for clearance. Until this date, forest grasses, reeds, and mud turfs were used to check water and divert it to Dhongre canal made by old Tharu Zamindars.

2018 B.S. Started to use other materials at the headworks like scrubs, leaves, straws, that continued to depend heavily on forests.

2021 B.S. By this time, the entire area was cleared of forest to about the level it is now except that there were many stumps in the fields which have now been taken out.

2022 B.S. Migrants from the hills moved more extensively into the area. Until this date, only paddy had been grown in this system. Tharus learned maize cultivation from hill migrants and it started to be a crop grown in the area. Also maize was introduced in a seed production program that is no longer around.

2026-2027 B.S. Land survey was redone. Major flood of the Lothar River destroyed the intake from that river, and also diverted a substantial amount of water into Dhongre Khola.

2038-2039 B.S. Purchased 12 katha of land at the head. They had built an earth bund which submerged this land. The farmer who owned the land, a migrant settler, indicated that he either wanted the land purchased or wanted compensation. They could use the land for developing sod turfs for the headworks so it had some value for the system. After much discussion they settled at a price of NRs 21,000. All land in the com mand area was assessed NRs 175 per Dhur.

2040-2041 B.S. FIWUD helped extend an aqueduct to serve the new section at the eastern side of village near Dhongre Khola bank. Thirteen new settlers were sold public land (14 x 16 cu bit size at Rs 125 per plot.

2042 B.S. New gabion box diversion weir constructed at the headworks with the assistance of FIWUD. Shortage of local forest resources due to deforestation forced the changing of diversion weir type.

2047 B.S. The new aqueduct at the eastern side of village collapsed with part of the loan still outstanding. A wooden chute installed for this land. Twenty-five landless families of village (mostly Tharus) were provided 8 Katha land on the tail end.

2048-2049 B.S. Forest Utilization and Conservation Commission (Ban Sudhridikaran Ayog) inspected the public land provided to landless farmers and took account of it.

2049 B.S. The new Samiti (WUA) officially registered. ERIP helped in the process of registering the samiti.